## The (e-p-v) Equation of State

An experimental Hugoniot curve $p_H(p_o, v_o, v)$ is the locus of experimentally measured pressure-volume states produced by passing constant velocity shocks of various strengths into an initial state $(p_o, v_o)$. The change in internal energy along a Hugoniot curve is given by Eq. 4. A family of Hugoniot curves, each of which is centered on a curve along which the energy change is known, is therefore sufficient to determine the (e-p-v) equation of state over the domain of the (p-v) plane covered by the Hugoniots.

In the present work we choose to measure a family of Hugoniots centered on the atmospheric ($p \approx 0$) isobar, because the energy change can easily be measured along this cross curve.

## Calculation of the (T-p-v) from the (e-p-v) Equation of State

Since the (T-p-v) and (e-p-v) equations of state are both incomplete, it is necessary to establish what additional data are required to calculate temperature when the (e-p-v) relationship is known. It follows from thermodynamic identities that the (e-p-v) and (T-p-v) equations of state are related through isentropes. The position of an isentrope in the (p-v) plane is determined by the (e-p-v) equation of state and the isentropic condition $de = -pdv$ obtained by setting $ds = 0$ in Eq. 6. The temperature along an isentrope is given as

$$T = T_i \exp\left[ -\int_{v_i}^{v} \left(\frac{\partial p}{\partial e}\right)_v dv \right] \tag{9}$$

by integrating the identity

$$ds = \left(\frac{\partial e}{\partial T}\right)_v \frac{dT}{T} + \left(\frac{\partial p}{\partial T}\right)_v dv \tag{10}$$

subject to the isentropic condition $ds = 0$.