

SEMI F41-1116

GUIDE FOR QUALIFICATION OF A BULK CHEMICAL DISTRIBUTION SYSTEM USED IN SEMICONDUCTOR PROCESSING

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 August 31, 2016. Available at www.semiviews.org and www.semi.org in November 2016; originally published June 1999.

NOTICE: This Document was completely rewritten in 2016.

1 Purpose

1.1 This Guide sets forth a logical and systematic approach to the qualification of bulk chemical distribution systems (BCDS) that may be used by end users and suppliers as a basis for developing site-specific BCDS specifications.

2 Scope

2.1 The qualification processes cover:

2.1.1 Bulk distribution systems for large transfer facilities such as main unloading tank facilities that would transfer to smaller day tanks or transport vessels.

2.1.2 Bulk distribution systems at the facility level that receive from another system and dispense fab wide or to multiple points of use.

2.1.3 Bulk distribution system that dispenses only to a specific use system.

2.1.4 Bulk distribution systems that dispense to other smaller systems not specified above.

2.2 This Guide assumes that the BCDS has been installed per the BCDS manufacturer's recommendations and the customer's specifications, and has been appropriately leak tested and shown to meet all requirements of mechanical and physical integrity up to the point of use (POU). For purposes of this document a POU is taken to be: a vessel, a subsystem, a fab wide or multi point distribution system, or a process consumption point.

2.3 BCDS are typically tested for particle levels and trace metal impurities according to specified levels agreed upon in advance. For certain applications or specific chemicals, other testing may become incorporated in the qualification process. These other tests may include assay analysis, anion analysis, cation analysis, total oxidizable carbon (TOC) analysis, moisture analysis, extractables, and other impurities.

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 does not define the test methods that shall be used for evaluation of samples taken during the qualification process, or distinguish test methods that will generate accurate and reliable results from those that will not generate accurate or reliable results.

3.2 This Guide does not define or describe the sampling methodologies that are required in order to physically take a representative and a non-contaminated batch sample. However, appropriate sampling procedures and equipment must be used consistent with the actual specifications.

3.3 This Guide does not define the type of containers that shall be used for sampling. Pretreatment of containers is necessary to assure that the data generated by testing actually measures the chemical being delivered to the process tool and not the impurities in the container itself, from the environment, or from human handling.

3.4 This Guide does not address the type, level, or frequency of testing necessary and appropriate for ongoing monitoring of a BCDS.

3.5 This Guide does not address the special case of a system designed and used for the generation and distribution of high purity water used in semiconductor processing.

3.6 This Guide does not address the testing and prequalification of materials, subassemblies, or components used in a BCDS.

3.7 This Guide does not address the specific protocols and requirements defined by the manufacturer concerning the installation of the BCDS.

3.8 This Guide does not define the actual specifications generally negotiated between the user and the manufacturer of the BCDS, against which chemical samples are tested and qualification is passed.

3.9 This Guide does not address the qualification process for chemicals through the process tool. While the sampling considerations and timing make the initial tool qualification a natural adjunct to the BCDS qualification, the responsibility for this task generally falls within a different jurisdiction and is generally handled separately.

3.10 This Guide does not address systems designed to handle chemicals that have adverse reactions with water. These will typically skip a UPW qualification step or use an alternative method.

4 Referenced Standards and Documents

4.1 SEMI Standards and Safety Guidelines

SEMI C1 — Guide for the Analysis of Liquid Chemicals

SEMI F57 — Specification for Polymer Materials and Components Used in Ultrapure Water and Liquid Chemical Distribution Systems

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

5 Terminology

5.1 Abbreviations and Acronyms

5.1.1 BCDS — bulk chemical distribution system

5.1.2 POU — point of use

5.1.3 TOC — total oxidizable carbon

5.2 Definitions

5.2.1 *pickling* — to condition the BCDS by exposing to an aggressive chemical that extracts impurities from the internal surfaces of the system.

5.2.2 *sample* — sample taken from a system into a sampling container and measured off-line.

5.2.3 *point of use (POU)* — typically located downstream of the bulk chemical distribution system.

6 Qualification Methodologies

6.1 There are two fundamental ways of qualification for system after installation prior to turn over. These would be qualification by analysis and qualification by time. A hybrid combination of these two can be used, if agreed to with the customer in advance during the specification phase.

7 Pre-Chemical Qualification

7.1 *Advantage of Pre-Chemical Qualification* — The pre-chemical qualification is designed to ensure that the piping systems and storage tanks are able to accept chemicals. This step is often initiated after the ultra pure water (UPW) system is functional and an acceptable resistivity is achieved but before chemicals are authorized to be brought on-site. Although UPW does not extract high levels of metallic and ionic impurities from the BCDS materials of construction, this step can ensure that the BCDS and distribution piping is free of any gross contamination that may have been introduced into the system during installation. In addition, the UPW flush can be effective for the elimination of some types of particles.

7.2 *Particle Qualification* — The BCDS is flushed with UPW and the levels of particles are measured using an on-line optical particle counter. The steps followed include:

7.2.1 Install an acceptable UPW water filter element(s) per the filter and BCDS manufacturer's specifications.