One of the facts that has been discovered from single shock measurements on many solids and liquids is that over the pressure range accessible with plane explosive systems the shock velocity U_s and particle velocity U_p exhibit a linear relationship of the form

$$U_s = C + MU_p \ . \tag{31}$$

A particular relationship only holds within a given phase. The theoretical significance of this linear relationship has been investigated[29,30] to some extent but at the present is still not well understood. By combining Eq. (31) with Eqs. (7) and (8), the Hugoniot pressure P_H can be written in terms of the corresponding volume V as

$$P_H = \frac{C^2(V_0-V)}{\left[V_0-M(V_0-V)\right]^2} \ . \tag{32}$$

Isentropes and isotherms can be calculated from the Mie-Gruneisen equation of state as expressed in Eq. (24) when the pressure P and the specific energy E are related to the corresponding quantities on the Hugoniot curve H as a function of volume. Assuming Γ/V is constant, for an isentrope Eq. (24) becomes

$$P_S - P_H = k(E_S - E_H) \ , \tag{33}$$

where P_S and E_S are the pressure and energy on an isentrope and

$$k = \Gamma/V = \Gamma_0/V_0 \ . \tag{34}$$

If Eq. (33) is differentiated with respect to V, the result is a differential equation for pressure along an isentrope

$$\left(\frac{\partial P}{\partial V}\right)_S - \left(\frac{\partial P}{\partial V}\right)_H = k\left(\frac{\partial E}{\partial V}\right)_S - \left(\frac{\partial E}{\partial V}\right)_H \ . \tag{35}$$

Since P and E are functions of volume on a given isentrope then