SEMI E149-0708
GUIDE FOR EQUIPMENT SUPPLIER-PROVIDED DOCUMENTATION FOR THE ACQUISITION AND USE OF MANUFACTURING EQUIPMENT

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NOTICE: Paragraphs titled NOTE and sections entitled RELATED INFORMATION are not official parts of this document and are not intended to modify or supersede it.

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1 Purpose

1.1 This standard presents recommendations for content and usability of documentation provided by the equipment supplier to the equipment purchaser for acquisition and use of semiconductor, flat panel display (FPD), or other related manufacturing equipment. This standard will support more effective equipment acquisition (e.g., purchase, lease) agreements between the equipment supplier and purchaser. Complete documentation can improve the purchaser's ability to acquire, install, use, maintain, and repair the equipment, which increases productivity and reduces costs.

2 Scope

2.1 This standard applies to all documentation provided by the equipment supplier to the equipment purchaser for new semiconductor, FPD, or other related manufacturing equipment and supplier-provided support equipment to cover aspects of equipment acquisition, installation, operation, maintenance, repair, and disposal.

NOTICE: This standard does not purport to address safety issues, if any, 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 or other limitations prior to use.

3 Limitations

3.1 Not all sections of this standard may apply to all equipment types due to the wide range of manufacturing and support equipment in terms of cost, complexity, and volume produced.

3.2 This standard primarily lists categories/types of documentation content (sometimes as just italicized headings) and is not intended to define each category/type in detail.

3.3 Much of this standard is written assuming suppliers and purchasers negotiate highly detailed contracts covering compliance to individual sections of this standard as appropriate (see ¶ 3.1 and ¶ 3.2). For contracts where this detailed negotiation is not initially done, suppliers and purchasers may need to negotiate in more detail what suppliers may and may not provide to purchasers when a compliance question arises, perhaps well after an agreement on a more general low-detail contract.

3.4 This standard is not intended to:

3.4.1 Address the tool accommodation process (i.e., generic process flow for equipment purchasing through acceptance) already covered by SEMI E70, but it does support it by providing additional recommendations for equipment-related documentation during the equipment accommodation process.

3.4.2 Address information tagging specifications (e.g., markup philosophy, markup framework) already covered by SEMI E36.

3.4.3 Define how the equipment supplier organizes the specified content (i.e., how content is combined or divided between individual documents, how the content is ordered within the documentation).

3.4.4 Define requirements for equipment documentation for the sole purpose of internal equipment supplier use by equipment supplier personnel only.

3.4.5 Define when supplier provides each type of documentation unless specifically stated.

3.4.6 Apply to the equipment software source code.

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3.4.7 Apply to the equipment communications interfaces used solely internal to the equipment for communications between internal component parts.

3.4.8 Define requirements for documentation provided with used equipment by the seller to the purchaser.

3.4.9 Define additional requirements for what supplier and purchaser should agree to during negotiations.

NOTE 1: Related Information 3 provides some optional recommended items related to documentation and other topics that the supplier and purchaser may want to discuss and agree upon during negotiations.

4 Referenced Standards and Documents

4.1 *SEMI Standards*

SEMI E5 — SEMI Equipment Communications Standard 2 Message Content (SECS-II)

SEMI E6 — Guide for Semiconductor Equipment Installation Documentation

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

SEMI E30 — Generic Model for Communications and Control of Manufacturing Equipment (GEM)

SEMI E36 — Semiconductor Equipment Manufacturing Information Tagging Specification

SEMI E72 — Specification and Guide for 300 mm Equipment Footprint, Height, and Weight

SEMI E70 — Guide for Tool Accommodation Process

SEMI E76 — Guide for 300 mm Process Equipment Points of Connection to Facility Services

SEMI E89 — Guide for Measurement System Analysis (MSA)

SEMI E137 — Guide for Final Assembly, Packaging, Transportation, Unpacking, and Relocation of Semiconductor Manufacturing Equipment

SEMI E139 — Specification for Recipe and Parameter Management (RaP)

