U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

MEMORANDUM REPORT NO. 1-47

PROGRESS REPORT NO. 1
ON DEVELOPMENT OF HIGH VELOCITY ARMOR-PIERCING PROJECTILES

1 November 1947

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NPG MEMORANDUM REPORT NO. 1-47

PROGRESS REPORT NO. 1 ON DEVELOPMENT OF HIGH VELOCITY ARMOR-PIERCING PROJECTILES

Prepared by: J. J. Glancy
Ordnance Engineer

Reviewed by: Dr. R. H. Lyddane
Senior Physicist
Director of Terminal Ballistics Research

J. G. Franklin
Comdr., USN
Terminal Ballistics Officer

W. C. Bryson
Capt., USN
Experimental Officer

W. H. Benson
Capt., USN
Ordnance Officer

Approved by:
C. F. JOY
Rear Admiral, USN
Commanding Officer

MEMORANDUM REPORT NO. 1-47

PREFACE

AUTHORIZATION

This study is being carried out under Bureau of Ordnance Task Assignment Re3b-202-1 as authorized by the Bureau of Ordnance in reference (b). A copy of the local directive for this Task Assignment is included in Appendix III.

OBJECT

This progress report is part of a continuing investigation to develop a 3" armor piercing projectile of improved ballistic quality at high striking velocities and high obliquities. The study described herein was conducted in order to gain more information concerning the behavior of currently available 3" AP projectiles when fired against 3" homogeneous armor at high obliquities and high impact velocities up to the maximum presently obtainable.

A-1

SUMMARY

Two available lots of 3" M62 Capped AP projectiles and one lot of 3" Mk. 29-2 Capped AP projectiles were tested versus 3" homogeneous armor at 120,000 p.s.i. tensile strength at 30° and 45° obliquity. Ballistic limits were obtained when possible under the above conditions. Striking velocities of the projectiles were then increased in increments above the limit velocities up to the maximum presently obtainable. The condition of projectiles after impact was observed.

In general the terminal ballistic performance of M62 projectiles was poorer than that of Mk. 29-2 projectiles. In terms of BuOrd Sk. 78841, the ballistic limits of M62 projectiles were higher than those of Mk. 29-2 projectiles. Up to the highest impact velocities obtained and reported herein (approximately 2900 ft./sec.), the Mk. 29-2 projectiles showed no shatter, but the M62 projectiles split and broke up on impact even at striking velocities above the limit. The hardness pattern made of one M62 projectile shows a soft area at the nose which probably accounts for the poor performance of the M62 projectiles.

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REFERENCES

(a) Definitions of Terms Used in the Ballistic Testing of Armor. Revision B. U. S. Naval Proving Ground Report No. 10-46 dated June 1946.

(b) BuOrd ltr. S78-1(55) Re3 (Re3b-202) dated 30 September 1947 to NPG.

(c) BuOrd ltr. S78-1(55) Re3 (Re3b-202) dated 8 August 1947 to NPG.

(d) Office of the Chief of Ordnance ltr. ORDTM dated 28 July 1947 to BuOrd.

I. INTRODUCTION

The contemplated use of high muzzle velocity guns makes it important that the Army and Navy develop armor-piercing projectiles with satisfactory performance against armor at high striking velocities. The Naval Proving Ground has undertaken the task of developing 3" armor-piercing projectiles with improved ballistic qualities at high striking velocities and high obliquities. Additional information about this task is given in references (b), (c), and (d). This first progress report describes the performance of two existing 3" AP projectiles at striking velocities above limit against 3" homogeneous armor at 30° and 45° obliquity.

II. MATERIALS AND METHODS

Projectiles:

Chevrolet 14.7 lb. 3" M62 Capped AP Projectile
Lot CM-2-81-1943 and Lot CM-3-59-1943
Oldsmobile 13 lb. 3" Mk. 29-2 Capped AP Projectile
Lot 130-1942
Figure 1 is a photograph of these projectiles.
Figure 2 is a hardness pattern of 3" M62 projectile Lot-2-81-1943.

