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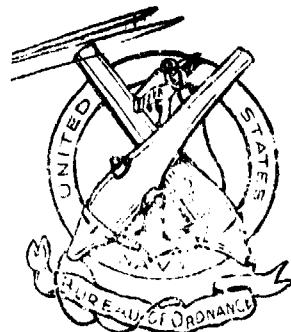
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U. S. NAVAL PROVING GROUND
Dahlgren, Virginia.

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REPORT NO. 10-43

PENETRATION OF FACE HARDENED BULLET PROOF STEEL
BY YAWED .50 CAL. A.P. BULLETS
AT 0° OBLIQUITY

CLASSIFICATION (CANCELLED) ~~SECRET~~
Unclassified
7/1/76 (DATE) *B. Broyles* (SIGNATURE) *North Atlantic 652/1178: PAH* (RANK) *5511 10/31/73*

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July 9, 1943

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U. S. NAVAL PROVING GROUND,
DAHLGREN, VA.

Typed 5/7/43

From: The Commanding Officer.
To: The Chief of the Bureau of Ordnance.
Subject: Penetration of Face Hardened Bullet
Proof Steel by Yawed .50 cal. AP Bullets
at 0° Obliquity. - NPG Report No. 10-43.
Reference: (a) Buord ltr S13-1(4)(Re3) dated
31 December, 1942.
Enclosure: (A) Twenty-five (25) copies of the
(S. C.) subject report.

1. By enclosure (A) twenty-five (25) copies
are submitted of a report on the project authorized
in reference (a).

2. In the subject report the results are
given of the firing of yawed .50 cal. AP bullets
against 1/4", 3/8", and 1/2" BPS at 0° obliquity.
Curves of limit velocity against angle of yaw are
plotted for several plates of each gauge.

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NAVAL PROVING GROUND
Dahlgren, Virginia

REPORT NO. 10-43

July 9, 1943

PENETRATION OF FACE HARDENED BULLET PROOF STEEL
BY YAWED .50 CAL. A.P. BULLETS
AT 0° OBLIQUITY

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Page 1

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DATE *7/1/70* BY *B. Broyles* (SIGNATURE) *McDonnell* (RANK) *0652/1178:PAH*
5511 10/31/73

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P R E F A C E

AUTHORIZATION

The investigation reported herein was authorized in Bureau of Ordnance letter S13-1(4)(Re3) dated December 31, 1942 and carried out under Experimental Department Project No. E-661.

OBJECT

The purpose of the investigation described in this report was to obtain the variation of limit velocity with angle of yaw for the attack of 1/4", 3/8" and 1/2" RPS by .50 Cal. M2 A.P. bullets at normal obliquity.

SUMMARY

The curves of angle of yaw against limit velocity were found to be approximately linear up to 30° yaw with the limit velocity increasing at a rate of 0.5% to 0.7% per degree of yaw. A maximum limit velocity was approached at angles of from 40° to 50° yaw, thereafter the limit velocity increased slightly or fell off considerably as the angle of yaw was increased to 90°. Fully yawed (40° or more) limits were 115-135% of the normal unyawed limits and were about equal to those previously reported (reference 1) for experimental homogeneous armor of the same gauges.

The fact that in some cases the limit velocity was lower at 90° yaw than in the 40° to 50° zone indicates a type of brittleness to shock. Although selected plates that failed to pass the present 20mm shock test did not exhibit this behavior, it is believed that the 20mm shock test will eliminate those plates which show a drop in ballistic limit at high angles of yaw.

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I

INTRODUCTION.

In a series of firings at the Naval Proving Ground (reference 1) and at the Aberdeen Proving Ground (reference 2) it has been observed that some machine gun bullets in passing through the fuselage of an aircraft may develop considerable yaw before striking the armor. Reports from the Naval Proving Ground (reference 1) and the Naval Research Laboratory (reference 3) describe the results of investigations on the effect of yaw upon armor penetration. The Naval Proving Ground (reference 1) reported the results of firing yawed .50 cal. M2 A.P. bullets against 3/8" and 1/2" experimental homogeneous aircraft armor at 0° obliquity. These firings indicated yawed limits to be from 135% to 165% of the unyawed limits. The Naval Research Laboratory (reference 3) reported a 1.4% increase in limit velocity per degree yaw for STS vs. .30 cal. A.P. bullets and a 0.6% to 0.7% increase in limit velocity per degree yaw up to about 25° yaw for 1/4" BPS vs. .30 cal. M1922 A.P. bullets at 0° obliquity. The investigation described in this report was carried out for the purpose of establishing the form of the variation of limit velocity with angle of yaw from 0° to 90° yaw and to obtain limit velocities for fully yawed .50 cal. M2 A.P. bullets against BPS of different gauges at 0° obliquity.

II

MATERIAL AND METHODS.

Projectile: .50 caliber M2 A.P. Bullet.
Plate: (All plates passed U.S. Navy specifications. O.S. 595 - Table 1).

1/4" BPS

O'240 BPS Diebold No. 934-200-3-8
O'263 BPS Diebold No. 610-200-1679-4
O'261 BPS Diebold No. 224-200-724-1
O'279 BPS Diebold No. 610-200-1679-5
O'259 BPS Diebold No. 210-200-66

3/8" BPS

O'381 BPS Diebold No. 31-300-6
O'394 BPS Diebold No. 977-300-2
O'402 BPS Atkins DAG 54
O'379 BPS Atkins DAG 78
O'385 BPS Atkins DAG 94
O'382 BPS Atkins DAG 56
O'367 BPS Diebold No. 605-300-9

1/2" BPS

07495 BPS Diebold No. 132-2289-4657-185
07509 BPS Diebold No. 156-2289-4088-164
07503 BPS Diebold No. 132-2289-4660-186
07502 BPS Atkins No. G69J-11
07503 BPS Diebold No. 132-2290-4738-189
07507 BPS Diebold No. 132-2290-4618-184
07528 BPS Atkins No. DA9
07503 BPS Diebold No. 131-2290-4996-199

Test Conditions.

All firing was carried out at 0° obliquity with .50 caliber M2 A.P. bullets against 1/4", 3/8" and 1/2" BPS manufactured by Diebold and Atkins. Limit velocities were determined on each plate for unyawed bullets and for bullets having various amounts of yaw.

Method

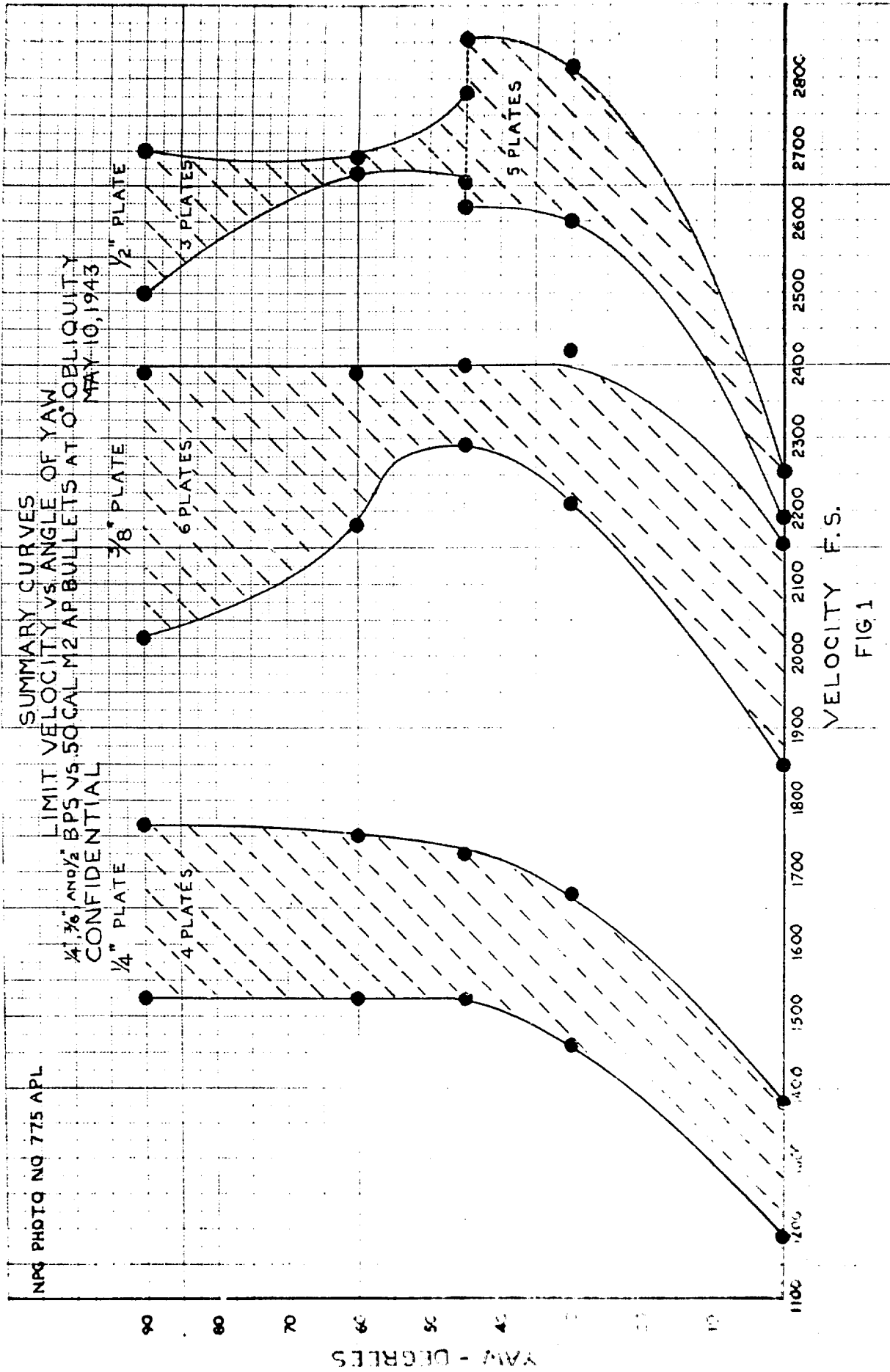
The limit velocity at 0° yaw was determined in the usual manner, that is, several rounds were fired until a satisfactory straddle was obtained. To produce yaw a 2-inch pine plank was interposed between the gun and the plate and tilted at various angles. It was found that this method would produce angles of yaw only up to about 50° maximum, however, by placing an additional 1-inch board parallel to and about 4 inches behind the 2-inch board the desired large angles of yaw were obtained. The velocity loss of the bullet in going through this barrier was less than 20 ft./sec. at the lowest striking velocities used, as determined from unyawed limits on the same plate with and without the barrier in front of the plate. The yaw at the plate was determined by use of yaw cards placed within 6 inches of the plate.

III

RESULTS.

In the analysis of the results it is necessary to bear in mind the statistical nature of the problem. In the case of BPS the bullets, whether yawed or unyawed, are shattered on all impacts, and the stage of penetration at which the bullets break, depending on statistical variations in projectile or plate quality, has a marked effect on the observed limit velocity.

The definition of limit velocity is of most importance. Since in all of the described firing the bullets



were being broken , it was difficult to ascertain when all of a given bullet had penetrated the plate. Accordingly the limit velocity for the breaking projectile was defined as that minimum velocity for which a major portion of the bullet penetrated the plate.

The detailed results given in the appendix are summarized below and plotted in Fig. 1. The curves of Fig. 1 represent the spread of limit velocities obtained for BPS plates of the same gauge at various angles of yaw.

The points plotted in Fig. 1 represent the maximum and minimum limit velocities as determined from Table 1.

Table I

Estimated Limit Velocity at Various Angles of Yaw

<u>Plate No.</u>	<u>Limit Velocity F.S.</u>				
Yaw-----0°	30°	45°	60°	90°	
<u>1/4" BPS</u>					
Diebold 610-200-1679-5	1375	1670	1725	1750	1765
Diebold 934-200-3-8	1190	1490	1525	1525	1525
Diebold 610-200-1679-4	1380	1555	1585	1600	1615
Diebold 224-200-724-1	1315	1460	1525	1540	1540
*Diebold 210-200-66	1145	1500	1580	1600	1600
<u>3/8" BPS</u>					
Atkins DAG 54	2025	2330	2390	2390	2390
Diebold 31-300-6	2020	2310	2340	2225	2025
Atkins DAG 78	2005	2210	2290	2295	2295
Diebold 977-300-2	2035	2420	2400	2180	2065
Atkins DAG 94	1850	2320	2400	2350	2220
Atkins DAG 56	2155	2315	2355	2250	2080
*Diebold 675-300-9	1960	2150	2190	2190	2200

* Note: 0.259 BPS Diebold No. 210-200-66 and 0.367 BPS Diebold No. 675-300-9 were two selected plates that failed the 20mm shock test. They are not included in the summary curves of Fig. 1.

Table I - (Cont'd.)

<u>Plate No.</u>	<u>Limit Velocity F.S.</u>				
	0°	30°	45°	60°	90°
<u>1/2" BPS</u>					
Diebold 132-2289-4657-185	2200	2775	2825	-----	-----
Diebold 156-2289-4088-164	2190	2605	2780	-----	-----
Diebold 132-2289-4660-136	2195	2815	2875	-----	-----
Atkins G69J-11	2210	2600	2655	2680	2700
Diebold 132-2290-4738-189	2205	2600	2620	-----	-----
Diebold 132-2290-4618-184	2200	2725	2855	-----	-----
Atkins DA9	2255	2790	2705	2665	2640
Diebold 131-2290-4996-199	2250	2700	2780	2690	2500

IV DISCUSSION.

An inspection of the summary curves given in Fig. 1 as well as the detailed plots for each plate in the appendix shows that the general features of the dependence of limit velocity upon angle of yaw for the subject plates under the stated test conditions are the same for 1/4", 3/8" and 1/2" plate. For all three gauges the limit velocity increases with yaw in an approximately linear fashion up to about 30° yaw. In general the limit velocity reaches a maximum in the 40° to 50° range and as the yaw is increased to 90° it either remains constant or decreases.

For the linear portions of the curves the following representative values are given for the increase of limit velocity with angle of yaw. The values listed were obtained by taking limit velocities midway between the maximum and minimum values at 0° and 30° yaw from the curves of Fig. 1.

<u>Gauge</u>	<u>Mean Limit Velocity</u>		<u>Increase in Limit Velocity</u>	
	0°	30°	F.S./degree	%/degree
1/4"	1285	1565	9.3	0.7
3/8"	2002	2315	10.4	0.5
1/2"	2220	2707	16.2	0.7

The Naval Research Laboratory (reference 3) obtained a value of 0.7% as the increase in limit velocity per degree yaw up to 25° yaw for .30 cal. Model 1922 A.P. bullets against 1/4" BPS at 0° obliquity, which is in agreement with the above

values.

The maximum limit velocities on all plates except one (Atkins DAG 56) were in the range 115% to 130% of the normal unyawed limit velocity. The maximum limit velocity did not correspond in all cases to maximum yawed bullets, since for some of the 3/8" and 1/2" plates the limit velocity was lower at 90° than at 45° yaw. The reason for this behavior was not apparent but it is suggested that the decrease might be due to a brittle type of failure due to shock at high angles of yaw. Some of the plates did crack badly and disks one to two inches in diameter were thrown from the plate at 90° yaw indicating brittleness, however, this failure did not always occur for curves that indicated lower limit velocities at 90° than at 45°. In no case was the limit velocity at 90° less than the 0° yaw limit but on two 3/8" plates (Figs. 7 and 9) the limit velocities were only slightly greater at 90° than at 0° yaw. In order to determine whether the present 20mm shock test would eliminate those plates which behave in this fashion, two plates, a 1/4" (Diebold No. 210-200-66) and a 3/8" (675-300-9), were selected which failed the 20mm test by throwing of large disks from the plate. Testing these plates with .50 cal. yawed bullets, Fig. 20 and 21, did not show a decrease in limit at high angles of yaw. This probably indicates that the chosen plates, though failing the 20mm test, were not sufficiently brittle to give the high yaw effect observed for some plates.

Naval Proving Ground results (reference 1) for yawed .50 cal. M2 A.P. bullets against experimental homogeneous armor (BHN 360-415), tested in accordance with Specifications O.S. 2490, showed maximum yawed limits to be essentially the same as for BPS of the same gauge. However, the maximum yawed limit velocities for homogeneous armor lie in the range 135-165% of the unyawed limit, which is considerably greater than that obtained against BPS (115 to 130%) due to the lower normal unyawed limit of homogeneous armor.

V

CONCLUSIONS:

The limit velocity for yawed .50 cal. M2 A.P. bullets against 1/4", 3/8" and 1/2" BPS at 0° obliquity

increases approximately linearly with angle of yaw up to 30° yaw with a rate of increase of from 0.5 to 0.7% of the normal unyawed limit.

The maximum limit velocity is reached or closely approached at angles of yaw of 40° to 50°.

In some cases the plate protection is less at 90° yaw than at 40°-50°; this is believed to be a result of lack of shock resistance of the plates exhibiting this behavior.

VI

REFERENCES.

1. NPG ltr F1-5(B35450) dated February 5, 1943.
2. Aberdeen Proving Ground 2nd Partial Report on Test of Armor Plate in Aircraft and 2nd Report on Ordnance Program No. 5439, dated June 20, 1941.
3. Naval Research Laboratory Fifth Partial Report on Light Armor. No. 0-1540 dated June 19, 1939.

VII

APPENDIX

Symbols

Penetration

PP.....Partial Penetration
CP.....Complete Penetration
(Penetration is defined in Paragraph III).

Bullet Condition

NR.....Not recovered
FOP.....Fuzed on Plate
FCIP.....Fractured Core in Plate
RJ.....Rejected

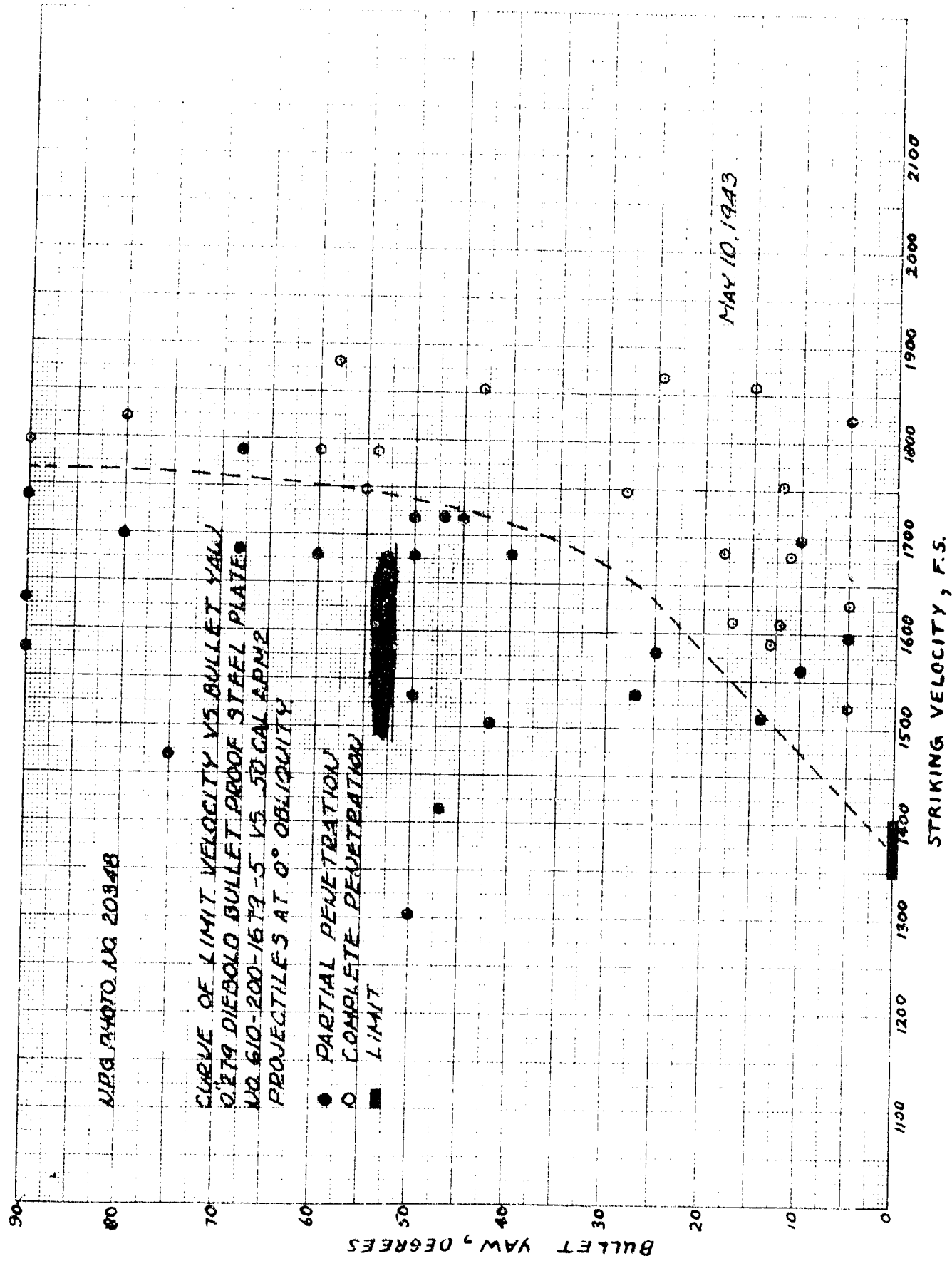


Plate Condition

SB.....Slight Bulge
 MB.....Medium Bulge
 HB.....Heavy Bulge
 Pun S.....Punching Started
 Pun T.....Punching Thrown
 NL.....Near Limit
 Circ. C.....Circular Crack

TABLE II

BALLISTIC DATA FOR 0:279 DIEBOLD B.P.S. PLATE
NO. 610-200-1679-5

.50 Cal. M2 A.P. Bullets at 0° Obliquity

<u>Rd.</u> <u>No.</u>	<u>Striking</u> <u>Velocity</u>	<u>Yaw</u>	<u>Pene-</u> <u>tration</u>	<u>Bullet</u>	<u>Condition</u> <u>of Plate</u>
1	1502	12°	PP	NR	SB No Crack.
2	1473	0	PP	FOP	SB No Crack.
3	1640	0	CP	NR	1/2" Hole.
4	1570	0	CP	NR	1/2" Hole.
5	1551	0	CP	NR	1/2" Hole.
6	1449	0	PP	NR	1/4" Hole.
7	1550	0	CP	NR	1/2" Hole.
8	1345	0	PP	NR	SB No Crack.
9	1404	0	CP	NR	1/4" Hole.
10	1275	0	PP	FOP	SB
11	1325	0	PP	FOP	SB
12	Miss	2	PP	FCIP	Nose thru & off. 1/4" Hole.
13	1302	50	PP	RJ	SB
14	1509	0	PP	RJ	SB
15	1440	0	PP	RJ	SB
16	1470	75	PP	RJ	HB 1-1/4" Crack.
18	1504	0	PP	RJ	MB
19	1579	90	PP	RJ	1-1/2" Crack MB
20	1683	68	PP	RJ	AB; 1-1/4" Crack.
21	1718	47	PP	RJ	HB, 1/2" & 1" Crack.

