

SEMI F24-0697 (Reapproved 0712) PARTICLE SPECIFICATION FOR GRADE 10/0.2 INERT SPECIALTY GASES

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1 Purpose

1.1 The purpose of this Document is to set a maximum permissible particle concentration for 10/0.2 grade inert specialty gases and to describe a reference method for its verification.

2 Scope

2.1 This Document applies only to inert gases delivered through specialty gas systems at pressures up to 8×10^5 Pa (8 atmospheres). This method is not suitable for direct sampling from high pressure cylinders at pressures above 8×10^5 Pa (8 atmospheres). This Document applies only to the following gases:

Argon (Ar)
Halocarbon 23 (CHF ₃)
Halocarbon 116 (C ₂ F ₆)
Helium (He)
Nitrogen (N ₂)
Sulfur Hexafluoride (SF ₆)
Tetrafluoromethane (CF ₄)

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 C6.5 — Particle Specification for Grade 10/0.2 Nitrogen (N₂) and Argon (Ar) Delivered as Pipeline Gas

3.2 JIS Standard¹

JIS B 9921 — Light Scattering Automatic Particle Counter

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

4 Terminology

4.1 Variables

V _{Mi} =	Volume of the i th sample interval of the system gas
V _{Bi} =	Volume of the i th sample interval of the background
X _{Mi} =	Concentration of particles observed in the i th sample of interval of the system gas

¹ Japanese Standards Association, 4-1-24 Akasaka, Minato-ku, Tokyo 107-8440, Japan; Telephone: +81.3.3583.8005, Fax: +81.3.3586.2014, <http://www.jsa.or.jp>

X_{Bi} =	Concentration of particles observed in the i^{th} sample of interval of the background
N_M =	Number of sample intervals of the system gas
N_B =	Number of sample intervals of the background
$\bar{X}_M$ =	Average observed concentration of counts in the system gas sample
$\bar{X}_B$ =	Average observed concentration of background counts
$\bar{X}_C$ =	Calculated concentration of particles in the system gas
S_M =	Standard deviation of $\bar{X}_M$
S_B =	Standard deviation of $\bar{X}_B$
S_C =	Standard deviation of $\bar{X}_C$

4.2 *gas sample volume* (V_{Mi} , V_{Bi}) — the volume of the sample interval, expressed in standard liters at standard conditions, 0°C (32°F) and 1×10^5 Pa (1 atmosphere) pressure. Standard cubic feet (SCF) is defined at 21.1°C (70°F) and 1×10^5 Pa (1 atmosphere) pressure.

4.3 *average observed concentration of counts* ($\bar{X}_M$, $\bar{X}_B$) — the average concentration of counts, that is:

$$\bar{X}_M = \frac{\sum X_{Mi}}{N_M} \quad \bar{X}_B = \frac{\sum X_{Bi}}{N_B}$$

4.4 *calculated concentration of particles* ($\bar{X}_C$) — the concentration of particles in the system gas obtained by correcting the observed concentration in the system gas for the observed concentration in the background, that is:

$$\bar{X}_C = \bar{X}_M - \bar{X}_B$$

4.5 *standard deviation* (S_M , S_B , S_C) — a statistical measure of the spread of the concentration of the counts or particles. The first two are obtained from the interval and average concentrations and the number of intervals, that is:

$$S_M = \sqrt{\frac{\sum (X_{Mi} - \bar{X}_M)^2}{(N_M - 1)}}$$

$$S_B = \sqrt{\frac{\sum (X_{Bi} - \bar{X}_B)^2}{(N_B - 1)}}$$

NOTE 1: The third is obtained from the first two, that is:

$$S_C = \sqrt{S_M^2 + S_B^2}$$

5 Requirements

5.1 *Maximum Permissible Particle Concentration* — 10 particles per 25 standard liters as determined by the instrument specified in § 6.

5.2 The specification will be considered met if the calculated concentration of particles plus 2 times the standard deviation does not exceed 10 particles per 25 standard liters, that is:

$$\bar{X}_C + 2 \times S_C \leq 10 \text{ particles/25 standard liters}$$