$$A_{i+1} = -\frac{(2M-kV_0-iM)A_i+kMA_{i-1}}{(i+1)V_0} \quad \text{for } i \geq 2 \ . \tag{41}$$

Integration by parts suggests that

$$A_0 = 0,\ A_1 = 1,\ A_2 = 0,\ \text{and } A_3 = -kM/3V_0 \ . \tag{42}$$

Expanding Eq. (40) to obtain the first three terms and using the results from Eqs. (32) and (42), the solution becomes

$$P_S = P_H + Ae^{k\alpha} + \frac{C^2}{(V_0-M\alpha)^2} \sum_{i=3}^{\infty} A_i \alpha^i \ . \tag{43}$$

The constant of integration A is determined from the point at which the Hugoniot and the isentrope curves cross. Here $P_S = P_H$ and $\alpha = \alpha_H$ so that

$$P_H = P_H + Ae^{k\alpha_H} + \frac{C^2}{(V_0-M\alpha_H)^2} \sum_{i=3}^{\infty} A_i \alpha_H^i$$

and

$$A = -\frac{C^2 e^{-k\alpha_H}}{(V_0-M\alpha_H)^2} \sum_{i=3}^{\infty} A_i \alpha_H^i \ . \tag{44}$$

From Eq. (43), the pressure in terms of α anywhere along an isentrope can be calculated since the A_i's are determined from Eq. (41), A is found from Eq. (44), and P_H and α_H are experimentally determined values.

The calculation of an isotherm is very similar. Starting again with Eq. (24)

$$P_T - P_H = \Gamma/V(E_T - E_H) \tag{45}$$

where P_T and E_T are the pressure and energy along an isotherm. Differentiating Eq. (45) with respect to volume yields

$$\left(\frac{\partial P}{\partial V}\right)_T - k\left(\frac{\partial E}{\partial V}\right)_T = \left(\frac{\partial P}{\partial V}\right)_H - k\left(\frac{\partial E}{\partial V}\right)_H \tag{46}$$

which represents the differential equation for pressure along an isotherm. At this point, it becomes advantageous to express $(\partial E/\partial V)_T$