TABLE II - (Cont'd.)

BALLISTIC DATA FOR QV279 DIEBOLD B.P.S. PLATE
NO. 610-200-1679-5

.50 Cal. M2 A.P. Bullets at 0° Obliquity

<u>Rd. No.</u>	<u>Striking Velocity</u>	<u>Yaw</u>	<u>Pene- tration</u>	<u>Bullet</u>	<u>Condition of Plate</u>
22	1698	80°	PP	RJ	NB
23	1718	50	PP	RJ	1-1/2" x 1" Cracks, HB.
24	1787	54	CP	NR	1-1/2" x 1" Hole.
25	1787	68	PP	RJ	HB, 1-1/2" Crack.
26	1748	28	CP	NR	3/8" Hole.
27	1718	45	PP	RJ	NB
28	1822	5	CP	NR	1/2" Hole.
29	1822	80	CP	NR	2" x 1" Hole.
30	1797	90	CP	NR	1-1/2" x 3/4" Hole.
31	1738	90	PP	RJ	HB, 1-1/2" Crack.
32	1748	55	CP	NR	1-1/2" x 1" Hole.
33	1857	15	CP	NR	7/8" x 1/2" Hole.
34	1883	58	CP	NR	1-1/2" x 3/4" Hole.
35	1867	24	CP	NR	1" Hole.
36	1853	43	CP	NR	2" x 1-1/2" Hole.
37	1753	50	PP	RJ	SB
38	1787	60	CP	NR	2" x 1" Hole.
39	Miss	38	PP	RJ	SB
40	1580	25	PP	RJ	3/8" Pun S, Out 1/8".
41	1698	10	PP	FCIP	Nose off 3/8" Hole.
42	1535	27	PP	FCIP	1/4" Hole.
43	1828	0	CP	NR	1/2" Hole.
44	1668	0	PP	FOP	SB No Cracks.
45	1678	50	PP	RJ	1-1/2" Crack.
46	1680	40	PP	FOP	SB No Crack.
47	1680	60	PP	RJ	SB No Crack.
48	1756	12	CP	NR	1/2" Hole.
49	1630	5	CP	NR	1/2" Hole.
50	1591	0	CP	NR	1/2" Hole.
51	1681	11	CP	NR	1/2" Hole.
52	1684	18	CP	NR	3/8" Hole.
53	1630	90	PP	RJ	HB Circular Crack.
54	1596	5	PP	NR	SB No Crack.
55	1611	17	CP	FCIP	1/2" Hole.
56	1532	50	PP	RJ	2" Circular Crack.
57	1610	12	CP	NR	1/2" Hole.

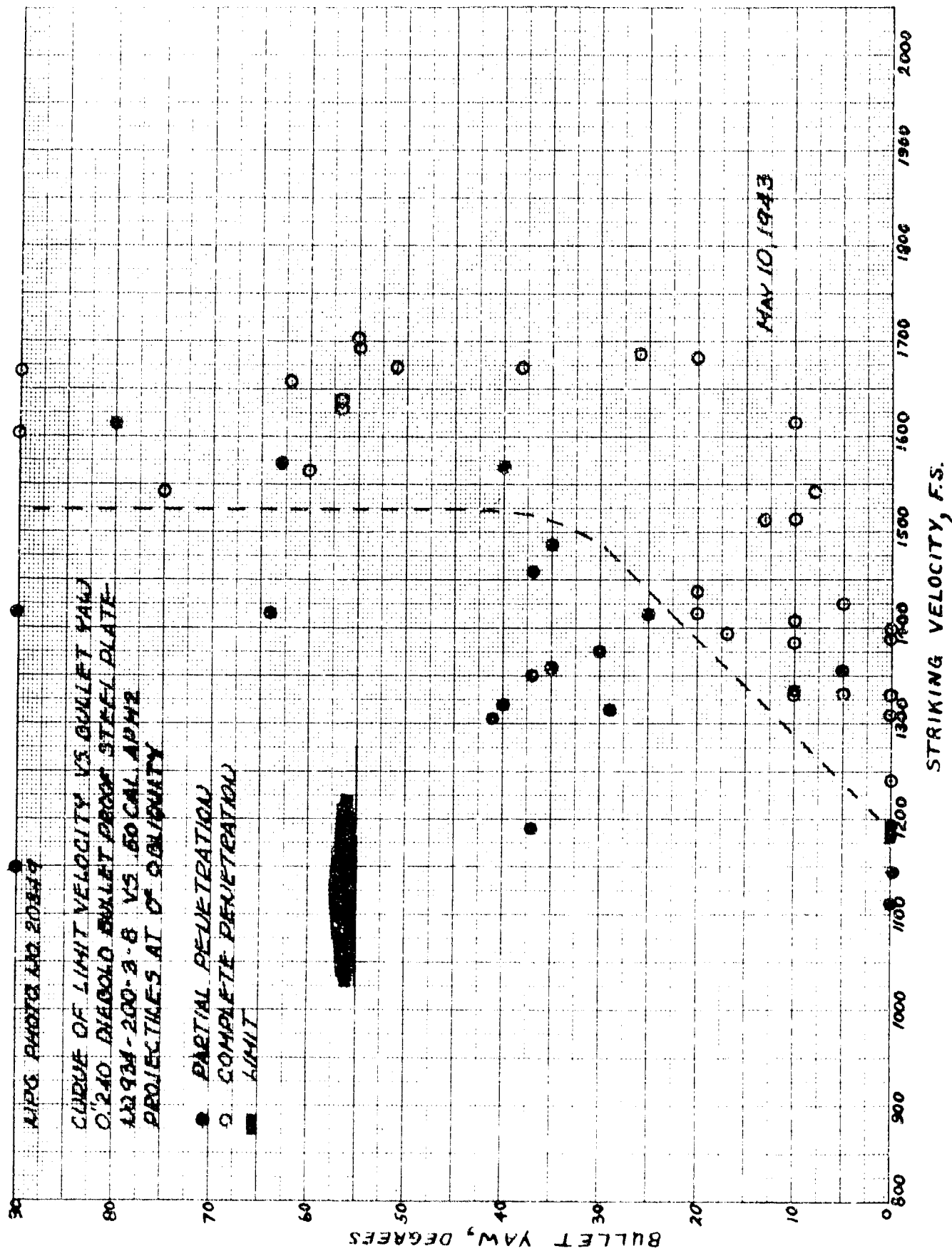


TABLE II - (Cont'd.)

BALLISTIC DATA FOR 0.279 DIEBOLD B.P.S. PLATE
NO. 610-200-1679-5

.50 Cal. M2 A.P. Bullets at 0° obliquity

<u>Rd. No.</u>	<u>Striking Velocity</u>	<u>Yaw</u>	<u>Pene- tration</u>	<u>Bullet</u>	<u>Condition of Plate</u>
58	1590	13°	CP	NR	1/2" Hole.
59	1561	10	PP	FOP	SB No Crack.
60	1415	47	PP	RJ	SB No Crack.
61	1510	14	PP	RJ	SB No Crack.
62	1521	5	CP	NR	1/2" Hole.

COMPANY DATA

Heat No. E-70880.

<u>YP</u>	<u>TS</u>	<u>%E1</u>	<u>R.A.</u>
80,000-100,000	120,000-140,000	18-24	35-45

BHN Face 495-555 Back 415.

<u>C</u>	<u>Mn</u>	<u>Si</u>	<u>P</u>	<u>Si</u>	<u>Ni</u>	<u>Cr</u>	<u>Mo</u>
.60-85	.50	.017	.015	.19	4-15	.15	.30
.19-23							

Quench 1525/1550°F.

Draw 300/325°F.

TABLE III

BALLISTIC DATA FOR 1/4" DIEBOLD B.P.S. NO. 934-200-3-8

.50 Cal. M2 A.P. Bullets at 0° Obliquity

<u>Rd. No.</u>	<u>Striking Velocity</u>	<u>Yaw</u>	<u>Pene- tration</u>	<u>Bullet</u>	<u>Condition of Plate</u>
1	1310	0°	CP	NR	1/2" Hole.
2	1415	20	CP	NR	1/4" Hole.
3	"1400"				
	Miss	47	PP	RJ	MB
4	1415	90	FP	RJ	1" Crack.

TABLE III - (Cont'd.)

BALLISTIC DATA FOR 1/4" DIEBOLD B.P.S. NO. 934-200-3-8.50 Cal. M2 A.P. Bullets at 0° Obliquity

<u>Rd. No.</u>	<u>Striking Velocity</u>	<u>Yaw</u>	<u>Pene- tration</u>	<u>Bullet</u>	<u>Condition of Plate</u>
5	1415	64°	PP	RJ	1-1/2" Crack.
6	1542	8	CP	NR	3/8" Hole.
7	1573	63	PP	RJ	HB, 1" Crack at impact. 3" circ. crack.
8	1568	40	PP	RJ	HB
9	1702	55	CP	NR	1-1/4" Hole.
10	1693	55	CP	NR	2" x 1-1/2" Hole.
11	1638	57	CP	NR	1-1/2" Hole.
12	1658	62	CP	NR	1-1/4" Hole.
13	1613	80	PP	RJ	HB, 3/4" Crack at impact. 3" circ. crack (NL)
14	1683	20	CP	NR	1-1/2" Hole.
15	1673	51	CP	NR	3/4" Hole, hit edge of frame.
16	1613	10	CP	NR	1/2" Hole.
17	1668	90	CP	NR	2" x 1" Hole.
18	1628	57	CP	NR	2" x 1-1/2" Hole.
19	1638	26	CP	NR	1-1/2" x 3/4" Hole.
20	1673	38	CP	NR	2" Hole.
21	1603	90	CP	NR	2" x 1" Hole.
22	1513	13	CP	NR	1/2" Hole.
23	1514	13	CP	NR	3/8" Hole.
24	1407	10	CP	NR	1/4" Hole.
25	1305	41	PP	RJ	SB
26	1315	29	PP	RJ	SB
27	Miss	5	PP	FCIP	Nose thru & off. 3/8" Hole.
28	1396	17	CP	FCIP	Nose thru & off. 1/8" Hole.
29	1357	35	PP	RJ	SB
30	1415	25	PP	RJ	HB
31	1514	10	CP	NR	3/8" Hole.
32	1544	75	CP	NR	2" x 1-1/2" Hole.
33	1489	35	PP	RJ	SB
34	1564	60	CP	NR	1-1/4" Hole.
35	1439	20	CP	NR	3/8" Hole.
36	1459	37	PP	RJ	HB
37	1240	0	CP	NR	1/2" Hole.

TABLE III - (Cont'd.)

BALLISTIC DATA FOR 1/4" DIEBOLD B.P.S. NO. 934-200-3-8

.50 Cal. M2 A.P. Bullets at 0° Obliquity

<u>Rd. No.</u>	<u>Striking Velocity</u>	<u>Yaw</u>	<u>Pene- tration</u>	<u>Bullet</u>	<u>Condition of Plate</u>
38	1145	0°	PP	FOP	Pun S 1/16"
39	1317	0	CP	NR	1/2" Hole.
40	1708	0	CP	NR	1/2" Hole.
41	1748	0	CP	NR	1/2" Hole.
42	1664	0	CP	NR	1/2" Hole.
43	1250	0	PP	FCIP	Nose off. 1/2" Hole.
44	1112	0	PP	RJ	SB
45	1122	15	CP	NR	1/8" Hole.
46	1190	37	PP	NR	SB No cracks.
47	1302	40	PP	NR	SB No cracks.
48	1330	10	CP	NR	1/2" Hole.
49	1400	0	CP	NR	1/2" Hole.
50	1356	5	PP	CIP	Nose through 3/4".
51	1148	90	PP	NR	SB No cracks.
52	1330	5	CP	NR	1/2" Hole.
53	1425	5	CP	NR	1/2" Hole.
54	1386	10	CP	NR	1/2" Hole.
55	1334	10	CP	FCIP	Nose through 1/4".
56	1338	0	CP	NR	1/2" Hole.
57	1327	0	CP	NR	1/2" Hole.
58	1351	37	PP	RJ	SB No Cracks.
59	1281	5	PP	FCIP	Nose through 1/8" Hole.
60	1384	55	PP	RJ	SB No Cracks.
61	1295	0	CP	NR	1/2" Hole.
62	1304	0	CP	NR	1/2" Hole.
63	1270	0	CP	NR	1/2" Hole.
64	1376	30	PP	RJ	Circular Crack 2".

COMPANY DATA

<u>YP</u>				<u>TS</u>			<u>El</u>
155,800				210,000			10.4
<u>C</u>	<u>Mn</u>	<u>S</u>	<u>P</u>	<u>Si</u>	<u>Ni</u>	<u>Cr</u>	<u>Mo</u>
-	.51	.02	.02	.20	3.35	.12	.31

Quench 1530°F 45/50 Min. Full Oil.
 Draw 300/325°F 15/30 Min.

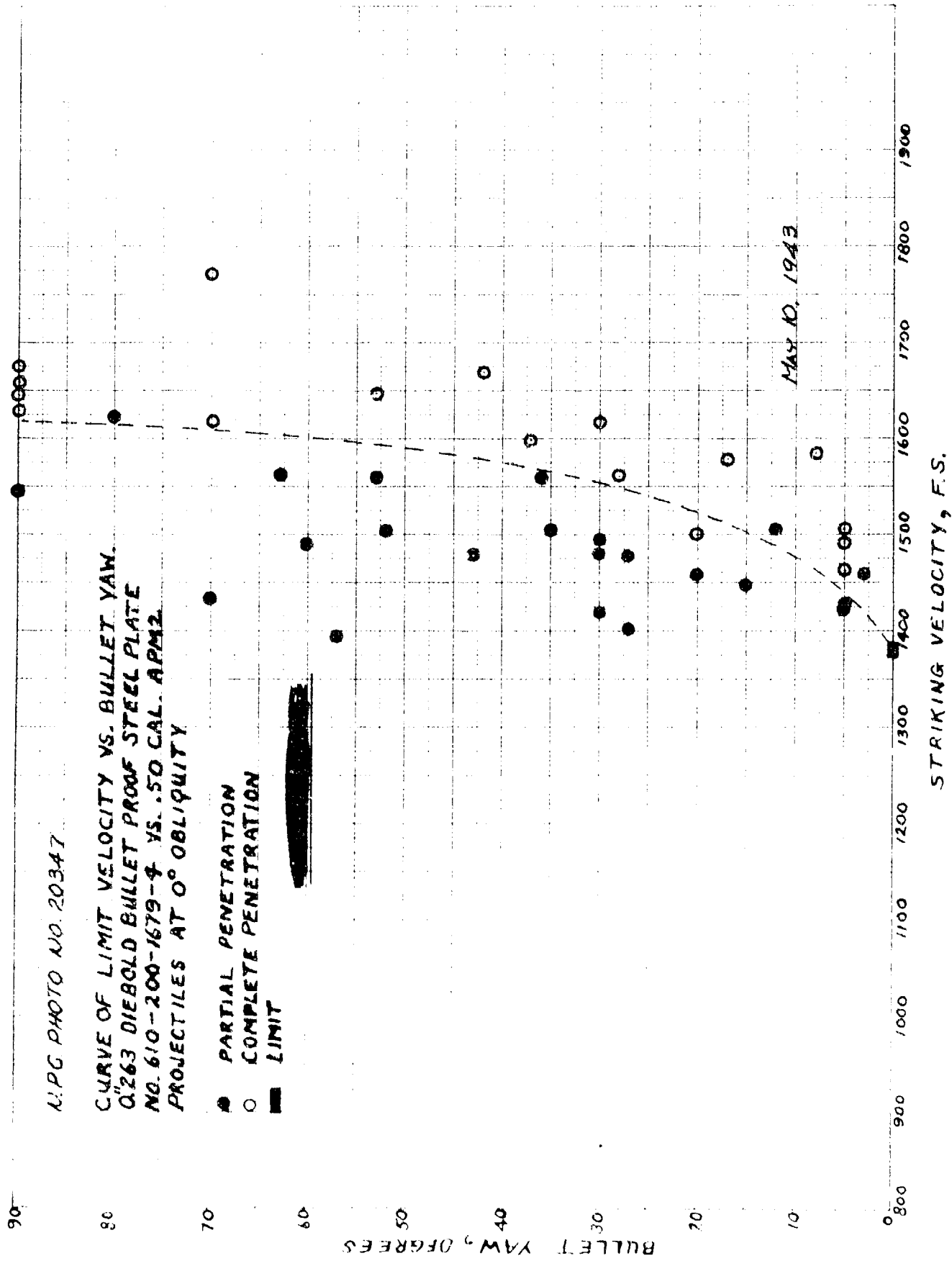


TABLE IV
BALLISTIC DATA FOR 07263 DIEBOLD B.P.S. PLATE
NO. 610-200-1679-4

.50 Cal. M2 A.P. Bullets at 0° Obliquity

<u>Rd. No.</u>	<u>Striking Velocity</u>	<u>Yaw</u>	<u>Pene- tration</u>	<u>Bullet</u>	<u>Condition of Plate</u>
1	1494	30°	PP	RJ	MB
2	1594	52	PP	RJ	5" Circular Crack, NL separated 1/8" at bottom.
3	1420	30	PP	RJ	3/8" Pun S, Out 1/8".
4	1460	3	PP	RJ	Pun S 1/16"
5	1433	70	PP	RJ	MB
6	1578	0	CP	NR	1/4" Hole.
7	1490	60	PP	RJ	SB
8	1480	43	PP	RJ	SB
9	1579	17	CP	NR	1/2" Hole.
10	1544	90	PP	RJ	5" Circ. Crack, Button out 1/4" (NL)
11	1562	63	PP	RJ	1/4" Pun Out 1/8"
12	1561	28	CP	NR	3/8" Hole.
13	1559	53	PP	RJ	5" Circ. Crack.
14	1584	8	CP	NR	1/2" Hole.
15	1618	30	CP	NR	1/4" Hole.
16	1559	36	PP	RJ	MB
17	1669	42	CP	NR	5" Hole.
18	1674	90	CP	NR	1" Hole.
19	1773	70	CP	NR	2" Hole.
20	1658	90	CP	NR	3" x 2" Hole.
21	1644	90	CP	NR	2" x 1" Hole.
22	1628	90	CP	NR	2" x 1" Hole.
23	1619	70	CP	NR	1-1/4" x 3/4" Hole.
24	1648	53	CP	NR	3" Hole.
25	1623	80	PP	RJ	Pun out 1/4"
26	1505	35	PP	RJ	Several Circ. C. (NL)
27	1402	27	PP	RJ	SB No Crack.
28	1395	57	PP	RJ	2" Crack.
29	1305	0	PP	FOP	Circular Cracks 2".
30	1302	0	PP	FOP	SB No Crack.
31	1495	0	CP	NR	SB No Cracks.
32	1405	0	PP	FOP	1/2" Hole.
33	1480	0	CP	NR	SB No Cracks.
34	1384	0	CP	NR	1/2" Hole.
35	1377	0	PP	FCIP	1/2" Hole. 1/4" Hole.

TABLE IV - (Cont'd.)

BALLISTIC DATA FOR 0.263 DIEBOLD R.P.S. PLATE
NO. 610-200-1679-4

.50 Cal. M2 A.P. Bullets at 0° Obliquity

<u>Rd. No.</u>	<u>Striking Velocity</u>	<u>Yaw</u>	<u>Pene- tration</u>	<u>Bullet</u>	<u>Condition of Plate</u>
36	1444	0°	CP	NR	1/2" Hole.
37	1406	0	PP	FCIF	Pun S 1/4".
38	1506	0	CP	NR	1/2" Hole.
39	1372	0	PP	FCF	SB No Crack.
40	1387	0	CP	NR	1/2" Hole.
41	1477	27	PP	NR	MB 1" Crack.
42	1428	5	PP	NR	SB No Crack.
43	1457	20	PP	RJ	MB
44	1500	20	CP	RJ	1/4" Hole.
45	1423	5	PP	NR	SB No Crack.
46	1408	0	CP	NR	1/2" Hole.
47	1461	5	CP	NR	1/2" Hole.
48	1493	5	CP	NR	1/2" Hole.
49	1599	37	CP	NR	1/2" Hole.
50	1480	30	PP	NR	1/4" Hole.
51	1448	15	PP	NR	SB No Crack.
52	1505	12	PP	FCIF	MB
53	1505	5	CP	NR	MB 1/2" Hole.

