

SEMI E49.4-0419

GUIDE FOR ULTRAHIGH PURITY SOLVENT DISTRIBUTION SYSTEMS WITH METALLIC FLUID PATHS IN SEMICONDUCTOR MANUFACTURING EQUIPMENT

This Standard was technically approved by the Liquid Chemicals Global Technical Committee. This edition was approved for publication by the global Audits and Reviews Subcommittee on December 13, 2017. Available at www.semiviews.org and www.semi.org in April 2019; originally published in 1995; previously published February 1998.

NOTICE: The section symbol (§) is used to reference a numbered section, paragraph, or header and all subordinate paragraphs, headers, and embedded material (i.e., EXCEPTIONs, lists) therein. The paragraph symbol (§) is used to reference a particular numbered paragraph and embedded material therein. When duplicated (i.e., §§ and §§) the symbols are used to reference more than one section or paragraph, respectively.

NOTICE: Paragraphs entitled 'NOTE:' are not an official part of this Standard or Safety Guideline and are not intended to modify or supersede the official Standard or Safety Guideline. These have been supplied by the global technical committee to enhance the usage of the Standard or Safety Guideline.

NOTICE: This Standard was completely rewritten in 2018.

1 Purpose

1.1 This Guide provides design guidelines for liquid solvent distribution systems in semiconductor production equipment.

2 Scope

2.1 The distribution systems consist of stainless steel (SS) piping and enclosure(s) designed to supply flammable liquid solvents only, at system operation and delivery pressures of less than 100 psig.

2.2 Typical processes include photolithography, solvent distribution systems, clean, etch, and solvent 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 Limitations

3.1 This Guide, if used, is applicable only for systems that have stainless steel wetted process designs. Refer to SEMI E49.5 for systems that utilize polymeric wetted process designs.

4 Referenced Standards and Documents

4.1 SEMI Standards and Safety Guidelines

SEMI C87 — Test Method for Determining Roughness of Polymer Surfaces Used in Ultrapure Water and Liquid Chemical Distribution Systems by Contact Profilometry

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

SEMI E49.5 — Guide for the Design of Ultrahigh Purity Solvent Distribution Systems in Non-Metallic Fluid Paths in Semiconductor Manufacturing Equipment

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 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

4.2 *ASTM® Standards*¹

ASTM A269 — Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service

ASTM A479 — Standard Specification for Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels

ASTM A632 — Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing (Small-Diameter) for General Service

ASTM F1375 — Standard Test Method for Energy Dispersive X-Ray Spectrometer (EDX) Analysis of Metallic Surface Condition for Gas Distribution System Components

ASTM F1394 — Standard Test Method for Determination of Particle Contribution from Gas Distribution System Valves

4.3 *ASME™ Standards*²

ASME SA479 — Specification for Stainless and Heat-Resisting Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels (ASTM A479/A479-90) (Boiler and Pressure Vessel Codes, 1989)

4.4 *SEMATECH Specifications*³

SEMASPEC 90120403B — Test Method for XPS Analysis of Surface Composition and Chemistry of Electropolished Stainless Steel Tubing for Gas Distribution System Components

SEMASPEC 90120573B — Test Method for AES Analysis of Surface and Oxide Composition of Electropolished Stainless Steel Tubing for Gas Distribution System Components

4.5 *United States Military Standards*⁴

MIL-STD-105D — Military Standard: Sampling Procedures and Tables for Inspection by Attributes

4.6 *Other Documents*

UNS S31603 — Composition of Standard Stainless Steels⁵

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

5 Terminology

5.1 *Definitions*

5.1.1 *filter* — a porous device, generally constructed of polymer, metal, or ceramics and housed in a metal chamber, which traps particles, preventing them from being transported downstream.

5.1.2 *filter cartridge* — the filtration media element.

5.1.3 *filter housing* — the shell that contains the filter cartridge.

5.1.4 *filtration* — the removal of suspended solids by passing water (or chemical) through some form of solid or semi-solid medium.

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>. ASTM trademark is owned by ASTM International.

² The American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990, USA; Telephone: +1.973.882.1170, Fax: +1.973.882.1717, <https://www.asme.org>. ASME trademark is owned by The American Society of Mechanical Engineers.

³ SEMATECH, 257 Fuller Road, Suite 2200, Albany, NY 12203, USA; Telephone: +1.518.649.1000, <http://www.sematech.org>.

⁴ United States Military Standards, available as freely downloadable PDF files from the ASSIST Quick Search website at <http://quicksearch.dla.mil>.

⁵ ASM International, ASM World Headquarters, 9639 Kingsman Road, Materials Park, OH 44073-0002, USA; Telephone: +1.440.338.5151, <https://www.asminternational.org>