SEMI E150 — Guide for Equipment Training Best Practices

SEMI S2 — Environmental, Health and Safety Guideline for Semiconductor Manufacturing Equipment

SEMI S8 — Safety Guideline for Ergonomics Engineering for Semiconductor Manufacturing Equipment

SEMI S13 — Environmental, Health and Safety Guideline for Documents Provided to the Equipment User for Use with Semiconductor Manufacturing Equipment

SEMI S16 — Guide for Semiconductor Manufacturing Equipment Design for Reduction of Environmental Impact at End of Life

SEMI S20 — Safety Guideline for Identification and Documentation of Energy Isolation Devices for Hazardous Energy Control

SEMI S23 — Guide for Conservation of Energy, Utilities and Materials Used by Semiconductor Manufacturing Equipment

4.2 *SEMATECH/TECHNICIAN PERFORMANCE IMPROVEMENT COUNCIL (TPIC)*[1]

93031567B-TR — Technician Training Guidelines: 1998

NOTE 2: SEMATECH stopped support of the SEMATECH – SEMI/SEMATECH Technician Training Council in 2003. TPIC incorporated as an independent organization in 2004 to continue technician training-related activities. SEMATECH transferred ownership of this document to TPIC and removed it from the SEMATECH Web site.

NOTICE: Unless otherwise indicated, all documents cited shall be the latest published versions.

1 Technician Performance Improvement Council (TPIC) , 2200 Panther Trail, #216, Austin, TX 78704, USA. Telephone: 512-632-2361; http://www.tpic.org

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5 Terminology

5.1 *Abbreviations and Acronyms*

5.1.1 *AC* — Alternating Current

5.1.2 *ASCII* — American Standard Code for Information Interchange

5.1.3 *AVI* — Audio Visual Interleave

5.1.4 *CD* — Compact Disk

5.1.5 *DC* — Direct Current

5.1.6 *FPD* — Flat Panel Display

5.1.7 *FRU* — Field-Replaceable Unit

5.1.8 *IP* — Intellectual Property

5.1.9 *MPEG* — Moving Picture Experts Group

5.1.10 *OEM* — Original Equipment Manufacturer

5.1.11 *OS* — Operating System

5.1.12 *PCB* — Printed Circuit Board

5.1.13 *PM* — Preventive Maintenance

5.1.14 *P.O.* — Purchase Order

5.1.15 *RaP* — Recipe and Parameter Management

5.1.16 *SECS-II* — SEMI Equipment Communications Standard Part 2

5.1.17 *SVG* — Scaleable Vector Graphics

5.1.18 *TPIC* — Technician Performance Improvement Council

5.1.19 *UI* — User Interface

5.1.20 *XML* — eXtensible Markup Language

5.2 *Definitions*

5.2.1 *acceptance* — acknowledgment by a purchaser's authorized representative to the supplier that a system, subsystem, assembly, subassembly, or component part has satisfied the negotiated technical requirements. It also may be referred to as sign-off.

5.2.2 *adjust* — to change the condition or performance of the equipment within specifications by changing the mechanical, electrical, and/or software settings of the equipment (e.g., align, calibrate, configure).

5.2.3 *align* — to properly position one part in relation to another part or parts, or in relation to a reference point or points outside the equipment.

5.2.4 *assembly* — two or more component parts and/or subassemblies joined together to perform a specific function and capable of disassembly.

NOTE 3: The distinction between an assembly and subassembly is determined by the individual application. An assembly in one instance may be a subassembly in another where it forms a portion of an assembly.

5.2.5 *block diagram* — a modified schematic diagram in which each group of maintenance-significant components that together perform one or more functions is represented by a single symbol or block. The block or symbol representing the group of component parts and assemblies shows simplified relevant input and output signals pertinent to the subject diagram.

5.2.6 *calibrate* — to measure and correct the accuracy of the equipment using an instrument that is periodically compared and certified to a certified reference material (e.g., standard).

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5.2.7 *certified reference material (CRM)* — reference material, one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation issued by a certifying body [SEMI E89].

5.2.8 *check* — see test.

