

All factors from Howl-Mann are comprehended in Mil. Std 883 Test Method 1014.14 test conditions A1 and A2 for helium leak testing. Condition A1 is the “fixed” method in which a sample package is tested under specific conditions tabulated in the test method. The longest bomb time in the fixed method is 10 hours (minimum time) at 45 psi helium, for packages with volume ranging from 10 to 20 cm<sup>3</sup>. Condition A2 is the “flexible” method, wherein the leak rate reject limit  $L_a$  in the Howl-Mann equation is first established in terms of the true air leak rate. Any values of the test parameters  $P_b$ ,  $t_b$ , and  $t_{dwell}$  (i.e., the methodology is “flexible”) can then be chosen for running the test. The only requirement is that the parameters chosen must yield a measurable signal in the mass spectrometer.

Neither the fixed nor the flexible method quantifies the rate at which a package leaks. The methods only qualify a package by establishing that it leaks at some rate relative to a particular reject limit.

When ultrafine leak rates, in the E-10 to E-12 cm<sup>3</sup> atm sec<sup>-1</sup> range, are of interest for packages intended for high reliability and long-lifetime field service, test parameters  $t_b$  (helium “soak” or “bomb” time) and  $t_{dwell}$  (analysis time in the mass spectrometer) become pacing items in test and production cycle time. The lower the leak rate to which a package needs to be qualified, the longer these times must become in order to be able to qualify a package to ultrafine leak rates.

To determine test cycle time and leak detection sensitivity, the length of time specimen packages must be “soaked” or “bombed” in tracer gas and the pressure level of the tracer gas must be selected. The smaller a leak path, the longer it takes to force tracer gas under pressure through the path into the interior headspace. Enough tracer gas must ingress the cavity to give enough escape time in the detection portion of the test to obtain a measurable result.

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