Plates:

3" Class B Carnegie-Illinois No. X-9021
3" Class B Carnegie-Illinois No. BD-389 1/4

Chemical Analysis of Plates

	C	Mn	P	S	Si	Ni	Cr
C.I. X-9021	.31	.25	.013	.020	.08	3.26	1.43
C.I. BD-389 1/4	.34	.25	.013	.020	.08	4.10	2.23

Physical Properties of Plates

Two 3' x 3' sections from each of the above plates were used in the ballistic tests. The following table lists the arbitrary numbers assigned each of the sections and the physical properties of each plate section:

Table I

Plate	APL Plate No.	Y.S.(.2%)	T.S.	% El.	% RA	BHN	RC
C.I. X-9021	673	102,475	121,650	22.0	60.3	256	23.8
C.I. X-9021	675	101,725	120,800	22.3	62.0	256	23.1
C.I. BD-389 1/4	676	98,600	120,100	24.0	67.9	255	23.1
C.I. BD-389 1/4	677	101,100	120,300	23.0	65.3	256	23.0

Yield Strength (Y.S.), Tensile Strength (T.S.), % Elongation (% El.), and % Reduction of Area (% RA) are the average of two tests. Brinell Hardness Number (BHN) and Rockwell "C" Hardness (Rc) are the average of five readings.

Methods:

All ballistic limits in this report are expressed in terms of $F(e/d,\theta)$ values, where $F(e/d,\theta)$ is defined as follows:

$$F(e/d,\theta) = \frac{41.57\ M\ 1/2\ V_L\ \text{Cos.}\ \theta}{e\ 1/2\ d}$$

NP9-35625 - 3" Projectiles used: Left, 3" Mk. 29-2 AP Capped Lot 130-1942, Manufacturer - Oldsmobile; Right, 3" M62 AP Capped Lot CM-2-81-1943, Manufacturer - Chevrolet.
October 1947

[redacted]

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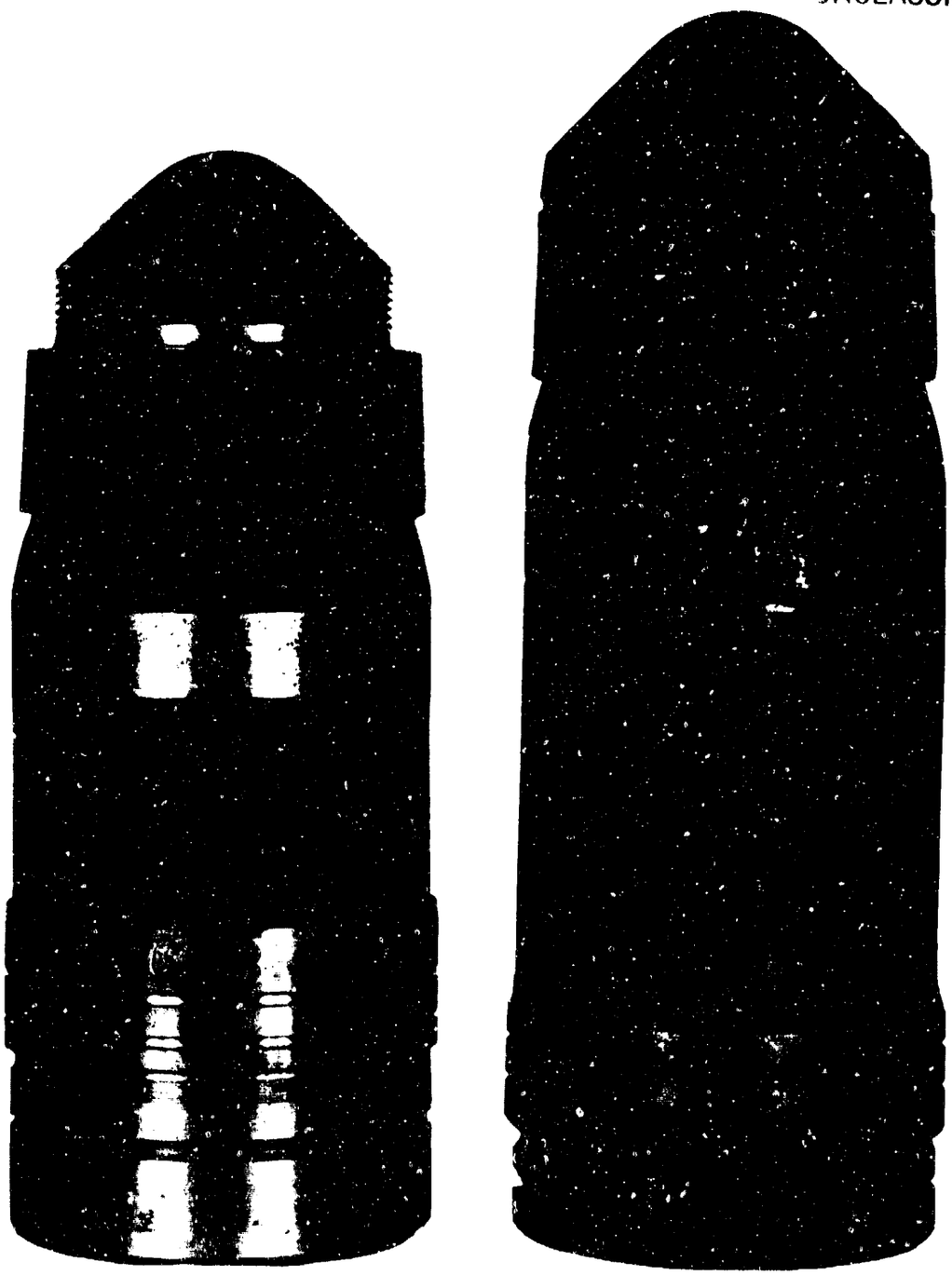

