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WATERTOWN ARSENAL LABORATORY

MEMORANDUM REPORT

NO. WAL 710/594

Preliminary Metallurgical Examination of Twenty-four Samples of Rolled Homogeneous Armor to be Fired During the 1943-44 Cold Test Program

BY

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DATE 16 March 1944

WATERTOWN ARSENAL
WATERTOWN, MASS.

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Watertown Arsenal Laboratory

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Third Partial Report on Problem B-12.1

16 March 1944

Preliminary Metallurgical Examination of Twenty-four Samples of Rolled Homogeneous Armor to be Fired During the 1943-44 Cold Test Program

(1)

1. In accordance with a directive from the Office, Chief of Ordnance, twenty-four (24) samples of rolled homogeneous armor were received from the Ordnance Research Center for metallurgical examination preliminary to their being fired as part of the 1943-44 Cold Test Program.

2. These samples had been cut at Aberdeen from ballistic test samples in sections approximately 4" x 36" x T(the thickness of the ballistic plates). From these samples sections for metallurgical examination have been cut at this arsenal according to Figure 1.

3. Section A (8" x 4" x T) was used to determine steel quality in the direction parallel to the 36" edge of the original plate. All such samples were nicked-in, by flame-cutting, a distance of 3/8" on each side and were broken uniformly slowly by means of a steam forge press. The results of these tests are listed in Table I, in the column headed "A".

4. Section B (8" x 4" x T) was used to determine the response of the ballistic test plates to heat treatment. All 1-1/2" samples were nicked-in 1-1/4"; all 1" and 1/2" samples were nicked-in 1-1/2". All nicking was done by flame and all samples were fractured uniformly fast by means of a steam forge hammer. The results appear in Table I, in the column marked "B".

5. In order to determine the steel quality and response to heat treatment as shown by a fracture in the opposite direction, section C (4" x 3" x T) was cut and all such samples were nicked in 3/4" to provide a fracture surface suitable for the dual purpose of the test. These samples were broken uniformly slowly in a steam forge press. The results of the ratings for steel quality and response to heat treatment as indicated by these tests are shown in Table I, in the two columns headed "C".

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(1) O.O. 470.5/5139 (r); Wtn. 470.5/7578 (r).

6. Section D was cut off by saw and prepared by Blanchard grinding for a Brinell hardness traverse according to Figure 2. The individual readings of the traverse and their average is set out in Table I. One surface of each sample was prepared by Blanchard grinding for Brinell impression and an average of three such readings is included in Table I. The average Brinell hardness numbers reported by the manufacturer also appear in this table.

7. By examination of the fractures the orientation, with respect to the direction of major rolling, of the samples cut at Aberdeen has been determined. The results appear in the column entitled "Rolling Direction". "L" indicates that the 36" edge of the samples were parallel to this direction, whereas "T" indicates that these edges were perpendicular to this direction. All of this group of samples appeared to have been cut parallel to the major rolling direction.

8. The results of metallurgical examinations of further groups of samples in this program will be reported as they become available.

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Jr. Engineer

APPROVED:

N. A. MATTHEWS
Major, Ordnance Dept.

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TABLE I

Summary of Metallurgical Examinations Conducted Prior to Ballistic Testing on 24 Samples of Rolled Homogeneous Armor to be Fired During the 1943-44 Cold Test Program

Sample No.	Nominal Gauge	Rolling Direction[1]	Steel Quality[2] A	Steel Quality[2] C	Fibre Fracture[2] B	Fibre Fracture[2] C	Brinell Hardness Number[3] W. A. Laboratory Results Cross Section 1	2	3	4	5	Ave.	Surface Ave.	Company Ave.
1R118Z5	1/2"	L	B	C	F	F	363	363	363	363		363	356	363
2R119Z5	"	L	C	B	F	F	375	375	375	375		375	348	363
3R120Z5	"	L	C	B	F	F	363	363	363	375		366	359	363
4R121Z5	"	L	C	D	F	F	363	363	363	363		363	352	363
5R122Z5	"	L	C	B	F	F	363	363	363	363		363	356	363
6R123Z5	"	L	C	B	F	F	363	363	363	363		363	363	363
1R124Z10	1"	L	D	D	F	F	311	321	321	311		316	311	311
2R125Z10	"	L	C	D	F	F	302	311	311	311		309	296	311
3R126Z10	"	L	B	D	F	F	311	321	311	311		313	311	311
4R127Z10	"	L	D	D	F	F	302	311	321	311		311	302	311
5R128Z10	"	L	D	D	F	F	302	302	302	311		304	311	311
6R129Z10	"	L	D	D	F	F	311	311	302	311		309	308	311
1R130Z15	1-1/2"	L	B	B	F	F	262	262	262	262	262	262	255	255
2R131Z15	"	L	C	B	F	F	248	248	255	255	255	252	255	255
3R132Z15	"	L	B	B	F	F	255	241	255	262	262	255	262	255
4R133Z15	"	L	B	B	F	F	255	255	255	262	255	256	248	255
5R134Z15	"	L	C	B	F	F	262	248	255	255	262	256	262	255
6R135Z15	"	L	C	B	F	F	262	262	262	262	262	262	262	255
1R136Z15	"	L	B	B	F	F	311	293	311	302	311	306	302	293
2R137Z15	"	L	D	D	F	F	302	293	302	302	302	300	308	293
3R138Z15	"	L	C	C	F	F	302	293	311	302	302	302	311	293
4R139Z15	"	L	C	B	F	F	302	302	302	302	311	304	308	293
5R140Z15	"	L	B	B	F	F	285	285	302	302	302	295	285	293
6R141Z15	"	L	C	B	F	F	293	302	302	302	302	300	285	293