COMPANY DATA

Heat No. E70880.

<u>YP</u>		<u>TS</u>	<u>%E1</u>	<u>%RA</u>		
80,000 - 100,000		124,000-140,000	18-24	35-45		
BHN	Face	555	Back	415		
<u>C</u>	<u>Mn</u>	<u>S</u>	<u>P</u>	<u>Ni</u>	<u>Cl</u>	<u>Mo</u>
.60-.85	.50	.017	.015	4.15	.15	.30
.19-.23						
Quench	1525/1550°F.		Draw	300/325°F		

N.P.G. PHOTO No. 20346

CURVE OF LIMIT VELOCITY VS
BULLET YAW
0.261 DIEBOLD BULLET PEROF
STEEL PLATE No 224-200-724-1
US 50 CAL APME PERJECTILES
AT 0° OBQUQNTY

● PARTIAL PENETRATION
○ COMPLETE PENETRATION
■ LIMIT

BULLET YAW, DEGREES

STRIKING VELOCITY, F.S.

MAY 10, 1943

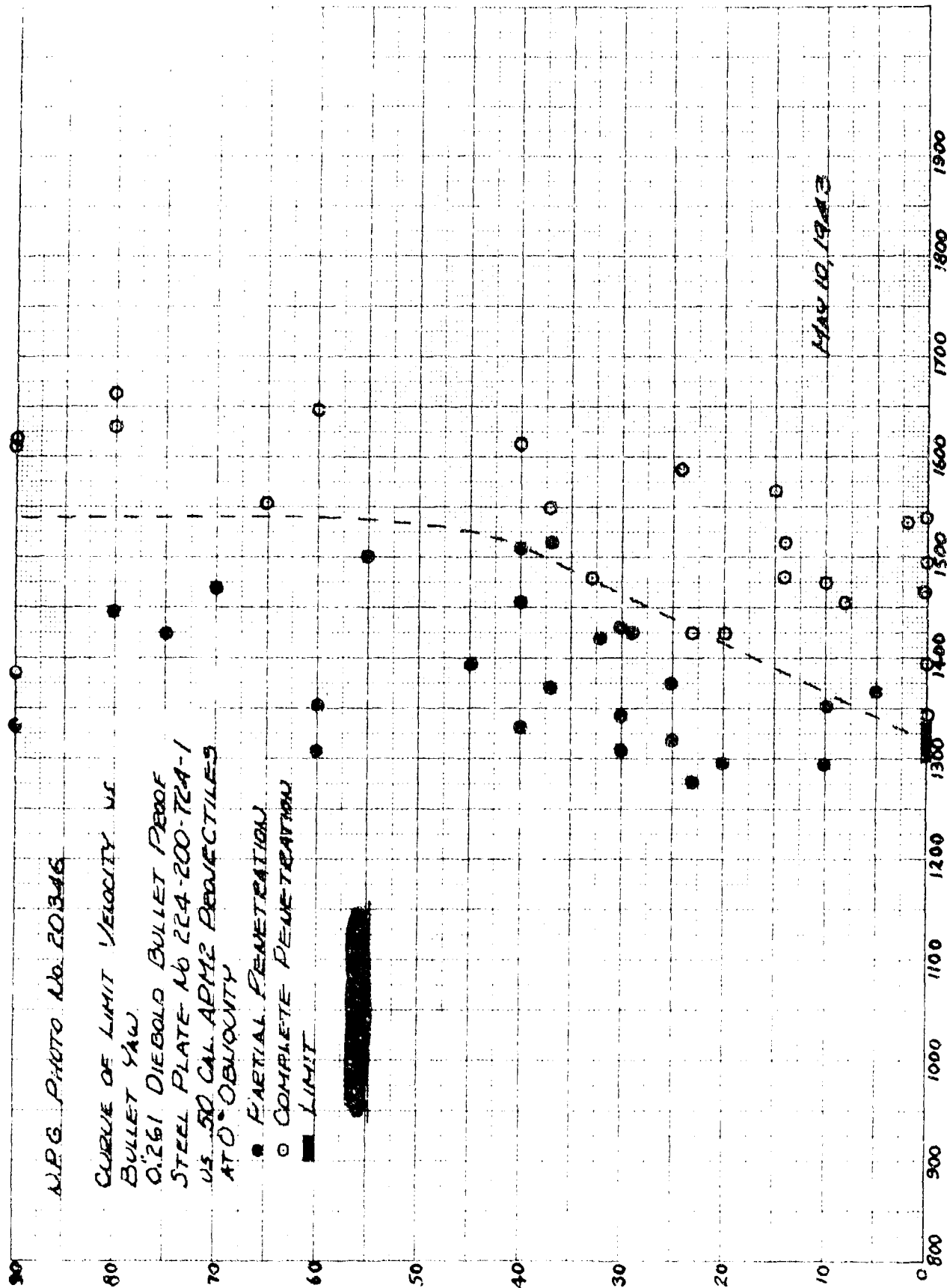


TABLE V

BALLISTIC DATA FOR 01261 DIBOLD B.P.S. PLATE
NO. 224-200-724-1

.50 Cal. M2 A.P. Bullets at 0° Obliquity

<u>Rd.</u> <u>No.</u>	<u>Striking</u> <u>Velocity</u>	<u>Yaw</u>	<u>Pene-</u> <u>tration</u>	<u>Bullet</u>	<u>Condition</u> <u>of Plate</u>
1	1455	40°	PP	RJ	1" Crack.
2	1480	14	CP	NR	1/2" Hole.
3	1425	29	PP	RJ	HB
4	1475	10	CP	NR	1/4" Hole.
5	1480	33	CP	NR	1/4" Hole (NL)
6	1425	23	CP	NR	1/4" Hole.
7-8	1455	8	CP	NR	1/2" Hole.
9	1446	80	PP	RJ	HB, 1-1/4" Crack, 2 Circ. Cracks (NL)
10	1430	30	PP	RJ	HB
11	1386	90	PP	RJ	1-1/4" back crack, HB
12	1420	32	PP	RJ	SB
13	Miss	34	CP	NR	1/4" Hole.
14	1539	2	CP	NR	1/2" Hole.
15	1630	80	CP	NR	2" x 1-1/4" Hole.
16	1608	90	CP	NR	1-1/2" x 1-1/4" Hole.
17	1559	65	CP	NR	1" x 1-1/2" Hole.
18	1425	75	PP	RJ	HB, 1" Crack.
19	1375	25	PP	RJ	MB
20	1370	37	PP	RJ	SB
21	1395	45	PP	RJ	SB
22	1470	70	PP	RJ	1-1/4" Crack, HB.
23	1663	80	CP	NR	1-3/4" x 1-1/4" Hole.
24	1618	90	CP	NR	1-1/2" x 5/8" Hole.
25	1588	24	CP	NR	1/4" Hole.
26	1564	15	CP	NR	3/8" Hole.
27	1509	40	PP	RJ	MB, Cir. Crack.
28	1495	0	CP	NR	1/2" Hole.
29	1312	60	PP	NR	SB, No Cracks.
30	1308	30	PP	NR	SB, No Cracks.
31	1277	23	PP	NR	Pun S 1/8".
32	1332	90	PP	NR	MB, 1" Crack.
33	1317	25	PP	NR	1/8" Hole.
34	1466	0	CP	NR	1/2" Hole.
35	1297	20	PP	NR	SB, No Crack.
36	1294	10	PP	NR	Pun S 1/8".
37	1297	0	PP	NR	SB No Cracks,
38	1425	20	CP	NR	1/2" Hole.
39	1070	0	PP	NR	SB No Crack.

TABLE V - (Cont'd.)

BALLISTIC DATA FOR 08261 DIEBOLD B.P.S. PLATE
NO. 224-200-724-1

.50 Cal. M2 A.P. Bullets at 0° Obliquity

<u>Rd.</u> <u>No.</u>	<u>Striking</u> <u>Velocity</u>	<u>Yaw</u>	<u>Pene-</u> <u>tration</u>	<u>Bullet</u>	<u>Condition</u> <u>of Plate</u>
40	1300	0°	PP	FCIP	1/2" Hole.
41	1260	0	PP	FOP	SB No Cracks.
42	1335	0	CP	NR	1/2" Hole.
43	1236	0	PP	FOP	SB No Crack.
44	1294	0	PP	FCIP	1/4" Hole.
45	1238	0	PP	NR	1/8" Hole.
46	1250	0	PP	FCIP.	1/8" Hole.
47	1360	0	CP	NR	1/2" Hole.
48	1351	10	PP	NR	1/4" Hole.
49	1353	60	PP	NR	1" Circular Crack.
50	1292	0	PP	NR	SB No Crack.
51	1395	0	CP	NR	1/2" Hole.
52	1365	5	PP	NR	SB No Cracks.
53	1342	30	PP	NR	SB No Cracks.
54	1331	40	PP	NR	1" Circular Crack.
55	1344	0	CP	NR	1/2" Hole.
56	1514	14	CP	NR	1/2" Hole.
57	1500	55	PP	RJ	2" Circular Crack.
58	1648	60	CP	NR	1-1/2" Hole.
59	1613	40	CP	NR	2" Hole.
60	1539	0	CP	NR	1/2" Hole.
61	1514	37	PP	RJ	SB No Crack.
62	1549	37	CP	NR	1-1/2" Hole.

COMPANY DATA

Physical Properties not given.

BHN 555 - 401/415.

<u>C</u>	<u>Mn</u>	<u>S</u>	<u>P</u>	<u>Si</u>	<u>Ni</u>	<u>Mo</u>
.19-.23	.44	.018	.014	.19	4.95	.28

Quench 1540°F

Draw 315°F.

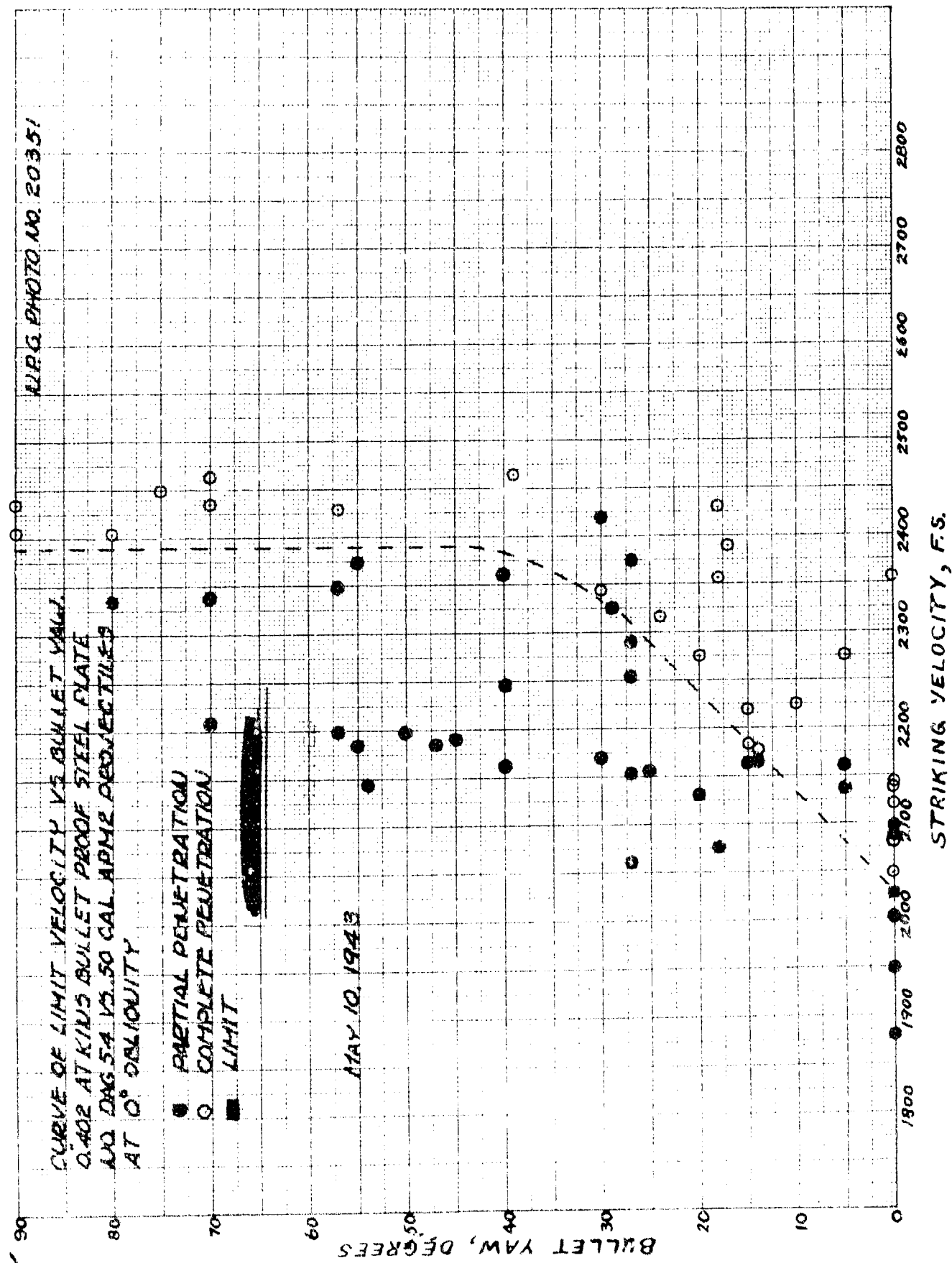


TABLE VI

BALLISTIC DATA FOR 0V402 ATLINS B.P.S. PLATE NO. DAG 54

.50 Cal. M2 A.P. Bullets at 0° Obliquity

<u>Rd. No.</u>	<u>Striking Velocity</u>	<u>Yaw</u>	<u>Pene- tration</u>	<u>Bullet</u>	<u>Condition of Plate</u>
1	2048	0°	CP	NR	1/8" Hole.
2	1880	0	FP	NR	SB
3	1950	0	PP	FOP	SB
4	2002	0	PP	FCIP	SB No Crack.
5	1998	0	PP	FOP	SB No Crack.
6	2138	0	CP	NR	1/2" Hole.
7	2120	0	CP	NR	1/2" Hole.
8	2084	0	PP	FOP	SB No Crack.
9	2097	0	PP	FOP	SB No Crack.
10	2100	0	PP	FCIP	1/4" Hole in back.
11	2197	50	PP	NR	No Cracks.
12	2200	57	FP	NR	SB No Cracks.
13	2185	47	FP	NR	SB No Cracks.
14	2356	0	CP	NR	1" Hole.
15	2344	30	CP	NR	1" x 1-1/2" Hole.
16	2355	18	CP	NR	3/4" Hole.
18	2290	27	FP	NR	1-1/2" Crack.
19	2246	40	PP	NR	1" Crack.
20	2275	20	CP	NR	1/8" Hole.
21	2275	5	CP	NR	1/2" Hole.
22	2253	27	PP	NR	1" Crack.
23	2218	15	CP	NR	1/2" Hole.
24	2225	10	CP	NR	1/4" Hole.
25	2155	25	PP	RJ	SB
26	2170	30	PP	RJ	SB
27	2185	55	PP	RJ	MB
28	2145	54	PP	RJ	1" Crack.
29	2335	80	PP	RJ	1-1/2" Crack.
30	2315	24	CP	NR	3/8" x 5/8" Hole.
31	2375	27	PP	RJ	Pun S 1/2" near limit.
32	2325	29	PP	RJ	SB
33	2360	40	PP	RJ	1-1/4" Crack.
34	2430	18	CP	NR	1/4" Hole.
35	2389	17	CP	NR	1" Hole.
36	2374	55	PP	RJ	HB
37	2464	39	CP	NR	1" x 2" Hole.
38	2190	45	PP	NR	SB No Crack.
39	2148	0	PP	FOP	HB
40	2177	14	CP	NR	1/2" Hole.

TABLE VI - (Cont'd.)

BALLISTIC DATA FOR 0.402 ATKINS B.P.S. PLATE NO. DAG 54

.50 Cal. M2 A.P. Bullets at 0° Obliquity

<u>Rd.</u> <u>No.</u>	<u>Striking</u> <u>Velocity</u>	<u>Yaw</u>	<u>Pene-</u> <u>tration</u>	<u>Bullet</u>	<u>Condition</u> <u>of Plate.</u>
41	2208	70	PP	NR	Pun S 1/2" (Near Limit)
42	2153	27	PP	NR	SB - No Crack.
43	2162	40	PP	NR	SB - No Crack.
44	2183	15	CP	NR	1/8" Hole.
45	2146	5	CP	NR	1/2" Hole.
46	2082	0	CP	NR	1/8" Hole.
47	2144	0	CP	NR	1/8" Hole.
48	2163	15	PP	NR	SB - No Crack.
49	2130	20	PP	NR	SB - No Crack.
50	2075	18	PP	NR	SB - No Cracks.
51	2061	27	PP	NR	SB - No Cracks.
52	2137	5	PP	FOP	MB - No Crack.
53	2160	5	PP	FOP	SB - No Crack.
54	2197	0	PP	FOP	SB - No Crack.
55	2165	14	PP	RJ	Pun S 1/4".
56	2434	70	CP	NR	1/2" x 1-1/2" Hole.
57	2462	70	CP	NR	1/2" x 1-1/2" Hole.
58	2435	90	CP	NR	3/4" x 2" Hole.
59	2338	70	PP	RJ	SB - No Cracks.
60	2348	57	PP	RJ	Pun S 1/4".
61	2405	90	CP	NR	1/2" x 1-1/2" Hole.
62	2405	80	CP	NR	3/4" x 1-1/2" Hole.
63	2420	30	PP	NR	Pun S 1/8".
64	2429	57	CP	NR	3/4" x 1" Hole.
65	2450	75	CP	NR	3/4" x 1-1/2" Hole.

COMPANY DATA

Heat No. 11740-18

<u>YP</u>		<u>TS</u>		<u>E1%</u>		
171,230		211,660		11		
<u>C</u>	<u>Mn</u>	<u>S</u>	<u>P</u>	<u>Si</u>	<u>Ni</u>	<u>Mo</u>
.55	.50	.021	.014	.221	3.55	.54
.17	.51	.014	.013	.211	3.71	.48

Quench 848.8°C
Draw 164.4°C

15 min. oil
1 hour.