FIG. 1

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NP9 35487

17 OCTOBER 1947

HARDNESS DISTRIBUTION AND MACROSECTION OF 3" AP PROJECTILE M62 MANUFACTURED BY CHEVROLET LOT No. CM-2-81

Hardness Values: Vickers Pyramid (50 kg.)
Etch: Ammonium Persulphate

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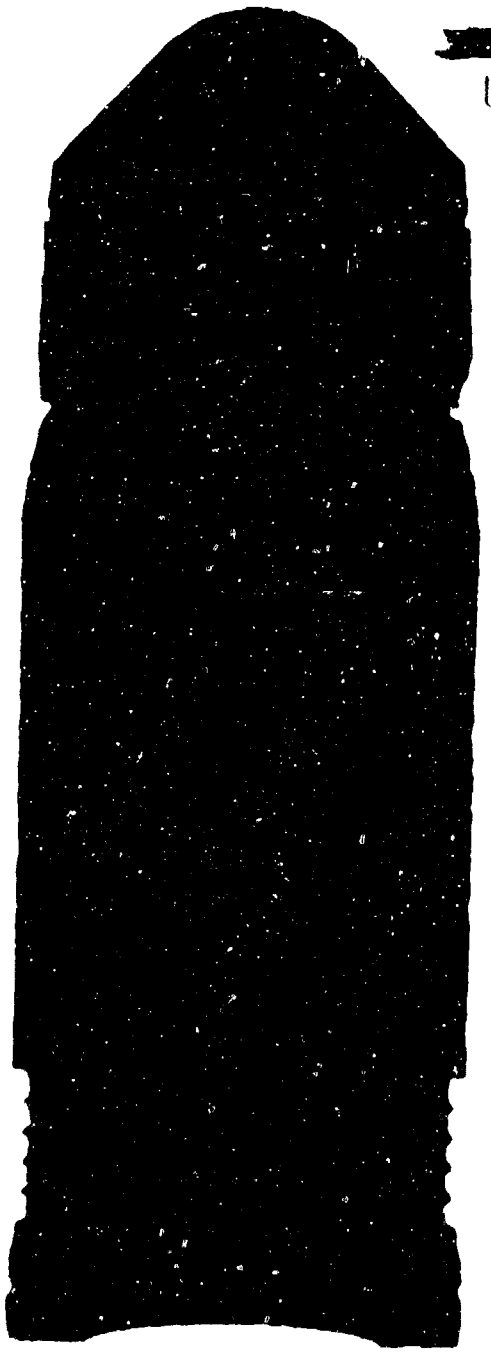

