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NASA TECH BRIEF

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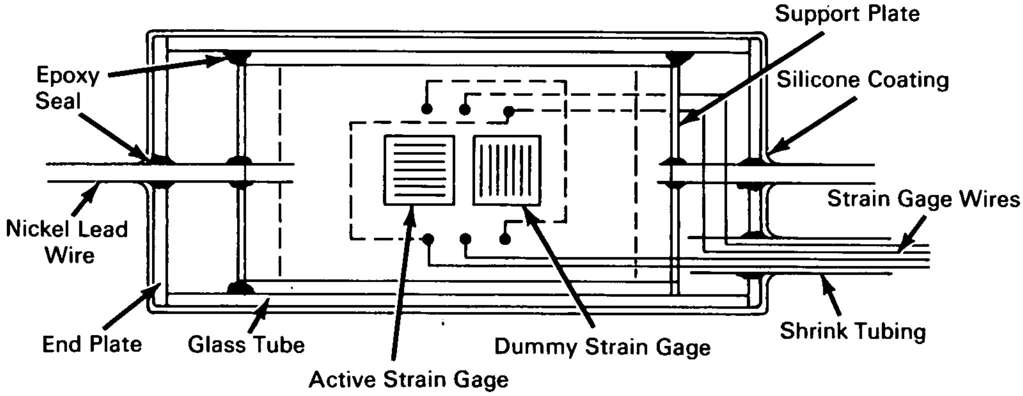
Transducer Measures Embedment Stresses in Electronic Modules



The problem:

To design a transducer that will measure axial embedment stresses in resins used for encapsulation of welded electronic modules. During the encapsulation (polymerization) process and subsequent thermal cycling, sensitive electronic components and interconnections within the modules may be degraded by the axial stresses developed within the encapsulating materials. These axial stresses produce longitudinal (compressive and tensile) forces along lead wires of encapsulated components. Prior measurements were based on tests with pressure transducers that did not simulate the configuration of typical discrete components with axial leads encapsulated in the modules.

The solution:

A strain gage load transducer that simulates the geometry of an actual electronic component with axial leads used in encapsulated modules. The transducer is calibrated mechanically and thermally to measure the longitudinal forces along the component lead wires.

How it's done:

The transducer consists of two strain gage units mounted on a stainless steel baseplate in a sealed glass tube. In order to eliminate bending effects and ensure accurate measurement of axial stresses, the two gage units (each unit constituting one active gage and one dummy or temperature-compensating gage) are mounted back-to-back on opposite surfaces of the baseplate. In each of the two units, the grid pattern of the active strain gage is mounted parallel to the lead wires. The gages are wired as a full bridge tension-loading unit. Polyolefin shrinkfit tubing is applied to the wire bundle. Support plates, which fit tightly inside the glass tube, keep the lead wires rigid to minimize the sensitivity of the tranducer to nonaxial loads. The support plates are bonded to the lead wires with an epoxy adhesive. The gage assembly is placed inside the glass tube and secured in place by bonding the support plate corners to the inner wall of the tube. The transducer is sealed with aluminum endplates at each end of the tube. At the completion of the assembly

(continued overleaf)

operation, the transducer is baked for a minimum of 4 hours. The transducer (except for the wire leads) is then coated with a silicone resin. The cured silicone resin prevents encapsulation material (in subsequent tests) from adhering to the transducer body, thus isolating the transducer from any nonaxial loading effects.

Notes:

1. The transducer can be modified in size and shape to simulate various electronic components. It is designed to operate at temperatures from −100° to +200°F, and can be modified to operate at cryogenic temperatures.
2. Inquiries concerning design details and performance of the transducer may be directed to:

   Technology Utilization Officer
   Marshall Space Flight Center
   Huntsville, Alabama 35812
   Reference: B67-10367

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

Source: Martin H. Smith
of Douglas Aircraft Co., Inc.
under contract to
Marshall Space Flight Center
(MFS-13486)