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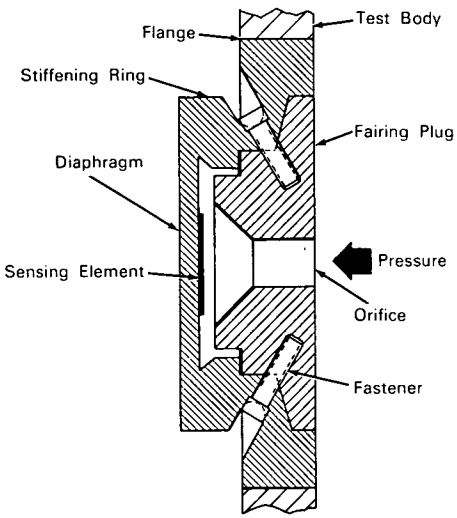
Brief 64-10021

NASA TECH BRIEF

Pressure Transducer 3/8-Inch in Size Can Be Faired into Surface



TRANSDUCER ASSEMBLY

The problem: To design a small pressure transducer that can be imbedded and faired into the surface of a model or a device under test. Fairing allows fluid pressure measurements to be made with minimum disturbance to the fluid flow about a test item. Small faired pressure transducers should be useful in making point-to-point measurements of high pressure-gradient areas and measurements of flow through marginally accessible or narrow-clearance spaces.

The solution: A miniature pressure transducer that can be imbedded and faired into the selected test surface. Piezoresistive elements mounted on a diaphragm transform strains induced by pressure into a proportional electrical signal. It has a range of more than 500 pounds per square inch and furnishes an electrical output suitable for recording instruments, without amplification. This device provides a stress-free system.

How it's done: Three parts are needed: a flange which is imbedded or threaded into the test surface, a fairing plug, and a diaphragm on which the piezoelectric sensing element is mounted. Only normal machining is needed for parts, and the mounting hole can be made quickly and easily. Transducers as small as 0.350-inch in diameter by 0.190-inch in thickness, weighing 0.05 ounce, have been used.

With this design the sensing element is assembled so that it is free to reflect the static and dynamic forces of the liquid or gas pressure, and not unwanted forces affecting the body in which the transducer is imbedded. Thus, the mounting flange provides an

(continued overleaf)

elastic suspension, maintains axial and radial alignment, and, in some cases, seals the exterior portion of the diaphragm.

The fairing plug or core receives all compressive forces from the mounting flange and serves as a trim surface which can be contoured to the material in which the transducer is mounted. It also supplies a small sensing orifice, provides a smooth run for fluid away from the parting line, and dampens vibratory elastic energy.

Units of this type offer considerable utility since they can measure absolute pressure or can sense relative pressure between one side of a test body and the other. Transducers of this type can be installed on either the high-pressure or the low-pressure side of a rotating blade if one side is inaccessible, as in an array of blades of an axial flow pump.

An alternate design can be used having an orifice in both sides of the transducer. Sensing elements would then be mounted on two sides of a separate diaphragm placed between the stiffening ring and an inner core surface. A variety of diaphragms, such as flat, hat type, rimmed, or dished, can be used. The cavity, on one or both sides of the diaphragm, can be utilized for damping the undesirable effects of fluids in certain installations by filling the cavity with a suitable substance.

Notes:

1. This innovation is suitable for use in models when testing hydrofoils, airfoils, fluid flow nozzles, nose cones, and aircraft surfaces, particularly when it is desirable to fair the transducer to the surface.
2. For further information about this innovation inquiries may be directed to:

   Technology Utilization Officer
   Western Operations Office
   160 Pico Boulevard
   Santa Monica, California 90406
   Reference: B64-10021

Patent status: NASA encourages commercial use of this innovation. No patent action is contemplated.

Source: Robert J. Schaffer
(WOO-065)