5.2.9 *component part* — a constituent part, which can be separated from or attached to an assembly, not normally considered capable of independent operation. Also sometimes just called part.

5.2.10 *configuration* — the functional and/or physical characteristics of hardware/software as achieved in the equipment.

5.2.11 *configure* — to set hardware or software for one of a set of possible options.

5.2.12 *corrective maintenance* — corrective (e.g., repair) actions, typically the result of troubleshooting, necessary to change the equipment from an unscheduled downtime state to another equipment state in preparation for it to be capable of performing its intended function (e.g., running production units). Also sometimes called unscheduled maintenance.

5.2.13 *critical task* — task that demonstrates the specific basic, intermediate, or advanced skills and knowledge required to install, operate, maintain, troubleshoot, and repair the equipment.

5.2.14 *decision tree* — an intuitive and easily understood representation of an inductive decision procedure used during troubleshooting to determine the root cause associated with a given problem.

5.2.15 *disassemble* — the step-by-step taking apart (or breakdown) of a subassembly or assembly.

5.2.16 *documentation collection* — a set of documentation content that is logically related, usually by its content, target audience, or origin.

5.2.17 *documentation content* — substance of a text document, audio clip, or video clip instead of the form (e.g., text, video, audio) and/or media (e.g., electronic, paper) in which it is stored.

5.2.18 *equipment* — the combination of hardware and software required to perform an operation or activity (e.g., processing, transporting, storing), including all direct auxiliary support or peripheral equipment (e.g., vacuum pumps, heat exchanges, effluent/exhaust treatment equipment).

5.2.19 *equipment documentation* — recorded documentation content intended to communicate equipment information (e.g., installation, operation, maintenance, illustrated field-replaceable units [FRUs] lists) to the user and released in any form (e.g., text, video, audio) or media (e.g., electronic, paper).

5.2.20 *field-replaceable unit (FRU)* — a component part, subassembly, assembly, or subsystem of the equipment that can be removed and replaced on-site (i.e., in the field).

5.2.21 *functional diagram* — a type of illustration in which symbols are connected by lines to show relationships among the symbols. The symbols may be rectangles or other shapes; standard electronic symbols representing component parts or functions; or pictorials representing equipment, assemblies, or component parts. Where appropriate, voltage readings may be shown. The lines may represent procedures or processes, such as signal or logic flow, and physical items, such as wires. Functional diagrams may include schematic diagrams, wiring diagrams, piping diagrams, logic diagrams, flow charts, and block diagrams.

5.2.22 *help documentation* — recorded documentation content intended to communicate embedded assistance information to the user, regardless of format, used in conjunction with the equipment documentation.

5.2.23 *inspect* — see test.

5.2.24 *inspection* — determination of the serviceability of an item (e.g., component part, assembly) by comparing its physical, mechanical, and/or electrical characteristics with specifications through examination (e.g., by sight, sound, or feel).

5.2.25 *logic tree* — a diagram comprised of a branching series of questions, resulting in a “yes” or “no” answer, used during troubleshooting to determine and resolve a problem.

5.2.26 *maintain* — the act of sustaining equipment in a condition to perform its intended function.

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5.2.27 *maintenance task* — a series of related maintenance procedures (e.g., adjust, align, calibrate, check, disassemble, reassemble, inspect, rebuild, remove/reinstall, repair, replace) with a definite beginning and end.

5.2.28 *operate* — the act of using equipment for its intended purpose without change.

5.2.29 *part* — see component part.

5.2.30 *preventive maintenance* — the performance of preventive actions (e.g., scheduled inspections, maintenance tasks) during a scheduled downtime state designed to reduce the likelihood of equipment failure during operation when it is performing its intended function (e.g., running production units). Also sometimes called scheduled maintenance.

5.2.31 *product notices* — documentation provided over time by the supplier about the equipment to notify the purchaser of specific updates, actions required, changes, etc.

5.2.32 *reassemble* — the step-by-step putting back together of a subassembly or assembly.

