

SEMI F107-0309

GUIDE FOR PROCESS EQUIPMENT ADAPTER PLATES

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1 Purpose

1.1 The purpose of the process equipment adapter plate guide is to provide guidance on the expectations and application for process equipment adapter plates. The use of adapter plates has been shown to reduce the time and cost associated with process equipment installation. Additionally, there is a potential for reduced floor space and facility connections to the equipment. The incorporation of adapter plates in the initial design of process equipment may benefit equipment suppliers and IC manufacturers.

2 Scope

2.1 This document establishes guidance for adapter plate design and installation. Adapter plates are subsystems of the process equipment and will conform to many of the design practices employed by primary system equipment suppliers.

NOTE 1: A third party may manufacture the adapter plate under the control of the process equipment manufacturer.

2.2 This Guide is intended to address the application of adapter plates for process equipment cluster tools and single module process equipment whose installation requirements are typically complex (e.g., more than seven facility connections and more than three utility types, excluding power and communications). The adapter plates are used to support installation of the chassis rather than peripheral support equipment. This Guide's focus is 300 mm and next generation wafer equipment requirements, but application to other wafer size equipment or non-wafer equipment may be appropriate and should be discussed by supplier and end-user.

2.3 It is intended that each adapter plate design will be unique for a particular process equipment type as determined by the equipment suppliers.

NOTE 2: Equipment suppliers can use their adapter plates across numerous equipment sets.

2.4 The utility types and systems covered in this Guide are listed in Table 1.

Table 1 Service Categories

<i>Service Category Number^{#1}</i>	<i>Service Category Description</i>
100	Equipment Identification
200	Environmental Conditions
300	Physical Characteristics
400	Electrical Power
500	Water
600	Bulk Chemicals
700	Drains
800	Gases
900	Vacuum
1000	Exhaust

#1 See SEMI E6 for information on the Service Categories.

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 This Guide does not address the process capability of the semiconductor equipment.

NOTE 3: It is the equipment supplier's responsibility to design the process equipment and adapter plate(s) to provide the required process capability.

3.2 This Guide does not address process consequences of using different utilities or designing for different rates of consumption.

3.3 This Guide is not intended to be applied retroactively to equipment models already designed.

3.4 This Guide does not address jigs, templates or interface boxes.

NOTE 4: See SEMI E70 for additional discussion and application of these devices.

4 Referenced Standards and Documents

4.1 SEMI Standards and Safety Guidelines

SEMI E6 — Guide for Semiconductor Equipment Installation Documentation

SEMI E49 — Guide for High Purity and Ultrahigh Purity Piping Performance, Subassemblies, and Final Assemblies

SEMI E70 — Guide for Tool Accommodation Process

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

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

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

SEMI S22 — Safety Guideline for the Electrical Design of Semiconductor Manufacturing Equipment

4.2 International Code Council¹

IBC — International Building Code

4.3 NFPA Document²

NFPA 704 — Standard System for the Identification of the Hazards of Materials for Emergency Response

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

5 Terminology

5.1 Abbreviations and Acronyms

5.1.1 *AMHS* — automated material handling system

5.1.2 *ATL* — accredited testing laboratory

5.1.3 *CDS* — chemical distribution system

5.1.4 *CE* — European conformity

5.1.5 *CIM* — computer integrated manufacturing

5.1.6 *CMP* — chemical mechanical polishing

5.1.7 *DI* — de-ionized

5.1.8 *EMC* — electromagnetic compatibility

5.1.9 *FPD* — flat panel display

5.1.10 *HF* — hydrofluoric acid

1 International Code Council, 500 New Jersey Avenue, NW, 6th Floor, Washington, DC 20001-2070, USA; <http://www.iccsafe.org>

2 National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02269, USA; Telephone: 617.770.3000; Fax: 617.770.0700; <http://www.nfpa.org>

5.1.11 *IC* — integrated circuit

5.1.12 *MEMS* — microelectromechanical systems

5.1.13 *POC* — point of connection

5.1.14 *RF* — radio frequency

5.2 Definitions

5.2.1 *accredited testing laboratory* — an independent organization dedicated to the testing of components, devices, or systems; competent to perform evaluations based on established safety standards; and recognized by a governmental or regulatory body. [SEMI S2]

5.2.2 *adapter plate* — a subsystem of the process equipment that contains connections to the chassis as well as to the facility connectors. The adapter plate is intended to be installed and connected to facility connectors before placement of the chassis.

