

SEMI F47-0999

PROVISIONAL SPECIFICATION FOR SEMICONDUCTOR PROCESSING EQUIPMENT VOLTAGE SAG IMMUNITY

This provisional specification was technically approved by the Global Facilities Committee and is the direct responsibility of the North American Facilities Committee. Current edition approved by the North American Regional Standards Committee on April 15, 1999. Initially available on SEMI OnLine August 1999; to be published September 1999.

NOTE: This specification is considered provisional since it lacks a reference for the required test method in Sections 4.2, 6.2b, and 8.1. This test method is being concurrently developed and cannot be officially referenced until passed and published by SEMI Standards.

1 Purpose

1.1 Semiconductor factories require high levels of power quality due to the sensitivity of equipment and process controls. Semiconductor processing equipment is especially vulnerable to voltage sags. This document defines the voltage sag ride-through capability required for semiconductor processing, metrology, and automated test equipment.

1.2 The requirements in this international standard were developed to satisfy semiconductor industry needs. While more stringent than existing generic standards, this industry-specific specification is not in conflict with known generic equipment regulations from other regions or generic equipment standards from other organizations (see Related Information section).

1.3 It is the intent of this standard to provide specifications for semiconductor processing equipment that will lead to improved selection criteria for sub-components and improvements in equipment systems design. While it is recognized that in certain extreme cases or for specific functions battery storage devices may be appropriate, it is not the intent of this standard to increase the size or use of battery storage devices provided with equipment. Focus on improvements in equipment component and system design should lead to a reduction or elimination in the use of battery storage devices to achieve equipment reliability during voltage sag events.

2 Scope

2.1 This document specifies the minimum voltage sag ride-through capability design requirements for equipment used in the semiconductor industry. The expected equipment performance capability is shown graphically on a chart representing voltage sag duration and percent deviation of equipment nominal voltage. Standard evaluation test method references are also included.

2.2 The primary focus for this specification is semiconductor processing equipment including but not limited to the following tool types:

- Etch equipment (Dry & Wet),
- Film deposition equipment (CVD & PVD),
- Thermal equipment,
- Surface prep and clean,
- Photolithography equipment (Stepper & Tracks),
- Chemical Mechanical Polishing equipment,
- Ion Implant equipment,
- Metrology equipment, and
- Automated test equipment.

2.3 This specification applies to semiconductor processing equipment to include the equipment mainframe and all subsystems whose electrical power is directly affected by the operation of the equipment's EMO system.

2.4 This standard does not purport to address all of the safety issues associated with its use. It is the responsibility of the users of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

3 Limitations

3.1 Not included in this standard are over voltage conditions, voltage sag duration of less than 0.05 seconds (50 milliseconds), and voltage sag duration of greater than 1.0 seconds. If necessary, the Information Technology Industry Council (ITIC) "CBEMA-curve" contained in IEEE 446, IEEE 1100, and SEMI E51 can be used to specify additional requirements outside the range of this document (see Related Information, Section R1-1).

3.2 This specification does not address wafer quality with regard to processing variation caused by voltage sags. It is recommended that each equipment supplier consider the effects of voltage sags on their equipment processes. If voltage sags above the defined line can result in known wafer quality problems, then an appropriate notification-only scheme should be considered in the equipment design. To be in conformance with this

standard that notification scheme should not be classified as an equipment interrupt per SEMI E10.

3.3 This standard addresses specifications for semiconductor processing equipment voltage sag immunity. Factory systems voltage sag immunity and electric utility voltage sag performance are covered in other related standards.

3.4 This standard is intended to be a performance specification, it is not intended to address design issues related to safety which are covered elsewhere in the SEMI Standards (see SEMI S2).

NOTE: Safety related systems may require ride-through capability for conditions up to and including full power failure. Further, if hazards could result from voltage sags greater than those allowable in Table 1, provisions should be made to negate or eliminate such hazards.

3.5 International, national and local codes, regulations and laws should be consulted to ensure that the equipment meets regulatory requirements in each location.

4 Referenced Standards

4.1 SEMI Standards

SEMI E10 — Standard for Definition and Measurement of Equipment Reliability, Availability, and Maintainability (RAM)

SEMI E51 — Guide for Typical Facilities Services and Termination Matrix

SEMI S2 — Safety Guidelines for Semiconductor Manufacturing Equipment

NOTE: A voltage sag ride-through test method is currently being developed and can be referenced when passed and published by SEMI standards.

4.2 IEEE Standards¹

IEEE 446 — IEEE Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications (IEEE Orange Book)

IEEE 1100 — IEEE Recommended Practice for Powering and Grounding Sensitive Electronic Equipment (IEEE Emerald Book)

IEEE 1250 — IEEE Guide for Service to Equipment Sensitive to Momentary Voltage Disturbances

NOTE: As listed or revised, all documents cited shall be the latest publications of adopted standards.

5 Terminology

assist — an unplanned interruption that occurs during an equipment cycle where all three of the following conditions apply:

- The interrupted equipment cycle is resumed through external intervention (e.g., by an operator or user, either human or host computer).
- There is no replacement of a part, other than specified consumables.
- There is no further variation from specification of equipment operation [SEMI E10].

failure — any unplanned interruption or variance from the specifications of equipment operation other than assists [SEMI E10].

interrupt — any assist or failure [SEMI E10].

ride-through capability — the ability of equipment to withstand momentary interruptions or sags [IEEE 1250]. Also known as voltage sag immunity.

voltage sag — an rms reduction in the ac voltage at power frequency for durations from half-cycle to a few seconds [IEEE 1250]. Also known as voltage dip.

6 Ordering Information

6.1 Semiconductor manufacturers may use this standard when procuring processing equipment to specify equipment ride-through requirements capability to the equipment supplier. This document may also be used by semiconductor processing equipment suppliers to specify ride-through requirements to component and module suppliers.

6.2 Orders for equipment in accordance with this standard shall include:

- This specification number and date of issue.
- Requirements for qualification testing as agreed to between the supplier and buyer.

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- Any certification showing passage of qualification tests required to be provided (optional).
- Any test results required to be included in reports to be provided (optional).

7 Requirements

7.1 Semiconductor processing, metrology, and automated test equipment must be designed and built to conform to the voltage sag ride-through capability shown in Figure 1. Equipment must continue to operate without interrupt (see Terminology) during conditions identified in the area above the defined line.

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