5.2.33 *rebuild* — consists of those services/actions necessary for the restoration of unserviceable component parts, subassemblies, assemblies, or equipment to a like-new condition in accordance with original manufacturing tolerances or specifications.

5.2.34 *recondition* — restore an item (e.g., component part, subassembly) to the original normal operating condition by readjustments and material replacement.

5.2.35 *remove/reinstall* — to remove and reinstall the same field-replaceable unit (FRU) when required to perform service or other maintenance tasks.

5.2.36 *repair* — the act of restoring component parts, subassemblies, assemblies, or equipment to operational status by performing one or more maintenance tasks (e.g., adjust, align, calibrate, replace), thereby correcting specific damage, fault, malfunction, or failure.

5.2.37 *replace* — to remove an unserviceable field-replaceable unit (FRU) and install a serviceable FRU in its place.

5.2.38 *revision* — the unique identification (e.g., number, letter, date) of any version of documentation content approved for release with changes that are strictly controlled.

NOTE 4: Different revisions of documentation content may occur to fix an error, through the natural development of the equipment, because of maintenance procedure improvement, etc.

5.2.39 *scheduled maintenance* — see preventive maintenance.

5.2.40 *schematic diagram* — a graphic representation showing the interrelationship of each component part or assembly in the subsystem/equipment. The essential characteristic of these diagrams is that every maintenance-significant functional component part and assembly is separately represented. Also, where appropriate, voltage readings are shown.

5.2.41 *sign-off* — see acceptance.

5.2.42 *simulation* — any representation or imitation of reality used as an instructional strategy to teach problem solving, procedures, or operations by immersing learner in situations resembling reality. The learner's actions can be analyzed, feedback about specific errors provided, and performance can be scored.

NOTE 5: Simulations provide safe environments for users to practice real-world skills. They can be especially important in situations where real errors would be too dangerous or too expensive.

5.2.43 *subassembly* — two or more component parts joined together to perform a specific function and capable of disassembly.

5.2.44 *subsystem* — an integrated structure of component parts, subassemblies, and assemblies capable of performing, in aggregate, one or more specific functions within an equipment.

5.2.45 *system* — the combination of an equipment and its associated operating environment (e.g., operator, host controller, automation interface) required to perform an operation or activity (e.g., processing, transporting, storing).

5.2.46 *task* — a series of procedural action steps taken to accomplish a part of a procedure typically used to break a complex procedure down into parts.

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5.2.47 *test* — to verify the serviceability of an item (e.g., component part, subassembly, assembly, equipment) by comparing its physical, mechanical, and/or electrical performance characteristics with prescribed standards or specifications through measurement or examination (e.g., by sight, sound, or feel).

5.2.48 *training certification* — training documentation showing student's completion of all defined qualifications required to accomplish a specific job, operation, or process.

5.2.49 *training documentation* — recorded documentation content intended to communicate equipment information to the user, regardless of format, typically used in conjunction with training classes provided by suppliers to enhance the skill and knowledge levels of the intended user.

5.2.50 *troubleshooting* — the act of determining the root cause of a fault, problem, malfunction, or failure.

5.2.51 *tutorial* — typically a connected series of test cases that lead the user through the key features of the software, help, or documentation to help the user learn how to use the software, help, or documentation.

5.2.52 *unit* — any wafer, die, packaged device, or piece part thereof (includes product and non-product units).

5.2.53 *unscheduled maintenance* — see corrective maintenance.

5.2.54 *video* — a medium for delivering information created from the recording of real events into both video and audio components, to be viewed and heard at the same time. The initial recording, typically on analog or digital videotape, is converted to a digital compressed format like Moving Picture Experts Group (MPEG) or audio visual interleave (AVI).

6 General Documentation Recommendations

6.1 Supplier should provide up-to-date and verified documentation at the time of equipment acceptance that accurately represents the equipment information (e.g., purchaser's specific configuration).

6.2 If upgrades and modifications installed on the equipment throughout the installation, acceptance, and warranty periods affect documentation, then supplier should provide revised documentation to the purchaser in all media formats provided with the equipment.