5.2.3 *adapter plate hookup* — connection of facilities connectors to equipment connectors that are included in the adapter plate.

5.2.4 *automated material handling system (AMHS)* — a factory system used to transport and store carriers. AMHS has two major types of subsystems: an automated transport system and one or more storage systems (stockers). [SEMI E98]

5.2.5 *bulkhead connector* — a pipe, tube, or duct that ends in a common industry fitting or end condition. The pipe, tube, or duct section is secured to the adapter plate.

5.2.6 *chassis* — the subsystem or subsystems of the equipment to which utilities would be connected were an adapter plate not used.

5.2.7 *chemical distribution system (CDS)* — the collection of subsystems and components used in a semiconductor manufacturing facility to control and deliver process chemicals from source to point of use for wafer manufacturing processes. [SEMI S2]

5.2.8 *easement space* — the floor space that must remain clear to the rear and sides of the piece of equipment (but not in front of the load face plane). This includes safety aisles, ergonomic maintenance access space, component removal space, and room for doors to swing out. [SEMI E72] (See Figure 1.)

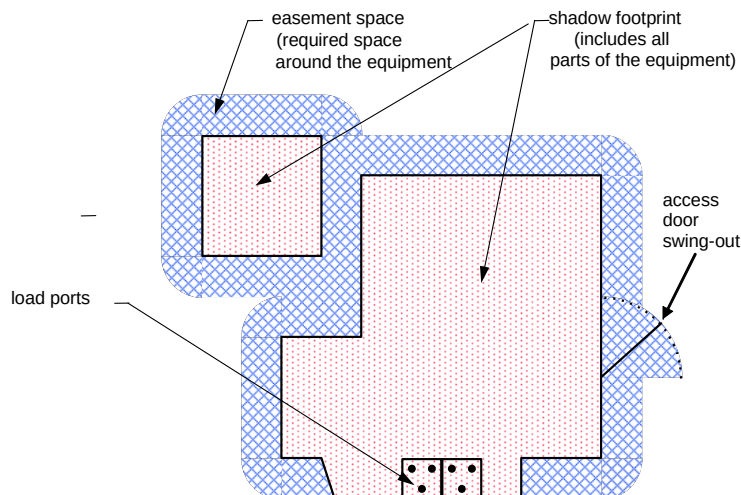


Figure 1
Example of Easement Space

5.2.9 *equipment configuration* — the arrangement, location, type and quantity of facility connections needed for installation.

5.2.10 *equipment connector* — the part of the equipment to which a facility connector is connected to allow transfer of a facility service to or from the equipment. A connector may be device (e.g., a face-seal fitting or electrical plug) or the unterminated end of what carries the utility (e.g., a tube stub or a wire pigtail). An equipment connector may be part of an adapter plate or of some other part of the equipment.

5.2.11 *fab* — the main cleanroom facility for processing semiconductor wafers. Abbreviation for fabrication facility.

5.2.12 *facility connector* — the part of the facility to which an equipment connector is connected to allow transfer of a facility service to or from the equipment. A connector may be device (e.g., a face-seal fitting or electrical plug) or the unterminated end of what carries the facility service (e.g., a tube stub or a wire pigtail).

5.2.13 *footprint* — the total area or floor space consumed by a piece of equipment when viewed perpendicular to the area of reference (e.g., normally, when viewed from directly overhead and considering the floor). [SEMI E76]

5.2.14 *hazardous voltage* — voltages greater than 30 Volts RMS, 42.4 Volts peak, or 60 Volts DC. [SEMI S22]

5.2.15 *hookup* — the act of connection of interconnections and of facilities connectors to equipment connectors.