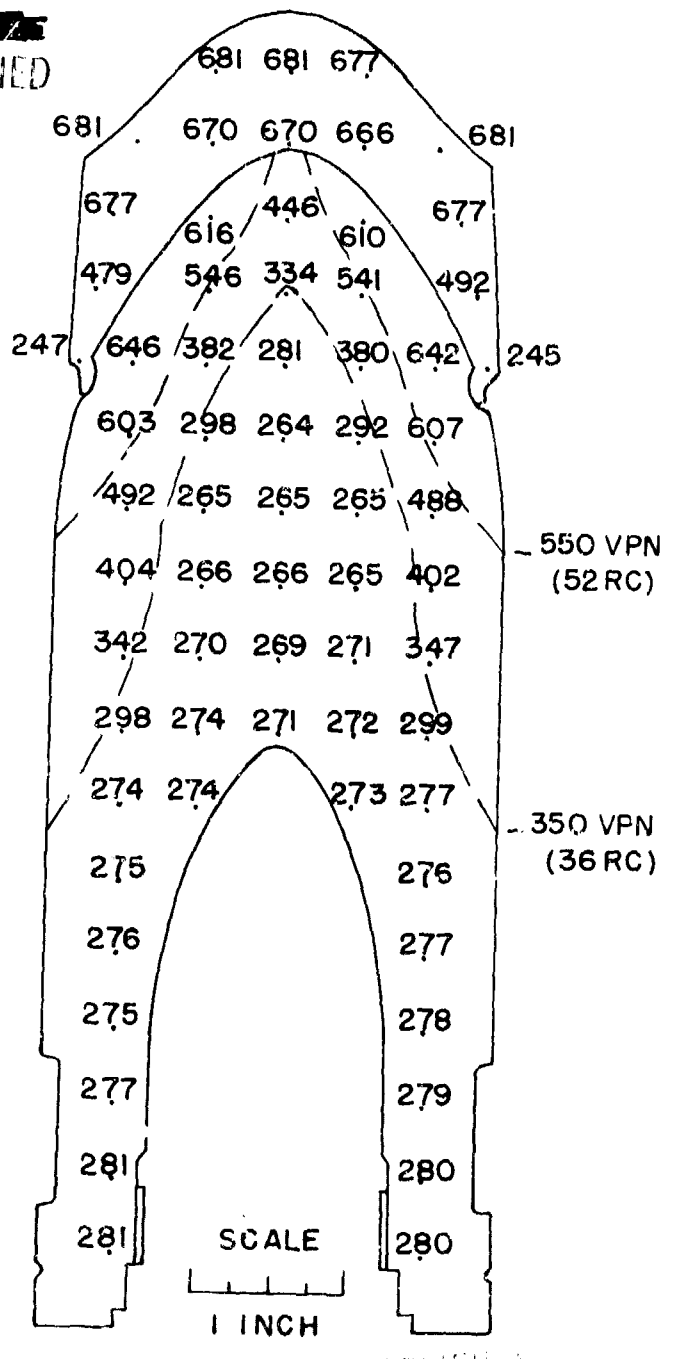

FIG. 2

[redacted]

Where

M, is the projectile mass in pounds, V_L, is the limit velocity in feet per second (the minimum velocity required for the major portion of the projectile to pass completely through the plate), θ, the obliquity, is the angle between the normal to the plate and the line of flight, e, is the plate thickness in inches at the point of impact, and d, is the diameter of the projectile in inches. All quantities entering on the right side of the defining expression above are susceptible of measurement. The limit penetration coefficient, or F-coefficient, as the method of writing shows, is a function of e/d and θ only. Its usefulness lies in the fact that it is a slowly varying function of these quantities and that its use enables comparison between plates of slightly differing thicknesses tested at slightly differing obliquities by projectiles of slightly differing properties.

The striking coefficient, usually designated by F_s, is defined in the same manner as the F-coefficient except that the velocity entering into the formula is striking velocity rather than limit velocity. It is useful for interpolation in allowing for small changes in obliquity and thickness for the several impacts in a limit determination.

It is customary in the Navy to refer F-coefficients to the empirical expression, derived from a 1931 analysis of penetration data, embodied in Bureau of Ordnance Sketch No. 78841. F-coefficients thus referred are expressed as "% Sk. 78841". In this connection care must be taken not to expect that a plate of average quality will necessarily have a limit of 100%, and by the same token, not to compare limits in % Sk. 78841 taken under widely differing conditions.

More complete information on all the above terms is to be found in reference (a).

III. RESULTS

The results are given in detail in Appendices I and II and are summarized in Table II.

IV. DISCUSSION:

3" Mk. 29-2 Capped A. P. Projectiles.

Against 3" homogeneous armor at 30° and 45° obliquity the 3" Mk. 29-2 projectiles generally remained intact and effective at striking velocities up to the maximum velocity tested to date, namely, up to approximately 2900 feet per second.

