

SEMI C3.34-0116 (Reapproved 0922) SPECIFICATION FOR DISILANE (Si₂H₆) IN CYLINDERS, 97% QUALITY

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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.

1 Purpose

1.1 The purpose of this Standard is to provide a specification for disilane (Si₂H₆) used in the semiconductor industry.

2 Scope

2.1 This Standard covers requirements for disilane (Si₂H₆) used in the semiconductor industry.

2.2 If analytical methods are not complete, the requirements are presented as a guideline.

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 Description

3.1 Disilane is a pyrophoric, flammable, noncorrosive, colorless gas. It is a powerful irritant.

4 Referenced Standards and Documents

4.1 *SEMI Standards and Safety Guidelines*

SEMI C3 — Specification for Gases

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

5 Terminology

5.1 Terminology appropriate to this Standard is defined in SEMI C3.

6 Specifications

6.1 Purity: The impurity limits are shown in Table 1.

Table 1 Impurity Limits for 97% Disilane

<i>Impurities</i>	<i>Maximum Acceptable Level (ppm)^{#1}</i>
Argon (Ar) + Oxygen (O ₂)	1
Carbon dioxide (CO ₂)	1
Carbon monoxide (CO)	1
Chlorosilanes (Total hydrolyzable chlorides, reported as (Cl-))	5
Disiloxane (H ₃ SiOSiH ₃)	5

<i>Impurities</i>	<i>Maximum Acceptable Level (ppm)^{#1}</i>
Hydrogen (H ₂)	500
Monoethylsilane	50
Nitrogen (N ₂)	10
Silane (SiH ₄)	2.5%
Total methane, ethane, propane	10
Total trisilane and tetrasilane	500
Water (H ₂ O)	1
TOTAL SPECIFIED IMPURITIES	2.6084%

#1 An analysis of significant figures has not been considered. The number of significant figures will be based on analytical accuracy and the precision of the provided test method.

#2 To be determined between supplier and user.

6.2 This Specification applies to the gas phase of the cylinder as received.

7 Properties of Disilane (for information only)

Table 2 Properties of Disilane

	<i>Metric Units</i>	<i>US Units</i>
Molecular Formula	Si ₂ H ₆	Si ₂ H ₆
CAS Number	1590-87-0	1590-87-0
Molecular Weight	62.22	62.22
Boiling Point at 1 atm	-14.8°C	5.4°F
Freezing Point	-132.5°C	-206.5°F
Vapor Density (air = 1)	2.38	2.38

8 Test Methods for Determining Concentrations

8.1 *Carbon Monoxide and Carbon Dioxide* — This method is for the determination of carbon monoxide and carbon dioxide in disilane using a gas chromatograph with a methanizer and a flame ionization detector. (Refer to Figure 1, Notes 1 and 2.)

NOTE 1: An optional temperature ramping during vent will shorten the analysis time.

NOTE 2: Carrier gases should contain less than 0.1 ppm carbon monoxide and less than 0.1 ppm carbon dioxide.

8.1.1 *Detection Limit* — 0.1 ppm for each impurity.

8.1.2 *Instrument Parameters*

8.1.2.1 *Column* — Ethylvinylbenzene-divinylbenzene porous polymer absorbent, 3 m (10 ft.) by 1.6 mm (1/16 in.) ID ss or equivalent.

8.1.2.2 *Carrier Flow* — 30 mL/min helium.

8.1.2.3 *Sample Volume* — 1.5 mL.

8.1.2.4 *Support Gases* — As specified by the instrument manufacturer.

8.1.2.4.1 *Hydrogen* — 20 to 30 mL per min added to the carrier gas between the column outlet and the methanizer inlet.

8.1.2.4.2 *Air* — 500 mL/min.

8.1.2.5 Temperatures

- *Detector* — 110°C.
- *Injector* — 60°C.
- *Oven* — 60°C.
- *Methanizer* — 370°C to 400°C.

8.1.3 *Calibration Standards* — 1 to 10 ppm carbon monoxide, 1 to 10 ppm carbon dioxide, balance helium.

8.1.4 Operating Method

8.1.4.1 Inject the calibration standard into the column using a gas sampling valve. Record the retention times and peak areas. The order of elution is carbon monoxide, carbon dioxide.

8.1.4.2 Inject the sample to be tested in same manner as the calibration standard and vent after elution of carbon dioxide is completed, in case any silane is present. Record the retention times and peak areas.

8.1.4.3 Repeat ¶ 8.1.4.1.

8.1.4.4 Compare the average peak areas of the calibration standard to that of the disilane sample being tested. Calculate the concentrations of carbon monoxide and carbon dioxide using the formula below. The results may not exceed the specifications in § 6 of this Standard.

$$\frac{\text{Sample Peak Area}}{\text{Standard Peak Area}} \times \frac{\text{Concentration of Standard}}{\text{Concentration of Sample}} = \text{Concentration of Sample} \quad (1)$$

8.1.4.5 Other accepted analytical techniques such as helium ionization detection may be used.

8.2 *Methane, Ethane, Propane, and Silane* — This method is for the determination of hydrocarbons (methane, ethane, and propane) and silane in disilane using a gas chromatograph with a thermal conductivity detector.

8.2.1 *Detection Limit* — 3 ppm for each impurity.

8.2.2 Instrument Parameters

8.2.2.1 *Column* — Ethylvinylbenzene-divinylbenzene porous polymer absorbent, 3 m (10 ft.) by 1.6 mm (1/16 in.) ID ss or equivalent.

8.2.2.2 *Carrier Flow* — 25 mL/min helium.

8.2.2.3 *Sample Volume* — 1 mL.

8.2.2.4 Temperatures

- *Detector* — 80°C.
- *Injector* — 60°C.
- *Oven* — 60°C.

8.2.3 *Calibration Standards* — 10 to 50 ppm methane, 5 to 10 ppm ethane, 5 to 10 ppm propane, 0.1% to 1% silane, balance helium.

8.2.4 Operating Method

8.2.4.1 Inject the calibration standard into the column using a gas sampling valve. Record the retention times and peak areas. Order of elution is methane, silane, ethane, propane.

8.2.4.2 Inject the sample to be tested in same manner as the calibration standard. Record the retention times and peak areas.

8.2.4.3 Repeat ¶ 8.2.4.1.