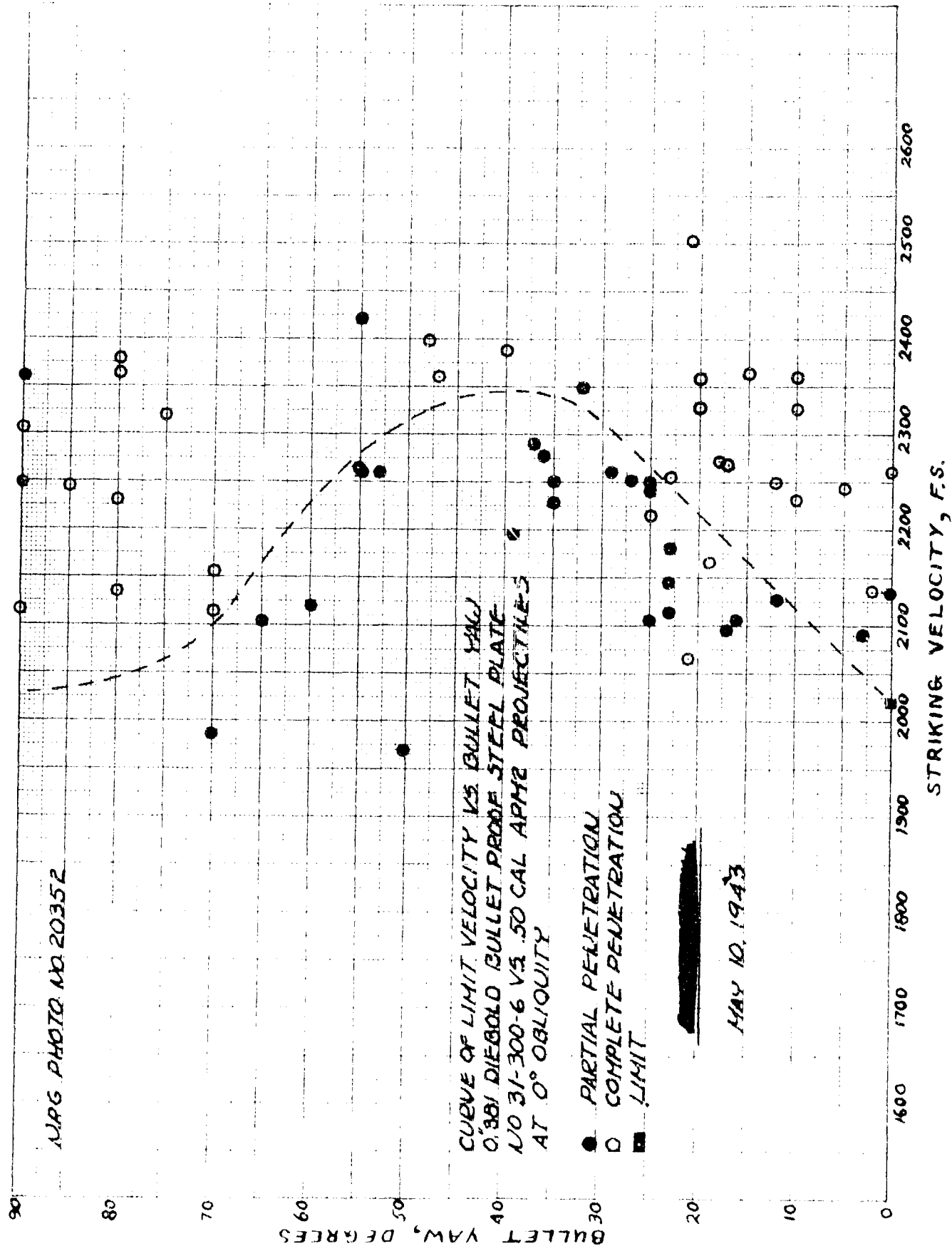


TABLE VII
BALLISTIC DATA FOR 07381 DIEBOLD B.P.S. PLATE
NO. 31-300-6

.50 Cal. M2 A.P. Bullets at 0° Obliquity

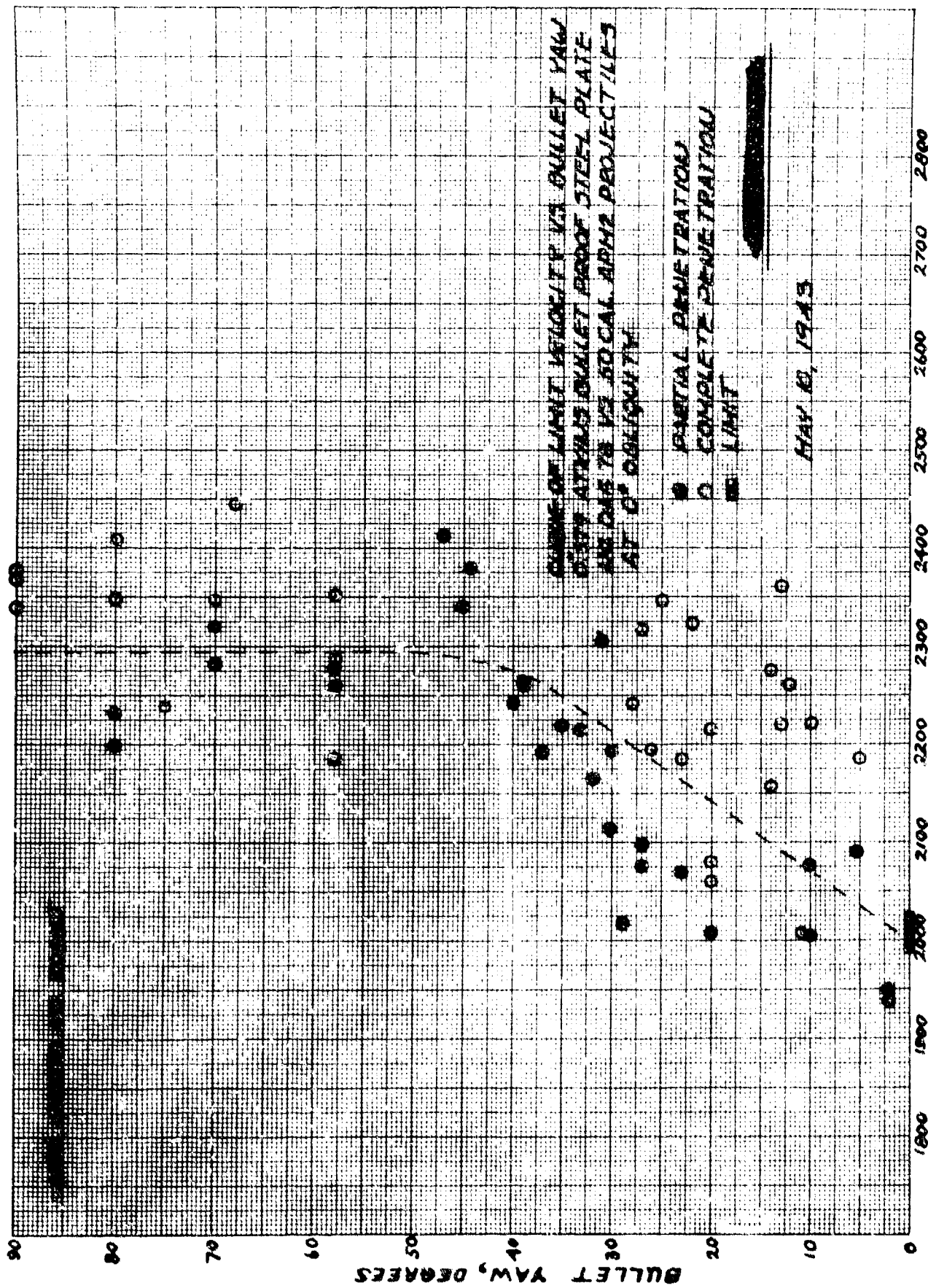
<u>Rd. No.</u>	<u>Striking Velocity</u>	<u>Yaw</u>	<u>Pene- tration</u>	<u>Bullet</u>	<u>Condition of Plate</u>
1	Miss	43°	CP	NR	1" Hole
2	2613	29	CP	NR	1" x 5/8" Hole.
3	Miss	40	CP	NR	1" x 5/8" Hole.
4	2504	21	CP	NR	3/4" Hole.
5	2399	48	CP	NR	1-1/2" Hole.
6	2215	25	CP	NR	1/2" Hole.
7	2165	19	CP	NR	1/2" Hole.
8	2135	2	CP	NR	3/8" Hole.
9	2120	60	FP	RJ	SB
10	1986	70	FP	RJ	MB
11	1648				
	Miss	80	CP	NR	1" x 1/2" Hole.
12	1967	50	PP	RJ	SB
13	2195	39	PP	RJ	SB
14	2090	3	PP	RJ	SB
15	2095	17	PP	RJ	SB
16	2105	25	PP	RJ	SB
17	2115	23	PP	RJ	SB
18	2105	16	PP	RJ	SB
19	2155	70	CP	NR	2" x 3/8" Hole.
20	2115	70	CP	NR	1" x 1/2" Hole.
21	2135	80	CP	NR	2" x 3/8" Hole.
22	2105	65	FP	RJ	HB, 1" Crack.
23	2066	21	CP	NR	3/8" Hole.
24	2115	90	CP	NR	1-1/2" x 3/8" Hole.
25	1976	0	FP	RJ	SB No Crack.
26	2034	40	FP	RJ	SB No Crack.
27	2040	0	CP	NR	1/2" Hole.
28	2019	0	PP	FOP	SB No Crack.
29	2010	0	PP	FOP	Pun S
30	1998	0	PP	FOP	SB No Crack.
31	2007	0	PP	FOP	SB No Crack.
32	2020	0	CP	NR	1/2" Hole.
33	2031	0	PP	FOP	SB No Crack.
34	2127	12	PP	RJ	SB No Cracks.
35	2136	0	PP	FOP	SB No Crack.
36	2144	25	PP	RJ	SE No Crack.
37	2180	23	PP	RJ	SB No Crack.

TABLE VII - (Cont'd.)

BALLISTIC DATA FOR 07381 DIEBOLD B.F.S. PLATE
NO. 31-300-6

.50 Cal. M2 A.P. Bullets at 0° Obliquity

<u>Rd. No.</u>	<u>Striking Velocity</u>	<u>Yaw</u>	<u>Pene- tration</u>	<u>Bullet</u>	<u>Condition of Plate</u>
38	2260	29°	PP	RJ	HB 1" Crack.
39	2243	5	CP	NR	1/2" Hole.
40	2259	0	CP	NR	3/4" Hole.
41	2233	10	CP	NR	1/2" Hole.
42	2265	55	PP	NR	2" Pun S.
43	2260	53	PP	NR	3" x 4" Crack.
44	2240	25	PP	RJ	HB No Crack.
45	2252	27	PP	RJ	HB No Cracks.
46	2290	37	PP	RJ	2" Crack.
47	2364	15	CP	NR	1/2" Hole.
48	2420	55	PP	RJ	3" Circular Crack.
49	2331	20	CP	NR	3/4" Hole.
50	2357	20	CP	NR	1/2" Hole.
51	2360	90	PP	NR	3" Circular Crack.
52	2387	40	CP	NR	1/2" x 1" Hole.
53	2350	32	PP	RJ	1/2" Pun S.
54	2359	10	CP	NR	1/2" Hole.
55	2326	10	CP	NR	1/2" Hole.
56	2381	80	CP	NR	1/2" x 2" Hole.
57	2363	80	CP	NR	1/2" x 1-1/2" Hole.
58	2360	47	CP	NR	3/4" x 1-1/2" Hole.
59	2260	55	PP	NR	Heavy Bulge, 1" Crack.
60	2319	75	CP	NR	1/2" x 2" Hole.
61	2277	36	PP	NR	HB, 1" Crack.
62	2272	18	CP	NR	3/4" Hole.
63	2250	25	PP	RJ	HB, 1" Crack.
64	2255	23	CP	NR	1" Hole.
65	2248	12	CP	NR	1/2" Hole.
66	2250	35	PP	RJ	HB, Circular Crack.
67	2229	80	CP	NR	1/2" x 1-1/2" Hole.
68	2268	17	CP	NR	3/4" Hole.
69	2247	90	PP	RJ	Heavy Bulge.
70	2304	90	CP	NR	1/2" x 2-1/2" Hole.
71	2227	35	PP	RJ	HB, No Crack.
72	2245	86	CP	NR	1/2" x 2" Hole.



STRIKING VELOCITY, F.S.

TABLE VII - (Cont'd.)

BALLISTIC DATA FOR C7381 DIEBOLD B.P.S. PLATE
NO. 31-300-6

.50 Cal. M2 A.P. Bullets at 0° Obliquity

COMPANY DATA

Heat No. 25421

Armco.

Physical Properties not given.

<u>C</u>	<u>Mn</u>	<u>S</u>	<u>P</u>	<u>Si</u>	<u>Ni</u>	<u>Mo</u>
-	.55	.020	.012	.20	3.26	.31

Quench 1500-1525°F. 1 hour Full oil O.H.

TABLE VIII

BALLISTIC DATA FOR O7379 ATKINS B.P.S. PLATE NO. DAG 78

.50 Cal. M2 A.P. Bullets at 0° Obliquity

<u>Rd.</u> <u>No.</u>	<u>Striking</u> <u>Velocity</u>	<u>Yaw</u>	<u>Pene-</u> <u>tration</u>	<u>Bullet</u>	<u>Condition</u> <u>of Plate</u>
1	2407	80°	CP	NR	1/2" x 1-1/2" Hole.
2	2348	80	CP	NR	1/2" x 1" Hole.
3	2231	80	PP	NR	Pun S 1/8".
4	2320	70	PP	NR	1-1/2" Crack.
5	2340	45	PP	NR	SB No Crack.
6	2324	22	CP	NR	1/2" Hole.
7	2348	70	CP	NR	1/2" x 1-1/2" Hole.
8	2339	90	CP	NR	1/2" x 1-1/2" Hole.
9	2288	58	CP	NR	1/2" x 3/4" Hole.
10	2283	70	PP	NR	1" Crack.
11	2238	75	CP	NR	1/2" x 3/4" Hole.
12	2220	35	PP	NR	SB No Cracks.
13	2198	80	PP	NR	1-1/2" Crack.
14	2244	40	PP	NR	SB No Crack.
15	2241	28	CP	NR	1/2" x 3/4" Opening.
16	2260	58	PP	NR	SB No Cracks.
17	2264	39	PP	RJ	SB
18	2117	27	CP	NR	3/8" Hole.

TABLE VIII - (Cont'd.)

BALLISTIC DATA FOR 0.379 ATKINS B.P.S. PLATE NO. DAG 78

.50 Cal. M2 A.P. Bullets at 0° Obliquity

<u>Rd. No.</u>	<u>Striking Velocity</u>	<u>Yaw</u>	<u>Pene- tration</u>	<u>Bullet</u>	<u>Condition of Plate.</u>
19	2348	25°	CP	NR	5/8" Hole.
20	2277	58	PP	RJ	1-1/2" Crack, HB.
21	2261	39	PP	RJ	MB
22	2372	90	CP	NR	2" x 5/8" Hole.
23	2370	90	CP	NR	2" x 5/8" Hole.
24	2352	58	CP	NR	1" x 1/2" Hole.
25	2360	13	CP	NR	3/8" Hole.
26	Miss	80	PP	RJ	MB
27	2070	23	PP	RJ	1/2" Crack, MB.
28	2158	14	CP	NR	1/4" Hole.
29	2018	29	PP	RJ	SB
30	2006	11	CP	NR	3/16" Hole.
31	1938	2	PP	RJ	SB
32	2076	10	PT	RJ	MB
33	2090	5	PT	RJ	MB
34	2079	20	CP	NR	1/2" Hole.
35	2060	20	CP	NR	5/8" x 1/2" Hole.
36	2009	20	PP	RJ	SB
37	1950	2	PT	RJ	SB
38	2005	10	PT	RJ	SB
		or 11			
39	2026	0	CP	NR	1/4" Hole.
40	1975	0	PP	FCIP	Pun S 1/8".
41	2064	0	PT	FCIP	3/8" Hole.
42	2100	0	CP	NR	1/4" Hole.
43	2120	0	CP	NR	1/4" Hole.
44	2206	0	CP	NR	3/8" Hole.
45	2275	14	CP	NR	3/8" Hole.
46	2220	13	CP	NR	3/8" Hole.
47	2076	27	PP	RJ	SB
48	2195	26	CP	NR	3/8" Hole.
49	2185	23	CP	NR	3/8" Hole.
50	2105	27	CP	NR	1/4" Hole.
51	2100	27	PP	RJ	MB 1/2" Crack.
52	2115	30	PT	RJ	Pun S 1/8".
53	2195	30	PT	RJ	Pun S 5/8" limit, 1/8" Opening.
54	2215	33	TP	RJ	HB
55	2185	58	PP	RJ	HB, 1" Crack.

TABLE VIII - (Cont'd.)

BALLISTIC DATA FOR 0:379 ATHINS B.F.S. PLATE NO. DAG 78

.50 Cal. M2 A.P. Bullets at 0° Obliquity

<u>Rd. No.</u>	<u>Striking Velocity</u>	<u>Yaw</u>	<u>Pene- tration</u>	<u>Bullet</u>	<u>Condition of Plate</u>
56	2305	31	PP	RJ	Pun S 1/8".
57	2412	47	FP	NR	1" Crack.
58	2445	68	CP	NR	1/2" x 1-1/2" Opening.
59	2380	44	PP	NR	1" Crack.
60	2220	10	CP	NR	1/2" Hole.
61	2166	32	PT	NR	SB No Cracks.
62	2185	5	CP	NR	1/2" Hole.
63	1897	0	FP	FCIP	MB
64	1968	0	FP	FOP	MB
65	1987	0	FP	FOP	MB
66	2073	0	PP	FOP	HB
67	2137	0	CT	NR	1/2" Hole.
68	2260	12	CP	NR	1/2" Hole.
69	2215	20	CT	NR	3/8" Hole.
70	2192	37	PP	NR	1-1/2" Crack.

COMPANY DATA

Heat No. 11765-11.

<u>YP</u>		<u>TS</u>		<u>% El</u>		
171,230		211,660		11		
<u>C</u>	<u>Mn</u>	<u>S</u>	<u>P</u>	<u>Si</u>	<u>Ni</u>	<u>Mo</u>
.53	.53	.024	.017	.235	3.38	.49
.16	.41	.018	.015	.277	3.51	.48

Quench 848.8°C 15 min. oil.

Draw 154.4°C 1 hr.

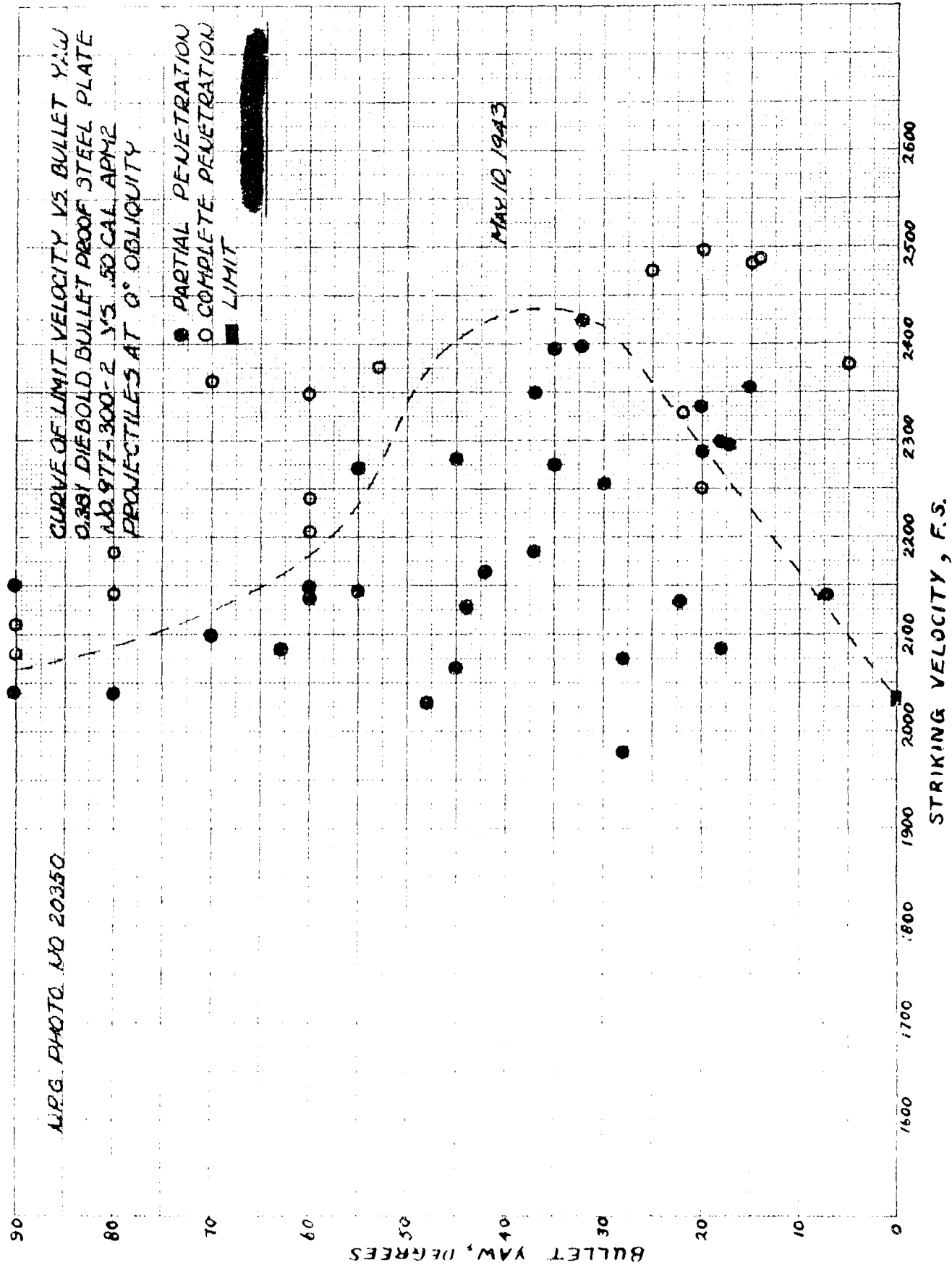


TABLE IX

BALLISTIC DATA FOR 07381 DIEBOLD B.P.S. PLATE
NO. 977-300-2

.50 Cal. M2 A.P. Bullets at 0° Obliquity

<u>Rd. No.</u>	<u>Striking Velocity</u>	<u>Yaw</u>	<u>Pene- tration</u>	<u>Bullet</u>	<u>Condition of Plate</u>
1	2041	0°	CP	NR	3/8" Hole.
2	2011	0	PP	FOP	MB
3	2001	0	PP	FOP	MB
4	2026	0	PP	FOP	MB
5	1957	0	PP	FOP	MB
6	1981	3	PP	FOP	SB
7	1995	0	PP	FOP	MB
8	2185	0	PP	FCIP	Nose thru & off, 1/4" Hole.
9	2190	0	CP	NR	3/8" Hole.
10	1985	0	PP	RJ	SB
11	2185	80	CP	NR	3/8" x 5/8" Hole (NL)
12	1977	28	PP	RJ	SB
13	2135	22	PP	RJ	SB
14	2140	7	PP	RJ	SB
15	2185	37	PP	RJ	SB
16	2205	60	CP	NR	2" x 3/8" Hole.
17	2165	42	PP	RJ	SB
18	2255	30	PP	RJ	HB, 1-1/2" Crack.
19	2290	20	PP	RJ	MB
20	2240	60	CP	NR	2" x 3/8" Hole.
21	2250	20	CP	NR	1" x 3/4" Hole.
22	2150	90	PP	RJ	MB
23	2085	63	PP	RJ	SB
24	2111	90	CP	NR	2" x 3/8" Hole.
25	2085	18	PP	RJ	SB
26	2142	80	CP	NR	1/2" x 1-1/2" Hole.
27	2148	60	PP	RJ	HB No Crack.
28	2144	55	PP	RJ	HB 1" Crack.
29	2137	60	PP	RJ	HB 1-1/2" Crack.
30	2128	44	PP	RJ	1" Crack.
31	2080	90	CP	NR	1/2" x 1-1/2".
32	2100	70	PP	RJ	SB No Crack.
33	2075	27	PP	RJ	SB No Crack.
34	2038	80	PP	RJ	HB 1" Crack.
35	2030	48	PP	RJ	SB No Crack.
36	2043	90	PP	RJ	SB 1" Crack.
37	2065	45	PP	RJ	SB No Crack.
38	2295	17	PP	RJ	Pun S.

TABLE IX - (Cont'd.)

