



Standard Test Methods for Leaks Using the Mass Spectrometer Leak Detector in the Inside-Out Testing Mode¹

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1. Scope

1.1 These test methods² cover procedures for testing devices that are sealed prior to testing, such as semiconductors, hermetically enclosed relays, pyrotechnic devices, etc., for leakage through the walls of the enclosure. They may be used with various degrees of sensitivity (depending on the internal volume, the strength of the enclosure, the time available for preparation of test, and on the sorption characteristics of the enclosure material for helium). In general practice the sensitivity limits are from 4.4×10^{-15} to 4.4×10^{-11} moles/s (10^{-9} standard cm^3/s to 10^{-5} standard cm^3/s at 0°C) for helium, although these limits may be exceeded by several decades in either direction in some circumstances.

1.2 Two test methods are described:

1.2.1 *Test Method A*—Test part preparation by bombing.

1.2.2 *Test Method B*—Test part preparation by prefilling.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

E 1316 Terminology for Nondestructive Examinations³

2.2 *Other Documents:*

SNT-TC-1A Recommended Practice for Personnel Qualification and Certification in Nondestructive Testing⁴

ANSI/ASNT CP-189 ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel⁴

¹ These test methods are under the jurisdiction of ASTM Committee E-7 on Nondestructive Testing and are the direct responsibility of Subcommittee E07.08 on Leak Testing.

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² The inside-out testing mode is characterized by an external vacuum and internal pressure. This document covers “evacuated,” “sealed with tracer,” and “air-sealed” testing procedures shown in Terminology E 1316.

³ *Annual Book of ASTM Standards*, Vol 03.03.

⁴ Available from American Society for Nondestructive Testing, 1711 Arlington Plaza, P.O. Box 28518, Columbus, OH 43228-0518.

3. Terminology

3.1 *Definitions*—For definitions of terms used in this standard, see Terminology E 1316, Section E.

4. Summary of Test Methods

4.1 These test methods require that the test part contain helium at some calculable pressure at the time of test. If the device cannot be sealed with a known pressure of helium inside, it is necessary to “bomb” the part in a helium pressure chamber in order to introduce helium into the test part if a leak exists.

4.2 After the test part has been subjected to helium pressurizing means, it is placed in an enclosure which is then evacuated and coupled to a mass spectrometer leak detector. In the event of a leak, an output signal will be obtained from the leak detector. If the actual leak rate of the test part must be known, this must then be calculated from the output reading and the test parameters.

5. Personnel Qualification

5.1 It is recommended that personnel performing leak testing attend a dedicated training course on the subject and pass a written examination. The training course should be appropriate for NDT level II qualification according to Recommended Practice No. SNT-TC-1A of the American Society for Nondestructive Testing or ANSI/ASNT Standard CP-189.

6. Significance and Use

6.1 Methods A or B are useful in testing hermetically-sealed devices with internal volumes. Maximum acceptable leak rates have been established for microelectronic devices to assure performance characteristics will not be affected by in-leakage of air, water vapor or other contaminants over the projected life expected. Care must be taken to control the bombing pressure, bombing time and dwell time after bombing or the results can vary substantially.

7. Interferences

7.1 Surface fissures, paint, dirt, polymer seals, etc., can all sorb helium during the bombing procedure and will contribute to the output signal on the leak detector. Unless this process is