

SEMI C84-0214 (Reapproved 1119) GUIDE FOR CYCLOPENTANONE

This Standard was technically approved by the Liquid Chemicals Global Technical Committee. This edition was approved for publication by the global Audits and Reviews Subcommittee on August 19, 2019. Available at www.semiviews.org and www.semi.org in November 2019; originally published February 2014.

1 Purpose

1.1 The purpose of this Document is to provide a guide for cyclopentanone for which a need has been identified.

2 Scope

2.1 The scope of this Document covers cyclopentanone which is 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 Referenced Standards and Documents

3.1 *SEMI Standards and Safety Guidelines*

SEMI C1 — Guide for the Analysis of Liquid Chemicals

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

4 Properties

Table 1 Properties of Cyclopentanone

Molecular Formula	C ₅ H ₈ O
Molecular Weight	84.12 g/mol
CAS Number	120-92-3
Density	0.95 g/cm ³
Boiling Point	131°C (1013 hPa)
Melting Point	-58.2°C
Solubility in Water	Slightly soluble
Flashpoint	26°C
Appearance	Colorless liquid

5 Suggested Values

5.1 The suggested values for cyclopentanone for Tier A are listed in Table 3.

6 Grade 1 Procedures

6.1 This section does not apply to this chemical.

7 Grade 2 Procedures

7.1 This section does not apply to this chemical.

8 Grade 3 Procedures

8.1 This section does not apply to this chemical.

9 Grade 4 Procedures

9.1 This section does not apply to this chemical.

10 Tier A Procedures

NOTE 1: Standardized test methods are being developed for all parameters at the purity level indicated. Until standardized test methods are published, test methodology should be determined by user and producer. The SEMI Standards Liquid Chemicals Global Technical Committee considers a method to be valid only if method validation according to SEMI C1 has been demonstrated.

10.1 *Assay* — Analyze the sample by gas chromatography (see SEMI C1, ‘Assay by Wide Bore Column Gas Chromatography’). The parameters cited have given satisfactory results.

10.1.1 Column: 50 meters × 320 micron I.D. fused silica capillary coated with 100% dimethyl polysiloxane which has been surface bounded.

10.1.2 Column temperature: 80°C isothermal for 3 minutes then programmed to 260°C at 20°C/min, then isothermal for 5 minutes.

Table 2 Chromatography Conditions

Injector Temperature	250°C
Detector Temperature	280°C
Sample Size	0.5 µL split ratio 1/50
Carrier Gas	Nitrogen
Detector	Flame ionisation detector (hydrogen)
Approximate Retention Time (min): cyclopentanone	6.6

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

10.3 *Water* — Analysis performed by coulometric Karl Fisher titration with the use of the appropriate anodic and cathodic coulometric reagents in methanol.

10.3.1 Prior to start the analysis, verify the cleanliness of the cell and prevent any exposure of the system to the humidity of the air.

10.3.2 Weigh accurately the sample volume (0.5 ± 0.001 g) using an analytical balance.

10.3.3 Inject the sample through the septum and start the automatic titration till the equilibrium end-point.

10.4 *Acidity* — Weigh 50 g of sample into a 150 mL beaker and record the weight. Add 50 mL of a mixture of DI water and methanol (1:1) and stir.

10.4.1 Titrate potentiometrically with standardized 0.1 N Sodium hydroxide till end-point.

$$Acidity \left(\frac{meq}{100g} \right) = \frac{Volume\ of\ NaOH\ (mL) \times Normality\ of\ NaOH\ \left(\frac{mol}{L} \right)}{Sample\ Mass\ (g) \times 10}$$

10.5 *Trace Metals Analysis* — The following method has given satisfactory results in determining trace metals impurities for the trace metals as specified using either inductively coupled plasma optical emission spectroscopy (ICP-OES) or inductively coupled plasma mass spectroscopy (ICP-MS).

10.5.1 The sample preparation is performed by evaporation in a closed PTFE recipient under an inert gas stream.

10.5.2 20 grams of sample are weighed in the recipient and heated on a hot plate at 180°C till nearly dryness. The residue is digested at 80°C with 2 mL of an HNO₃/HF acid solution and then diluted with DI water and cooled down.

10.5.3 It is recommended to run each sample in duplicate. In addition, prepare a sample preparation blank for each analysis. It is also recommended to use an internal standard or a spiked sample solution to correct for any matrix effect.