3" M62 Capped A. P. Projectiles.

Against 3" homogeneous armor at 30° and 45° obliquity the M62 projectiles from both lots fired showed a tendency to split and break up at striking velocities up to the maximum velocity tested to date, namely, up to approximately 2700 feet per second.

Future Action.

A lot of M62 projectiles of proven high quality is being procurred and tests of this lot should definitely establish the ballistic quality of the M62 projectile. In addition tests of currently available 3" projectiles will continue at higher velocities and other conditions until complete data are obtained.

TABLE II

SUMMARY OF BALLISTIC RESULTS

Projectile	No. Rounds Fired	Armor	Obl.	V_L Limit Vel. Ft/Sec	V_L Limit F(e/d,θ)	V_L Limit % Sk. 78841	Maximum * Vel. Ft/Sec	Maximum * F_s	Maximum * % Sk. 78841	Remarks
3" AP M62	8	Homo. T.S. 121,000 p.s.i.	30°	2420	64,500	127	2661	71,000	139.8	Projectiles split or broke up on most impacts.
3" AP Mk.29-2	10	Homo. T.S. 121,000 p.s.i.	30°	2322	58,400	114	2810	70,700	138.6	Projectiles did not shatter or break up on any impact.
3" AP M62	2	Homo. T.S. 120,000 p.s.i.	45°	2611	Greater than 56,800	Greater than 106.2	2611	56,800	106.2	Projectiles broke up and could not penetrate the armor at any striking velocity obtained to date.
3" AP Mk.29-2	7	Homo. T.S. 120,000 p.s.i.	45°	2708	55,600	103	2898	59,500	110.5	Projectiles did not shatter or break up on any impact.

* Maximum velocity fired to date.

V. FACILITIES

Certain special tools needed for the fabrication of projectiles are being obtained by the Navy. Procurement of these is proceeding satisfactorily. It is expected that the task of manufacturing the first complete projectile can be undertaken by 1 April 1948.

In addition, steps have been taken to obtain an experimental, high-velocity gun. A 5"/51 caliber gun lined down to 3" caliber has been ordered for this purpose. It will take, however, at least six (6) months to obtain this gun. It is hoped to minimize the time interval before high velocities can be obtained by the temporary use of a 3"/70 gun.

J. J. Glancy
Ordnance Engineer

MEMORANDUM REPORT NO. 1-47

APPENDIX I

IMPACT DATA

3" M62 & 3" Mk. 29-2

vs

3" Class B Plate

at

30 ° & 45° obliquity

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SYMBOLS

e - - - - - - Plate thickness at impact in inches

Θ - - - - - - Obliquity. Angle between trajectory and normal to plate at impact.

M - - - - - - Projectile mass in lbs.

V_S - - - - - - Striking velocity in feet per second.

Pene. - - - - - Depth of penetration in inches measured from front surface normal to plane of plate.

F (e/d,Θ) - - F coefficient - Limit penetration coefficient.

F_S - - - - - - The striking coefficient - It is the same as the F coefficient except that striking velocity is used instead of limit velocity.

% - - - - - - Limit Penetration F coefficient in % of empirical F (e/d,Θ) value (BuOrd Sk. 78841).

CP - - - - - - Complete penetration. Major portion of projectile completely through the plate.

Inc. - - - - - - Incomplete penetration. Major portion of the projectile rejected.

SIP - - - - - - Projectile stuck in plate.

Intact - - - - - Projectile whole but may be deformed.

Eff. - - - - - - Effective. Cavity and base plug not injured. Projectile would detonate if loaded and fuzed.

Split - - - - - The projectile split into two or more parts along its longitudinal axis.

For ballistic limit and other definitions see reference (a).

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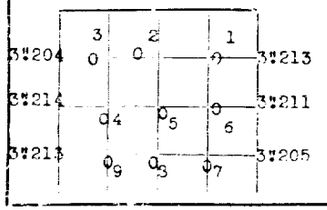
APL PLATE NO. 573
MFG Carnegie 3½ Cl. "B"
MFG PLATE NO. X-9021
NPG TENSILE STRENGTH (A6) (121,700) PSI.

