SELECTION AND EVALUATION OF A PRESSURE TRANSDUCER FOR BLAST MEASUREMENTS

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Five different pressure transducers were evaluated in a pressure driven shock tube for use in blast testing. The simulation allowed evaluation of the rise time characteristics of the transducers and caused the adverse effects previously seen in field tests. Large deviations from the input pressure field were measured - as much as 85 percent error in indicated pressure after only 4 milliseconds. It is shown that deviations in the recorded pressure pulses are due to the thermal pulse that accompanies a transient shock wave. Static pressure and "flash bulb" screening tests did not indicate any problem. Neither did stagnation or endwall configuration tests, but these tests did help to show that the effect was caused by temperature gradients across the sensing element. Traditional fixes, covering the sensing element with electrical tape, opaque grease, or silicon rubber, somewhat mitigate the thermal response, but are not feasible in many field test situations. These fixes also adversely affect transducer accuracy, acceleration sensitivity, and frequency response - resulting in a loss of peak values. Advances in transducer technology, namely sculpted diaphragms, silicon on silicon elements, and metallic coatings, have greatly reduced flash sensitivity, but have not overcome the transient thermal problem. Based on available technology, the Kulite HKM-375 transducer, which seals the sensing element in an insulating oil bath, is recommended for situations such as will be found in the Large Blast/Thermal Simulator where shock pressures greater than 240 kPa and high transient heat fluxes are expected and structural response is of primary interest. Also, transducers employed on blast events should be tested in a shock. tube that simulates the expected test environment to check dynamic response and thermal protection.