



SEMI F7-92

TEST METHOD TO DETERMINE THE TENSILE STRENGTH OF TUBE FITTING CONNECTIONS MADE OF FLUOROCARBON MATERIALS

This test method was technically reapproved by the Facilities Committee and is the direct responsibility of the North American Facilities Committee. Current edition approved by the North American Regional Standards Committee in October 1998. Initially available on SEMI OnLine February 1999; to be published February 1999. Originally published in 1992; previous published revision in 1996.

1. Purpose

1.1 This method provides a uniform procedure to determine the tensile strength of tube fitting connections made of fluorocarbon materials.

2. Scope

2.1 This method can be used to characterize tube fitting connections on the basis of test data developed under the conditions described herein, but the results are not intended to imply a performance rating.

2.2 Tube defined in this method has a circular cross section and is made of fluorocarbon materials.

2.3 All parts of the tube fittings tested by this method in contact with the internal fluid are made of fluorocarbon materials.

2.3.1 Parts such as a nuts or grippers are not limited to being made of a fluorocarbon material.

2.4 Only the seal between the tube and tube fitting being evaluated is within the scope of this document. All other, threaded seals are beyond the scope of this document.

2.5 When using this method for making comparisons among various tube fittings and/or manufacturers, the user must be specific in the selection of the tube and tube fittings to be evaluated.

2.6 The International System of Units (SI) is used as the standard unit of measure in this document. The U.S. Customary units are in parentheses for reference purposes only and have been rounded to the nearest whole value.

3. Referenced Documents

3.1 *ASTM Standards*¹

D3307 PFA — Fluorocarbon Molding and Extrusion Materials

D3296 — Standard Specification for FEP Fluorocarbon Tube

4. Summary of Method

4.1 Subject tube fitting connections made of fluorocarbon materials to extreme tensile forces.

5. Significance and Use

5.1 In the manufacturing of semiconductor products, many types of hazardous chemicals and solvents are required. As a result, tubing and various fitting designs of fluorocarbon materials (which are chemically resistant to these fluids) are used to transport those fluids. It is important to control the testing process when evaluating various fitting designs, so that accurate comparisons of the tensile strength can be made.

5.2 It is the intent of this method to provide a procedure in which the tensile force will be applied to tube fitting connections made of fluorocarbon materials. By using this method, accurate comparisons of various tube fitting designs can be achieved.

5.3 The results obtained when using this method are applicable only to conditions that specifically duplicate the procedures used within this method.

5.4 When using this test method, it is assumed that the test specimens are truly representative of the material and manufacturing process specified for that product. Departure from this assumption could introduce discrepancies that are greater than those introduced by departure from the details of the procedure outlined in this method.

6. Terminology

6.1 *characterize* — To describe the quality of.

6.2 *failure* — Tube separation from a tube fitting connection or tearing of the tube.

6.3 *subject* — To expose to.

6.4 *tensile* — Longitudinal, so as to lengthen the test object.

¹ American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959

7. Description of Test Equipment

7.1 A test apparatus capable of securing the test specimen while accurately providing a uniform rate of pull to the specimen. The test instrument shall have the capability of recording the maximum tensile force applied to the test specimen.

7.2 See Figure 1 for basic tensile test apparatus.

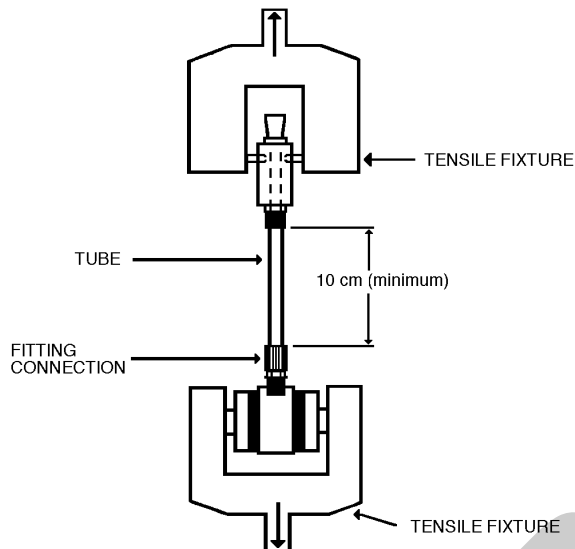


Figure 1
Basic Tensile Test Apparatus

8. Safety Precautions

WARNING: This test method will subject test specimens to conditions that may exceed the normal performance rating of the products under evaluation. Adequate precautions must be taken to prevent injury to the person conducting the test.

9. Test Specimens and Conditioning

9.1 *Sample Size* — A minimum of three specimens shall be tested.

9.2 *Specimen Size* — The specimen length shall be no less than 10 cm (4 in) between the tensile fixture and the tube end of the fitting connection.

9.3 *Specimen Surface* — All surfaces of the specimens shall be free of visible flaws, scratches, or other imperfections, unless typically found on a representative sample of the product.

9.4 *Specimen Conditioning* — All specimens must be conditioned for a minimum of one hour in an air

environment of $23^{\circ} \pm 2.8^{\circ}\text{C}$ ($73^{\circ} \pm 5^{\circ}\text{F}$) prior to being subjected to tensile forces.

10. Calibration

10.1 Calibrate the tensile test equipment's rate of pull to 2.5 cm (1 in) per minute, $\pm 5\%$.

10.2 Calibrate the tensile force instrument to $\pm 2\%$ full scale.

11. Test Procedure

11.1 Assemble a test fitting connection, per manufacturer's specification, to one end of the tube. (See 9.2.)

11.2 Install the fitting connection to the tensile fixture (see Figure 1) in a manner that prevents distortion of the connection.

11.3 Secure the open end of the tube to the tensile fixture, leaving a minimum of 10 cm (4 in) of exposed tube.

11.4 Begin pulling the test specimen at a rate of 2.5 cm (1 in) per minute.

11.5 Continue applying tensile force until the tube pulls through the fitting connection or until tearing of the tube occurs.

11.5.1 If the tube releases from the tensile fixture, the data from that specimen must be disregarded and an additional specimen tested.

11.6 Record on test data sheet (see Appendix 1 for a sample) the mode of failure and the maximum tensile force applied, in Newtons (lbs).

12. Calculations

12.1 Calculate the average "maximum tensile force" and record.

12.2 Calculate the standard deviation of "maximum tensile force" and record.

13. Data Accuracy

13.1 *Tensile Force* — Newtons: $\pm 2\%$.

14. Test Data Sheet

The test data sheet shall include the following information: