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Pantex Plant

EXPLOSIVE PERFORMANCE

SANL 712-004

L. D. Hanes

April, May, June 1970

DEVELOPMENT DIVISION

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ABSTRACT

The detonation pressure of small, unconfined PBX 9404 charges and of low density, lightly confined PETN pressings was determined by the aquarium technique. The PBX 9404 was $\sim 6\%$ below the usual 372 ± 3 kbar. The low density PETN yielded a pressure several kbars higher than the accepted value (24 kbar) indicating that the PETN may have been overdriven.

DISCUSSION

The aquarium technique was used to obtain the detonation pressure of unconfined PBX 9404, 1/2" long x 1" diameter and 1" long x 1" diameter right circular cylinder charges with density of 1.845 g/cm³ and of lightly confined PETN, 1" long x 1" diameter right circular cylinder pressings at 0.45 g/cm³. All tests were performed in the aquarium configuration used at Pantex in previous work.¹ Backlighting was furnished by bridgewires exploded in a TF Freon atmosphere. A plane wave lens was the donor in each shot: P-16 for PBX 9404 and P-22 for PETN. The low density PETN pressings were lightly confined in a hollow right circular cylinder composed of a syntactic foam² of .4-.5 ρ with approximately 0.25-inch wall thickness. The output end of the sleeve was closed with a taut 0.0005-inch Mylar cover. Waterproofing of the foam was effected by a light coat of clear enamel.

The streak records were analyzed on a Grant comparator with R-t readings taken every 250 μ on R. Both the exponential and the arc tangent models¹ were fitted to the data points. Curve fits to 0.5 μsec total data gave smooth curves with small residuals over the entire range; therefore, these curves were used to obtain jump-off velocity. The particle velocity was computed from a best fit quadratic to the Rice-Walsh data:

$$U = -.607 + .372 D + .0283 D^2$$

The measured shock velocity and computed particle velocity in the water were then used in the conservation of momentum equation to compute the transmitted pressure. The detonation velocities of the explosives were obtained from the relationships:

¹J. K. Rigdon, LRL Quarterly Report for July, August, September 1969.

²Special formulation of syntactic foam made in Septa Laboratory, Development Division, Pantex. For details contact H. W. Lichte, Pantex.

$$D = 2.176 + 3.6 \rho \text{ for PBX 9404}$$

$$D = 1.84 + 3.72 \rho \text{ for PETN}$$

The incident pressure was then calculated from the impedance mismatch equation.

The results of the tests are given in Table I. The detonation pressure of PBX 9404 calculated from the experimentally measured shock velocity in water is 352 kbar mean value in both sizes, consistent with earlier results at Pantex on small geometry PBX 9404 charges, i.e., ~ 6% below the value of 372 ± 3 kbars. The calculated PETN detonation pressure mean is 27 kbar, about 3 kbars higher than expected. This anomaly may be due to the acceptor being overdriven by the P-22 donor.

Table I
Aquarium Test Data

<u>Shot No.</u>	<u>Explosive</u>	<u>Charge Size</u> <u>Dia. (in.)</u>	<u>Length (in.)</u>	<u>Density (g/cm³)</u>	<u>D_i (mm/μsec)</u>	<u>D_t (mm/μsec)</u>	<u>P_t (kbar)</u>	<u>P_i (kbar)</u>	<u>Avg. P_i (kbar)ⁱ</u>
1070-2-12-2		1.0	1.0	1.8452	8.819	6.53	198	346	
13-1	PBX 9404	1.0	0.5	1.8454	8.819	6.58	202	351	352
10-1		1.0	1.0	1.8446	8.817	6.66	208	358	
1070-3-20-1		1.0	1.0	1.450	3.514	3.48	35.9	26.1	
30-1	PETN	1.0	1.0	1.450	3.514	3.57	38.6	27.8	27

FUTURE WORK; COMMENTS; CONCLUSIONS

The PBX 9404 exhibits no apparent difference in output pressure between the two charge lengths tested. The one-inch diameter shots show the same low output pressure in comparison to the accepted value that previous work³ indicated for half-inch diameter shots. This perhaps is due to divergence and lateral effects of the small diameter.

The low density PETN shots should be repeated using a plane wave lens and an attenuator system to insure against overdriving. Interest has been expressed by LRL to extend the detonation pressure measurements over a 0.4 to 1.76 g/cm³ range.

³J. K. Rigdon, *LRL Quarterly Report for July, August, September 1969.*