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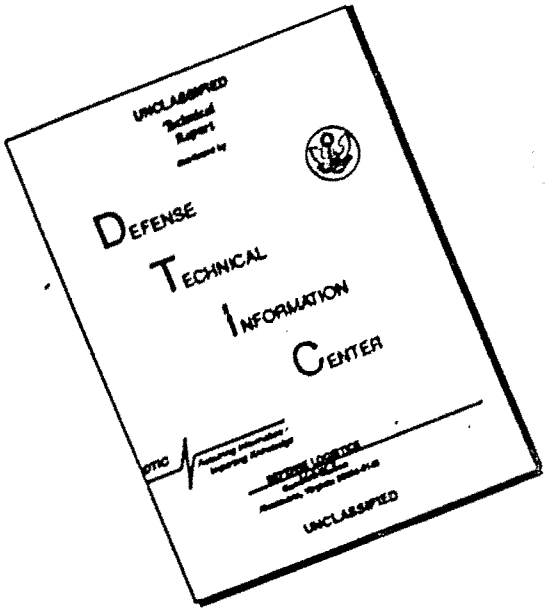

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WATERTOWN ARSENAL LABORATORY

MEMORANDUM REPORT

NO. WAL 710/317

Resistance of Samples of Laminates

Submitted by Victory Plastics Company

to Perforation by Fragment-Simulating Projectile, G-1-S

BY

J. F. SULLIVAN
Asst. Engineer

DATE 23 October 1944

WATERTOWN ARSENAL
WATERTOWN, MASS.

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WATERTOWN ARSENAL LABORATORY

MEMORANDUM REPORT NO. WAL 710/317

Twenty-Sixth Partial Report on Problem B-8.2

23 October 1944

Resistance of Samples of Laminates Submitted by Victory Plastics Company to Perforation by Fragment-Simulating Projectile, G-1-S

1. In accordance with a request from the Office, Chief of Ordnance[1], a program is being conducted at this arsenal to develop improved components of body armor assemblies. In conjunction with this program tests have recently been conducted on three samples of plastic laminates submitted by the Victory Plastics Company.

2. The extreme smallness of the samples submitted (2-3/4" x 2-3/4") vetoed any prospect of a quantitative evaluation of these samples. On the basis of the tests performed the sample containing a nylon constituent appeared definitely inferior to samples of Doron of equivalent weight-per-unit-area previously tested here. Of the two samples containing a rayon constituent one indicated at least a slight inferiority to Doron, whereas the second sample was subjected to such a severe test that no estimate of its relative resistance could be made.

3. In the past, experimental body armor component materials have been subjected to a screening test with cal. .45 steel-jacketed ball projectiles. The extreme smallness of the subject samples, however, would not allow the conduct of such a test. Since a jig had been recently designed to hold samples varying in size from 2½" square to 3" square, it was possible to subject the subject samples to impact with the cal. .30 fragment-simulating projectile, G-1-S, developed at this arsenal[2]. The samples were fired at normal incidence, supported around the edges with an area approximately 2½" square unsupported into which the impacts were directed. The results appear in Table I.

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1. O.O. 422.3/71(c) - Wtn. 470.5/7443(c).
2. WAL 710/247(c)

4. Sample I (101944A) was perforated at a velocity of 975 f/s. Since it was equivalent in weight to .029" of steel, an equal weight of Doron would be expected to resist perforation at 760 f/s, but not at greater velocities. Thus, perforation of this sample at a greatly higher velocity does not necessarily disqualify it. It was not considered possible to impact this sample fairly a second time.

5. Sample II (102044A) was perforated at 845 feet-per-second, but resisted perforation at 705 feet-per-second. An equivalent weight of Doron (.034" of steel) would be expected to resist perforation at 860 feet-per-second. There is thus evidence of some slight inferiority of this sample to Doron. Since Sample I was of substantially identical makeup except for thickness it may be inferred that Sample I might have shown some slight inferiority to an equivalent weight of Doron had the test of that sample been continued.

6. Sample III (101944B) was perforated at 860 feet-per-second. An equivalent weight of Doron (.047" steel) would have resisted perforation at 1095 feet-per-second. Thus, this sample appears distinctly inferior to Doron.

7. Inasmuch as these qualitative tests have not definitely eliminated Samples I and II, the manufacturers have decided to do further work on samples similar in constitution, but in a size more adaptable to evaluation. Results of such tests will be reported as soon as available.

J. F. Sullivan

J. F. Sullivan
Asst. Engineer

APPROVED:

E. L. Reed. MAM 4/2/45

E. L. REED
Research Metallurgist
Acting Chief of Armor Section

TABLE I

Summary of Tests Conducted at Watertown Arsenal on Samples of Laminates Submitted by Victory Plastics Company, 20 October 1944

Sample No.	Company No.	Makeup	Wt. (Grams)	Size	Results with Projectile G-1-S[1] Equiv. Steel Gauge	High Complete Perforation	Low Partial Perforation	Ballistic Limit
I	101944A	11 Plies 2 oz. rayon alternated with 11 plies fiberglas	28	2-3/4 x 2-3/4"	.029"	975	—	<975
II	102044A	14 plies 2 oz. rayon alternated with 14 plies fiberglas	33	2-3/4 x 2-3/4"	.034"	845	705	775 ± 70
III	101944B	11 plies 6 oz. nylon alternated with 11 plies fiberglas	46	2-3/4 x 2-3/4"	.047"	860	—	<860
FOR COMPARISON:								
DORON					.029"	-	--	760
"					.034"	-	—	860
"					.047"	-	—	1095

1. Cal. .30 fragment-simulating projectile - 34 grains.