

SEMI F46-0999

GUIDE FOR ON-SITE CHEMICAL GENERATION (OSCG) SYSTEMS

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NOTICE: This Standard or Safety Guideline has Inactive Status because the conditions to maintain Current Status have not been met. Inactive Standards or Safety Guidelines are available from SEMI and continue to be valid for use.

1 Purpose

1.1 This Guide establishes the minimum System and Overall Implementation requirements for requirement of On-Site Chemical Generation (OSCG) used in semiconductor manufacturing. It is also intended to establish a common basis for developing detailed guides in subsequent documents concerning design, performance, and certification of OSCG systems.

2 Scope

2.1 This Guide applies to the OSCG system design used for the generation of chemicals, particularly ultra high purity, used in the silicon wafer, integrated circuit, and/or substrate manufacturing processes. These will include, but are not limited to, various concentrations of NH_4OH , HCl , HF , and NH_4F aqueous solutions.

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 is not intended to cover all chemicals used in these processes but only to those that can be generated, on-site, by means of reacting ultra-pure process gas with the appropriate liquid solution.

3.2 This Guide is not intended to be applicable to 'point-of use' generated process solutions.

3.3 This Guide excludes construction protocols for OSCG such as clean manufacturing, integrity of fabrication, and prequalification of materials.

3.4 This Guide does not intend to cover all the important safety considerations which relate to the OSCG systems, feed gas, equipment, or installations.

4 Referenced Standards and Documents

4.1 SEMI Standards and Safety Guidelines

SEMI S2 — Safety Guideline for Semiconductor Manufacturing Equipment

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

5 Terminology

5.1 Definitions

5.1.1 *blending (or dilution)* — the combination of two or more chemicals (one of which may be DI water) to create the desired solution mixture.

5.1.2 *clean sampling* — a specifically designed scheme to allow for the taking of chemical samples, avoiding any contamination from the operator or background environment of the area.

5.1.3 *day tank* — a chemical storage vessel, of appropriate material(s), used to store a volume of product chemical that could be consumed in one or more days.

5.1.4 *DI water* — high purity 18 megohm water.

5.1.5 *OSCG system* — the stand-alone unit that produces (or uses) a high purity gas and reacts it with water (or the appropriate aqueous solution) to produce the desired ultra pure chemical solution. This unit is intended for use on the manufacturing site and in a centralized scheme to support all or a portion of the site's chemical requirement(s).

5.1.6 *overall implementation* — this term is used to refer to the entire scope for an OSCG installation, including the Gas Storage/Supply system, the OSCG system, chemical storage tanks, chemical plumbing, and interface with the chemical distribution system. Gas supplies are covered in related guides.

5.1.7 *process plumbing* — tubing or piping whose surface is directly in contact with the chemical. Typically constructed from high purity perfluorinated materials or other high purity polymers.

5.1.8 *product chemical* — the name given to the actual chemical produced on site by the OSCG system.

5.1.9 *pump* — a mechanical or pneumatically operated device used to create hydraulic force for chemical transfer.

5.1.10 *QC tank* — storage tank for the staging of chemical to be quality verified prior to release to the Product storage tank. This optional quality verification scheme allows for 100% chemical verification.

5.1.11 *secondary containment* — pipe or tubing that contains the process plumbing intended to provide a second level of containment in the event of failure of the primary process plumbing. Clear PVC pipe is typically, but not exclusively, used for the secondary containment.

5.1.12 *SPC scheme* — an alternate quality verification scheme that would involve random sampling and analysis of product chemical. This scheme relies on Statistical Process Control to monitor and ensure product chemical quality.

6 General Requirements

6.1 *Materials* — Only specific materials are permitted to be in direct contact with the gas(es) and/or chemical(s) used or produced in the OSCG system. This is driven by both chemical compatibility to ensure long term system survivability and product chemical purity.

6.2 *Cabinet Construction* — Polypropylene or other suitable materials house chemical handling components (pumps, valves, filters, etc.). All cabinets must be designed to be leak tight and provide a minimum of 110% liquid containment within the cabinet.

6.2.1 *Process Plumbing and Components* — Polymeric materials are recommended for all plumbing and components that will be in direct, routine contact with the chemical solutions.

6.2.2 *Feed Gas Plumbing and Components* — Feed Gas, prior to purification (when gas purification is part of the OSCG system), will be plumbed using compatible materials such as stainless steel.

6.2.3 *Storage Tanks* — Liner materials used in chemical storage tanks that will be in direct contact with the chemical solution will be chosen to maintain chemical purity.

6.3 Overall System Installation

6.3.1 All OSCG systems, support equipment, process plumbing, and tanks will be installed and facilitated according to vendor guide which ensures mechanical integrity, leak integrity, minimal contamination, and overall proper operation.

6.3.2 All OSCG implementations will require the following basic components: Feed Gas Storage and Delivery Subsystem, the OSCG system(s), some type of Quality Control Scheme with 'Clean Sampling' provisions, Product Chemical Storage with a suitable volume of Product storage, and, optionally, a Back-up Chemical scheme.

6.3.3 Prior to any introduction of chemical to any system or subsystem, a complete water test is performed to verify leak integrity. This process will also be used to provide the initial clean-up of all systems, tanks, and process plumbing.

6.3.4 The protocol for the installation and start-up of all systems and subsystems follows a predefined procedure and timeline which incorporates all of the physical activities, testing parameters, and check points for approval at each stage.

6.3.5 Cleanroom environment is not necessary.

6.4 *Initial System Qualification* — The following general procedure will be required for the initial mechanical and chemical qualification of the OSCG installation.