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WATERTOWN ARSENAL LABORATORY

MEMORANDUM REPORT

NO. WAL 710/713

Comparison of 24ST and 75ST Aluminum Alloys on the Basis of Resistance to Perforation by Fragment-Simulating Projectiles

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DATE 8 January 1945

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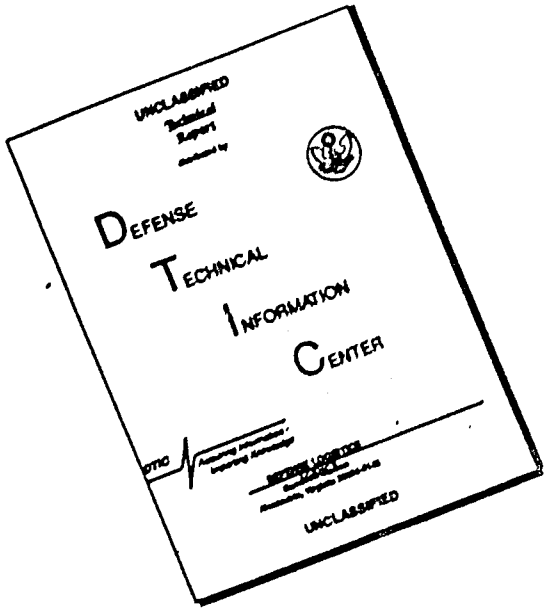

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30th Partial Report on Problem B-8.2

8 January 1945

Comparison of 24ST and 75ST Aluminum Alloys on the Basis of Resistance to Perforation by Fragment-Simulating Projectiles

1. At the request of the Office, Chief of Ordnance[1], tests were recently been conducted at this arsenal on various samples of 24ST and 75ST aluminum alloys which had earlier been subjected to actual fragmentation tests at Aberdeen Proving Ground.

2. There appears to be no significant difference in the resistance characteristics of these two alloys with respect to impact with cal. .45 steel-jacketed ball projectiles or with the fragment-simulators G-1-S[2] and G-23. Their resistance to perforation by these projectiles is considerably inferior to that of an equivalent weight of Hadfield manganese steel and their experience in this respect is consistent with that of other aluminum alloys tested previously.

3. Two test samples (one 12" x 12" and one 6" x 12"), free of perforations, were cut out of each sheet received from Aberdeen Proving Ground. These samples were clamped rigidly to wooden ballistic frames and the 12" x 12" samples were subjected to impact by cal. .45 steel-jacketed ball projectiles while the 6" x 12" pieces were tested with cal. .22 fragment-simulating projectiles, G-2, and with cal. .30 fragment-simulating projectiles, G-1-S. The results of these tests are shown in Table I.

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1. O.O. 400.112/11981 - Wtn 400.112/3227 - 7 November 1944

2. WAL 762/247

3. WAL 762/253

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4. Although the resistance of individual pieces of 24ST was sometimes higher than that of 75ST it is felt that the results disclose no significant difference between the resistance characteristics of the two alloys under impact of the projectiles employed in these tests. There is apparent, of course, the customary inferiority of these materials to Hadfield manganese steel of equivalent weight under these test conditions. It should be pointed out that this inferiority does not extrapolate to actual service conditions, because, under actual fragmentation tests (in which 20mm. high explosive shell are detonated) the subject materials appear to be superior to Hadfield manganese steel and it is considered that the latter tests are more significant of actual service conditions than any ballistic limit tests currently in use.

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TABLE I

Summary of Ballistic Tests Conducted at Watertown Arsenal on Samples of 24ST and 75ST Duralumin Which Had Been Previously Subjected to Fragmentation Tests at Aberdeen Proving Ground

Type	Sample No.	Nominal Gauge	Actual Gauge	Grams/ Sq.Ft.	Equiv. Steel Gauge	Ballistic Limits .45[1]	G-2[2]	G-1-S[3]
75ST	8	.156	.154"	1016"	.055	922		
"	"	"	.154	1008	.054		960±25	1063±23
"	9	.156	.160	1043	.056	847		
"	"	"	.157	1028	.056		970±5	1077±27
"	2	.156	.156	1022	.055	887		
"	"	"	.155	1016	.055		955±10	1083±23
"	11	.125	.127	832	.046	772		
"	"	"	.123	798	.043		775±15	825±10
"	7	.125	.125	821	.044	753		
"	"	"	.125	816	.044		800±25	803±23
"	8	.125	.124	821	.044	790		
"	"	"	.127	838	.045		827±17	898±13
"	1	.102	.100	656	.035	522		
"	"	"	.101	664	.036		728±13	803±23
"	4	.102	.103	672	.036	537		
"	"	"	.102	674	.036		760±30	720±25
"	20	.102	.101	665	.036	541		
"	"	"	.101	662	.036		725±40	723±13
24ST	16-A-53	.156	.156	1031	.056	927		
"	"	"	.157	1028	.056		1030±10	1025±15
"	7-A-69	.156	.161	1046	.057	880		
"	"	"	.157	1022	.055		965	1042±17
"	13-A-67	.156	.157	1028	.056	929		
"	"	"	.158	1032	.056		983±23	1090±15
"	10-B-179	.125	.124	826	.045	720		
"	"	"	.125	834	.045		823±27	870±25
"	13-A-136	.125	.124	837	.045	777		
"	"	"	.128	836	.045		825±10	868±17
"	13-B-183	.125	.127	837	.045	736		
"	"	"	.126	836	.045		835±20	842±27
"	16	.102	.104	684	.037	568		
"	"	"	.105	678	.037		735±20	710±20
"	26	.102	.104	685	.037	539		
"	"	"	.104	672	.036		740±25	690±15
"	29	.102	.104	688	.037	522		
"	"	"	.104	682	.035		775±25	745±10
FOR COMPARISON:								
Hadfield Manganese Steel			—	—	.045	950	1675	1050

1. Cal..45 steel-jacketed ball projectile - 230 grains
2. Cal..22 fragment-simulating projectile - 17 grains
3. Cal..30 fragment-simulating projectile - 34 grains