

SEMI C9.1-0212 (Reapproved 0318) GUIDE FOR ANALYSIS OF UNCERTAINTIES IN GRAVIMETRICALLY PREPARED GAS MIXTURES

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1 Purpose

1.1 This Document is intended to provide the minimum criteria for the analysis of uncertainty associated with preparation and use of gravimetric gas mixtures used for calibrating analytical instruments to determine whether various SEMI impurity specification are satisfied.

2 Scope

2.1 This Guide is intended for preparation of binary gas mixtures using individual cylinders.

2.2 It is the intent of this Document to provide general guidelines for preparation of calibration gas mixtures in compliance with ISO 6142, with additional requirements to meet the needs of the semiconductor industry.

2.3 This Guide is applicable only to gaseous components which do not react between themselves or with the cylinder walls, and to condensable components which are totally vaporized under the test conditions. It is not intended for moisture calibration mixtures.

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 ISO Standards¹

ISO 6142 — Gas Analysis; Preparation of Calibration Gas Mixtures – Weighing Methods

Addendum 1 to ISO 6142, Annex — Precautions to be taken when weighing, handling and filling cylinders

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

4 Weight Traceability

4.1 The weights used to prepare the gas mixtures or certify the balance should be Class S1-tested at least annually with reference standards traceable to the National Institute of Standards and Technology or to another national standards organization.

5 Acceptable Mixture Criteria

5.1 *Cylinder* — Cylinder must comply with National or International Codes. The type of cylinder used for the gas mixture may affect the stability of the mixture. Historical and experimental data should be requested from the supplier on the stability of similar mixtures. The cylinder material should be chosen based on its compatibility with the gas mixture.

5.2 *Valve* — A packless valve is recommended and the construction materials selected according to their compatibility with the gas mixture.

5.3 *Homogenous Mixture* — The cylinder and its contents should be at room temperature prior to use. The cylinder mixture components must be mixed to insure a homogenous mixture.

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5.4 *Stability* — The gas mixture will have a demonstrated stability within the acceptable relative uncertainties given in § 6 for a period of 1 year. The minimum useful pressure should be in accordance with the supplier's recommendations.

5.5 *Gas Purity* — Analyze both component gases used for preparing the binary gas mixture to ensure that there are no contaminants present that may interfere analytically and that the major gas does not contain in excess of 1% of the minor gas.

5.6 *Analysis* — Confirmation analysis of the calibration mixture should be performed to determine if any gross weighing errors occurred.

6 Acceptable Relative Uncertainties

6.1 Using the ISO procedures the acceptable maximum relative uncertainties for the component of interest are given below.

Table 1 Acceptable Maximum Relative Uncertainties for Interest Component

<i>Concentration Range</i>	<i>Relative Uncertainty</i>
Standard Concentrations > 1000 ppm	2%
100 ppm < Standard Concentrations ≤ 1000 ppm	2%
10 ppm < Standard Concentrations ≤ 100 ppm	5%
1 ppm ≤ Standard Concentrations ≤ 10 ppm	10%

7 Report

7.1 The composition of the mixture should be reported including the relative uncertainty for a given mixture.

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