

SEMI C3.41-0703 (Withdrawn 1104) STANDARD FOR OXYGEN (O₂), BULK, 99.9998% QUALITY

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NOTICE: This Document was balloted and approved for withdrawal in 2004.

1 Description

1.1 Oxygen is a colorless, odorless, and oxidizing gas. It supports combustion.

2 Specifications

QUALITY: 99.9998%

A purifier is allowed to be used to meet this specification.

<i>Impurities</i>	<i>Maximum Acceptable Level (ppm)^{#1}</i>
Argon (Ar)	1.0
Carbon Dioxide (CO ₂)	0.1
Carbon Monoxide (CO)	0.1
Hydrogen (H ₂)	0.1
Nitrogen (N ₂)	0.5
Particles	#2
Total Hydrocarbons (as CH ₄)	0.1
Water (H ₂ O) (v/v)	0.1
TOTAL SPECIFIED IMPURITIES	2.0

#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 user and supplier.

3 Physical Constants (for information only)

	<i>Metric Units</i>	<i>US Units</i>
Molecular weight	31.999	31.999
Boiling point at 1 atm	−183.0°C	−297.4°F
Density of gas at 25°C (77°F) and 1 atm	1.309 kg/m ³	0.082 lb/ft ³
Specific gravity of gas	1.1049	1.1049
Density of liquid at boiling point	1142 kg/m ³	71.27 lb/ft ³

4 Analytical Procedures

4.1 *Argon and Nitrogen* — This procedure is for the determination of argon and nitrogen in oxygen using a gas chromatograph with a discharge ionization detector (see Figure 1).

4.1.1 *Detection Limit* — 0.1 ppm.

4.1.2 Instrument Parameters

4.1.2.1 Column(s)

- 3 m (10 ft.) by 3.2 mm (1/8 in.) o.d. in Molecular Sieve 5A
- 3 m (10 ft.) by 3.2 mm (1/8 in.) oxygen trap (see Figure 1)

4.1.2.2 Carrier Flow — 44 cc/min.

4.1.3 Sample Volume — 0.1 mL.

4.1.3.1 Temperatures

- Detector — 100°C.
- Column — 30°C.
- Oxygen Trap — 150°C.

4.1.4 Calibration Standards — 1 ppm to 5 ppm nitrogen and argon in oxygen.

4.1.5 Operating Procedures

4.1.5.1 Inject the calibration standard into the column using a gas sampling valve. Record the retention times and peak area. Order of elution is argon, nitrogen. If methane is present, the order is argon, nitrogen, methane.

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

4.1.5.3 Repeat ¶ 4.1.5.1.

4.1.5.4 Compare the average peak areas of the calibration standard to that of the sample being tested. Calculate the concentrations of impurities as shown in SEMI C3. The result may not exceed the specification in § 2 of this Standard.

NOTE 1: Oxygen trap conditioned per manufacturer's recommendations using hydrogen, carbon monoxide, or blend in helium.

4.2 Carbon Dioxide — This procedure is for the determination of carbon dioxide in oxygen using a gas chromatograph with a flame ionization detector and a methanizer.

4.2.1 Detection Limit — 0.02 ppm.

4.2.2 Instrument Parameters

4.2.3 Column(s) — 2.3 m (91 in.) by 3.2 mm (1/8 in.) HayeSep Db.

4.2.3.1 Carrier Flow — 50 cc/min nitrogen.

4.2.3.2 Sample Volume — 5 mL.

4.2.3.3 Temperatures

- Detector — 275°C.
- Column — 50°C.
- Methanizer — 295°C.

4.2.4 Calibration Standards — 0.1 ppm to 1 ppm carbon dioxide in oxygen.

4.2.5 Operating Procedures

4.2.5.1 Inject the calibration standard into the column using a gas sampling valve. Record the retention times and peak area. Order of elution is: oxygen + carbon monoxide, methane, carbon dioxide.

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

4.2.5.3 Repeat ¶ 4.2.5.1.