

SEMI C3.2-0611 (Reapproved 0218) SPECIFICATION FOR ARSINE (AsH₃) IN CYLINDERS, 99.94% QUALITY

This Standard was technically approved by the Gases Global Technical Committee. This edition was approved for publication by the global Audits and Reviews Subcommittee on May 16, 2017. Available at www.semiviews.org and www.semi.org in February 2018; originally published in 1992; previously published June 2011.

1 Purpose

1.1 The purpose of this Document is to provide specifications for arsine (AsH₃) that is used in the semiconductor industry.

2 Scope

2.1 This Document covers requirements for arsine used in the semiconductor industry.

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 Arsine is a highly toxic, flammable, colorless gas with a disagreeable garlic-like odor. It is a hemolytic poison.

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 Properties of Arsine

Table 1 Properties of Arsine (for information only)

	<i>Metric Units</i>	<i>US Units</i>
Molecular Formula	AsH ₃	AsH ₃
CAS Number	7784-42-1	7784-42-1
Molecular Weight	77.946	77.946
Boiling point at 1 atm	−62.48°C	−80.46°F
Density of gas at 20°C (68°F) and 1 atm	3.243 kg/m ³	0.202 lb/ft ³
Specific gravity of gas at 21.1°C (70°F) and 1 atm (air = 1)	2.695	2.695
Density of liquid at B.P.	1653 kg/m ³	103.96 lb/ft ³

7 Requirements

Table 2 Impurity Limits for Arsine

<i>Grade</i>	<i>99.94%</i>
<i>Impurities</i>	<i>Maximum Acceptable Level (ppm)^{#1}</i>
Carbon monoxide and carbon dioxide (CO + CO ₂)	2
Hydrocarbons (methane (CH ₄), ethane (C ₂ H ₆), ethylene (C ₂ H ₄), and acetylene (C ₂ H ₂))	1
Hydrogen (H ₂)	500
Hydrogen Sulfide (H ₂ S)	1
Nitrogen (N ₂)	10
Oxygen (O ₂) + Argon (Ar)	5
Phosphine (PH ₃)	10
Water (H ₂ O)	4
TOTAL LISTED IMPURITIES	533

^{#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 procedure.

8 Analytical Procedures

8.1 Carbon Monoxide, Carbon Dioxide, and Hydrocarbons (Methane, Ethane, Ethylene, Acetylene) — This procedure is for the determination of carbon monoxide, carbon dioxide, and hydrocarbons in arsine using a gas chromatograph with a methanizer and a flame ionization detector. (See Note 1 and Figure 1.)

8.1.1 Detection Limit — 0.1 ppm each impurity.

8.1.2 Instrument Parameters

8.1.2.1 Column — Porous polymeric spherical beads such as Porapak[®] QS, 3.5 m (12 ft.) by 2 mm ID (1/8 in. OD) ss or equivalent.

8.1.2.2 Carrier Flow — 35 mL/min helium.

8.1.2.3 Support Gases — Set the flow rates as specified by the instrument manufacturer. If not specified, recommended flow rates are set as followings:

- *Hydrogen* — 30 mL/min added to the carrier gas between the column outlet and the methanizer inlet.
- *Air* — 500 mL/min.

8.1.2.4 Temperatures:

- *Detector* — 110°C.
- *Injector* — 40°C.
- *Oven* — 40°C.
- *Methanizer* — 370°C to 400°C.

8.1.2.5 Sample Volume — 3 mL.

8.1.3 Calibration Standards — 1 ppm to 4 ppm carbon monoxide, 1 ppm to 4 ppm carbon dioxide, 1 ppm to 2 ppm methane, 1 ppm to 2 ppm ethane, 1 ppm to 2 ppm ethylene, and 1 ppm to 2 ppm acetylene; balance helium.

8.1.4 Calibration Standards — 1 ppm to 4 ppm each: carbon monoxide, carbon dioxide, methane, ethane, ethylene, and acetylene; balance helium.