

SEMI F17-95 (Withdrawn 0704) SPECIFICATION FOR HIGH PURITY QUALITY ELECTROPOLISHED 316L STAINLESS STEEL TUBING, COMPONENT TUBE STUBS, AND FITTINGS MADE FROM TUBING

This specification was technically reapproved by the Global Gases Committee and is the direct responsibility of the North American Gases Committee. Current edition approved by the North American Regional Standards Committee on October 25, 2002. Initially available at www.semi.org December 2002; to be published March 2003. Originally published in 1995.

NOTICE: This document was balloted and approved for withdrawal in 2004.

1 Purpose

1.1 The purpose of this specification is to define the ordering, surface condition, and quality assurance requirements for high purity quality electropolished 316L stainless steel tubing, component tube stubs, and fittings made from tubing.

2 Scope

2.1 This specification defines the special criteria for nominal sizes of electropolished 316L stainless steel tubing, component tube stubs, and fittings made from tubing for use in high purity chemical (gas or liquid) distribution systems in semiconductor manufacturing facilities.

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

3.1 SEMI Standard

SEMI F16 — Specification for 316L Stainless Steel Tubing Which Is to Be Finished and Electropolished for High Purity Semiconductor Manufacturing Applications

3.2 ANSI/ASME Standards¹

B31.1 — Power Piping

B31.3 — Chemical Plant and Petroleum Refinery Piping

B46.1 — Surface Texture: Surface Roughness, Waviness, and Lay

¹ American Society of Mechanical Engineers, United Engineering Center, 345 East 47th Street, New York, NY 10017

3.3 ASTM Standards²

A269 — Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service

A632 — Specification for Seamless and Welded Austenitic Stainless Steel Tubing (Small Diameter) for General Service

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

4 General Requirements

4.1 The finished tubing, component tube stubs, and fittings made from tubing furnished under this specification shall use the tubing governed by SEMI F16 and shall meet the additional finish requirements herein.

5 Ordering Information

5.1 Orders for finished tubing, component tube stubs, or fittings made from tubing under this specification shall include the following, as a minimum, to describe the item:

- Quantity (meters, feet, number of items, or number of lengths),
- Type of tubing (seamless or welded),
- Size (nominal outside diameter and wall thickness),
- Length (specific or random), and
- Other specific dimensions (such as for fittings).

6 Surface Condition

6.1 The internal surface of all finished tubing, component tube stubs, and fittings made from tubing shall be electropolished.

² American Society for Testing and Materials International, 100 Barr Harbor Drive, West Conshohocken, Pennsylvania 19428-2959, USA. Telephone: 610.832.9585, Fax: 610.832.9555 Website: <http://www.astm.org>

6.2 The internal surface of the finished tubing, component tube stub, or fitting made from tubing shall be free from all macroscopic pitting, staining or discoloration, and surface flaws. The O.D. of the tube shall be homogeneous in texture and brightness and free of obvious flaws.

6.3 Finished tubing, component tube stubs, and fittings made from tubing shall be measured for internal surface finish. Testing shall verify conformance to a surface roughness standard of one of the following:

Table 1 Roughness Average (R_a)

<i>Multiple Measurements</i>		<i>Maximum Single Measurement</i>	
<i>micrometers</i>	<i>microinches</i>	<i>micrometers</i>	<i>microinches</i>
0.25	10	0.30	12
0.18	7	0.25	10
0.13	5	0.18	7

7 Surface Condition Measurements

7.1 *Surface Roughness* — When specified as per Section 6.3, surface roughness shall be measured in accordance with ANSI B46.1, using a stylus-type instrument and a cutoff of 760 micrometers (0.030 inches), or equivalent process (which shall be submitted for approval to the customer prior to order acceptance). The results reported shall be Roughness Average (R_a), expressed in micrometers or microinches.

7.1.1 Measurements shall be made at 0, 90, 180, and 270 degrees around the tube's inner circumference.

7.2 Scanning Electron Microscopy (SEM) photographs of the electropolished internal surfaces of tubing, component tube stubs, and fittings made from tubing shall be provided by the manufacturer in accordance with the sampling frequency criteria specified by the customer. SEM analysis shall verify that no more than 40 defects shall be distinguishable in a 3400 to 3600× field view in a 64 × 89 mm (2 ½ in. × 3 ½ in.) picture.

7.3 Chemical analysis, using electron spectroscopy for chemical analysis (ESCA), shall be performed on the electropolished internal surfaces of tubing, component tube stubs, and fittings made from tubing and shall be provided by the manufacturer in accordance with the sampling frequency criteria specified by the customer. Elemental composition shall be expressed in atomic percent units and shall verify a minimum chromium oxide to iron oxide ratio of 2.2:1.

7.4 Auger Electron Spectroscopy (AES) analysis shall be performed on the electropolished internal surfaces of tubing, component tube stubs, and fittings made from

tubing and shall be provided by the manufacturer in accordance with the sampling frequency criteria specified by the customer.

8 Cleanliness

8.1 After electropolishing, finished tubing shall be final cleaned with a process that uses deionized (DI) water with a minimum resistivity of 17.5 megohm-cm at 25°C as the final cleaning agent, and nitrogen or a suitable filtered inert gas, as a drying agent. Both the water and the gas shall be heated to a minimum of 60°C.

8.2 Tubing, component tube stubs, and fittings made from tubing shall be sealed with polyethylene caps pressed over 0.05 mm (1.75 mil) or thicker polyamide squares after having been purged with nitrogen or a suitable inert gas. Capped tubing, stubs, or fittings shall be heat-sealed in a single 0.15 mm (6 mil) or thicker polyethylene bag.

9 Permissible Variations in Dimensions

9.1 The permissible variations in dimensions shall be as outlined in Table 3 of ASTM A269 for nominal sizes ½ in. diameter and larger and in Table 3 of ASTM A632 for nominal sizes smaller than ½ in. diameter.

9.2 Finished wall thicknesses for tubing, component tube stubs, and fittings made from tubing are shown in Table 2. The finished thicknesses must also comply with the requirements of ANSI/ASME B31.1 and B31.3 for the intended service temperature and pressure. The appropriate tolerances per Section 9.1 shall apply to these finished wall thicknesses.

Table 2 Finished Wall Thickness for Various Tube Sizes

<i>Nominal O.D.</i>	<i>Finished Tube Wall Thickness</i>
¼ in., 3/8 in.	0.89 mm (0.035 in.)
½ in.	1.25 mm (0.049 in.)
¾ in., 1 in., 1 ½ in., 2 in., 3 in.	1.65 mm (0.065 in.)
4 in., 6 in.	2.11 mm (0.083 in.)

10 Certification

10.1 The supplier shall provide the following reports and certification with all shipments of electropolished tubing, component tube stubs, or fittings made from tubing:

10.1.1 Type of tubing (seamless or welded),

10.1.2 Size (nominal outside diameter and wall thickness),

10.1.3 Material composition report,