5.2.16 *installation* — the activities performed after the equipment is received at a user site through preparation for initial service, including transportation, lifting, uncrating, placement, leveling, and facilities fit up. [SEMI S8, SEMI S24]

5.2.17 *interconnection* — connections between the chassis and peripheral subsystems and support equipment.

5.2.18 *interface box* — an enclosure located between the chassis and facility services typically containing subsystems for pressure regulation and filtration. It functions to consolidate facility service requirements to single points of connection. The interface box can provide location and ability to install and qualify utilities in advance of equipment delivery. [SEMI E76]

5.2.19 *jig* — a three dimensional fixture, typically a frame that contains equipment installation aides which serve to indicate location and type of connector needed for equipment hook-up. [SEMI E76]

5.2.20 *microelectromechanical systems (MEMS)* — the integration of mechanical and electronic elements (sensors, actuators, etc.) on a common substrate. The micromechanical components are fabricated using “micromachining” processes that selectively etch away parts of the substrate or add new structural layers to form the mechanical or electro-mechanical devices.

5.2.21 *pedestal* — structural support element upon which equipment or raised floor rests. [SEMI E70, SEMI E76]

5.2.22 *point of connection (POC)* — the physical location where the equipment connector and the facility connector are connected to each other.

5.2.23 *pre-facilitization* — the stage in the equipment installation process that follows base build and precedes chassis placement. Pre-facilitization brings the various utilities close to the new equipment location, including new utilities required to prepare the facility to accept the equipment.

5.2.24 *process equipment* — equipment used in the design, development, manufacture, assembly, measurement and test of semiconductors

5.2.25 *qualification* — certification of compliance with contractual stipulations before release to manufacturing production use. [SEMI E70]

5.2.26 *raised floor* — the removable floor system installed above the building floor within cleanroom environments to control air flow and allow access for utility routing and connection. [SEMI E76]

5.2.27 *seismic bracing* — structural reinforcement to minimize damage due to earthquakes. [SEMI E76]

5.2.28 *single line drop* — a hookup strategy where a piece of processing equipment has only one point of connection per facility service. All manifold for an individual service is handled within the equipment. [SEMI E76]

5.2.29 *subfab* — the area below or outside of the cleanroom production area that can be a single or multiple levels and may or may not be clean. [SEMI E76]

5.2.30 *subsystem* — a subsystem is an assembly of two or more components that is manufactured as a single entity. A subsystem must be combined with one or more additional components or subsystems to form a complete system. [SEMI F1]

5.2.31 *supplier* — provider of equipment or services to the user. Also called equipment vendor or equipment manufacturer.

5.2.32 *support equipment* — ancillary equipment not part of the process equipment main chassis. [SEMI F49]

5.2.33 *template* — a dimensional outline of the equipment footprint including overall dimensions, equipment datum point, utility connector/penetration locations, equipment interconnection/penetration locations, maintenance and access spaces, and wafer load/unload stations. It can be made from any cleanroom compatible material.

5.2.34 *user* — party that acquires equipment for the purpose of using it to manufacture semiconductors. See also the definition for *supplier*. [SEMI S2]

5.2.35 *utility* — power, data communications, or any gas, liquid or other material which is supplied to or carried away from the equipment.

6 General Adapter Plate Guidelines

NOTE 5: To maximize the benefit of using an adapter plate, the user should have the support systems, subsystems, and documentation early enough to permit planning and completion of the pre-delivery work before the chassis is scheduled to be placed in its intended location.

NOTE 6: This guide does not address qualification of lines to adapter plate. Users and suppliers should consider the qualification of lines to the adapter plate prior to the equipment placement.

6.1 General Design Considerations

6.1.1 High-level constraints for design of adapter plates include:

6.1.1.1 The adapter plate should be installed within the process equipment footprint and easement space (see Figure 1)

6.1.1.2 The adapter plate(s) should contain all equipment connectors, other than electrical power and communications, to enable process equipment hookup to facility connectors.

