

SEMI S4-0304

SAFETY GUIDELINE FOR THE SEPARATION OF CHEMICAL CYLINDERS CONTAINED IN DISPENSING CABINETS

This Safety Guideline was technically approved by the Environmental, Health & Safety Global Technical Committee. This edition was approved for publication by the global Audits and Reviews Subcommittee on December 4, 2003. Available at www.semi.org in March 2004; originally published in 1992.

NOTICE: Conformance to the ‘should’ provisions of this Safety Guideline is necessary to declare conformance to this Document. Conformance to ‘may’, ‘suggested’, ‘preferred’, ‘recommended’, ‘NOTE’, or ‘Related Information’ provisions is not necessary to declare conformance.

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 Safety Guideline was completely rewritten in 2003.

NOTICE: This Standard or Safety Guideline has an 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 Safety Guideline provides a method for determining cylinders of which types of chemicals should be in separate gas cabinets and which cylinders may be in gas cabinets with each other.

1.2 This Safety Guideline is intended to be used by those working or doing research in semiconductor-related technology.

2 Scope

2.1 This Safety Guideline refers to chemicals, which includes gases and liquids, contained in cylinders, that are used in gaseous form because of their vapor pressure or because they may be transported as a vapor by a carrier gas.

2.2 It also pertains to all types of cylinders, up to and including an internal volume of 1000 liters.

2.3 The primary intent of this Safety Guideline is directed to a cylinder gas in use in, or being dispensed in, the research and manufacturing processes.

2.4 This Safety Guideline addresses purge gases supplied in cylinders and used to purge process chemical lines.

2.5 This Safety Guideline addresses process chemicals in cylinders which are designed to provide them at pressures less than 101.3 kPa (one atmosphere).

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 Safety Guideline does not pertain to those cases where chemical cylinders are incorporated within a piece of process equipment.

NOTE 1: Guidance regarding other aspects of the safety and management of gas cylinders is contained in several of the documents listed in the Related Documents section of this safety guideline.

3.2 This Safety Guideline does not pertain to chemicals used in fabrication facilities for ancillary purposes, such as welding.

4 Referenced Standards and Documents

4.1 CGA® Standards¹

CGA P20 — Standard for the Classification of Toxic Gas Mixtures

CGA P23 — Standard for Categorizing Gas Mixtures Containing Flammable and Nonflammable Components

4.2 ISO® Standards²

ISO 10156:1996 — Gases and Gas Mixtures – Determination of Fire Potential and Oxidizing Ability for the Selection of Cylinder Valve Outlets

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

5 Terminology

5.1 Definitions

5.1.1 *acid* — a corrosive chemical whose chemical reaction characteristic is that of an electron acceptor.

5.1.2 *base* — a corrosive chemical whose chemical reaction characteristic is that of an electron donor.

5.1.3 *chemical* — a liquid or gas used in a process for its ability to react with or displace other substances.

5.1.4 *combustible material* — a material that, in the form in which it is used and under the conditions anticipated, may ignite, burn, or release flammable vapors when subjected to fire or heat.

5.1.5 *corrosive* — a chemical that causes visible destruction of, or irreversible alterations in, living tissue by chemical action at the site of contact. A chemical is considered to be corrosive if, when tested on the intact skin of albino rabbits by the method described in the U. S. Department of Transportation in Appendix A to 49 CFR 173, it destroys or changes irreversibly the structure of the tissue at the site of contact following an exposure period of four hours. This term shall not refer to action on inanimate surfaces.

5.1.6 *cylinder* — a pressure vessel designed for containing chemicals at positive gauge pressure and having a circular cross section. The definition of ‘cylinder’ does not include a portable tank, multiunit tank car tank, cargo tank, or tank car.

5.1.7 *flammable gas* — any gas that forms an ignitable mixture with air at 20°C (68°F) and 101.3 kPa (14.7 psia). [SEMI S2]

5.1.8 *gas* — the fluid form of a substance in which it can expand indefinitely and completely fill its container; form that is neither liquid or solid. [SEMI F78]

5.1.9 *gas cabinet* — a metal enclosure which is intended to provide local exhaust ventilation, protection for the gas cylinder from fire from outside the cabinet, and protection for the surroundings from fire from inside the cabinet.

