

SEMI C6.3-89 (Reapproved 0303) PARTICLE SPECIFICATION FOR GRADE 20/0.2 HYDROGEN (H₂) DELIVERED AS PIPELINE GAS

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1 Purpose

1.1 The purposes of this document are (1) to set a maximum permissible particle concentration for Grade 20/0.2 hydrogen gas and (2) to describe a reference method for its verification.

2 Scope

2.1 This document applies only to hydrogen gas delivered through pipelines; it is not applicable to cylinder gases or gases in their liquid state.

NOTICE: This standard does not purport to address safety issues, if any, associated with its use. It is the responsibility of the users of this standard to establish appropriate safety and health practices and determine the applicability of regulatory or other limitations prior to use.

3 Referenced Standards

None.

4 Terminology

4.1 Definitions

4.1.1 *background count* — The total number of counts registered by a specific particle counter within the time needed to sample 1.0 SCF of gas under conditions where zero particles transverse the sensing volume, averaged over at least a sequence of twenty-four consecutive sampling periods of 1.0 SCF each or eight consecutive periods of 30 minutes each, whichever is longer. The background count is to be reported as mean number of count per SCF; the number of hours on which the average is based is also reported.

4.1.2 *gas sample volume* — The volume of the sample, expressed in standard cubic feet (SCF) is the volume occupied by the gas sample at standard conditions, 20°C (68°F) and 1.00 atmosphere pressure.

4.1.3 *particle concentration* — The total number of particles counted, divided by the total gas sample volume, and corrected for background count as defined in Section 4.1.1, rounded to the nearest integer, for particles equal to or larger than the specified size.

4.1.4 *particle size/particle diameter* — The optical equivalent diameter as detected by a given light scattering particle counter.

NOTE 1: The optical equivalent diameter varies from counter to counter and with differing particle shape and refractive index.

4.1.5 *sampling period* — The time needed to sample 1.0 SCF or 30 minutes, whichever is longer.

5 Apparatus

5.1 *Light Scattering Optical Particle Counter* — With a lower detection limit of 0.2 micrometers or less, based on a calibration with polystyrene latex spheres; and with a maximum background of 2 counts/SCF at 0.2 micrometers. It should be suitable for use in hydrogen service per the manufacturer's specifications or encased in an explosion-proof enclosure which satisfies Class I, Division I of the NFPA Code.

6 Test Method

NOTE 2: The precise details of any sampling configuration, measurement procedure, or any instrument calibration procedure and frequency must be agreed upon between user and supplier, taking into account good engineering practice.

6.1 The sampling point should be as close as practical to the downstream side of the supplier's final gas filter. Sampling lines should be as short as possible.

6.2 Suggested sampling probe configuration for turbulent main line flow:

Alternative a:	Figure 1a (preferred)
Alternative b:	Figure 1b
Alternative c:	Figure 1c
Alternative d:	Figure 1d

6.3 For configurations 1a, 1b, and 1c, the flow rate in the sampling tube at pipeline pressure should be set so that the mean sampling flow velocity at the probe inlet matches as closely as possible the axial flow velocity in the pipeline. Sampling tube ID should be no less than 2 mm (0.08 in).

6.4 Determine the background count for the particle counter by using the standard method recommended by the instrument manufacturer using hydrogen gas.

7 Specification

7.1 Maximum permissible total concentration: 20 particles per SCF equal to or larger than 0.2 micrometers, after subtracting background count as defined in Section 4.1.1.

7.2 The specification will be considered as met, if the particle concentration does not exceed 20 particles per SCF in any five consecutive sampling periods as defined in Section 4.1.5.

8 Report

8.1 Report each of the five consecutive sampling periods to read as total number of particles per SCF of gas, equal to or larger than 0.2 micrometers optical equivalent diameter, without reference to any specific size distribution function. The background count shall be reported as defined in Section 4.1.1.

9 Calibration

9.1 The optical particle counter is normally calibrated using latex spheres of a known diameter suspended in a gas. Since the gas density and refractive index enter into the amount of scattering detected by the instrument, hydrogen should be used for calibration.

10 Safety

10.1 The lower explosive limit (LEL) for hydrogen in air is 4%; therefore, proper precautions should be taken to insure that the maximum possible concentration of hydrogen in air does not exceed 2%. The particle counter and any other ancillary equipment must be checked for leaks and the hydrogen exiting the equipment must be disposed of appropriately to insure that its concentration in air at any point does not exceed 2%.

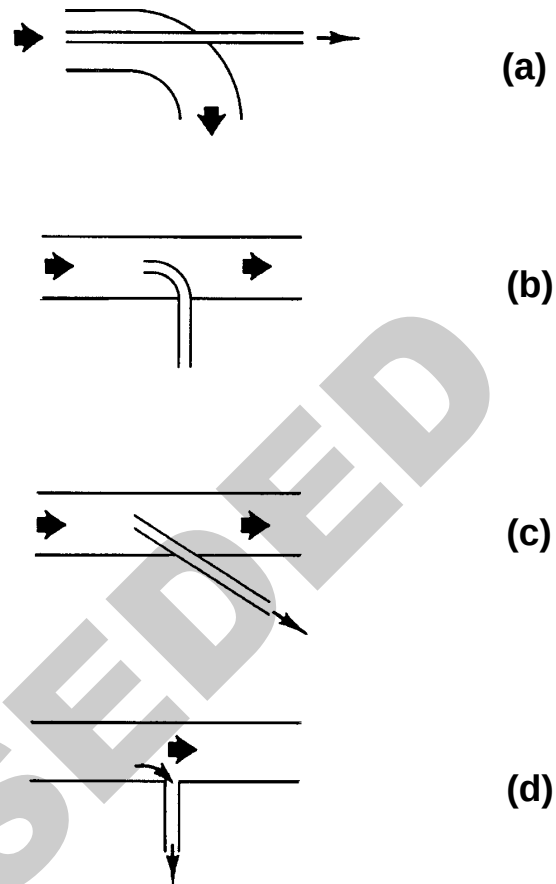


Figure 1
Schematic Diagrams of Configurations of
Different Merit for Obtaining Particle Samples
from Pipelines

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