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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION



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JEDEC STANDARD

JESD22-A109

Test Method A109
Hermeticity

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ELECTRONIC INDUSTRIES ASSOCIATION
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

HERMETICITY

FOREWORD

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The text of this PAS is based on the following document:

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Draft PAS	Report on voting
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TEST METHOD A109**HERMETICITY**

(From JEDEC Council Ballot JCB-86-25A, formulated under the cognizance of JC-14.1 Committee on Transportation/Automotive Electronics.)

1. PURPOSE

The purpose of this test is to determine the effectiveness of the seal of hermetically sealed solid-state devices.

The seal tests are considered nondestructive. They are intended to be used for 100% screen, lot acceptance, product monitoring or for qualification testing as applicable. The seal tests may also be employed as end points for other environmental durability tests.

1.1 Definition**Measured Leak Rate**

The measured leak rate is defined as the leak rate of a given package as measured under specified conditions and employing a specified test medium. Measured leak rate shall be expressed in units of atmosphere cubic centimeters per second (atm-cm³/s).

2. APPARATUS**2.1 Test Condition A - Helium Fine Leak Test**

Apparatus required shall consist of suitable pressure and vacuum chambers and a mass spectrometer-type leak detector, preset and properly calibrated for a helium leak rate sensitivity to read **measured helium leak rates of 10⁻⁹ atm-cm³/s and greater.** The volume of the chamber used for leak measurement should be held to the minimum practical, since this chamber volume has an adverse effect on sensitivity limits. The leak detector indicator shall be calibrated using a diffusion-type calibrated standard leak at least once during every working shift.

2.2 Test Condition B - Radioisotope Fine Leak Test

The apparatus for this shall consist of:

- (1) Radioactive tracer gas activation console.
- (2) Counting equipment consisting of a scintillation crystal, photomultiplier tube, preamplifier, ratemeter, and krypton-85 reference standards. The counting station shall be of sufficient sensitivity to determine the radiation level of any krypton-85 tracer gas present within the device. The counting station shall have a **minimum sensitivity corresponding to a leak rate of 10^{-9} atm-cm³/s** of krypton-85 and shall be calibrated at least once every working shift using krypton-85 reference standards and following the equipment manufacturer's instruction.
- (3) A tracer gas consisting of a mixture of krypton-85 and dry nitrogen. The concentration of krypton-85 in dry nitrogen shall be no less than 100 microcuries per atmospheric cubic centimeter. This value shall be determined at least once per month.

2.3 Test Condition C - Fluorocarbon Bubble Gross Leak

The apparatus for this test shall consist of:

- (1) A vacuum/pressure chamber for the evacuation and subsequent pressure bombing of devices up to 75 psig for up to 10 hours.
- (2) A suitable observation container with provisions to maintain the indicator fluid at a temperature of 125°C and a filtration system capable of removing particles greater than 1 micron in size from the fluid.
- (3) A magnifier with a magnification in the range between 3X and 30X for observation of bubbles emanating from devices when immersed in the indicator fluid.
- (4) Sources of FC-72, FC-84 or D-80 fluorocarbon detector fluids, and FC-40, FC-43 or DO-2 fluorocarbon indicator fluids.

- (5) A lighting source capable of producing at least 15 thousand foot candles in air at a distance equal to that which the most distant device in the bath will be from the source. The lighting source shall not require calibration, but the light level at the point of observation (i.e., where the device under test is located during observation for bubbles) shall be verified.
- (6) Suitable calibrated instruments to indicate that test temperatures, pressures and times are as specified.
- (7) Suitable fixtures to hold the device(s) in the indicator fluid.

2.4 Test Condition D - Fluorocarbon Vapor Detection Gross Leak

The apparatus for this test shall consist of:

- (1) A vacuum/pressure chamber for the evacuation and subsequent pressure bombing of devices up to 75 psig for up to 12.5 hours.
- (2) Sources of FC-84 or D-80 fluorocarbon detector fluids.
- (3) Suitable calibrated instruments to indicate that test temperatures, pressures and times are as specified.
- (4) A fluorocarbon vapor detection system capable of detecting vapor quantities equivalent to 0.28 mg of FC-84.
- (5) A calibration source for the vapor detector. The vapor detector shall be calibrated at least once each working shift per the manufacturer's instructions.

3. PROCEDURE

Fine and gross leak tests shall be conducted in accordance with the requirements and procedures of the specified test condition. Testing order shall be fine leak, followed by gross leak. Where bomb pressure specified exceeds the device package capability, alternative pressure, exposure time and dwell time conditions may be used provided they satisfy the leak rate, pressure, time relationships which apply, and provided no less than 30 psia bomb pressure is applied in any case.

3.1 Test Condition A - Helium Fine Leak

3.1.1 Test Condition A1, A2

Test condition A1 is a "fixed" method with specified conditions per Table I that will ensure the test sensitivity necessary to detect the required measured leak rate (R1). Test condition A2 is a "flexible" method that allows the variance of test conditions in accordance with the formula of 3.1.1.3 to detect the specified equivalent standard leak rate (L) at a predetermined leak rate (R1).

3.1.1.1 Test Conditions A1 and A2 - Procedure Applicable to "Fixed" and "Flexible" Methods

The completed device(s) shall be placed in a sealed chamber, which is then pressurized with a tracer gas of 100 +0/-5 percent helium for the required time and pressure. The pressure shall then be relieved and each specimen transferred to another chamber(s) which are connected to the evacuating system and a mass-spectrometer-type leak detector. When the chamber(s) is evacuated, any tracer gas which was previously forced into the specimen will thus be drawn out and indicated by the leak detector as a measured leak rate (R1). (The number of devices removed from pressurization for leak testing shall be limited to such that the test of the last device can be completed within 60 minutes for test condition A1 or within the chosen value of dwell time t_2 for test condition A2).

3.1.1.2 Test Condition A1 - Fixed Method

The device(s) shall be tested using the appropriate conditions specified in Table I for the internal cavity volume of the package under test. The time t_1 is the time under pressure and time t_2 is the maximum time allowed after release of pressure before the device shall be read. The fixed method shall not be used if the maximum equivalent standard leak rate limit given in the procurement document is less than the limits specified herein for the flexible method.