6.3 Supplier should provide schematic diagrams, which are in electronic documentation format, in color if the supplier's original schematic diagram uses color coding (e.g., for line types).

6.4 Supplier should provide electronic documentation that allows for maximum content to be displayed to the user (e.g., minimum-sized headers, borders, and/or menu bars; user-selectable minimizing of headers, borders, and/or menu bars).

6.5 If practical, supplier should provide static and moving graphics in electronic documentation that allow for high resolution scaling by the user (e.g., graphics created using scaleable vector graphics [SVG] format) unless such scaling or motion puts supplier intellectual property (IP) at risk.

NOTE 6: Refer to Related Information 2 for common electronic documentation format types.

6.6 *Supplier Shipping Documentation (if Supplier is Responsible for Shipping Instead of the Purchaser)*

6.6.1 Supplier or freight forwarder/carrier should provide a complete waybill/bill of lading documentation.

6.6.2 Supplier should require freight forwarder/carrier to provide shipping alerts to the contacts (e.g., e-mail addresses) that purchaser provides in the purchase order (P.O.).

6.6.2.1 Freight forwarder/carrier should include all flight details and invoice numbers in the shipping alerts.

6.6.3 Supplier should require freight forwarder/carrier to fax invoice copies and air waybills to the fax number that purchaser provides in the P.O.

7 Equipment Documentation

7.1 *Generic Documentation Content for Each Manual/Documentation Collection*

NOTE 7: This section and the following ones primarily contain lists of documentation content types, with clarifications as needed, for each type of documentation specified. The supplier should determine what is proprietary or IP-related information.

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NOTE 8: As technical documentation generally transitions away from traditional, linear manuals and more towards modular, topic-based electronic documentation, some content identified herein may be easily included as metadata instead. Because SEMI E36 addresses information tagging (i.e., metadata) and information tagging is outside the scope of this standard (see ¶ 3.4.2), see SEMI E36 for details. Because not all suppliers and users may make this documentation type shift at the same time, a substantial transition period may likely occur in the industry. During this transition period, traditional terms (e.g., manuals) describing documentation continue to be used for clarity.

7.1.1 Manual/Documentation Collection Revision Status (e.g., Revision Number, Revision Date).

7.1.2 Supplier Name and Contact Information (e.g., Address, Phone Number, Web site).

7.1.3 Equipment Covered.

7.1.4 Revision History (e.g., Revision Number, Revision Date, Change Descriptions).

7.1.5 *References* — References/links to other related documents or documentation collections.

7.1.6 Table of Contents.

7.1.7 List of Illustrations (e.g., Line Art, Schematics, Photographs).

7.1.8 List of Tables.

7.1.9 How to Use Manual/Documentation Collection with Other Manuals/Documentation Collections.

7.1.10 List of Related Documents or Documentation Collections.

7.1.11 Required Service Tooling.

7.2 *Introduction*

7.2.1 *Equipment Description*

7.2.1.1 Purpose/function.

7.2.1.2 Basic equipment structure/features.

7.2.2 *Equipment Specifications*

7.2.3 *Configuration*

7.2.3.1 Hardware features supplied.

7.2.3.2 Software features supplied.

7.2.4 *Model Number and/or Name of Equipment*

7.2.5 *Accessories*

7.3 *Environmental, Health, and Safety Documentation Content*

7.3.1 *Documentation* — As specified in SEMI S2.

NOTE 9: SEMI S2 refers to other SEMI documents (e.g., SEMI S12, SEMI S14) that contain criteria for documentation.

7.3.2 *Documentation* — As specified in SEMI S8.

7.3.3 *Documentation* — As specified in SEMI S13.

7.3.4 *Documentation* — As specified in SEMI S16.

7.3.5 *Documentation* — As specified in SEMI S20.

7.3.6 *Documentation* — As specified in SEMI S23.

7.4 *Assembly, Packaging, Transportation, Receiving, Unpacking, Relocation/Move-In, and Hookup/Installation Documentation Content*

7.4.1 *Documentation* — As specified in SEMI E6.

7.4.2 *Documentation* — As specified in SEMI E76.

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