

SEMI E49.5-1104

GUIDE FOR ULTRAHIGH PURITY SOLVENT DISTRIBUTION SYSTEMS IN SEMICONDUCTOR MANUFACTURING EQUIPMENT

This Standard was technically approved by the Gases Global Technical Committee. This edition was approved for publication by the global Audits and Reviews Subcommittee on August 16, 2004. Available at www.semi.org in November 2004; originally published in 1995; previously published February 1998.

NOTICE: This Document was completely rewritten in 2004.

1 Purpose

1.1 This Document specifies guidelines for ultrahigh purity (UHP) solvent distribution systems in semiconductor production equipment.

2 Scope

2.1 The distribution systems consist of stainless steel piping designed to supply flammable solvents only.

2.2 Typical tools include photolithography track equipment, solvent wet stations, and isopropyl alcohol vapor dryers.

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 SEMI Standards and Safety Guidelines

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

SEMI E49.6 — Guide for Subsystem Assembly and Testing Procedures – Stainless Steel Systems

SEMI F1 — Specification for Leak Integrity of High-Purity Gas Piping Systems and Components

SEMI F19 — Specification for the Surface Condition of the Wetted Surfaces of Stainless Steel Components

SEMI F20 — Specification for 316L Stainless Steel Bar, Forgings, Extruded Shapes, Plate, and Tubing for Components Used in General Purpose, High Purity and Ultra-High Purity Semiconductor Manufacturing Applications

SEMI F32 — Test Method for Determination of Flow Coefficient for High Purity Shutoff Valves

SEMI F37 — Method for Determination of Surface Roughness Parameters for Gas Distribution System Components

SEMI F60 — Test Method for ESCA Evaluation of Surface Composition of Wetted Surfaces of Passivated 316L Stainless Steel Components

SEMI F73 — Test Method for Scanning Electron Microscopy (SEM) Evaluation of Wetted Surface Condition of Stainless Steel Components

SEMI F78 — Practice for Gas Tungsten Arc (GTA) Welding of Fluid Distribution Systems in Semiconductor Manufacturing Applications

SEMI F81 — Specification for Visual Inspection and Acceptance of Gas Tungsten Arc (GTA) Welds in Fluid Distribution Systems in Semiconductor Manufacturing Applications

3.2 ASTM Standards¹

3.3 See § 3.3 of SEMI E49.

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

¹ ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, USA; Telephone: +1.610.832.9585, Fax: +1.610.832.9555, <http://www.astm.org>

4 Terminology

4.1 See § 4 of SEMI E49.

5 Performance Guidelines

5.1 See SEMI E49.6 for recommended solvent system testing procedures.

5.2 *Reliability and Maintainability Indices* — Equipment supplier should provide actual gas system performance data and/or component reliability data, accompanied by the associated failure analysis method.

6 Design Guidelines

6.1 All weld joints should be automatically orbital butt welded in accordance with SEMI F78 and inspected per SEMI F81.

6.2 Mechanical fittings should be used where required for component removal/replacement.

6.3 Dead volumes should be less than three pipe diameters in length/height. Blind runs such as pressure gauges should not be used.

6.4 A means of process liquid sampling should be installed as close as possible to point of dispense.

6.5 Incoming process liquids require filters and should be located downstream of any regulator and as close as possible to point of dispense.

6.6 The system internal volume should be minimized by use of dead space free (DSF) branch valves and/or multi-component integrated assemblies.

6.7 Design should include a means of flow through flushing and draining for removable components or assemblies.

6.8 Pumping systems should include surge/pulse suppression devices and provisions for vibration isolation.

6.9 Supply and drain lines on a recirculation system should be separated by an isolation valve. The system should not use one line to perform both functions.

6.10 All filters should be able to be isolated from process stream for maintenance.

6.11 Ball and needle type valves should not be used.

6.12 Backflow/back pressure protection should be included in the system.

6.13 For processes requiring pressure control, regulators should be included in the system. Pressure transducers and a means of pressure display should be included on the equipment.

6.14 The systems should have a means of manifolding supply and drain lines onboard, so that there is a single point connection for each individual liquid.

7 Materials Guidelines

7.1 *Stainless Steel*

7.1.1 Components should be fabricated from electropolished 316L stainless steel per SEMI F20.

7.2 *Other Materials*

7.2.1 Materials for valve seats, diaphragms, gaskets, and O-rings should be chemically compatible with the liquid flowing through the system. All materials exposed to the liquid should be reported.

8 Component Guidelines

8.1 Components in subassemblies should comply with the surface requirements of SEMI F19, and with the additional requirements listed in Table 1.

8.2 All components should meet the inboard/outboard leak requirements of SEMI F1.

8.3 Valves should be springless, packless, diaphragm type with all metal bonnet seals. All valves should meet the leak across the seat requirements of SEMI F1.