

SEMI C3.29-96 (Withdrawn 0303) STANDARD FOR NITROGEN (N₂), BULK GASEOUS, 99.9995% QUALITY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 April 15, 1999. Available at www.semi.org in September 1999; originally published in 1986; previously published in 1996.

NOTICE: This Document was balloted and approved for withdrawal in 2003; it has been replaced by SEMI C59.

1 Description

1.1 Nitrogen is an odorless, tasteless, diatomic gas comprising approximately 78% of the earth's atmosphere; colorless liquid; chemically unreactive. Noncombustible; an asphyxiant gas; cryogenic. Derived from liquid air by fractional distillation.

2 Specifications

QUALITY: 99.9995% (see Note 1)

<i>Impurities</i>	<i>Maximum Acceptable Level (ppm^{#1})</i>
Carbon dioxide (CO ₂)	0.2
Carbon monoxide (CO)	2
Hydrogen (H ₂)	2
Oxygen (O ₂)	0.2
Particles	#2
Total Hydrocarbons expressed as Methane (THC)	0.2
Water (H ₂ O) (v/v)	0.2
TOTAL IMPURITIES	4.8

#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.

3 Physical Constants (for information only)

	<i>Metric Units</i>	<i>US Units</i>
Molecular weight	28.013	28.013
Boiling point at 1 atm	-195.8°C	-320.4°F
Density of gas at 21.1°C (70°F) and 1 atm	1.1605 kg/m ³	0.07245 lb/ft ³
Specific gravity of gas at 21.1°C and 1 atm (air = 1)	0.967	0.967
Density of liquid at boiling point	808.8 kg/m ³	50.49 lb/ft ³

4 Analytical Procedures (see Notes 2, 3)

4.1 *Carbon Monoxide and Hydrogen* — This procedure is for the determination of carbon monoxide and hydrogen in nitrogen using a gas chromatograph with a reduction gas detector (see Note 4).

4.1.1 *Detection Limits* — 2 ppb (mole/mole) carbon monoxide, 20 ppb (mole/mole) hydrogen.

4.1.2 *Instrument Parameters*

4.1.2.1 *Column* — 5A molecular sieve, 0.9 m (3 ft.) by 3 mm (1/4 in.) ss, or equivalent.

4.1.2.2 *Carrier Flow* — 40 mL/min air or nitrogen.

4.1.2.3 *Sample Volume* — 2.0 mL.

4.1.2.4 *Temperatures*

- *Detector* — 280°C.
- *Column Oven* — 250°C.

4.1.3 *Calibration Standard* — 1 ppm to 5 ppm (mole/mole) carbon monoxide, 1 ppm to 5 ppm (mole/mole) hydrogen in nitrogen.

4.1.4 *Operating Procedure*

4.1.4.1 Inject the calibration standard into the column using a gas sampling valve. Record the retention times and peak areas. Order of elution is hydrogen, then carbon monoxide. Run standard analysis in triplicate for stability determination relative to purging of calibration system components.

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

4.1.4.3 Repeat ¶ 4.1.4.1.

4.1.4.4 Compare the average peak areas of the calibration standard to that of the nitrogen sample being tested. Calculate the concentrations of carbon monoxide and hydrogen, using the formula below. The results may not exceed the specifications in § 2 of this Standard.

$$\frac{\text{Sample Peak Area}}{\text{Standard Peak Area}} \times \text{Concentration of Standard} = \text{Concentration of Sample} \quad (1)$$

4.2 *Carbon Dioxide* — This procedure is for the determination of carbon dioxide in nitrogen using a continuous flow, non-dispersive infrared analyzer.

4.2.1 *Detection Limit* — 50 ppb (mole/mole).

4.2.2 Set sample flow rate and pressure in accordance with the instrument manufacturer's instructions.

4.2.3 *Calibration Standard* — Zero nitrogen with a known quantity of carbon dioxide at not more than 0.05 ppm (mole/mole). Span gas nitrogen with a known concentration of 1 ppm to 10 ppm (mole/mole) carbon dioxide.

4.2.4 *Operating Procedure*

4.2.4.1 Do not change the initial sample flow setting once established.

4.2.4.2 Introduce the zero nitrogen with known quantity of carbon dioxide and set the needle (or output reading) to read the correct level using the zero adjustment knob.

4.2.4.3 Introduce the span gas standard in nitrogen and using the span adjust knob, set the needle (or output reading) to match the levels of carbon dioxide in the span gas.

4.2.4.4 Repeat steps 1 and 2 until reproducibility of readings is better than 1% of full scale.

4.2.4.5 Introduce nitrogen sample into the analyzer and read the quantity of carbon dioxide on the analyzer meter. The result may not exceed the specification in § 2 of this Standard.

4.3 *Oxygen* — This procedure is for the determination of oxygen in nitrogen using a continuous flow analyzer using an electrochemical method.