BALLISTIC DATA FOR 07381 DIEBOLD B.P.S. PLATE
NO. 977-300-2

.50 Cal. M2 A.P. Bullets at 0° Obliquity

<u>Rd. No.</u>	<u>Striking Velocity</u>	<u>Yaw</u>	<u>Pene- tration</u>	<u>Bullet</u>	<u>Condition of Plate.</u>
39	2298	18°	PP	RJ	Pun S.
40	2335	20	PP	RJ	1/2" Crack.
41	2347	60	CP	NR	1/2" x 1" Hole.
42	2350	37	PP	RJ	4" Crack (Circular)
43	2362	70	CP	NR	1/2" x 1-1/2" Hole.
44	2327	22	CP	NR	1/2" Hole.
45	2355	15	PP	RJ	Pun S.
46	2375	53	CP	NR	1/2" x 1" Hole.
47	2275	35	PP	RJ	SB No Crack.
48	2270	55	PP	RJ	1" Crack.
49	2280	45	PP	RJ	No Cracks.
50	2380	5	CP	NR	1/2" Hole.
51	2397	32	PP	RJ	1" Crack.
52	2395	35	PP	RJ	2" Crack.
53	2424	32	PP	RJ	3" Crack.
54	2475	25	CP	NR	1-1/2" Hole.
55	2497	20	CP	NR	1/2" Hole.
56	2484	15	CP	NR	1/2" Hole.
55	2489	14	CP	NR	1/2" Hole.

COMPANY DATA

Heat No. 254 18

Armco.

Physical Properties not given.

<u>C</u>	<u>Mn</u>	<u>S</u>	<u>P</u>	<u>Si</u>	<u>Ni</u>	<u>Mo</u>
.52	.017	.010	.20	3.25	.28	

Quench 1500 - 1525°F

1 hour Full Oil O.H.

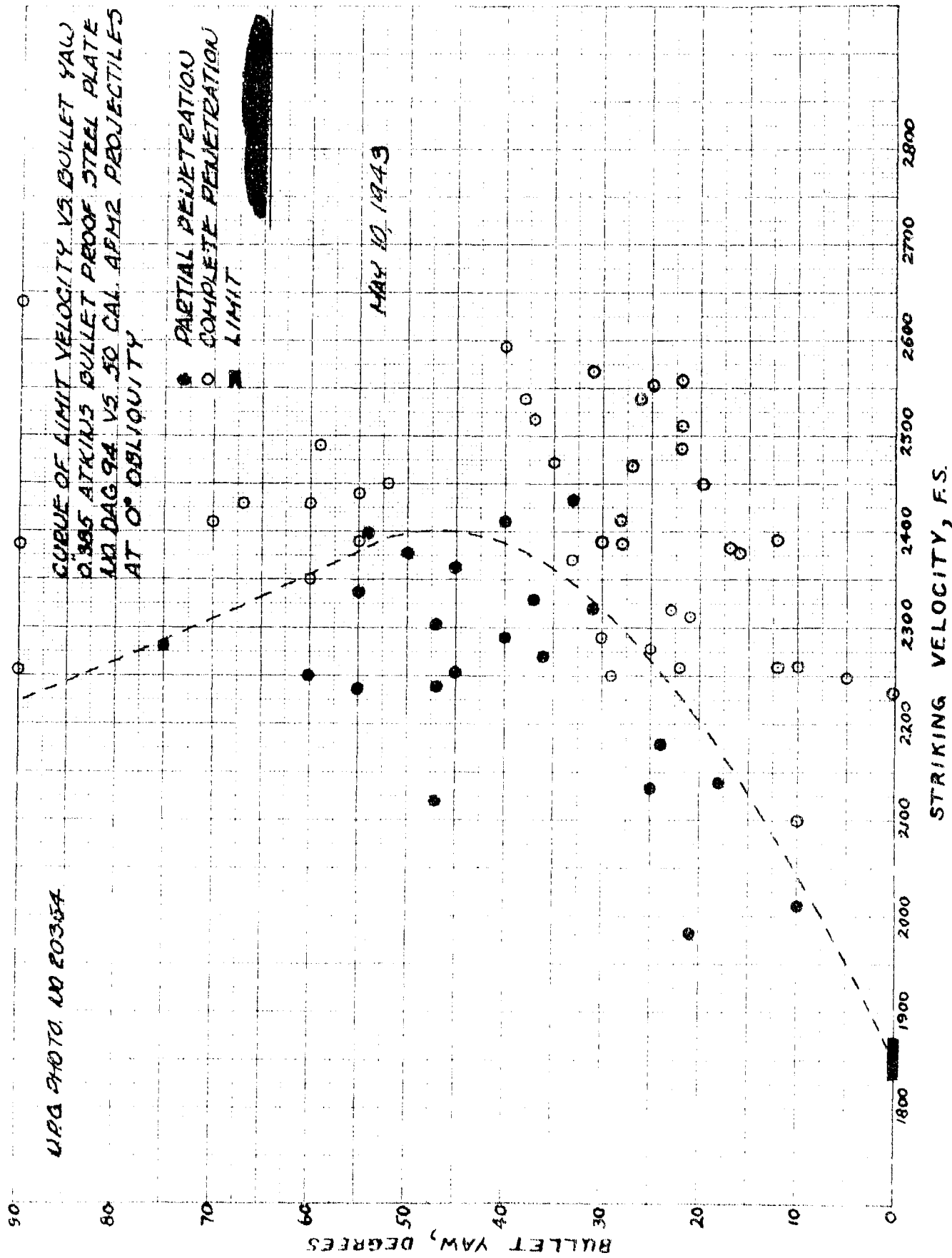


TABLE X

BALLISTIC DATA FOR 07385 ATKINS B.P.S. PLATE NO. DAG 94

.50 Cal. M2 A.P. Bullets at 0° Obliquity

<u>Rd. No.</u>	<u>Striking Velocity</u>	<u>Yaw</u>	<u>Pene- tration</u>	<u>Bullet</u>	<u>Condition of Plate</u>
1	2257	45°	PF	RJ	SB
2	2433	33	PF	RJ	Pun 3 3/4" out 1/4" Opening (Near Limit)
3	2640	90	CP	NR	2" x 5/8" Hole.
4	2510	22	CP	NR	1" Hole.
5	2382	17	CP	NR	1/2" Hole.
6	2248	5	CP	NR	1/2" Hole.
7	2120	47	PF	RJ	SB
8	2552	25	CP	NR	1/2" x 1" Hole.
9	2557	22	CP	NR	3/8" Hole.
10	2539	38	CP	NR	1/2" Hole, button started.
11	2593	40	CP	NR	3/8" x 1-1/2" Hole.
12	2472	35	CP	NR	3/8" x 1-1/4" Hole.
13	2490	59	CP	NR	3/8" Hole (near limit)
14	2411	28	CP	NR	3/8" Hole (near limit)
15	2240	47	PF	RJ	SB
16	2311	21	CP	NR	3/8" Hole.
17	2133	25	PI	RJ	SB
18	2179	24	PF	RJ	MB
19	2281	75	PF	RJ	SB
20	2260	10	CP	NR	3/8" Hole.
21	2258	22	CP	NR	3/8" Hole.
22	2140	18	CP	NR	MB
23	2100	10	CP	NR	1/4" Hole.
24	1982	21	PF	RJ	SB
25	2010	10	PF	RJ	MB
26	2255	90	CP	NR	2" x 1/2" Hole.
27	2320	31	PF	RJ	MB
28	2278	25	CP	NR	5/8" Hole.
29	2232	0	CP	NR	1/2" Hole.
30	2260	12	CP	NR	1/2" Hole.
31	2236	55	PF	RJ	SB No Crack.
32	2567	31	CP	NR	1" Hole.
33	2538	26	CP	NR	3/4" Hole.
34	2518	37	CP	NR	1/2" x 1" Hole.
35	2486	22	CP	NR	1/2" x 1" Hole.
36	2468	27	CP	NR	1/2" x 1" Hole.
37	2440	55	CP	NR	1/2" x 1-1/2" Hole.
38	2391	12	CP	NR	1/2" Hole.
39	2373	16	CP	NR	1/2" Hole.

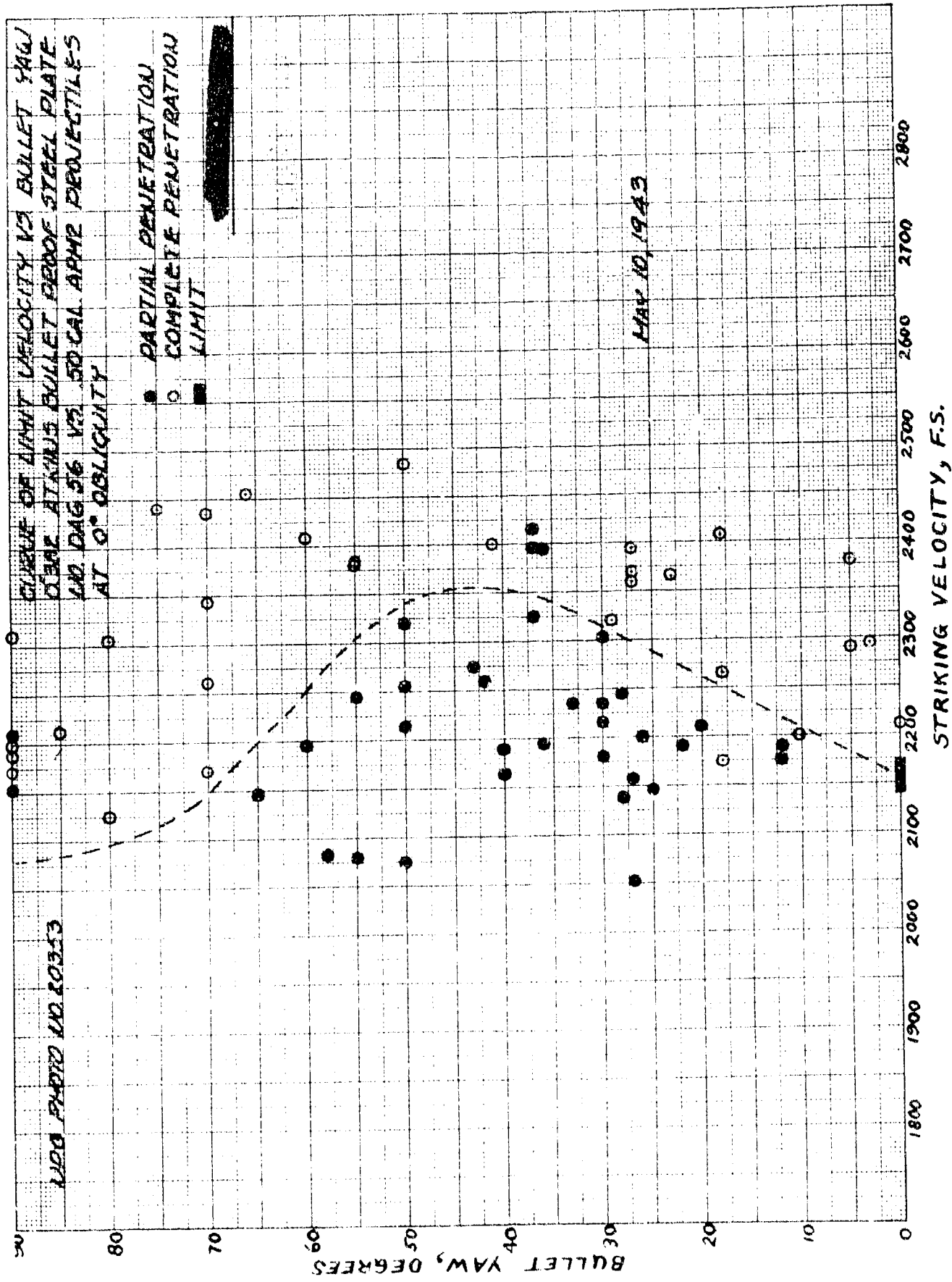


TABLE XI

BALLISTIC DATA FOR 07382 ATKINS B.P.S. PLATE NO. DAG 56.50 Cal. M2 A.P. Bullets at 0° Obliquity

<u>Rd. No.</u>	<u>Striking Velocity</u>	<u>Yaw</u>	<u>Pene- tration</u>	<u>Bullet</u>	<u>Condition of Plate</u>
1	2140	0°	PP	FOP	SB
2	2110	0	PP	FOP	SB
3	2215	0	CP	NR	1/2" Hole. 2" x 1-1/2" button.
4	2175	0	CP	NR	1/4" Hole.
5	2160	0	PP	FCIP	Nose thru & off. 1/4" Hole.
6	2115	0	PP	FOP	SB
7	2195	0	CP	NR	1/2" Hole.
8	2484	50	CP	NR	1-1/2" Ragged Hole. 2-1/2" spall.
9	2320	29	CP	NR	1" Hole. 1-1/2" spall.
10	2275	43	PP	RJ	SB
11	2310	90	CP	NR	2" x 5/8" Hole. 2" x 3" button.
12	2305	80	CP	NR	2" x 5/8" Hole. 2" x 1" Button.
13	2210	90	PP	RJ	HB, 1-1/2" Crack.
14	2235	33	PP	RJ	SB
15	2245	28	PP	RJ	SB
16	2344	70	CP	NR	2" x 5/8" Hole. 3" x 1-1/2" button.
17	2260	70	CP	NR	1-1/2" x 5/8" Hole. 1/2" Petal.
18	2235	30	PP	RJ	SB
19	2245	55	PP	RJ	MB
22	2260	42	PP	RJ	SB
23	2440	75	CP	NR	1-1/2" x 5/8" Hole. 3" x 1-1/2" Button.
24	2364	23	CP	NR	3/8" Hole.
25	2325	37	PP	RJ	MB
26	2320	50	PP	RJ	3/4" Petal (near limit)
27	2414	37	PP	RJ	MB
28	2394	36	PP	RJ	MB
29	2454	66	CP	NR	2" x 5/8" Hole. 2" Button.
30	2394	27	CP	NR	1/2"x3/16" Hole.
31	2211	85	CP	NR	1/2" x 2" Hole.
32	2213	50	PP	RJ	SB No Crack.

TABLE XI - (Cont'd.)

BALLISTIC DATA FOR 0:382 ATKINS B.P.S. PLATE NO. DAG 56

.50 Cal. M2 A.P. Bullets at 0° Obliquity

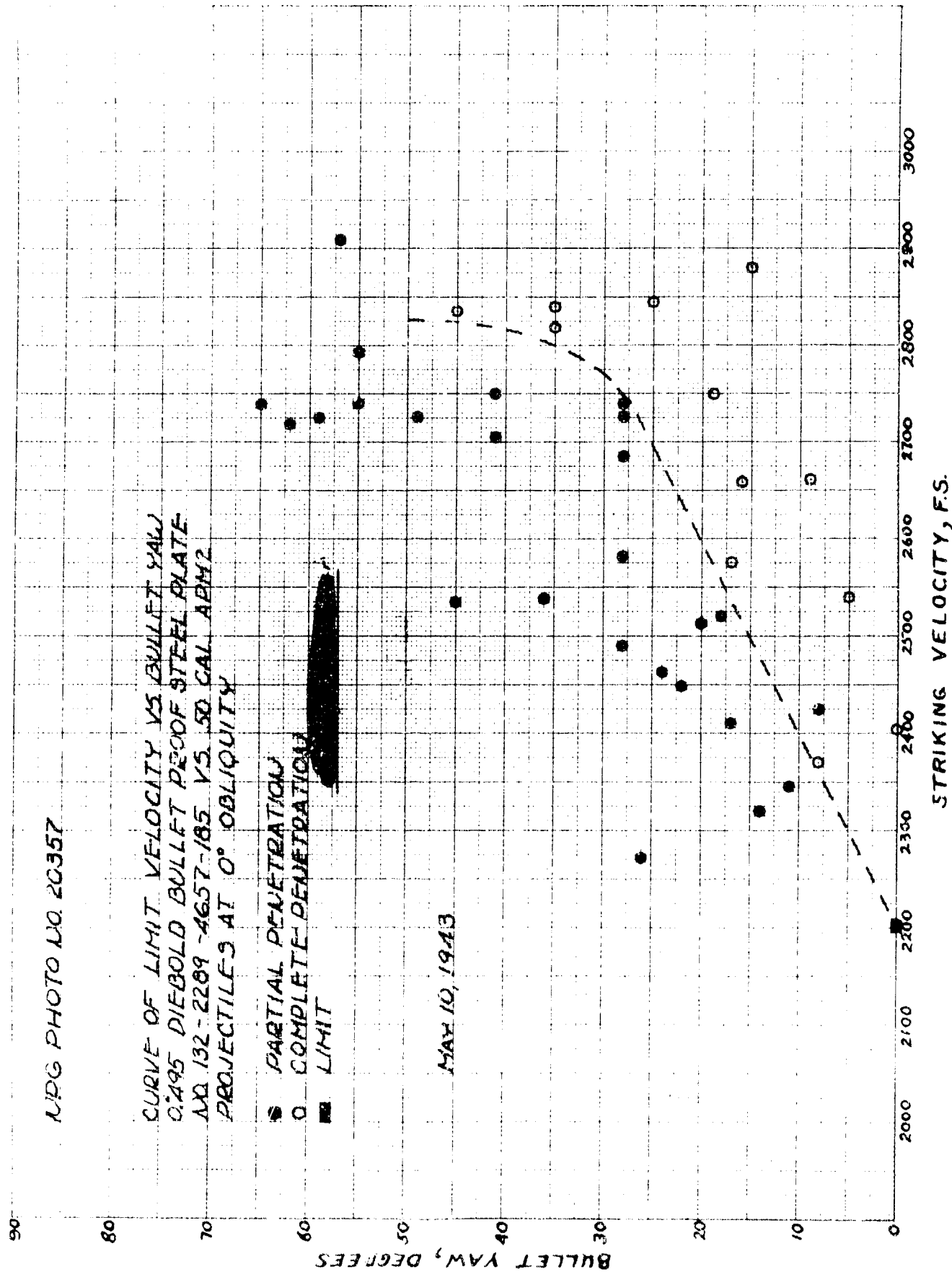
<u>Rd. No.</u>	<u>Striking Velocity</u>	<u>Yaw</u>	<u>Pene- tration</u>	<u>Bullet</u>	<u>Condition of Plate</u>
33	2180	30°	PP	NR	SB No Crack.
34	2196	60	PP	NR	SB 1" Crack.
35	2157	27	PP	NR	SB No Crack.
36	2200	90	CP	NR	1/2" x 2" Opening.
37	2188	90	CP	NR	1/2" x 2" Opening.
38	2154	90	PP	NR	SB No Crack.
39	2164	40	PP	NR	SB No Crack.
40	2188	40	PP	NR	SB No Crack.
41	2172	90	CP	NR	1/2" x 1-3/4" Hole.
42	2170	70	CP	NR	1/2" x 1-1/2" Hole.
43	2146	65	PP	NR	Pun S 1/8".
44	2146	25	PP	NR	SB No Cracks.
45	2080	55	PP	NR	SB No Cracks.
46	2125	80	CP	NR	1/2" x 2" Opening.
47	2138	28	PP	NR	SB No Crack.
48	2082	58	PP	NR	SB No Cracks.
49	2052	27	PP	NR	SB No Cracks.
50	2074	50	PP	NR	SB No Crack.
51	2435	70	CP	NR	1/2" x 2" Opening
52	2350	27	CP	NR	3/4" Hole.
53	2304	30	PP	NR	SB No Crack.
54	2407	60	CP	NR	1/2" x 1" Hole.
55	2369	27	CP	NR	1/8" Hole.
56	2380	55	CP	NR	1/2" x 1" Hole.
57	2384	55	CP	NR	1/2" x 1" Hole.
58	2400	41	CP	NR	1/2" Hole.
59	2379	5	CP	NR	1/2" Hole.
60	2407	18	CP	NR	3/4" Hole.
61	2396	37	PP	NR	2" Crack.
62	2295	3	CP	NR	1/2" Hole.
63	2290	5	CP	NR	1/2" Hole.
64	2195	36	PP	NR	SB No Crack.
65	2255	50	PP	RJ	MB No Cracks.
66	2175	18	CP	NR	1/8" Hole.
67	2200	26	PP	NR	SB No Cracks.
68	2210	0	CP	NR	1/2" Hole.
69	2215	30	PP	NR	SB No Crack.
70	2235	0	CP	NR	1/2" Hole.
71	2265	18	CP	NR	1/2" Hole.
72	2210	0	CP	NR	1/2" Hole.

NPG PHOTO NO. 20357

CURVE OF LIMIT VELOCITY VS BULLET YAW
 0.495 DIEBOLD BULLET PROOF STEEL PLATE
 NO 132-2289-4657-185 VS 50 CAL ABM2
 PROJECTILES AT 0° OBLIQUITY

● PARTIAL PENETRATION
 ○ COMPLETE PENETRATION
 ■ LIMIT

MAY 10, 1943



STRIKING VELOCITY, FS.

TABLE XI - (Cont'd.)

BALLISTIC DATA FOR 07382 ATKINS B.P.S. PLATE NO. DAG 56

.50 Cal. M2 A.P. Bullets at 0° Obliquity

<u>Rd. No.</u>	<u>Striking Velocity</u>	<u>Yaw</u>	<u>Pene- tration</u>	<u>Bullet</u>	<u>Condition of Plate</u>
73	2210	20°	PP	NR	SB No Crack.
74	2190	22	PP	NR	Pun S 1/8".
75	2200	10	CP	NR	1/8" Hole.
76	2190	12	PP	NR	SB No Crack.
77	2175	12	PP	NR	SB No Cracks.