See following page for explanations.

Explanation of headings in Table I:

[1] "L" indicates that long dimension of sample cut at Aberdeen was parallel to major direction of rolling.

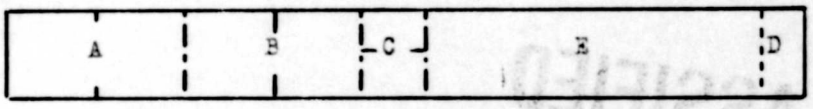
[2] "A", "B" and "C" were samples cut from lengths supplied by Aberdeen as indicated in Figure 1.

[3] Numbers indicate position of Brinell impression on cross section (see Figure 2). Surface value is an average of three readings.

Explanation of ratings: Steel quality: A to E according to Specification Axs-488, Revision 2.

Fibre Fracture: F - Fibrous.

Method of Cutting Samples Supplied by Aberdeen



-·-·- Cut by flame . All nicking by flame.

------ Cut by saw.

FIGURE 1

Location of Brinell Impressions on Cross-Sections

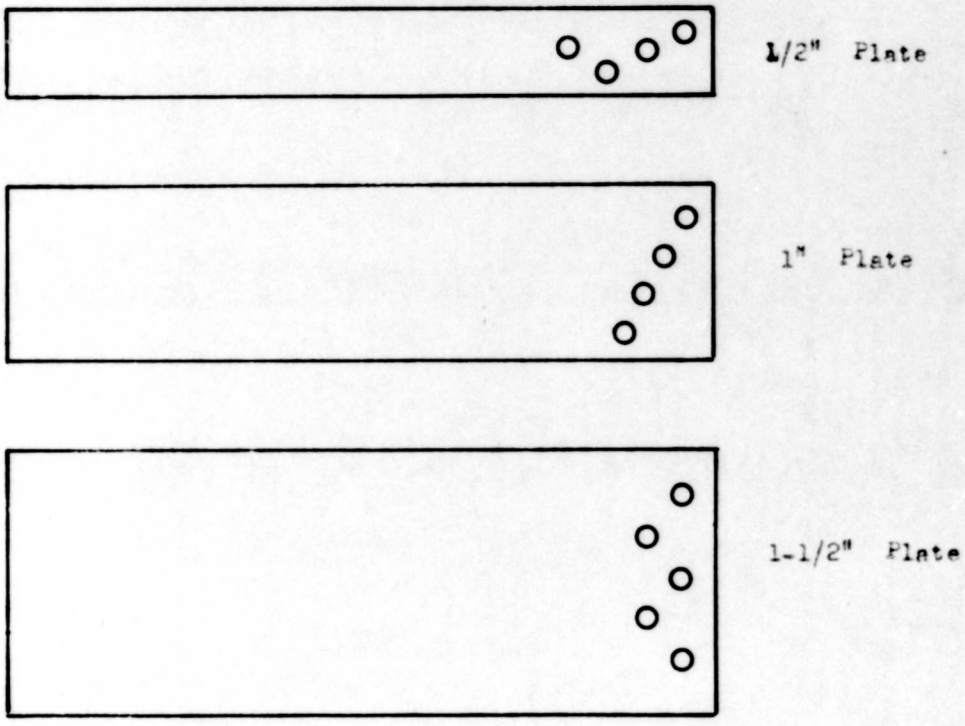


FIGURE 2