SEMI E126-0703
SPECIFICATION FOR EQUIPMENT QUALITY INFORMATION PARAMETERS (EQIP)

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1 Purpose

1.1 This provisional standard identifies key equipment quality information parameters, or EQIPs, for equipment process types or groups. The identification of these quality parameters is intended to help equipment users and suppliers specify and utilize capabilities for process control.

1.2 This provisional standard is designed to be updated as EQIPs are identified for new and/or existing equipment process types in this provisional standard.

1.3 *Intended Audience* — This provisional standard is intended for use by OEMs, users, and third party equipment and process control system suppliers who need to achieve equipment and process control of select process quality parameters, utilizing standardized methods for actuation of process control parameters.

2 Scope

2.1 The scope of this provisional standard is limited to identifying key EQIPs for select equipment process types, specifying that the equipment shall indicate a non-null list of settable process program parameters that impact each of these EQIPs, and specifying that the equipment shall allow individual actuation of each of these parameters using SEMI standard methods. The provisional standard is not intended to identify all quality parameters. It is not intended to specify a complete set of equipment types.

2.2 While this provisional standard requires that a capability shall exist for actuation of process program parameters to influence key EQIPs, the standard does not specify how this actuation will take place. For example, it does not define the communication protocol for actuation or the equipment or host models that will support and enable this actuation capability. The scope is limited to defining the key EQIPs and their linking to process program parameters.

2.3 The provisional standard is structured so that EQIPs for equipment types may be added to an existing set, as the community reaches consensus on these additions. Further, EQIPs may be defined for a new equipment type not previously addressed in this provisional standard. Additions to the provisional standard are made utilizing the SEMI standards balloting process.

2.4 This document is designated a provisional standard because it defines quality parameters for only a few equipment types. It is anticipated that quality parameters will be defined for additional equipment types. When a sufficient number of equipment types have been addressed by this standard, as determined by the equipment control systems task force, a recommendation to remove the provisional designation for this standard will be made.

NOTICE: This document does not purport to address safety issues, if any, associated with its use. It is the responsibility of the user of this provisional standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to its use.

3 Limitations

3.1 The provisional standard is structured so that EQIPs for equipment types may be added to an existing set, as the community reaches consensus on these additions. Further, EQIPs may be defined for a new equipment type not previously addressed in this provisional standard. Thus, this provisional standard does not necessarily specify a complete EQIP set for an equipment type, and does not necessarily address all equipment types.

3.2 This provisional standard does not specify how actuation of equipment settable process program parameters associated with these EQIPs will take place. It is limited to referencing other SEMI standards as examples of standardized methods for providing this capability.

4 Referenced Standards

4.1 *SEMI Standards*

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

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

SEMI E37 — High-Speed SECS Message Services (HSMS) Generic Services

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SEMI E39 — Object Services Standard: Concepts, Behavior, and Services

SEMI E40 — Standard for Processing Management

SEMI E54 — Sensor/Actuator Network Standard

SEMI E94 — Provisional Specification for Control Job Management

SEMI E98 — Provisional Standard for the Object-Based Equipment Model (OBEM)

4.2 *Other Sources*

Object Oriented Modeling and Design, — Prentice Hall, Englewood Cliffs, NJ, c1991 by James Rumbaugh, et. al.

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

5 Terminology

5.1 *Abbreviations and Acronyms*

5.1.1 *EQIP (Equipment Quality Information Parameter)* — a parameter that relates an aspect or quality of a wafer process or product. Specifically, an EQIP is a parameter of measure on a wafer that relates to the quality of the wafer, i.e., the closeness of the wafer to a design specification or the performance of the device being produced. EQIPs may be measurable directly or indirectly. EQIPs do not have to be measured at the process tool. EQIPs may also be referred to as "process quality parameters".

5.1.2 *PPP (Process Program Parameter)* — a parameter in the preplanned and reusable portion of the set of instructions, settings, and parameters under control of the equipment that determine the processing environment seen by the manufactured object and that may be subject to change between runs or processing cycles.

5.1.3 *R2R Control—Run-to-Run Control* — techniques for varying settings in one run based on analysis of either incoming product (feedfoward) or product from an earlier run (see SEMI E98). In this document, R2R Control is further defined as a form of discrete process control in which settable process attributes are adjusted, generally between process runs, to better achieve selected process quality targets.

5.2 *Definitions*

5.2.1 *equipment type* — a categorization or grouping of equipment based on capability, method of operation, effect on wafer, etc. The boundary of the type should be aligned with a generally perceived categorization of equipment in the industry.

5.2.2 *linked process program parameter* — an equipment process program parameter that can be altered to effect change of an EQIP with which it is associated.

