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WATERTOWN ARSENAL LABORATORY

MEMORANDUM REPORT

NO. WAL 710/540

Resistance of Unsized 19-Ounce Nylon Duck to Perforation by Fragment-Simulating Projectiles

BY

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Asst. Engineer

DATE 29 August 1944

WATERTOWN ARSENAL
WATERTOWN, MASS.

Form No. SPOBE-38
L 18 July 1944

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WATERTOWN ARSENAL LABORATORY

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Fourth Partial Report on Problem B-8.4

29 August 1944

Resistance of Unsized 19-Ounce Nylon Duck to Perforation by Fragment-Simulating Projectiles

1. In accordance with a request of the Office, Chief of Ordnance[1], various numbers of plies of unsized 19-ounce nylon duck have recently been tested at this arsenal.

2. In comparison with samples of sized 17½-ounce nylon duck previously tested here[2,3], the resistance of an equivalent weight of the subject material was slightly inferior. Thus the resistance engendered by the use of a sizing agent appears to more than compensate for the resultant increase in weight.

3. Samples of this material were cut into pieces 12" x 12", stretched taut, and attached rigidly to a wooden frame which allowed a generous area to be unsupported from the rear into which impacts of cal. .45 steel-jacketed ball projectiles and cal. .22 fragment-simulating projectiles, G-2, were directed. The results of these tests appear in Table I in which they have been compared with the results of earlier tests on sized 17½-ounce nylon duck.

4. The addition of a sizing agent to the 17½-ounce nylon duck increased its weight-per-unit-area so that the weight of a given number of plies in the range investigated was about equal to that of an assembly of unsized 19-ounce duck using one ply less. Nevertheless, it is apparent from the test results that the rigidity engendered by the use of the sizing agent caused an increase in the material's resistance which more than compensated for the increase in weight. In general, the addition of the sizing agent was more than equivalent in added resistance to the addition of an extra ply of the basic material.

5. On the other hand, the flexibility characteristic of the unsized material may be considered of such importance as to warrant a sacrifice of the margin of superiority in resistance which the use of the sizing agent has provided.

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1. O.O. 400.112/9391(r) - Wtn 400.112/3163(r).
2. WAL 710/596.
3. WAL 710/616.

6. If, however, flexibility is not of the utmost importance, the results of these tests indicate that the use of sized fabric is to be preferred in the fabrication of body armor assemblies to that of unsized fabric.

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TABLE I

Comparison of Resistance Characteristics of Unsized 19-Ounce Nylon Duck with Those of Sized 17½-Ounce Nylon Duck

Material	No. Plies	Equivalent Steel Gauge	Ballistic Limit F/S	
			Cal. .45[1]	G-2[2]
17½-Ounce, Sized	9	.033"	500	--
19-Ounce, Unsized	11	.036"	627	1260
17½-Ounce, Sized	10	.037"	675	1215
19-Ounce, Unsized	12	.039"	629	1283
17½-Ounce, Sized	11	.040"	704	1310
19-Ounce, Unsized	13	.043"	685 940	1309 1040
17½-Ounce, Sized	12	.044"	750	1360
19-Ounce, Unsized	14	.046"	688	1350

1. Cal. .45 steel-jacketed ball projectile - 230 grains.

2. Cal. .22 fragment-simulating projectile - 17 grains.

[redacted]

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ORIGINATING AGENCY: Watertown Arsenal, Watertown Arsenal Lab., Watertown, Mass.

PUBLISHED BY: (Same)

ATI- 39961

REVISION: (None)

ORIG. AGENCY NO.: WAL-710/540

PUBLISHING AGENCY NO.: (Same)

DATE	DOC. CLASS.	COUNTRY	LANGUAGE	PAGES	ILLUSTRATIONS
Aug '44	[redacted]	U.S.	Eng.	3	table

ABSTRACT:

Tests were conducted to determine the resistance of unsized 19-ounce Nylon duck to perforation by fragment -simulating projectiles. Samples of the material were cut into pieces 12" x 12", stretched taut, and attached rigidly to a wooden frame which allowed a generous area to be unsupported from the rear into which impacts of cal. 0.45 steel-jacketed ball projectiles and cal. 0.22 fragment- producing projectiles, G-2, were directed. The results of the tests are tabulated and compared with the results of tests on sized 17 1/2 ounce nylon duck. In general, the addition of the sizing agent was more than equivalent in added resistance to the addition of an extra ply of the basic material. If flexibility is not of the utmost importance, the results of the tests indicate that the use of sized fabric is to be preferred in the fabrication of body armor assemblies to that of unsized fabric.

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DIVISION: Ordnance and Armament (22)

SECTION: Armor (5)

SUBJECT HEADINGS: Textiles - Gunfire resistance (93280.4)

ATI SHEET NO.: R-22-5-33