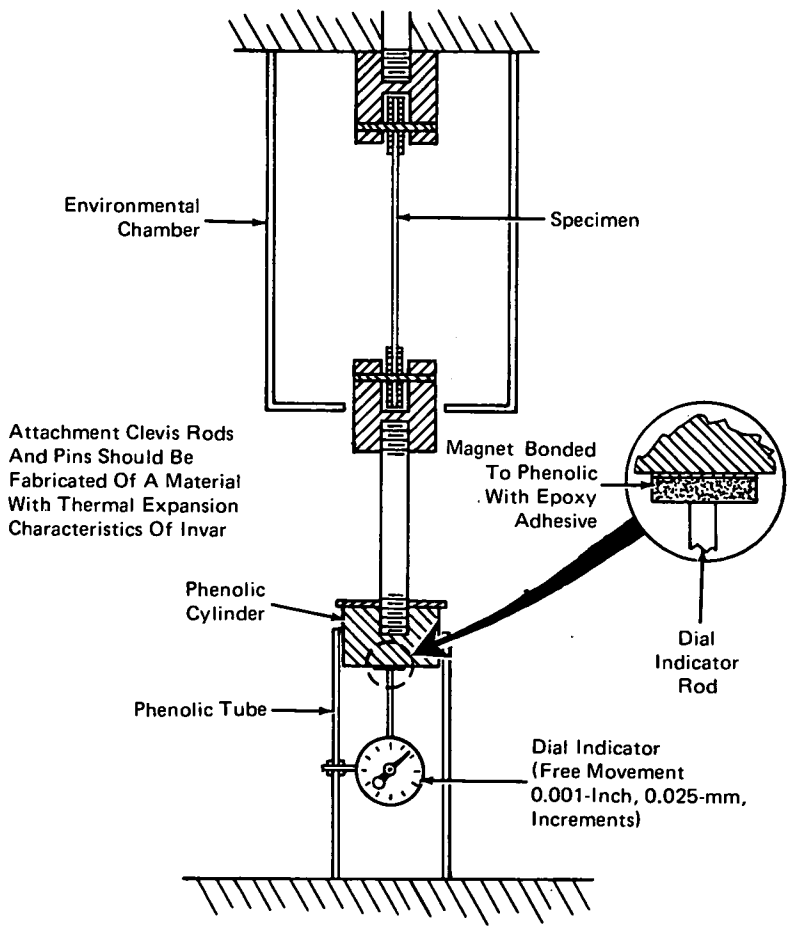
NASA TECH BRIEF

Marshall Space Flight Center

A Monostrain Test Apparatus



A monostrain testing apparatus was designed for determining the tensile strength, modulus of elasticity, elongation, and the thermal coefficient of contraction or expansion of uniformly shaped plastics, adhesives, and foam materials over a temperature range of 700 to 90K (800 to -300°F). Test specimens are prepared by several methods. For example, sheets of paste adhesive systems and primer materials are cast on a flat surface which is covered with an appropriate release material. The desired thickness of the sheet may be controlled with aluminum strips acting as dikes for the casting. Sheet adhesives and film plastics are cured on a flat sheet covered with an appropriate release material. Test specimens of foam are prepared by machining from sections of sprayed foam. All the test specimens, whether cut or machined to configuration required for the test, must be uniform in cross-sectional area within ten percent for specimens to 0.25 mm (0.010 inch) thick and

(continued overleaf)

five percent (or 0.025 mm, 0.001 inch, whichever is greater) for thicknesses to 1.52 mm (0.060 inch).

For the thermal contraction or expansion test (see figure), the specimen is installed in the environmental chamber and suspended from the upper clevis. A phenolic cylinder with a clevis attached is suspended freely from the lower end of the test specimen. A magnet bonded to the bottom of the cylinder point contacts the free moving arm of a dial indicator. The indicator is located within and attached to a phenolic tube that rests on the lower platen of the test machine. At stabilization of test temperature, the indicator will indicate the contraction or expansion of the test specimen. The free weight of the apparatus attached to the bottom of the specimen is such that room temperature elongation (creep) will not exceed 0.01% per unit length per hour. For thermal expansion tests, this suspended weight should not cause significant creep at the maximum temperature of the test.

In tensile testing, the specimen is assembled in the loading clevises within the environmental chamber after the test machine is balanced at zero load. Specimen alignment in the vertical axis must be accomplished prior to loading. The deflector, or strain measuring instrument, is installed in a position that will permit vertical movement at the center of the loading platen to be recorded. During heating or cooling of the test specimen, the test assembly is operated to position the movable platen and allow for expansion or contraction of the specimen. The tensile test is initiated after the desired test temperature has been stabilized within the specimen for a period of ten minutes. The rate of loading should be compatible with the material being tested in that creep will be negligible and failure should occur in two to five minutes. Tensile testing at temperatures in excess of 535K (500°F) requires serrated clamping type plates for gripping the ends of the specimens. Machining the hole for pin loading is omitted for specimens to be loaded in this manner.

Notes:

1. The mechanical and physical properties of materials determined by these tests may be used in design, quality control, and in the evaluation of new adhesives and plastic materials.
2. Requests for further information may be directed to:
   Technology Utilization Officer
   Marshall Space Flight Center
   Code A&PS-TU
   Marshall Space Flight Center, Alabama 35812
   Reference: B72-10679

Patent status:

NASA has decided not to apply for a patent.

Source: W. L. Hill, H. L. Pontius and J. C. Helf of
North American Rockwell Corp.
under contract to
Marshall Space Flight Center
(MFS-24221)