SEMI F26-0697 (Reapproved 0712)
PARTICLE SPECIFICATION FOR GRADE 10/0.2 TOXIC 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 toxic specialty gases and to describe a reference method for its verification.

2 Scope

2.1 This Document applies only to toxic 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 gas:

Ammonia (NH_3)
Arsine (AsH_3)
Phosphine (PH_3)

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 *JIS Standard*[1]

JIS B 9921 — Japanese Industrial Standard (1989), "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 ith sample interval of the system gas
V_{Bi} =	Volume of the ith sample interval of the background
X_{Mi} =	Concentration of particles observed in the ith sample of interval of the system gas
X_{Bi} =	Concentration of particles observed in the ith 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
$\overline{X}_M$ =	Average observed concentration of counts in the system gas sample
$\overline{X}_B$ =	Average observed concentration of background counts

[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

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$\overline{X}_C$ =	Calculated concentration of particles in the system gas
S_M =	Standard deviation of $\overline{X}_M$
S_B =	Standard deviation of $\overline{X}_B$
S_C =	Standard deviation of $\overline{X}_C$

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

$$\overline{X}_M = \frac{\Sigma X_{Mi}}{N_M} \qquad \overline{X}_B = \frac{\Sigma X_{Bi}}{N_B}$$

4.4 *calculated concentration of particles ($\overline{X}_C$)* — 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:

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

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:

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

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

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:

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

6 Apparatus

6.1 *Particle Counter* — An instrument suitable for counting particles in compressed toxic gases at a pressure of up to 8×10^5 Pa (8 atmospheres) with a 50% counting efficiency should reach 90% at 0.3 micrometer or smaller. The resolving power of the instrument near 0.2 micrometer should be no worse than 10%. The counting efficiency is determined by a calibration at 1×10^5 Pa (1 atmosphere) pressure using polystyrene latex spheres in an inert gas and a reference particle counter with a proven counting efficiency of not less than 95% at 0.2 micrometer.

NOTE 2: Suitable test methods for determining counting efficiency and resolving power are contained in Japanese Industrial Standard JIS B 9921 (1989), "Light Scattering Automatic Particle Counter". More sensitive particle counters result in a higher measured particle concentration.

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