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NASA TECH BRIEF

Marshall Space Flight Center

Leak Decay Method of Helium Bombardment Leak Testing

This innovation is a new method of applying a standard technique for the verification of hermetic seal quality of small components. No refinement of current quality control laboratory procedures, equipment, or operator skills is required. The standard technique, helium bombardment leak testing, is accomplished by subjecting the parts to be tested to "bombing" in a helium atmosphere at specified pressure for a specified time period. Within some limited time following the helium bombardment the parts are examined with a mass spectrometer leak detector to determine the rate at which helium gas, forced into the part during bombardment, is leaking back out through the seals. Parts which exhibit post-bombardment helium leak rates greater than a specified criterion limit are rejected.

In the new method, at least two post-bombardment leak rate measurements are made, and the acceptance/rejection decision is based upon the rate at which the measured leak rate decays, rather than upon leak rate magnitude. The new method stems from an analysis of gas flow into and out of the sealed volume which is rigorously correct only for the laws of exponential decay which apply to molecular permeation, or gaseous diffusion flow. The method is conservative, however, in its determinations of seal quality for those parts which, while having seals capable of permitting viscous flow, yet have hermetic requirements determined by prolonged atmospheric storage periods during which gas transport through viscous flow is negligible.

The new technique provides a more precise and repeatable measure of seal quality and reduces or eliminates the requirement for precisely controlled tracer gas bombardment pressures and durations. It eases the tight time constraint on leak rate measurement following bombardment, and reduces error arising from externally adsorbed tracer gas.

The technique eliminates errors in seal quality determinations resulting from absolute error in the reference leak standard and also from previous tracer gas fills introduced either in manufacturing or during previous bombardment. The method is excellent for performing precise leak tests or for checking the quality of hermetic seals.

Notes:

1. Information concerning this innovation may be of interest to seal manufacturers and of substantial interest to all industry in general.
2. Requests for further information may be directed to:
   Technology Utilization Officer
   Marshall Space Flight Center
   Code A&TS-TU
   Huntsville, Alabama 35812
   Reference: B72-10381

Patent status:

No patent action is contemplated by NASA.

Source: W. P. Garton of
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