COMPANY DATA

Heat No. 11588-6-1

YP - 171,230 TS - 211,660 %El - 11 RA - 4.2%

<u>C</u>	<u>Mn</u>	<u>S</u>	<u>P</u>	<u>Si</u>	<u>Ni</u>	<u>Mo</u>
.58	.57	.018	.020	.305	.49	.47
.26	.26	.014	.018	.239	.482	.47

Quench 848.8°C 15 Min. Oil Draw 173.3°C 1 hour.

TABLE XII

BALLISTIC DATA FOR 07495 DIEBOLD B.P.S. PLATE
NO. 132-2289-4657-185

.50 Cal. M2 A.P. Bullets at 0° Obliquity

<u>Rd. No.</u>	<u>Striking Velocity</u>	<u>Yaw</u>	<u>Pene- tration</u>	<u>Bullet</u>	<u>Condition of Plate</u>
1	Miss	40°	PP	RJ	SB
2	2439	90	PP	RJ	2" Back Crack. 1/8" Bulge.
3	2403	0	CP	NR	1/2" Hole.
4	2424	8	PP	RJ	Pun S, out 1/4", near limit.
5	2512	20	PP	RJ	Pun S, 3/8" out, near limit.
6	2538	36	PP	RJ	3/16" Bulge.

TABLE XII - (Cont'd.)

BALLISTIC DATA FOR 0.495 DIEBOLD B.P.S. PLATE
NO. 132-2289-4657-185

.50 Cal. M2 A.P. Bullets at 0° Obliquity

<u>Rd. No.</u>	<u>Striking Velocity</u>	<u>Yaw</u>	<u>Pene- tration</u>	<u>Bullet</u>	<u>Condition of Plate</u>
7	2685	28°	PP	RJ	Pun out 1/2".
8	2725	49	PP	RJ	1/4" Bulge, 1" back Crack.
9	2725	59	PP	RJ	HB
10	2739	65	PP	RJ	3/16" Bulge, No Cracks.
11	2717	62	PP	RJ	Pun S 1/8" out 1" Crack.
12	2726	28	PP	RJ	1/4" Bulge.
13	2738	28	PP	RJ	1-1/2" Crack, Pun S. 1/4" Bulge.
14	2750	19	CP	NR	2-1" Back Crack.
15	2880	15	CP	NR	3/4" Hole, 1/4" Petal.
16	2657	16	CP	NR	1" Hole, 1/2" Petal.
17	2660	9	CP	NR	3/4" Hole.
18	2575	17	CP	NR	1/2" Hole.
19	2581	28	PP	RJ	1/2" Hole (near limit)
20	2835	45	CP	NR	1/4" Bulge, 1" Crack.
21	2840	35	CP	NR	1" x 5/8" Hole.
22	2535	45	PP	RJ	1/2" x 5/8" Hole.
23	2490	28	PP	RJ	1/8" Bulge.
24	2540	5	CP	NR	1/4" Bulge, 1" Back Crack.
25	2520	18	PP	RJ	1/2" Hole.
26	2462	24	PP	RJ	3/16" Bulge.
27	2410	17	PP	RJ	Pun S, out 3/8" (near limit).
28	2449	22	PP	RJ	Pun S, Out 3/16".
29	2370	8	CP	NR	1/8" Bulge.
30	2320	14	PP	RJ	1/2" x 5/8" Hole.
31	2272	26	PP	RJ	1/8" Bulge.
32	2346	11	PP	RJ	1/16" Bulge.
33	2750	41	PP	RJ	1/16" Bulge.
34	2770	Hit Prev. Impact.			1/2" Bulge, 3" Back Crack. Pun S.
35	2740	55	PP	RJ	1/4" Bulge, 1" Ba Crack.
36	2705	41	PP	RJ	1/4" Bulge, 1" Back Crack.

TABLE XII - (Cont'd.)

BALLISTIC DATA FOR 0.495 DIEBOLD B.P.S. PLATE
NO. 132-2289-4657-185

.50 Cal. M2 A.P. Bullets at 0° Obliquity

<u>Rd. No.</u>	<u>Striking Velocity</u>	<u>Yaw</u>	<u>Pene- tration</u>	<u>Bullet</u>	<u>Condition of Plate</u>
37	2908	57°	FP	RJ	3/8" Bulge, 2" Back Crack.
38	2818	35	CF	NR	1" x 1/2" Hole.
39	2787	Missed Plate.			
40	2845	25	CP	NR	Punching T. 1-3/4" x 3/4".
41	Near Previous Impact.				
42	2792	55	PB	RJ	Pun S 1/8", Circ. Crack 1-1/2".
43	2828	47	CP	NR	1/2" x 1-1/2" hole.
44	2868	60	PP	NR	Pun S 1/2".
45	2852	60	PP	NR	Pun S 1/2".
46	2852	30	CP	NR	1/2" hole.
47	2838	90	CP	NR	3/4" x 2" hole.
48	2832	80	CP	NR	3/4" x 2" hole.
49	2788	50	FP	NR	HB No Cracks.
50	2757	85	CP	NR	3/4" x 2" hole.

COMPANY DATA

Heat No. 45871.

Republic.

<u>YP</u>	<u>TS</u>		<u>%El</u>			
198,800	227,200		12.5			
<u>C</u>	<u>Mn</u>	<u>S</u>	<u>P</u>	<u>Si</u>	<u>Ni</u>	<u>Mo</u>
.825	.46	.02	.018	.16	3.40	.32
.23						

U.P.G. PHOTO NO. 20350

CURVE OF LIMIT VELOCITY VS BULLET YAW
 0.504 DIEBOLD BULLET PROOF STEEL PLATE
 NO. 156-2289 - 4088-164 VS 50 CAL APH42
 PROJECTILES AT 0° OBliquITY

● PARTIAL PENETRATION
 ○ COMPLETE PENETRATION
 ■ LIMIT

MAY 12 1943

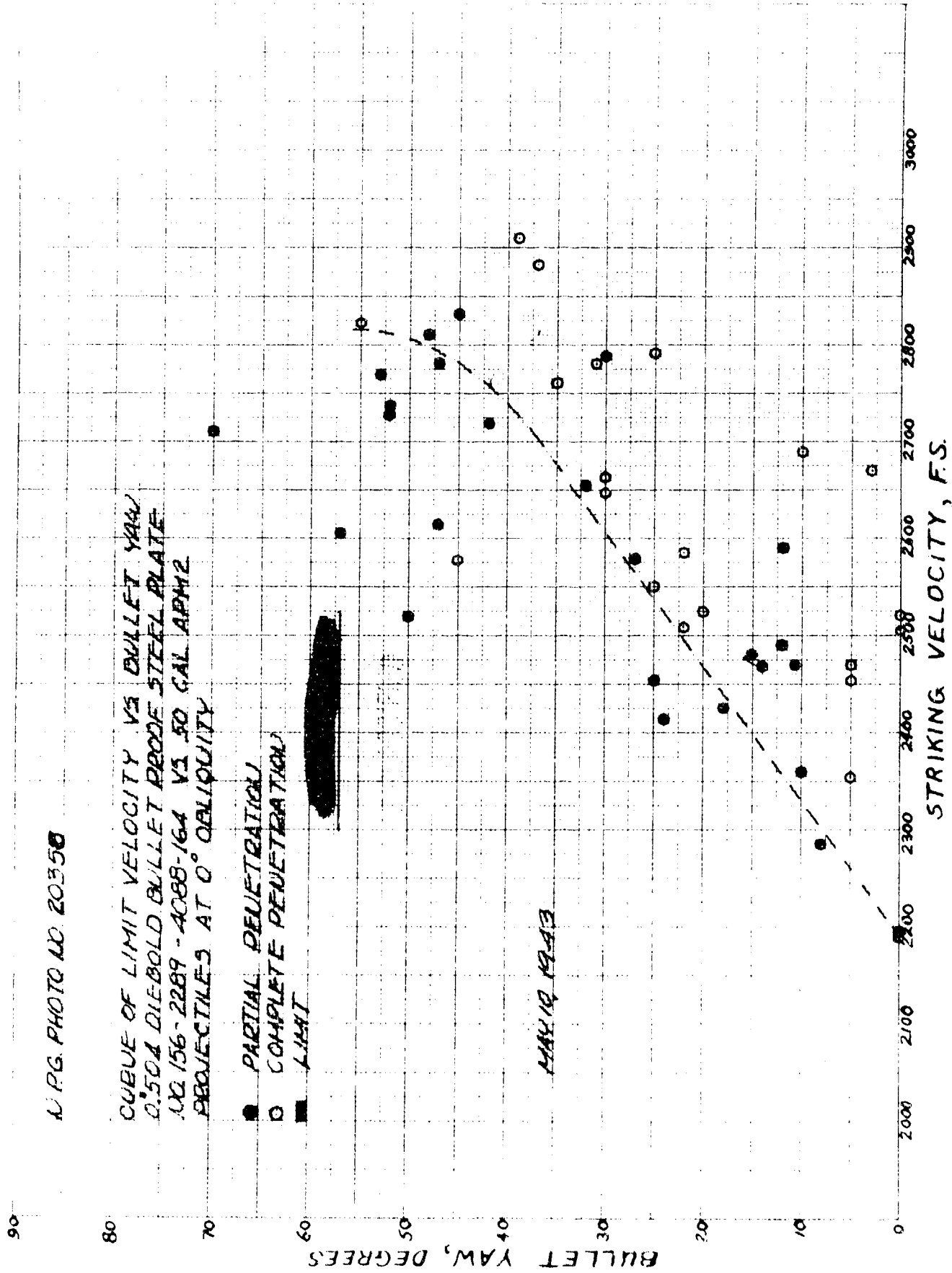


TABLE XIII

BALLISTIC DATA FOR 0.504 DIEBOLD B.P.S. PLATE
NO. 156-2289-4088-164

.50 Cal. M2 A.P. Bullets at 0° Obliquity

<u>Rd. No.</u>	<u>Striking Velocity</u>	<u>Yaw</u>	<u>Pene- tration</u>	<u>Bullet</u>	<u>Condition of Plate</u>
1	2508	22°	CP	NR	1/2" x 3/4" Opening.
2	2520	0	CP	NR	1/2" x 1/2" Opening. Pun T.
3	2470	11	PP	RJ	HB No Cracks.
4	2490	12	PP	RJ	Pun S 1/4".
5	2480	15	PP	RJ	Circular Crack 3/4".
6	2525	20	CP	NR	5/8" x 5/8" Punching Thrown.
7	2505	0	CP	NR	1/2" x 1/2" Pun. T.
8	2470	5	CP	NR	1/2" x 1/2" Pun T.
9	2425	18	PP	RJ	SB No Crack.
10	2669	3	CP	NR	1/2" x 1/2" Pun T.
11	2662	30	CP	NR	1/2" x 3/4" Opening.
12	2653	32	PP	RJ	Pun S 1/2" (Limit).
13	2647	30	CP	NR	1/2" x 3/4" Opening.
14	2550	25	CP	NR	5/8" Pun T.
15	2413	24	PP	NR	1/8" Bulge, 1/2" Crack.
16	2359	10	PP	RJ	1/8" Bulge.
17	2354	5	CP	NR	1/2" Hole.
18	2284	8	PP	RJ	Pun S, out 1/8" (Near limit).
19	2453	5	CP	NR	1/2" Hole.
20	2468	14	PP	RJ	1/8" Bulge.
21	2519	50	PP	RJ	1/8" Bulge.
22	2613	47	PP	RJ	1/8" Bulge.
23	2727	52	PP	RJ	1/4" Bulge.
24	2732	52	PP	RJ	1/4" Bulge, 1" Crack.
25	2781	47	PP	RJ	1/4" Bulge, 3/4" Crack.
26	2791	25	CP	NR	1" Hole.
27	2831	45	PP	NR	1/4" Bulge, 1" Crack.
28	Miss	5	PP	WCIP	Nose thru & off, 5/8" Hole.
30	2719	42	PP	NR	3/16" Bulge.
31	2788	30	PP	NR	Pun S, Out 3/8", (near limit).
32	2780	31	CP	NR	1" Hole, 2" Button.
33	2768	53	PP	NR	3/8" Pun S.
34	2882	37	CP	NR	1" x 5/8" Hole.
35	2810	48	PP	RJ	3/8" Bulge, 1" Crack.

L.P.G. PHOTO NO 20362

CURVE OF LIMIT VELOCITY VS. BULLET YAW.
 C.503 DIEBCLD BULLET PROOF STEEL PLATE
 NO. 132 - 2289 - 4660 - 186 VS. .50 CAL. APM2
 PROJECTILES AT 0° OBLIQUITY

- PARTIAL PENETRATION
- COMPLETE PENETRATION
- LIMIT

MAY 10, 1943

BULLET YAW, DEGREES

STRIKING VELOCITY, F.S.

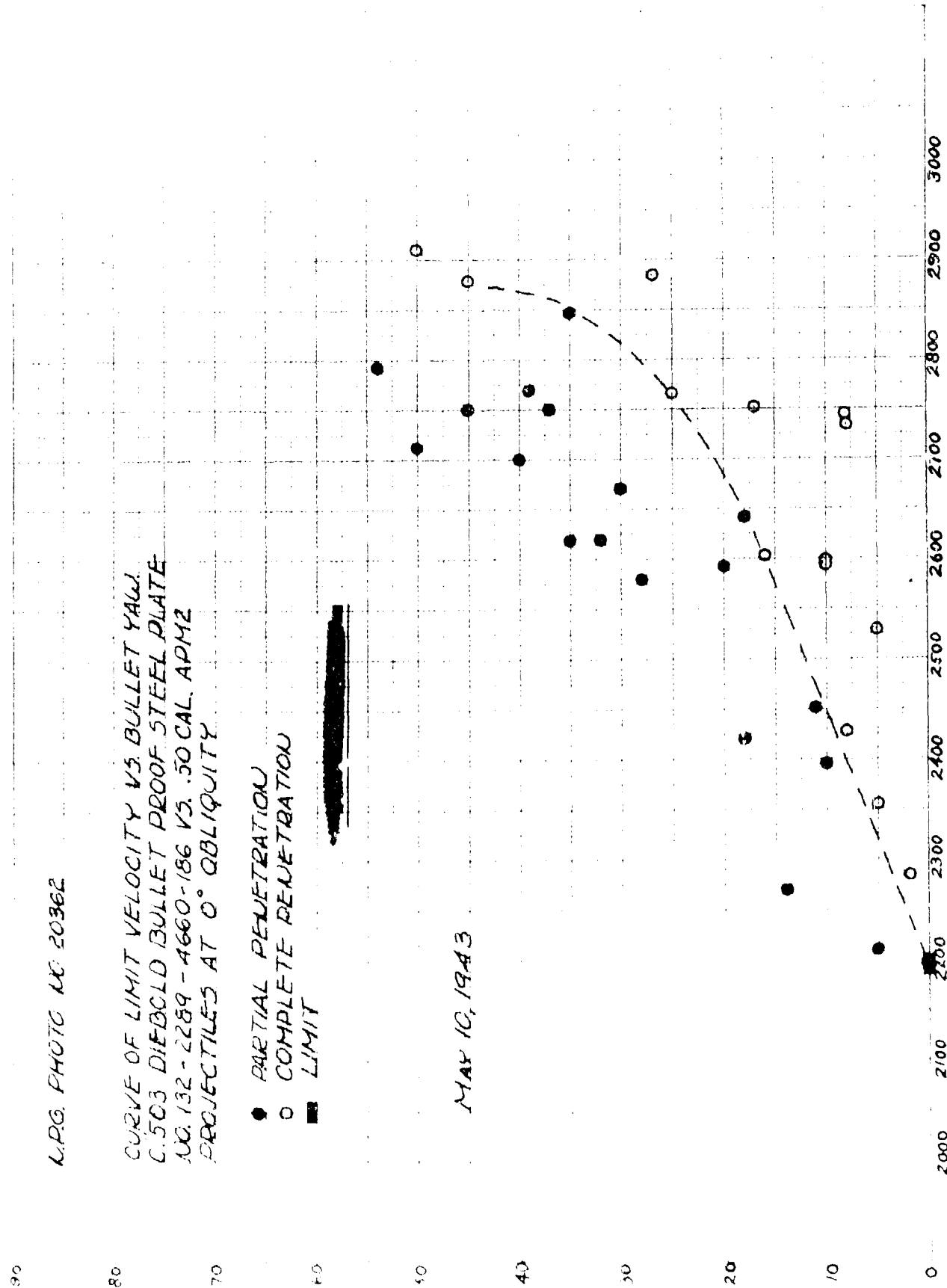


TABLE XIII - (Cont'd.)

BALLISTIC DATA FOR 0"504 DIEBOLD B.P.S. PLATE
NO. 156-2289-4088-164

.50 Cal. M2 A.P. Bullets at 0° Obliquity

<u>Rd. No.</u>	<u>Striking Velocity</u>	<u>Yaw</u>	<u>Pene- tration</u>	<u>Bullet</u>	<u>Condition of Plate</u>
36	Miss	29°	PP	RJ	Pun S, Out 1/2".
37	2823	55	CP	RJ	3/4" x 2" Hole.
38	2910	39	CP	NR	1" Hole.
39	2710	70	PP	RJ	SB No Crack.
40	2689	10	CP	NR	Pun T; 3/4" x 3/4".
41	2605	57	PT	RJ	Pun S, Out 1/8".
42	2578	27	PP	RJ	HB No Cracks.
43	2585	22	CP	NR	Pun T 1/2" x 1/2".
44	2577	45	CP	NR	Pun T 1/2" x 3/4".
45	2590	12	PP	RJ	Pun S 1/4".
46	2453	25	PP	RJ	SB

COMPANY DATA

Heat No. 44738.

Republic

<u>YP</u>	<u>TS</u>	<u>%E1</u>
200,400	220,500	12.5

<u>C</u>	<u>Mn</u>	<u>S</u>	<u>P</u>	<u>Si</u>	<u>Ni</u>	<u>Cr</u>	<u>Mo</u>
.39	.025	.018	.18	3.38	.17	.30	

Quench 1480/1550°F 1 hour oil O.H.

TABLE XIV

BALLISTIC DATA FOR 0"503 DIEBOLD B.P.S. PLATE
NO. 132-2289-4660-186

.50 Cal. M2 A.P. Bullets at 0° Obliquity

<u>Rd. No.</u>	<u>Striking Velocity</u>	<u>Yaw</u>	<u>Pene- tration</u>	<u>Bullet</u>	<u>Condition of Plate</u>
1	2578	28°	PP	RJ	Pun S 1/8".
2	2618	35	PP	RJ	SB No Cracks.

TABLE XIV - (Cont'd.)

BALLISTIC DATA FOR 07503 DIEBOLD B.P.S. PLATE

NO. 132-2289-4660-186

.50 Cal. M2 A.P. Bullets at 0° Obliquity

<u>Rd. No.</u>	<u>Striking Velocity</u>	<u>Yaw</u>	<u>Pene- tration</u>	<u>Bullet</u>	<u>Condition of Plate</u>
3	2618	32°	FP	RJ	Pun S 1/4".
4	2670	30	PP	RJ	SB No Cracks.
5	2765	25	CP	NR	Back Spall 1-1/2" x 1-1/2".
6	2712	50	PP	RJ	Circular Crack 1-1/2".
7	2750	37	PP	RJ	Pun S 3/8".
8	2700	40	PP	RJ	Pun S.
9	2733	8	CP	NR	Pun T 1/2" x 1/2".
10	2750	45	PP	NR	Pun S 1/4".
11	2883	27	CP	NR	Pun T 3/4" x 1".
12	2752	17	CP	NR	1" Hole, 2" Button.
13	2592	20	PP	RJ	3/16" Bulge.
14	2643	18	PP	RJ	Pun S, 1/2" Bulge 2" back crack.
15	2450	11	PP	RJ	Pun S 1/2".
16	2603	16	CP	NR	3/8" Hole, 1" button (near limit).
17	2593	10	CP	NR	1/2" Hole.
18	2598	10	CP	NR	5/8" Hole.
19	2528	5	CP	NR	1/2" Hole.
20	2420	18	PP	RJ	Pun S 1/8".
21	2428	8	CP	Part thru FOF	1/2" Hole (near limit)
23	2496	10	PP	RJ	1/8" Bulge.
24	2355	5	CP	NR	1/2" Hole.
25	2285	2	CP	NR	1/2" Hole.
26	2210	5	PP	RJ	SB
27	2270	14	PP	SB	SB
28	2745	8	CP	NR	1/2" Hole.
29	2847	35	PP	RJ	Pun S, Out 1/2" (near limit).
30	2910	50	CP	NR	3/4" Hole.
31	2878	45	CP	NR	3/4" Hole. 1-1/4" Petal.
32	2770	39	PP	RJ	1/4" Bulge, 1" Crack.
33	Miss	24	PP	RJ	Pun S 1/2".
34	2792	54	PP	RJ	3/8" Bulge, 1-1/2" Crack.
35	Miss	23	CP	NR	1/2" Hole.