6.1.1.3 The adapter plate designer should consider appropriate process equipment design and installation standards.

6.1.1.4 The adapter plate should use common connector types and sizes. Uncommon connectors may be used only where technically justified.

6.1.1.5 The adapter plate(s) should use a single facility connection for each utility unless justified by equipment supplier.

6.1.1.6 The adapter plate(s) should be designed so that proper alignment between adapter plate(s) and process equipment and between the chassis and the facility and AMHS can be achieved and maintained.

6.1.1.7 Equipment supplier documentation should show the location and position of the adapter plate relative to the equipment.

NOTE 7: If the end user cannot install the equipment and adapter plate according to the supplier's documentation, the supplier should be notified in advance of the planned install date.

6.1.2 *Future Equipment Compatibility* — Equipment suppliers should consider that, after their first generation of process equipment for which an adapter plate is designed, all future process equipment in an equipment family will also use an adapter plate. Therefore, the equipment supplier should consider the potential for reuse of adapter plates as equipment sets are upgraded.

6.1.3 Design of the adapter plate should conform to good engineering practices and relevant national and international standards and equipment codes for process equipment design, installation and safety.

6.1.4 Adapter plate dimensions (3-dimensional information) should be delivered to user so the latter can identify potential clearance and height issues.

NOTE 8: An additional adapter plate may enable faster relocation of equipment.

6.2 *Materials of Construction*

6.2.1 Adapter plate materials of construction should be selected with consideration to weight in order to minimize logistics and ergonomic issues during its installation. For example, an adapter plate could be designed so it could be moved in by two people without lifting equipment.

6.2.2 Materials should conform to current best practices and industry standards and ensure compatibility with gasses, liquids, and effluents. Materials should meet outgassing and cleanroom specifications of the process equipment of which is it a subsystem.

6.3 When feasible, support equipment that is not included in the chassis should be installed and the support equipment and its connections to the adapter plate qualified prior to the installation of the chassis. This equipment includes:

- Remote vacuum pumps
- Remote abatement units
- Remote chillers
- Remote power equipment
- Other peripheral equipment

6.4 *Adapter Plate Point of Connection Grouping*

6.4.1 Adapter plate connectors should be grouped together by service type to ensure ease of installation and qualification of the equipment.

6.4.2 The following groups should be considered during the configuration of the adapter plate: utilities requiring ventilation, special fittings, double containment and voltage levels.

6.4.3 Arrangement of the bulkhead fittings should be considered during adapter plate design. Design should provide spacing and clearance allowances for fastening tools, milling heads, and welding heads.

6.4.4 Designers should adhere to the groups defined in Table 1 when locating these groups of connectors on process equipment.

6.5 *Routing*

6.5.1 Segregation of utility types should be considered and employed where practical; e.g., grouping of electrical connectors together and segregation of electrical from fluid connectors. When segregating utility types, the designer should consider relevant national and international standards, codes and end user requirements.

6.5.2 Consideration should be given to grouping utility types to POCs close to each other. Manifolding internal to the process equipment, with minimal facility connections, should be considered.

NOTE 9: Internal equipment space limitations may preclude the use of internal manifolding and may require the designer to consider multiple adapter plates; such as the case for cluster tools. Equipment points of connection may not permit manifolding in all cases.

6.5.3 To ensure flexibility and extendibility for future modifications or upgrades of the process equipment, the use of interchangeable exhaust POC, vents, and blankouts through the adapter plate should be considered.

7 **Facility Utility Systems Guidance**

7.1 Facility utility system specifications for adapter plates should match the equipment supplier's specification document in SEMI E6. The utility requirements of the adapter plate should use the data sheets of SEMI E6 for documentation. Additional guidance for each utility type is listed below.

NOTE 10: Refer to Related Information 1 for additional guidance for facility systems infrastructure requirements and design practices.