5.1.10 *hazardous production material (HPM)* — a solid, liquid, or gas that has a degree of hazard rating in health, flammability, or reactivity of Class 3 or 4 as ranked by NFPA 704 and which is used directly in research, laboratory, or production processes which have as their end product materials which are not hazardous. [SEMI S2]

5.1.11 *highly toxic chemical* — a chemical that has a median lethal concentration (LC₅₀) in air of 200 parts per million by volume or less of gas or vapor, or 2 milligrams per liter or less of mist, fume, or dust, when administered by continuous inhalation for one hour (or less if death occurs within one hour) to albino rats weighing between 200 and 300 grams each.

5.1.12 *inert gas* — a gas which at ambient conditions does not react chemically with other chemicals.

5.1.13 *irritant* — a chemical is considered to be an irritant if: (1) it is classified as a ‘primary skin irritant’ per 16 CFR 1500, or (2) it is designated as an irritant according to European Directive 67/548/EEC, on the approximation

¹ Compressed Gas Association, 8484 Westpark Drive, Suite 220, McLean, Chantilly, VA 22102, USA; Telephone: +1.703.788.2700, Fax: +1.703.961.1831, <http://www.cganet.com>. CGA trademark is owned by Compressed Gas Association.

² International Organization for Standardization, ISO Central Secretariat, Chemin de Blandonnet 8, CP 401-1214 Vernier, Geneva, Switzerland; Telephone: +41.22.749.01.11, Fax: +41.22.733.34.30, <http://www.iso.org>. ISO trademark is owned by International Organization for Standardization.

of the laws, regulations and administrative provisions relating to the classification, packaging and labeling of dangerous substances including its amendments and adaptations to technical progress.

5.1.14 *liquid* — having its molecules moving freely with respect to each other so as to flow readily, unlike a solid, but because of cohesive forces not expanding infinitely like a gas. [SEMI F78]

5.1.15 *other health hazard* — a chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees, other than those for which a separate classification is defined. The term ‘other health hazard’ includes chemicals which are carcinogens, reproductive toxins, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, mutagens, agents which act on the hematopoietic system, and agents which damage the lungs, skin, eyes, or mucous membranes.

5.1.16 *oxidizer chemical* — a chemical which will support combustion or increase the burning rate of a combustible or flammable material with which it may come in contact.

5.1.17 *pyrophoric chemical* — a chemical which upon contact with air will ignite spontaneously at or below a temperature of 54°C (130°F).

5.1.18 *separation* — the condition of having the risks of mixing of chemicals and of exposure of cylinders to chemicals other than those they contain managed by the cylinders being in different gas cabinets.

5.1.19 *toxic chemical* — a chemical is considered to be toxic if: (1) it that has a median lethal concentration (LC₅₀) in air of more than 200 parts per million but not more than 2,000 parts per million by volume of gas or vapor, or more than 20 milligrams per liter of mist, fume, or dust, when administered by continuous inhalation for one hour (or less if death occurs within one hour) to albino rats weighing between 200 grams and 300 grams each, or (2) it is designated as ‘toxic’ according to European Directive 67/548/EEC on the approximation of the laws, regulations and administrative provisions relating to the classification, packaging and labeling of dangerous substances including its amendments and adaptations to technical progress.

5.1.20 *unstable (reactive)* — a chemical which in the pure state, or as produced or transported, will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shock, pressure, or temperature.

5.1.21 *water reactive* — a chemical that reacts with water to release a chemical that is either flammable or presents a health hazard.

6 Classification

6.1 Chemicals should be classified according to the categories and associated symbols as shown in Table 1.

6.2 Information on the properties of chemicals (other than mixtures) should be obtained through measurement or from literature, such as MSDSs.

Table 1 Classifications and Symbols

<i>Classification</i>	<i>Symbol</i>
Flammable	F
Pyrophoric	P
Corrosive Acid	CA
Corrosive Base	CB
Toxic	T
Highly Toxic	HT
Oxidizer	O
Inert	I
Irritant	IRR
Water Reactive	WR
Unstable (Reactive)	UR
Other Health Hazard	OHH