

Gross Leak Testing
See MIL-STD-883
Test Methods Standards for Microcircuits

Executive Summary:

Per MIL-STD-883, sealed StratEdge Corporation molded ceramic microcircuit packages are considered hermetic with respect to gross leak if they pass “the bubble test” after being pressurized under the following conditions:

Pressure (nominal¹) = 30 psia (pounds per square inch, absolute)
Minimum pressurization time = 23.5 hours

Packages with small internal volume must first be pre-conditioned by exposure to a vacuum before they are conditioned by exposure to the fluorocarbon liquid under pressure. StratEdge Corporation molded ceramic microcircuit packages with part numbers of 3333 or less will typically require the vacuum cycle and packages with part numbers of 4040 or greater typically will not require the vacuum cycle.

Method 1014.13

MIL-STD-883H, METHOD 1014.13 addresses several methods to test hermeticity of electronic devices. Following the required military format, METHOD 1014.13 first presents an overview of all the methods, then the equipment and procedure for all the methods, and finally the criteria for all the methods. To make things easier to follow, the key parts of ONE method, Test condition C1, using perfluorocarbon liquid to detect gross leaks is transcribed here along with some annotation to aid in understanding the MIL-STD requirement.

2.3 Test condition C, perfluorocarbon gross leak.

(Apparatus is described in some detail in the MIL-STD)

3.3 Test condition C₁ or C₃, perfluorocarbon gross leak. Test condition C₁ is a fixed method with specified conditions that will ensure the test sensitivity necessary. Test condition C₂ has been replaced by C₁. Test condition C₃ is a fixed method that uses a vapor detection system instead of an indicator bath.

Conditioning of samples is:

3.3.1 Procedure applicable to fixed (C₁) method. The devices shall be placed in a vacuum/pressure chamber and the pressure reduced to 5 torr or less and maintained for 30 minutes minimum. The vacuum cycle may be omitted for packages with an internal volume > 0.1 cm³. A sufficient amount of type I detector fluid shall be admitted to cover the devices. When the vacuum cycle is performed, the fluid will be admitted after the minimum 30 minute period but before breaking the vacuum. The devices shall then be pressurized in accordance with table IV. When the pressurization period is complete the pressure shall be released and the devices removed from the chamber without being removed from a bath of detector fluid for greater than 20 seconds. A holding bath may be another vessel or storage tank. When the devices are removed from the bath they shall be dried for 2 ± 1 minutes in air prior to immersion in type II indicator fluid, which shall be maintained at 125°C ± 5°C. The devices shall be immersed with the uppermost portion at a minimum depth of 2 inches below the surface of the indicator fluid, one at a time or in such a configuration that a single bubble from a single device out of a group under observation may be clearly observed as to its occurrence and source. The device shall be observed against a dull, nonreflective black background through the magnifier, while illuminated by the lighting source, from the instant of immersion until, expiration of a 30-second minimum observation period, unless rejected earlier.

Specific test conditions are listed in 3.3.1.1 Test condition C1, fixed method TABLE IV. Our objective is to ensure that the pressure conditions during the test do not damage the samples. The minimum test conditions from 3.3.1.1, TABLE IV are listed below:

¹ Set the pressure at 30 psia. 30 psia is required by the MIL-STD, but it's also the maximum recommended pressure for testing his style of package. **DO NOT CONDITION AT A PRESSURE ABOVE 30 PSIA.**

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TABLE IV. Condition C pressurization conditions. C1
Pressure psia (min) = 30
Minimum pressurization time (hour) = 23.5

Note that pounds per square inch absolute means the pressure gauge reads absolute pressure above zero, or relative to a vacuum. Most common gauges are calibrated psig (pounds per square inch, gauge). These gauges measure the pressure above the ambient air pressure. Ambient pressure is approximately 14.7 psia (or 15 psia at 2 significant figures). If one has a gauge reading psig, set the pressure to 15 psig. Most gauges indicate psia or psig on the gauge dial. **Checking this can avoid a common error of exposing the parts to excessive bomb pressure.**

Package volume is a consideration governing whether packages must be exposed to a vacuum before they are pressurized in the fluorocarbon test fluid. The vacuum cycle may be omitted for packages with an internal volume $> 0.1 \text{ cm}^3$. For some typical StratEdge Corporation molded ceramic packages, the volumes are as follows:

Part Number	volume cc³	Vacuum Cycle Required
G1010M-2	0.00265	Yes
G1010M-9	0.00235	Yes
G1616M-1	0.00851	Yes
GW2121M-3	0.01269	Yes
G2121M-8	0.01202	Yes
G3333M-1S	0.05357	Yes
G3333M-2	0.05151	Yes
G3838M-1	0.10177	No
G3838M-8	0.08590	Yes
G4040M-5	0.11007	No
G5050M-1	0.16268	No
G6237M-2	0.25643	No
G6237C-1	0.15158	No
GW6262CT-2	0.24332	No