

SEMI C3.6-0421

SPECIFICATION FOR PHOSPHINE (PH₃) IN CYLINDERS, 99.98% QUALITY

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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: 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.

1 Purpose

1.1 The purpose of this Document is to provide specifications for phosphine (PH₃) that are used in the semiconductor industry.

2 Scope

2.1 This Document covers requirements for phosphine 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 Phosphine is a highly toxic, flammable, colorless gas with an odor of decaying fish. It is shipped as a liquid in cylinders under its own vapor pressure.

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 Requirements

6.1 The requirements for phosphine (PH₃) are listed in Table 1.

Table 1 Impurity Limits and Other Requirements for Phosphine (PH₃), Quality: 99.98%

<i>Impurities</i>	<i>Maximum Acceptable Level (ppm)^{#1}</i>
Arsine (AsH ₃)	10
Carbon dioxide (CO ₂)	10
Carbon Monoxide (CO)	1
Heavy Metals	^{#2}

<i>Impurities</i>	<i>Maximum Acceptable Level (ppm)^{#1}</i>
Hydrogen (H ₂)	100
Nitrogen (N ₂)	50
Oxygen (O ₂) + Argon (Ar)	5
Particles	#2
Hydrocarbons expressed as Methane (C ₁ –C ₂)	4
Water (H ₂ O) (v/v)	1
TOTAL LISTED IMPURITIES	181

#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.

#2 To be determined between supplier and user.

7 Physical Constants (for information only)

Table 2 Properties of Phosphine (PH₃)

	<i>Metric Units</i>	<i>US Units</i>
Molecular Formula	PH ₃	PH ₃
CAS Number	7803-51-2	7803-51-2
Molecular Weight	33.997	33.997
Boiling point at 1 atm	–87.7°C	–125.9°F
Density of gas at 25°C (77°F) and 1 atm	1.402 kg/m ³	0.0875 lb/ft ³
Specific gravity of gas at 21.1°C (70°F) and 1 atm (air = 1)	1.146	1.146
Density of liquid at boiling point	744 kg/m ³	46.45 lb/ft ³

8 Analytical Procedures

8.1 *Carbon Monoxide, Carbon Dioxide, and Hydrocarbons (expressed as methane)* — This procedure is for the determination of carbon monoxide, carbon dioxide, and hydrocarbons in phosphine using a gas chromatograph with a methanizer and a flame ionization detector. See Figure 1.

8.1.1 *Detection Limit* — 0.1 ppm each impurity.

8.1.2 *Instrument Parameters*

8.1.2.1 *Column* — PoraPak^{TM1} QS, 3.5 m (12 ft.) by 3.2 mm (1/8 in.) OD by 2.2 mm (0.085 in.) ID ss or equivalent.

8.1.2.2 *Carrier Flow* — 35 mL/min helium.

8.1.2.3 *Support Gases*

- *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.

¹ Trademark is owned by Waters Corporation.