

SEMI F37-0299 (Reapproved 0611) METHOD FOR DETERMINATION OF SURFACE ROUGHNESS PARAMETERS FOR GAS DISTRIBUTION SYSTEM COMPONENTS

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NOTICE: This Document was reapproved with minor editorial changes.

1 Purpose

1.1 The purpose of this Test Method is to define a method for determining numerical values for surface roughness parameters measured on gas distribution system components. Application of this method is intended to yield comparable data among users of this method.

2 Scope

2.1 This Document will specify methods, measuring equipment, and test conditions for mechanical profile surface roughness measurement of gas distribution system components. This Test Method will not require nor recommend numerical values for specific surface roughness parameters. This Test Method is intended for use in quality control and process development for specification of and manufacturing of gas distribution system components.

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 Limitations

3.1 Numerical values for specific surface roughness parameters obtained using this Test Method may not provide sufficient information for determining the performance of the component, such as dry down times, corrosion resistance or amount of particle generation. Surface roughness measurement is one of many evaluation techniques for assessing the performance or quality of a surface. This Document is not concerned with characteristics such as component design, material, dimensions, appearance, etc. While surface defects traversed by the stylus may be included in the roughness measurement, this method does not govern the evaluation of surface defects. Surface defects may be measured by methods such as SEM and EDX. This Test Method is intended to measure surface features on the order of 10 µm in size. It is not intended to detect submicron surface features.

4 Referenced Standards and Documents

4.1 ANSI Standard¹

ANSI/ASQ Z1.9 — Sampling Procedures and Tables for Inspection by Variables for Percent Nonconforming

4.2 ASME Standard²

ASME B46.1 — Surface Texture (Surface Roughness, Waviness, and Lay)

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

5 Terminology

5.1 Abbreviations and Acronyms

5.1.1 EDX — energy dispersive x-ray spectroscopy

¹ American National Standards Institute, 25 West 43rd Street, New York, NY 10036, USA; Telephone: +1.212.642.4900, Fax: +1.212.398.0023, <http://www.ansi.org>

² American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990, USA; Telephone: +1.973.882.1170, Fax: +1.973.882.1717, <https://www.asme.org>

5.1.2 *SEM* — scanning electron microscopy

5.1.3 *SEM* — scanning electron microscope

5.2 Definitions

5.2.1 *cutoff* — a length selected to limit the spacing of surface irregularities. It separates a surface's roughness from its waviness.

5.2.2 *distinct regions* — visually unique areas of a surface defined by patterns of lay or differences in the appearance of surface roughness. In-line bores of different sizes or orientations and each leg of a shaped component should be considered distinct regions.

5.2.3 *evaluation length* — the actual length over which surface roughness is assessed.

5.2.4 *lay* — the general direction of orientation of surface features.

5.2.5 *skid* — a stylus probe support which acts as both a filter and a datum for probe movements.

5.2.6 *skidless* — a type of instrument that does not use an external skid attached to the probe to act as a datum. Instead, it references a datum plane internal to the measurement equipment.

5.2.7 *stylus* — the object which mechanically probes the surface.

5.2.8 *surface roughness* — the finer irregularities of the surface texture, usually including those irregularities that result from the inherent action of the production process, for example traverse feed marks from cutting tools. [ASME B46.1]

5.2.9 *surface texture* — repetitive or random deviations from the nominal surface that forms the three-dimensional topography of the surface. Surface texture includes roughness, waviness, lay, and flaws. [ASME B46.1]

5.2.10 *waviness* — the more widely spaced component of surface texture. Waviness may result from such factors as machine or workpiece deflections, vibrations, chatter, heat treatment, or warping strains. Roughness may be considered as superimposed on a 'wavy' surface.

6 Sampling

6.1 Acceptability criteria should be specified by the user and be developed in accordance with published sampling plans such as ANSI/ASQ Z1.9, Sampling Procedures and Tables for Inspection by Variables for Percent Nonconforming.

7 Apparatus

7.1 The instrument should be a stylus type as defined by ASME B46.1, § 2. Due to the limitations of skidded instruments (Type IV and V), a skidless instrument (Type I) is preferable.

7.2 The instrument should be calibrated using standard laboratory practices and manufacturer's recommendations with a roughness metrology standard calibrated by a certified testing laboratory and traceable to NIST.³

7.3 In order to resolve the features of the surface, a stylus with a conical tipped radius of 5 μm (200 μin) should be used.

8 Units of Measure

8.1 Surface roughness should be described by means of the Roughness Average, R_a , as defined per ASME B46.1.

8.2 Measurements should be specified in micrometers (μm) or microinches (μin).

9 Preparation of Apparatus

9.1 The surface should be clean and free from loose debris before taking a measurement.

³ National Institute of Standards and Technology, 100 Bureau Drive, Stop 3460, Gaithersburg, MD 20899-3460, USA; Telephone: +1.301.975.6478, <http://www.nist.gov>