

DENSITOMETER TESTING IN A SHOCK TUBE A COOPERATION EFFORT ON BLAST WAVE MEASUREMENT TECHNIQUE

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In the course of a France/Germany/UK cooperation programme on airflow measurements in shock-tubes and nuclear blast simulators, two density gauges were tested at the ZEPHIRE laboratory shock-tube operated by the Centre d'Etudes de Gramat (France).

The principle of the operation of the beta densitometer, developed by the WTD52 and the WIS in Germany, is based on the variation of β radiation attenuation through an air-layer of changing density. The principle of operation of the Corona gauge, developed by AWE in the UK, is based on the variation of a Corona type electrical discharge, through an air-layer of changing density, between two electrodes.

Results are analyzed in various ways: comparison between density as recorded at the shock wave arrival and theoretical value, computed on the basis of the Rankine-Hugoniot relationships, from the values of ambient pressure and temperature before the shock wave arrival and the shock wave propagation velocity; superimposition of static overpressure and density-time history profiles, recorded during the various tests under identical conditions. in order to verify shock-tube reproducibility (pressure profile) and measurement precision (density profile); comparison of density-time history profiles as recorded under the conditions necessary to locate the driver gas/driven gas contact surface to corresponding profiles as determined by numerical simulation.

The analysis of the numerous results gathered shows that in spite of certain drawbacks closely related to their respective principle of operation, both densitometers are able to meet current requirements.