SEMI F25-0118
SPECIFICATION FOR PARTICLE CONCENTRATION OF GRADE 10/0.2 OXIDANT SPECIALTY GASES

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NOTICE: Paragraphs entitled 'NOTE:' are not an official part of this Standard or Safety Guideline and are not intended to modify or supersede the official Standard or Safety Guideline. These have been supplied by the global technical committee to enhance the usage of the Standard or Safety Guideline.

1 Purpose

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

2 Scope

2.1 This Standard applies only to oxidant 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 Standard applies only to the following gases:

- Oxygen (O_2)
- Nitrous Oxide (N_2O)
- Nitrogen Trifluoride (NF_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 *SEMI Standards and Safety Guidelines*

SEMI C6.2 — Particle Specification for Grade 20/0.02 Oxygen Delivered as Pipeline Gas

3.2 *JSA Standards*[1]

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 *Definitions*

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

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

[1] JSA Group, Mita MT Bldg., 3-13-12 Mita, Minato-ku, Tokyo, 108-0073, Japan; Telephone: +81.50.1741.7520, Fax: +81.3.4231.8650, http://www.jsa.or.jp.

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4.1.2 *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:

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

4.1.3 *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.

4.1.4 *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:

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

4.2 *Variables*

4.2.1 N_B = average observed concentration of counts in the system gas sample.

4.2.2 N_M = number of sample intervals of the system gas.

4.2.3 S_B = standard deviation of $\overline{X}_B$.

4.2.4 S_C = standard deviation of $\overline{X}_C$.

4.2.5 S_M = standard deviation of $\overline{X}_M$.

4.2.6 V_{Bi} = volume of the ith sample interval of the background.

4.2.7 V_{Mi} = volume of the ith sample interval of the system gas.

4.2.8 X_{Bi} = concentration of particles observed in the ith sample of interval of the background.

4.2.9 X_{Mi} = concentration of particles observed in the ith sample of interval of the system gas.

4.2.10 $\overline{X}_B$ = average observed concentration of background counts.

4.2.11 $\overline{X}_C$ = calculated concentration of particles in the system gas.

4.2.12 $\overline{X}_M$ = average observed concentration of counts in the system gas sample.

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 two times the standard deviation does not exceed 10 particles per 25 standard liters, that is:

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

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