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The Dependence of Ammonal Detonation Product Energy on Cylinder Test Scale ERIC ANDERSON, SCOTT JACKSON, Los Alamos National Laboratory — For a detonation to propagate steadily, the compression shock must be supported by a sufficient amount of energy from the chemical reaction zone. Flow divergence reduces the available energy to drive the detonation forward, resulting in the diameter-effect and eventually detonation failure as charge size is reduced. Similarly, product energy tends to decrease with decreasing charge size. Non-ideal explosives such as Ammonium Nitrate blended with Aluminum Powder (Ammonal) are particularly sensitive to flow divergence. To quantify the effect of flow divergence on Ammonal performance, we applied an analytic method to examine cylinder test wall velocity profiles from Ammonal tests with inner diameters of 12.7 mm up to 76.2 mm. For these tests, we report detonation velocity and detonation product isentropes and energies. In addition, analysis of the velocity profiles revealed an experimental measurement of the Rayleigh line, which agreed well with the theoretical Rayleigh line for all experiments. Using this feature we are able to report inferred reaction zone times.

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