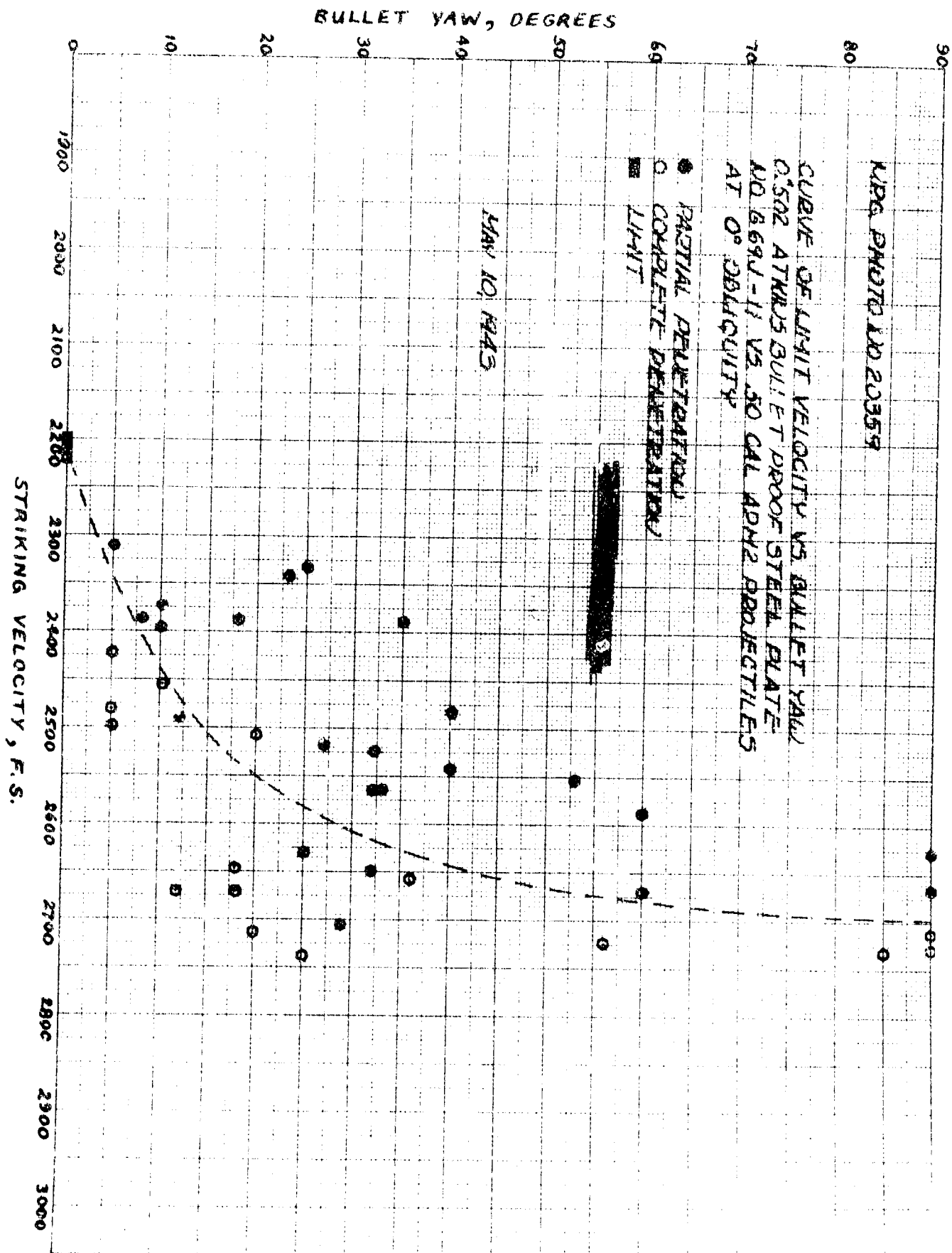


TABLE XIV - (Cont'd.)

BALLISTIC DATA FOR Q7503 DIEBOLD B.P.S. PLATE
NO. 132-2289-4660-186

.50 Cal. M2 A.P. Bullets at 0° Obliquity

COMPANY DATA

Heat No. 45871.		Republic	
YP - 198,800	TS - 227,200	% E1 - 12.5	
<u>C</u>	<u>Mn</u>	<u>S</u>	<u>P</u>
.825	.46	.02	.018
.23			
<u>Si</u>	<u>Ni</u>	<u>Mo</u>	
.16	2.40	.52	
Quench 1480/1500°F		1 hr. oil	O.H.

TABLE XV

BALLISTIC DATA FOR Q7502 ATKINS B.P.S. PLATE NO. G69J-11

.50 Cal. M2 A.P. Bullets at 0° Obliquity

<u>Rd.</u> <u>No.</u>	<u>Striking</u> <u>Velocity</u>	<u>Yaw</u>	<u>Pene-</u> <u>tration</u>	<u>Bullet</u>	<u>Condition</u> <u>of Plate</u>
1	2100	0°	PP	FOP	SB
2	2275	0	CP	NR	3/8" Hole.
3	2135	0	PP	FOP	MB
4	2295	0	CP	NR	3/8" Hole.
5	2280	0	CP	NR	3/8" Hole.
6	2285	0	CP	NR	1/2" Hole.
7	2225	0	CP	NR	1/2" Hole.
8	2185	0	PP	FOP	MB
9	2195	0	PP	FOP	MB
10	2713	20	CP	NR	3/4" x 1/2" Hole.
11	2738	25	CP	NR	1" x 1/2" Hole.
12	2628	31	PP	RJ	MB
13	2658	36	CP	NR	1" x 3/8" Hole.
14	2415	16	CP	NR	1/2" Hole.
15	2565	32	PT	RJ	HB
16	2525	32	PP	RJ	HB
17	2705	29	PP	RJ	Pun S 1/8".
18	2732	85	CP	NR	2" x 3/4" Hole.
19	2668	90	PP	RJ	Pun S 1/2" (limit).

TABLE XV - (Cont'd.)

BALLISTIC DATA FOR Q1502 ATKINS B.P.S. PLATE NO. G69J-11.50 Cal. M2 A.P. Bullets at 0° Obliquity

<u>Rd. No.</u>	<u>Striking Velocity</u>	<u>Yaw</u>	<u>Pene- tration</u>	<u>Bullet</u>	<u>Condition of Plate</u>
20	2588	60°	PP	RJ	HB, 1" Crack.
21	2544	40	FP	RJ	MB
22	2670	60	PP	RJ	Pun S 1/4".
23	2727	56	CP	NR	1/2" x 1-1/2" Hole.
24	2712	90	CP	NR	1/2" x 2" Hole.
25	2728	90	CP	NR	1/2" x 2" Hole.
26	2648	18	CP	NR	3/4" Hole.
27	2630	25	CP	NR	1/2" Hole.
28	2650	32	PP	NR	1/4" Pun S.
29	2498	5	CP	NR	1/2" Hole.
30	2343	23	PP	NR	SB
31	2334	25	PP	NR	SB
32	2380	8	PP	NR	Pun S.
33	2447	0	CP	NR	1/2" Hole.
34	2395	10	FP	RJ	Pun S.
35	2390	35	FP	RJ	SB
36	2670	18	CP	NR	1/2" Hole.
37	2387	18	PP	RJ	1" Crack.
38	2422	5	CP	NR	1/2" Hole.
39	2480	5	CP	NR	1/2" Hole.
40	2670	12	CP	NR	1/2" Hole.
41	2490	12	RJ	RJ	1" Crack.
42	2454	10	CP	NR	1/2" Hole.
43	2508	20	CP	NR	3/4" Hole.
44	2517	27	PP	NR	SB
45	2482	40	PP	RJ	SB
46	2374	10	PP	RJ	HB
47	2310	5	PP	RJ	MB
48	2554	53	PP	RJ	Pun S 1/8".
49	2629	90	PP	RJ	Pun S 1/8".

COMPANY DATA

Heat No. 21020-1

-

(A.L.)

Physical Properties not given.

<u>C</u>	<u>Mn</u>	<u>S</u>	<u>P</u>	<u>Si</u>	<u>Ni</u>	<u>Mo</u>
.53	.44	.016	.011	.221	3.25	.37
.18	.54	.016	.011	.277	3.13	.42

Heat Treatment 1500°F 15 Min. D-300°F 1-1/2 hrs. (air) 012
O.H.

NPG PHOTO NO 20369

CURVE OF LIMIT VELOCITY VS BULLET YAW
 0.503 DIEBOLD BULLET PROOF STEEL PLATE
 NO 132-2290-4 738-189 VS 50 CAL. APME
 PROJECTILES AT 0° OBLIQUITY

- PARTIAL PENETRATION
- COMPLETE PENETRATION
- LIMIT

MAY 10, 1943

BULLET YAW, DEGREES

STRIKING VELOCITY, F.S.

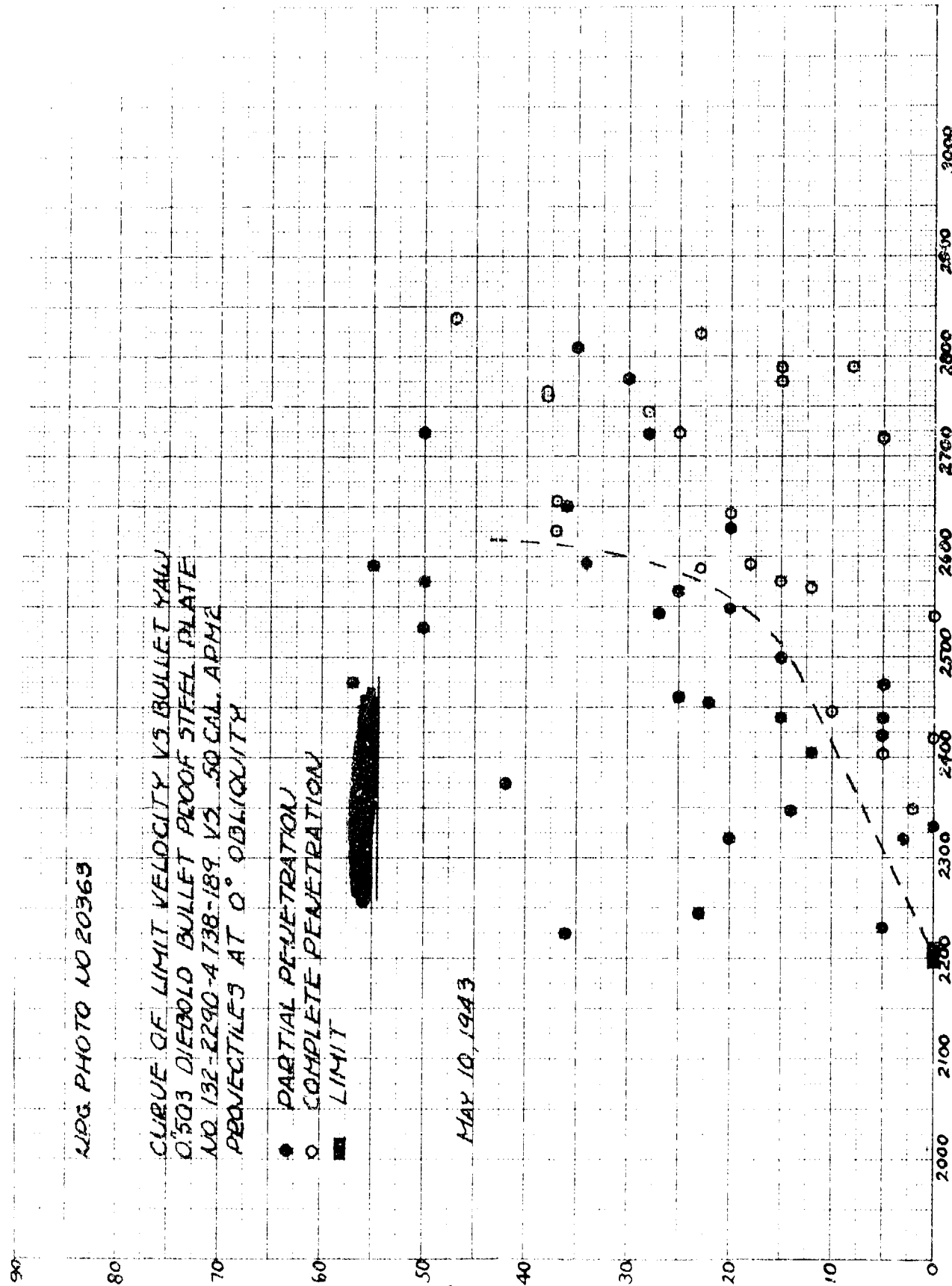


TABLE XVI

BALLISTIC DATA FOR 0"503 DIEBOLD B.P.S. PLATE
NO. 132-2290-4738-189

.50 Cal. M2 A.P. Bullets at 0° Obliquity

<u>Rd. No.</u>	<u>Striking Velocity</u>	<u>Yaw</u>	<u>Pene- tration</u>	<u>Bullet</u>	<u>Condition of Plate</u>
1	2842	Struck	Other Impact.		
2	2789	8°	CP	NR	Pun T 1" x 1".
3	2762	Struck	Other Impact.		
4	2745	28	CP	NR	Pun T 3/4" x 3/4".
5			Missed Plate.		
6	2759	38	CP	NR	1" x 2" Pun T.
7	2723	50	PP	NR	Pun S 1/8" CC-2" (Near Limit).
8	2765	38	CP	NR	1-1/4" x 2" Pun T.
9	2722	28	PP	RJ	SB
10	2718	5	CP	NR	1/2" Pun T.
11	2778	30	PP	RJ	Circ. C.
12	2775	15	CP	NR	1" x 1" Opening.
13	2723	25	CP	NR	3/4" x 3/4" Back.
14	2788	15	CP	NR	3/4" x 1" Opening.
15	2808	35	PP	RJ	Circ. Crack 2", Pun S 1/8".
16	2823	23	CP	NR	1" x 1" Opening.
17	2838	47	CP	NR	1" x 3/4" Opening.
18	2548	20	PP	RJ	Pun S 1/4" (Near Limit)
19	2625	37	CP	NR	1/2" x 3/4" Opening.
20	2588	23	CP	NR	1/2" x 3/4" Opening.
21	2592	55	PP	RJ	SB No Cracks.
22	2640	Keyhole.			
23	2655	37	CP	NR	1" x 1" Opening.
24	2575	50	PP	NR	Pun S 3/8". Near Limit.
25	2593	34	PP	NR	Pun S 1/16" Circ. Crack 1".
26	2543	27	PP	NR	Circ. Crack 1".
27	2529	50	PP	NR	SB No Crack.
28	2460	25	PP	NR	SB No Crack.
29	2374	42	PP	NR	SB No Crack.
30	2540	0	CP	NR	1/2" x 1/2" Opening.
31	2404	12	PP	NR	SB No Crack.
32	2439	5	PP	NR	SB No Crack.
33	2500	15	PP	NR	Circular Crack 1".
34	2422	5	PP	NR	Pun S 1/4" (Near Limit)
35	Miss	25	PP	NR	1/8" Bulge.
36	2446	10	CP	NR	1/2" Hole.

TABLE XVI - (Cont'd.)

BALLISTIC DATA FOR 0.503 DIEBOLD B.P.S. PLATE
NO. 132-2290-4738-129

.50 Cal. M2 A.P. Bullets at 0° Obliquity

<u>Rd. No.</u>	<u>Striking Velocity</u>	<u>Yaw</u>	<u>Pene- tration</u>	<u>Bullet</u>	<u>Condition of Plate</u>
37	2347	14°	FP	NR	1/8" Bulge.
38	2403	5	CP	NR	1/2" Hole.
39	2230	5	FP	FOP	1/8" Bulge, 1/2" Crack.
40	2349	2	CP	NR	1/2" Hole.
41	2440	15	FP	NR	1/8" Bulge.
42	2650	36	FP	NR	1/8" Bulge.
43	Miss	18	CP	NR	1/2" x 5/8" Hole.
45	2245	23	FP	NR	SB No Cracks.
46	2225	36	FP	NR	SB No Cracks.
47	2320	20	FP	NR	SB No Cracks.
48	2330	0	FP	FOP	HB - Circular Crack.
49	2318	3	FP	FOP	SB - No Cracks.
50	2418	0	CP	NR	Pun T Opening 1/2" x 1/2".
51	2475	57	FP	RJ	SB - No Cracks.
52	2568	12	CP	NR	3/4" x 5/8" Pun thrown.
53	2565	25	FP	RJ	1" Circular Crack.
54	2575	15	CP	NR	1/2" x 1/2" Punching Thrown.
55	2628	20	FP	RJ	HB No Cracks.
56	2592	18	CP	NR	1" x 5" Opening.
57	2472	5	FP	FOP	Circular Crack 1".
58	2455	22	FP	RJ	SB No Cracks.
59	2643	20	CP	NR	1/2" x 1/2" Opening.

COMPANY DATA

Heat No. 45871.

Republic.

<u>YP</u>		<u>TS</u>		<u>%E1</u>		
198,300		227,200		12.5		
<u>C</u>	<u>Mn</u>	<u>S</u>	<u>P</u>	<u>Si</u>	<u>Ni</u>	<u>Mo</u>
.825	.46	.02	.018	.16	3.40	.32
.23						
1480/1500°F		1 Hour		011	O.H.	

N.P.C. PHOTO NO. 20361

CURVE OF LIMIT VELOCITY VS. BULLET YAW
Q507 DIEBOLD BULLET PROOF STEEL PLATE
NO 132-2290 4610-184 VS. 50 CAL. APME
PROJECTILES AT 0° OBLIQUITY

● PARTIAL PENETRATION
○ COMPLETE PENETRATION
■ LIMIT

BULLET YAW, DEGREES

MAY 10, 1943

STRIKING VELOCITY, F.S.

80

70

60

50

40

30

20

10

0

3000

2500

2000

1500

1000

500

0

2000

2100

2200

2300

2400

2500

2600

2700

2800

2900

3000

TABLE XVII

BALLISTIC DATA FOR 0"507 DIEBOLD B.P.S. PLATE
NO. 132-2290-4618-184

.50 Cal. M2 A.P. Bullets at 0° Obliquity

<u>Rd. No.</u>	<u>Striking Velocity</u>	<u>Yaw</u>	<u>Pene- tration</u>	<u>Bullet</u>	<u>Condition of Plate</u>
1	2620	60°	PP	RJ	1/8" Bulge.
2	2725	45	PP	RJ	1/2" Bulge.
3	2746	54	PP	RJ	1" Crack, Pun S.
4	2870	48	CP	NR	5/8" Pun S (Near Limit)
5	2825	41	PP	RJ	1" Hole.
6	2892	30	CP	NR	1/4" Bulge.
7	2869	43	CP	NR	1" Hole; 2" Button.
8	2415	90	CP	NR	1" Hole, 2" Button.
9	2610	23	CP	NR	2" x 1" Hole.
10	2535	18	PP	RJ	1" Hole, 1-1/2" Button.
11	2542	8	CP	NR	Pun S 1/2" near limit.
12	2608	35	PP	RJ	1/2" Hole.
13	2505	5	CP	NR	SB No Crack.
14	2480	12	CP	NR	1/2" Hole.
15	2468	28	PP	NR	1/2" Hole.
16	2510	35	PP	NR	SB No Cracks.
17	2526	25	CP	NR	SB No Cracks.
18	2459	10	FP	FOP	1/2" x 5/8" Hole.
19	2732	31	PP	RJ	Pun S 1/8".
20	2689	29	PP	RJ	2" Crack.
21	2773	25	CP	NR	1/4" Bulge, 1" Crack.
22	2547	35	PP	RJ	1" Hole.
23	2488	12	CP	NR	1/8" Bulge.
24	2552	31	PP	RJ	1/2" Hole.
25	2297	4	CP	NR	1/4" Bulge, 1" Crack.
26	2335	8	PP	RJ	1/2" Hole.
27	2400	11	FP	RJ	SB
28	2335	5	PP	RJ	SB
29	2251	10	PP	RJ	Pun S 1/8".
30	Miss	17	PP	RJ	SB
31	2367	10	PP	RJ	SB
32	2426	10	FP	RJ	Pun S 1/8".
33	2743	28	PP	RJ	Pun S 1/8".
34	2752	36	PP	RJ	Pun S 5/8".
35	2741	26	CP	NR	3" Crack (Near Limit).
36	2749	27	CP	NR	Pun S, 1/2"
37	2625	27	PP	RJ	2" Crack.
					1/2" Hole, 1" Petals.
					1-1/2" Hole.
					Pun S 1/4".

TABLE XVII - (Cont'd.)

BALLISTIC DATA FOR 0.507 DIEBOLD B.P.S. PLATE
NO. 132-2290-4618-184

.50 Cal. M2 A.P. Bullets at 0° Obliquity

<u>Rd. No.</u>	<u>Striking Velocity</u>	<u>Yaw</u>	<u>Pene- tration</u>	<u>Bullet</u>	<u>Condition of Plate.</u>
38	2670	5°	CP	NR	1/2" Hole.
39	2650	25	PF	RJ	1" Crack.
40	2658	12	PF	FOP	Pun S 1/2" (limit).
41	2653	30	PF	RJ	Pun S 1/4".
42	2653	23	CP	NR	3/4" x 1/2" Hole.
43	2575	35	PF	RJ	1/2" Crack.
44	2595	37	PF	RJ	SB No Cracks.
45	2615	21	CP	NR	5/8" Opening.
46	2750	90	CP	NR	3/4" x 2" Hole.
47	2680	90	CP	NR	3/4" x 1-1/2" Hole.

COMPANY DATA

Heat No. 45871.

Republic.

YP

TS

%E1

198,800

227,200

12.5

C

Mn

S

P

Si

Ni

Mo

.825
.23

.46

.02

.018

.16

3.40

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Heat Treatment

1480/1500°F

1 Hr.

Oil

O.H.

