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WATERTOWN ARSENAL LABORATORY

MEMORANDUM REPORT

NO. WAL 710/249

Resistance of Various Samples of Aluminum
Alloys Furnished by Reynolds Metals Co. to
Perforation by Fragment-Simulating Projectiles

BY

J. F. SULLIVAN
Asst. Engineer

APR 25 1946

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WATERTOWN ARSENAL LABORATORY

MEMORANDUM REPORT NO. WAL 710/249

Twenty-Eighth Partial Report on Problem B-8.2

4 January 1944

Resistance of Various Samples of Aluminum

Alloys Furnished by Reynolds Metals Co.

to Perforation by Fragment-Simulating Projectiles

1. In response to a request of the Office, Chief of Ordnance¹, tests have recently been conducted on various samples of aluminum alloys made and submitted by the Reynolds Metals Co.

2. Although the resistance of these materials to perforation by the various projectiles used in these tests was much lower than that of Hadfield manganese steel of equivalent weight it is felt that this inferiority is not extrapolable to their resistance to service attack of fragments of high-explosive shell.

3. Samples were measured and weighed and the equivalent steel thicknesses determined. They were then clamped rigidly to wooden ballistic frames and impacted fairly with cal. .45 steel-jacketed ball projectiles and with cal. .22 fragment-simulating projectiles, G-2². The results of these tests are included in Table I.

4. There appears to be very little difference between the resistance characteristics of R-301-W alloy and those of the R-301-T alloy and both alloys are substantially inferior to Hadfield manganese steel in resistance to perforation by the projectiles used in these tests. However, results of actual fragmentation tests of 20mm. high-explosive shell against the subject materials indicate that, under such test conditions, these materials are superior to Hadfield manganese steel in resistance.

1. O.O. 470.1/476 - Wtn 470.1/7254 - 13 July 1944

2. WAL 762/253


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5. It is therefore suggested that the results of the subject tests, as well as those of tests with any fragment-simulator, be interpreted with caution. It is felt that judgment of a material's qualification as armor against fragments of a high-explosive shell should be based only on the results of actual fragmentation tests. Control of quality of successive lots of material may, however, be facilitated by the use of fragment-simulators.

J. F. Sullivan

J. F. Sullivan
Asst. Engineer

APPROVED:

E. L. Reed

E. L. Reed
Research Metallurgist
Acting Chief, Armor Section

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TABLE I

Summary of Ballistic Tests Conducted at Watertown Arsenal

on Several Samples of Aluminum Alloys (R-301-W, R-301-T),

Submitted by Reynolds Metals Company

Type	Ident.	Nominal Gauge	Actual Gauge	Grams/ Sq. Ft.	Equiv. Steel Gauge	Ballistic Limits		
						Cal. .45 ¹	G-2 ²	Cal. .30 Carbine ³
R-301-W	A	.125"	.126"	832	.045	730	---	---
	B	.125	.123	812	.044	691	---	---
	C	.125	.124	818	.044	---	812	---
	D	.125	.124	818	.044	---	810	---
R-301-W	A	.156	.152	1003	.054	875	---	---
	B	.156	.154	1016	.055	906	---	---
	D	.156	.155	1023	.055	---	923	---
	E	.156	.154	1016	.055	---	922	---
R-301-W	A	.188	.188	1241	.067	1110	---	---
	B	.188	.185	1221	.066	1098	---	---
	D	.188	.186	1228	.066	---	1082	---
	E	.188	.184	1214	.065	---	1127	---
R-301-W 14x14	A	.250	.246	1624	.087	---	---	1443
	B	.250	.251	1657	.089	---	1740	---
R-301-W	F	.250	.252	1663	.090	---	---	1498
R-301-T	A	.156	.155	1023	.055	984	---	---
	B	.156	.154	1016	.055	958	---	---
	D	.156	.156	1030	.056	---	945	---
	E	.156	.154	1016	.055	---	937	---
R-301-T	A	.250	.249	1643	.089	---	---	1405
	B	.250	.250	1650	.089	---	---	1418

FOR COMPARISON:

Hadfield Manganese Steel	---	---	.045	950	1675	1275
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1. Cal. .45 steel-jacketed ball projectile
2. Cal. .22 fragment-simulating projectile
3. Cal. .30 carbine ball projectile

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TITLE: Resistance of Various Samples of Aluminum Alloys Furnished by Reynolds Metals Co. to Perforation by Fragment-Simulating Projectiles

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ABSTRACT:

The resistance of various samples of aluminum alloys to perforation by fragment-simulating projectiles was investigated. Samples were clamped rigidly to wooden ballistic frames and impacted fairly with .45 cal. steel-jacketed ball projectiles and with .22 cal. fragment-simulating projectiles, G-2. Results show that there is little difference between the resistance characteristics of R-301-W alloy and those of the R-301-T alloy and both alloys are substantially inferior to Hadfield manganese steel in resistance to perforation by the projectiles used in these tests. However, results of fragmentation tests of 20 mm HE shell against the subject materials indicate that, under such test conditions, these materials are superior to Hadfield manganese steel in resistance.

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