

SEMI PV30-0212

SPECIFICATIONS FOR 2-PROPANOL, USED IN PHOTOVOLTAIC APPLICATIONS

This Standard was technically approved by the global Photovoltaic – Materials Technical Committee. This edition was approved for publication by the global Audits and Reviews Subcommittee on December 24, 2011. Available at www.semiviews.org and www.semi.org in February 2012.

1 Purpose

1.1 This Document standardizes the requirements for 2-propanol used in the photovoltaic manufacturing industry. The testing procedures are also included to support those requirements. Test methods have been shown to give statistically valid results. Alternative methods can be used as long as method validation as per SEMI C1 has been demonstrated.

2 Scope

2.1 The scope of this Document is for grades of 2-propanol used in the photovoltaic 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 Referenced Standards and Documents

3.1 SEMI Standards and Safety Guidelines

SEMI C1 — Guide for the Analysis of Liquid Chemicals

SEMI C35 — Specifications and Guideline for Nitric Acid

3.2 ASTM Standards¹

ASTM D5127 — Standard Guide for Ultra Pure Water Used in the Electronics and Semiconductor Industry

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

4 Terminology

4.1 None.

5 Properties of 2-Propanol

Table 1 Properties of 2-Propanol

Chemical Formula	C ₃ H ₈ O
CAS Number	67-63-0
Density at 25°C	0.78 g/mL
Boiling Point	82.3°C

6 Requirements

6.1 The requirements for 2-propanol for PV Grades 1 and 2 are listed in Table 3.

¹ American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, USA; Telephone: 610.832.9585, Fax: 610.832.9555, <http://www.astm.org>

7 PV Grade 1 Procedures

7.1 Assay — Analyze the sample by gas chromatography (see SEMI C1, 'Assay by Wide Bore Column Gas Chromatography'). The parameters cited in Table 2 have given satisfactory results.

- Column: 30 meter × 530 micron I.D. fused silica capillary, coated with 5 micron film of DB-Wax or equivalent (100% methyl silicone which has been surface bonded and cross linked).
- Column Temperature: 40°C isothermal for 5 minutes, then programmed to 200°C at 10°C/min.

Table 2 Parameters that Have Given Satisfactory Results When Analyzing 2-Propanol

Injector Temperature:	150°C
Detector Temperature:	250°C
Sample Size:	0.2 µL splitless
Carrier Gas:	Helium at 3 mL/min
Detector:	Thermal Conductivity
Approximate Retention Times (min):	
Acetone	4.5
2-Propanol	5.0

7.2 Color — Dilute 2.0 mL of platinum-cobalt stock solution (APHA No. 500, see SEMI C1) to 100 mL with water. Compare this standard (APHA No. 10) with 100 mL of sample in Nessler tubes. View vertically over a white background. The sample must be no darker than the standard.

7.3 Acidity — To 25 mL of water in a glass-stoppered flask, add 10 mL of sample and 0.1 mL of phenolphthalein indicator solution (see SEMI C1). Add 0.01 N sodium hydroxide until a slight pink color persists after shaking for one-half minute. Add 64 mL (50 g) of the sample, mix well, and titrate with 0.01 N sodium hydroxide until the pink color is reproduced. Not more than 1.0 mL of the sodium hydroxide solution shall be required.

7.4 Alkalinity — Add 128 mL (100 g) of sample to 25 mL of water and mix well. Add 0.05 mL of methyl red indicator solution (see SEMI C1). Titrate with 0.01 N hydrochloric acid until a slight pink color is produced. Not more than 1.0 mL of the hydrochloric acid shall be required.

7.5 Residue After Evaporation — Evaporate 256 mL (200 g) of sample to dryness. Dry at 105°C for 30 minutes, cool in a desiccator, and weigh (see SEMI C1, 'Residue After Evaporation').

7.6 Water — Add 25 mL of methanol to a dry titration flask and add Karl Fischer (KF) reagent to a visually or electrometrically determined endpoint that persists for 30 seconds. Add 25 mL (20 g) of sample, taking care to protect the sample and contents of the flask from moisture. Stir vigorously and titrate with Karl Fischer reagent to the same endpoint.

$$\% \text{ Water (H}_2\text{O)} = \frac{\text{mL KF reagent} \times \text{KF factor (g H}_2\text{O/mL)} \times 100}{\text{Mass of Sample (g)}} \quad (1)$$

7.7 Chloride — To 64 mL (50 g) of sample, add 10 mL of sodium carbonate reagent solution (see SEMI C1) and evaporate to dryness on a steam bath in a hood. Dissolve the residue in 10 mL of water, add 1 mL of nitric acid and dilute to 20 mL with water. Add 1 mL of silver nitrate reagent solution (see SEMI C1). Any turbidity produced shall be no greater than that produced when 0.01 mg of chloride ion (Cl) is treated as the sample.

7.8 Phosphate — To 26 mL (20 g) of sample, add 10 mL of sodium carbonate reagent solution (see SEMI C1) and evaporate to dryness on a steam bath in a hood. Dissolve the residue in 25 mL of 0.5 N sulfuric acid. Add 1 mL of ammonium molybdate reagent solution (see SEMI C1) and 1 mL of p-(methylamino)phenol sulfate reagent solution (see SEMI C1). Allow to stand at room temperature for 2 hours. Any blue color produced shall be no greater than that produced when 0.01 mg of phosphate ion (PO₄) is treated like the sample.