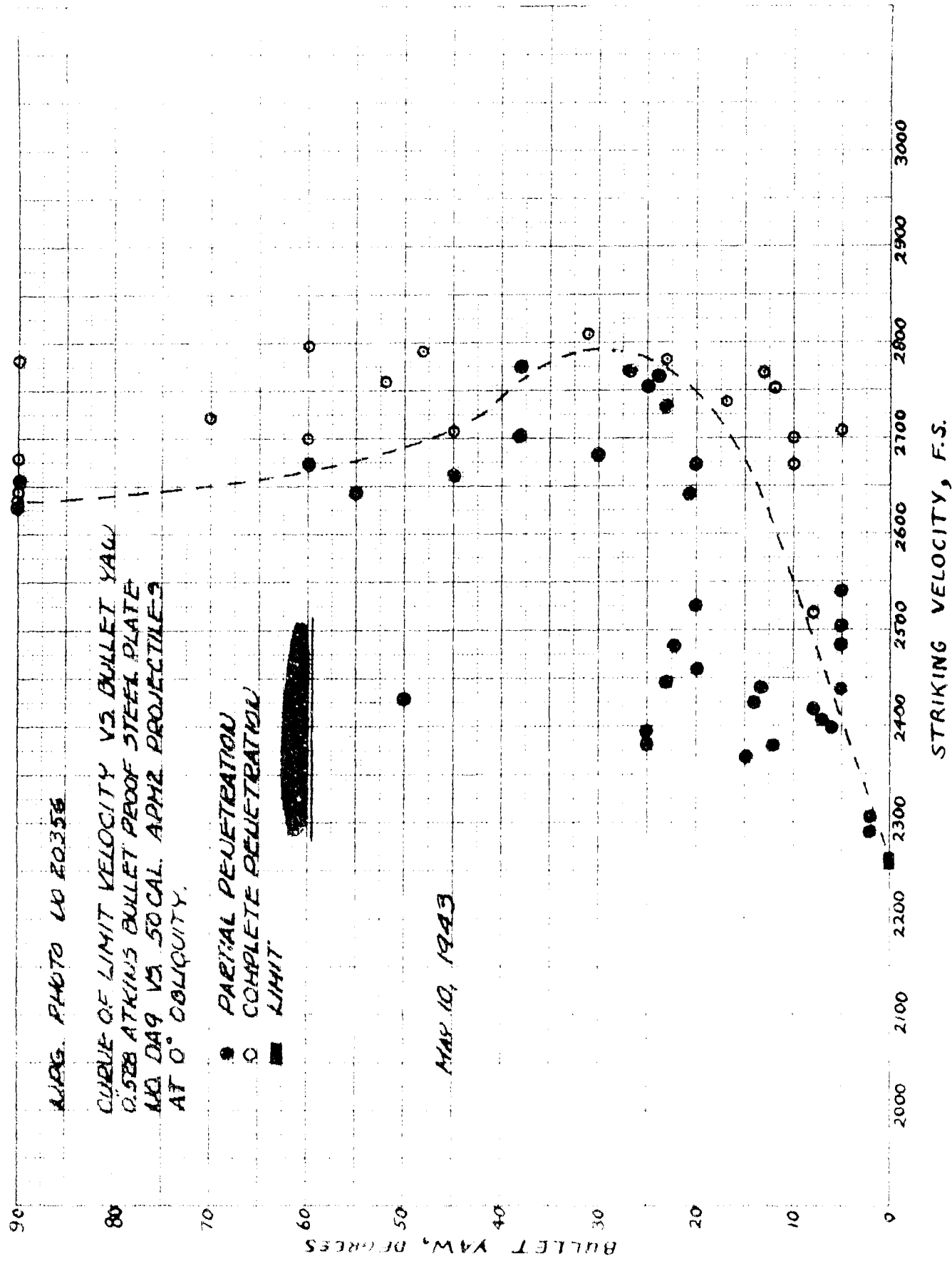


TABLE XVIII

BALLISTIC DATA FOR 0"528 ATKINS B.P.S. PLATE NO. DA 9

.50 Cal. M2 A.P. Bullets at 0° Obliquity

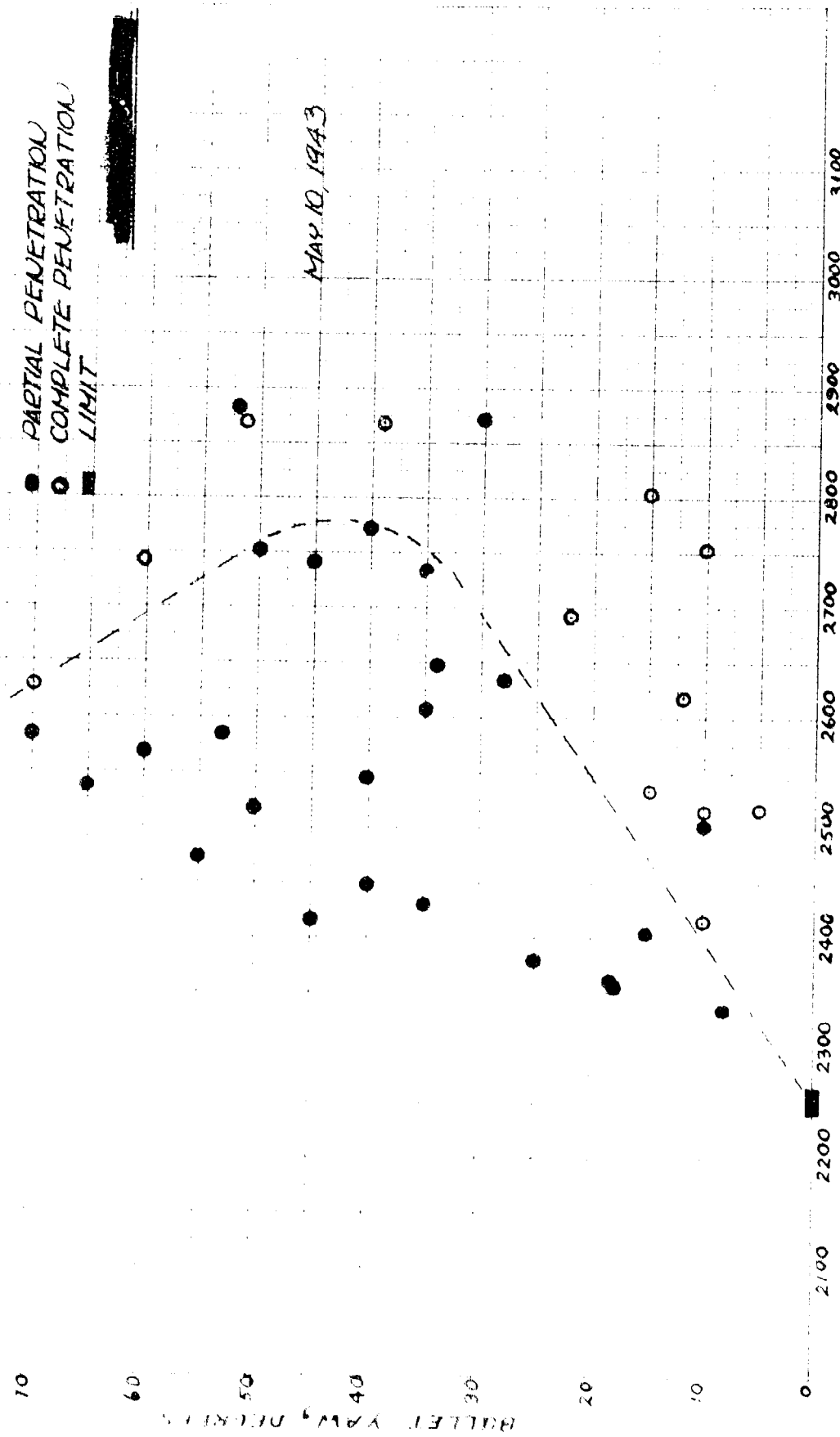
<u>Rd. No.</u>	<u>Striking Velocity</u>	<u>Yaw</u>	<u>Pene- tration</u>	<u>Bullet</u>	<u>Condition of Plate</u>
1	2659	0°	CP	NR	3/4" Hole, 2" Spall.
2	2305	2	PP	FOP	VSB
3	2275	0	PP	FOP	VSB
4	2295	0	CP	NR	5/8" Hole, 1-1/4" Spall.
5	2330	0	PP	FOP	SB
6	2295	3	PP	FOP	SB
7	2250	0	PP	FOP	SB
9	2354	0	PP	FOP	SB
10	2265	0	CP	NR	3/4" Hole, 2-1/2" Spall.
11	2290	2	PP	RJ	SB
12	2180	0	PP	RJ	SB
13	2210	0	PP	RJ	SB
14	2225	0	PP	RJ	SB
15	2310	0	PP	RJ	SB
16	2429	50	PP	RJ	SB
17	2483	22	PP	RJ	SB
18	2643	55	PP	RJ	HB, 5" Circ. Crack Pun 5-1/8".
19	Miss	49	CP	NR	2" x 3/4" Hole, 3" Spall.
20	2683	30	PP	RJ	SB
21	2723	70	CP	NR	1" x 3/4" Hole, 3" x 1-1/2" Spall.
22	2733	23	PP	RJ	SB
23	2700	60	CP	NR	1-1/2" x 5/8", 3" x 1-1/2" Spall.
24	2758	52	CP	NR	1" x 1-1/2", 1-1/2" x 2" Spall.
25	2702	38	PP	RJ	SB
26	2770	27	PP	RJ	SB
27	2754	25	PP	RJ	SB
28	2796	60	CP	NR	3/4" x 1-1/2", 1-1/4" x 2" Spall.
29	2792	48	CP	NR	3/4" Hole (Near Limit).
30	2775	38	PP	RJ	Spall started.
31	2807	31	CP	NR	3/4" Hole, 1-1/2" Spall.

URG PHOTO NO. 20360

CURVE OF LIMIT VELOCITY VS. BULLET YAW
 Q.503 DIEBOLD BULLET PROOF STEEL PLATE
 NO. 131-2290-4996-199 VS. .50 CAL. APH2
 PROJECTILES AT 0° OBLIQUITY

● PARTIAL PENETRATION
 ○ COMPLETE PENETRATION
 ■ LIMIT

MAY 10, 1943



STRIKING VELOCITY, F.S.

TABLE XVIII - (Cont'd.)

BALLISTIC DATA FOR 0.528 ATKINS B.P.S. PLATE NO. DA 9

.50 Cal. M2 A.P. Bullets at 0° Obliquity

<u>Rd. No.</u>	<u>Striking Velocity</u>	<u>Yaw</u>	<u>Pene-tration</u>	<u>Bullet</u>	<u>Condition of Plate.</u>
66	2458	20°	PP	RJ	SB
67	2395	25	PT	RJ	SB
68	2368	15	PP	RJ	1" Crack.
69	2417	8	PP	RJ	SB
70	2399	6	PT	FOP	Button started.
71	2380	12	PP	RJ	SB
72	2405	7	PT	RJ	SB
73	2655	0	CP	NR	3/4" Hole, 1-1/4" Spall.

COMPANY DATA

YP - 171,230 TS - 211,660 %EL - 11% RA - 42%.

BHN 652-627.

<u>C</u>	<u>Mn</u>	<u>S</u>	<u>P</u>	<u>Si</u>	<u>Ni</u>	<u>Mo</u>
.55	.52	.017	.015	.263	4.81	.49
.60						
.25						

Heat Treatment - Quench 760°C. Draw 146°C.

TABLE XIX

BALLISTIC DATA FOR 0.503 DIFBOLD B.P.S. PLATE
NO. 131-2290-4996-199

.50 Cal. M2 A.P. Bullets at 0° Obliquity

<u>Rd. No.</u>	<u>Striking Velocity</u>	<u>Yaw</u>	<u>Pene-tration</u>	<u>Bullet</u>	<u>Condition of Plate</u>
1	2742	60°	CP	NR	1/2" x 2" Hole.
2	2628	70	CP	NR	1/2" x 2-1/4" Hole.
3	2430	35	PP	RJ	SB No Crack.
4	2416	45	PP	RJ	SB No Crack.
5	2444	57	PP	RJ	HB No Crack.
7	2449	40	PT	RJ	SB No Crack.
8	2474	55	PT	RJ	MB 1/2" Crack.

TABLE XIX - (Cont'd.)

BALLISTIC DATA FOR 0"503 DIEBOLD B.P.S. PLATE
NO. 131-2290-4996-199

.50 Cal. M2 A.P. Bullets at 0° Obliquity

<u>Rd. No.</u>	<u>Striking Velocity</u>	<u>Yaw</u>	<u>Pene- tration</u>	<u>Bullet</u>	<u>Condition of Plate.</u>
9	2502	10°	PP	RJ	1" Crack.
10	2484	90	PP	RJ	Pun S 1/2".
11	2538	65	PP	RJ	HB No Crack.
12	2517	50	PP	RJ	MB No Crack.
13	2517	5	CP	NR	1/2" Hole.
14	2566	60	PP	RJ	1" Crack.
15	2604	90	CP	NR	1/2" x 2" Hole.
16	2546	40	PP	RJ	No Cracks.
17	2584	53	PP	RJ	HB
18	2595	90	CP	RJ	1/2" x 2" Hole.
19	2554	90	CP	NR	5/8" x 2" Hole.
20	2583	70	PP	RJ	HB No Crack.
21	2608	35	PP	RJ	SB
22	2635	28	PP	RJ	SB
23	2693	22	CP	NR	5/8" Hole.
24	2648	34	PP	RJ	Pun S 1/16".
25	2733	35	PP	RJ	Pun S 1/8".
26	2752	10	CP	NR	3/8" Hole.
27	2752	50	PP	RJ	Pun S 1/8".
28	2743	45	PP	RJ	HB
29	2772	40	PP	RJ	HB
30	2802	15	CP	NR	1" Hole.
31	2867	51	CP	NR	1" x 1/2" Hole.
32	2867	39	CP	NR	1" x 3/4" Hole.
33	2872	30	PP	RJ	Pun S 1/8".
34	2877	52	PP	RJ	Pun S 3/16".
35	2618	12	CP	NR	3/8" Hole.
36	2534	15	CP	NR	1/2" Hole.
37	2504	10	CP	NR	1/2" Hole.
38	2355	17	PP	RJ	SB
39	2335	8	PP	RJ	SB
40	2359	18	PP	RJ	SB
41	2379	25	PP	RJ	MB
42	2405	15	PP	RJ	MB, Pun S.
43	2514	10	CP	NR	1/2" Hole.

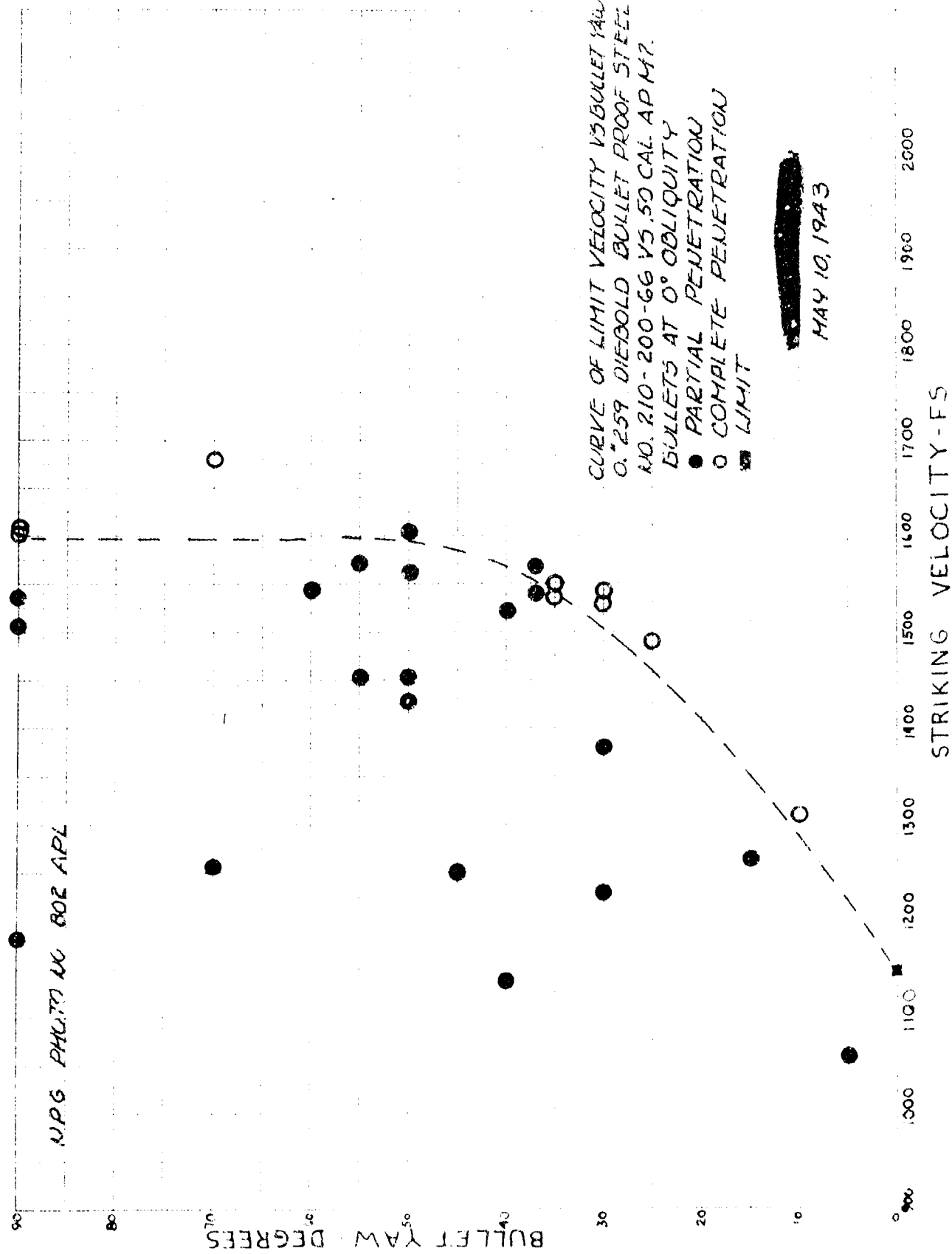


TABLE XIX - (Cont'd.)

BALLISTIC DATA FOR 0#503 DIEBOLD B.P.S. PLATE

NO. 131-2290-4996-199

.50 Cal. M2 A.P. Bullets at 0° Obliquity

COMPANY DATA

Heat No. 44728.

Republic.

YTP = 193,750

TS - 230,200

% E1 - 12.5

C

Min

S

F

51

N1

Mo

.25	.49	.022	.018	.18	3.31	.50
						.30

Heat Treatment 1480 - 1500°F.

1 Hour Cil O.H.

TABLE XX

BALLISTIC DATA FOR 01259 DIEBOLD B.P.S. PLATE

NO. 210-200-66

.50 Cal. M2 A.P. Bullets at 0° Obliquity

<u>Rd. No.</u>	<u>Striking Velocity</u>	<u>Yaw</u>	<u>Pene- tration</u>	<u>Bullet</u>	<u>Condition of Plate</u>
1	1407	0°	CP	NR	3/8" x 1/2" Hole (Pun nose thru & off).
2	1285	0	CP	FCIP	1/4" Hole.
3	1202	0	CP	NR	1/2" Hole.
4	1157	0	PP	FOP	SB
5	1177	0	CP	NR	1/4" Hole.
6	1255	0	CP	NR	1/2" Hole.
7	1194	0	CP	NR	1/4" Hole.
8	1101	0	PT	FOP	1/8" Pun S.
9	1143	0	PP	FOP	SB
10	1150	0	CP	FCIP	1/4" hole, nose thru and off.
11	1080	0	PP	FOP	Pun S.
12	1025	0	PP	FCIP	Slight opening.
13	1058	5	PP	FOP	SB
14	1059	0	PP	FCIP	1/8" opening.
15	1182	90	PP	RJ	SB No Cracks.
16	1137	40	PP	RJ	No Crack; SB.
17	1230	30	FP	RJ	No Crack, SB.
18	1309	10	CP	NR	1/2" Hole.

TABLE XX - (Cont'd.)

BALLISTIC DATA FOR 07259 DIEBOLD B.P.S. PLATE
NO. 210-270-66

.50 Cal. M2 A.P. Bullets at 0° Obliquity

<u>Rd. No.</u>	<u>Striking Velocity</u>	<u>Yaw</u>	<u>Pene- tration</u>	<u>Bullet</u>	<u>Condition of Plate.</u>
19	1308	10°	CP	FCIP	Nose thru and off, 3/8" hole.
20	1249	45	PP	RJ	SB
21	1263	15	PP	RJ	MB.
22	1256	70	PP	RJ	SB, No Cracks.
23	1381	30	PP	RJ	SB, No Cracks.
24	1429	50	PP	RJ	SB, No Cracks.
25	1545	30	CP	NR	1/2" Hole.
26	1545	60	PP	RJ	1" Crack.
27	1564	50	PP	RJ	No Crack, MB.
28	1529	30	CP	RJ	1/2" Hole.
29	1454	55	PP	RJ	SB
30	1490	25	CP	NR	1/4" Hole, 1" Crack.
31	1551	35	CP	NR	1/2" Hole.
32	1605	50	PP	RJ	1-1/2" Crack (NL)
33	1664	5	CP	NR	3/4" Hole.
34	1680	70	CP	NR	1-1/2" x 1" Hole, 3" Cracks.
35	1601	90	CP	NR	1-1/2" x 2" Hole.
36	1506	90	PP	RJ	3/4" Crack.
37	1572	55	PP	RJ	1" Crack.
38	1603	90	CP	NR	1" x 1/2" B Spall.
39	1536	35	CP	NR	1/2" Hole.
40	1542	37	PP	RJ	3/4" Crack.
41	1453	50	PP	RJ	SB
42	1568	37	PP	RJ	Pun S (NL).
43	1523	40	PP	RJ	1/2" Crack.
44	1536	90	PP	RJ	1-1/2" Crack.

COMPANY DATA

Physical Properties not given.

BHN: 514-555; 388-401

<u>C</u>	<u>Mn</u>	<u>S</u>	<u>P</u>	<u>Si</u>	<u>Ni</u>	<u>Mo</u>
.50	.017	.015	.188	3.38	.31	

Heat Treatment: 1575°F 45/50 Min. Oil O.H.
Draw: 300/325°F. 15/30 Min.