6 Background

6.1.1 Equipment processes can generally be categorized or grouped into types. Further, each type can be associated with a finite set of quality parameters that relate to the quality of process on the wafer. These process quality parameters are a function of tunable process inputs as well as external uncontrollable conditions, as shown in Figure 1.

6.1.2 Control solutions can provide a capability to improve process quality parameters by suggesting changes to tunable input parameters. Standards are needed to identify control capabilities for equipment. Specifically, a standard is needed to specify these quality parameters so as to guide the use of metrology and process program modification to support capabilities such as run-to-run (R2R) control.

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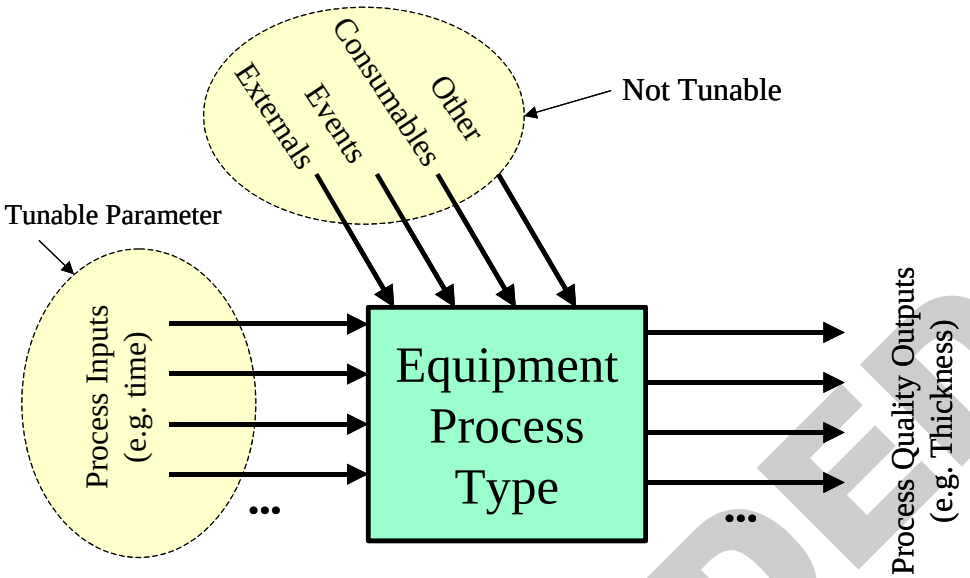

Figure 1
Equipment and Process Quality Parameters

7 Equipment Type Organization

7.1 This provisional standard categorizes semiconductor equipment into types according to functionality, effect, and or operational characteristics. The number of types is not limited. An equipment complying with this standard must belong to at least one type; an equipment can belong to more than one type. Note that the list of types in this standard does not necessarily provide complete specification for all equipment. Note also that the list of types is extendible as new equipment types are added.

7.2 For each specified equipment type, the following information shall be provided.

7.2.1 *Name* — A name for the type shall be provided that represents a common name used for this equipment type in the industry.

7.2.2 *Definition* — A definition of the type shall be provided. This definition shall indicate what the equipment does and, as necessary, how it does it. It shall also provide a scope of the equipment type, indicating as necessary which equipment belongs to this type and which equipment does not belong to this type.

7.2.3 List of Equipment Quality Information Parameters (EQIPs). For each equipment type, a non-null list of EQIPs must be specified.

7.3 For each EQIP specified, the following information shall be provided.

7.3.1 *Name* — A name for the EQIP shall be provided that represents a common name used for this parameter in the industry.

7.3.2 *Definition* — A precise definition of the EQIP shall be provided. If the parameter is derived from measurement data, the form of this derivation shall be provided. If this parameter is provided in different variants, each of these variants shall be listed and defined. The definition could include an indication of how the parameter is or is not measured.

7.3.3 *Format Descriptor Fields* — A listing of data type fields to be used to specify the format of an EQIP shall be provided. These fields could include data type, data length, data units, indication of requirement, range of values, and values used to represent error/fault/invalid data, etc. Note that the specification does not contain values for these fields; it is the listing of the fields.

7.4 *Specification Mechanism* — The listing and definitions of equipment types and EQIPs, and linking of EQIPs to types are specified utilizing the following components.

7.4.1 *Type Definitions Table* — This table includes a definition of all type elements. Fields in this table include name and definition, as specified in Section 7.2.

7.4.2 *Equipment Type to EQIP Associations Table* — This table provides a linkage between equipment type elements and EQIPs. Fields in this table include Equipment Type name, and "linked" EQIPs.

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