NP? 35466

IMPACT DATA

IMPACT NO.	PLATE THICKNESS	PLATE CONDITION	PROJECTILE MAG MARK AND MOD	PROJECTILE ORIGINAL DIAMETER	PROJECTILE FINAL DIAMETER	PROJECTILE MASS	PROJECTILE CONDITION	OBLIQUITY	STRIKING VELOCITY	PENETRATION	E/D	STRIKING COEFFICIENT	V50K 76841
4872	3".212	Ragged hole	Mds.3" Mk.29-2 Lot 130	CR-9 2".980		13.00	Base cracked, not eff.	30°00'	2367	Inc.	1.08	57,500	118.7
4873	3".209	Good petaling	"	CR-10 2".980		13.00	Base cracked off, not eff	29°30'	2428	Cp.	1.08	59,500	118.3
4874	3".206	Petals wiped, clean hole.	"	CS-1 2".980		13.00	Nose cracked, effective	29°40'	2571	Cp.	1.08	62,800	123.1
4875	3".211	Petals wiped, clean hole	"	CS-2 2".980		13.00	Nose cracked, effective	30°00'	2642	Cp.	1.08	64,200	125.9
4876	3".212	Petals wiped, clean hole	"	CS-3 2".981		13.00	Nose cracked, effective	30°20'	2747	Cp.	1.08	66,500	130.4
4877	3".212	Petals wiped, clean hole	"	CS-4 2".981		13.00	Intact, effective	30°10'	2655	Cp.	1.08	64,400	126.3
4878	3".207	Petals wiped, clean hole		CS-5 2".980		13.00	Intact, effective	30°10'	2817	Cp.	1.08	68,400	134.1
4879	3".209	Petals wiped, clean hole	"	CS-6 2".980		13.00	Intact, effective	30°20'	2879	Cp.	1.08	69,800	136.9
4880	3".211	Petals wiped, clean hole	"	CS-7 2".981		13.00	Intact, effective	30°20'	2920	Cp.	1.08	70,700	138.6
				V1 Min Limit= (114%) (V= 58,400 ± 900)									
				V2 Min Limit= (119%) (V= 60,500 ± 1000)									
				Projectiles did not shatter up to (138.6%) (V=70,700)									



ARMOR AND PROJECTILE LABORATORY
NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

APL PLATE NO. 675
MFG Carnegie 3½ Cl. "B"
MFG PLATE NOX-9021 (1B)

NP9 35467

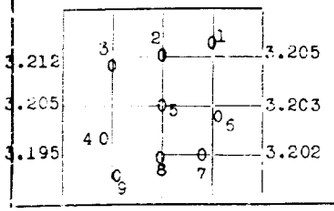
IMPACT DATA

MFG TENSILE STRENGTH (120,800) PSI

IMPACT NO	PLATE THICKNESS	PLATE CONDITION	PROJECTILE MAG MARK AND MOD	PROJECTILE ORIGINAL DIAMETER	PROJECTILE FINAL DIAMETER	PROJECTILE MASS	PROJECTILE CONDITION	OBLIQUITY	STRIKING VELOCITY	PENETRATION	E/D	STRIKING COEFFICIENT	FSV 78841
4884	3".207	Back cracked, 3-1/2" Pent.	Chev. 3" M62 Lot 2-61	PD-8 2".990		14.70	Split, not effective	30°10'	2423	Inc.	1.07	62,400	122.8
4885	3".209	Clean hole, petals wiped	"	PD-9 2".989		14.70	Broken, split, not eff.	30°10'	2522	Cp.	1.07	64,900	127.8
4886	3".211	Clean hole, petals wiped	"	PD-10 2".988		14.70	Broken, split, not eff.	30°10'	2649	Cp.	1.07	68,100	134.0
4887	3".197	Clean hole, petals wiped	Olds.3" Mk.29-2	CS-8 2".980		13.00	Intact, effective	30°10'	2606	Cp.	1.07	63,400	124.8
4888	3".204	Rag hole, petals wiped	Chev.3" M62 Lot 2-61	PC-1 2".988		14.70	Broken, split, not eff.	30°20'	2740	Cp.	1.07	70,400	136.5
4889	3".203	Clean hole, petals wiped	"	PC-2 2".988		14.70	Body cracked, effective	29°40'	2618	Cp.	1.07	67,700	133.2
4890	3".200	2-3/4" Pent.	Chev. 3" M62 Lot 3-59	GU-1 2".991		14.70	Split, not effective	29°40'	2496	Inc.	1.07	64,600	127.2
4891	3".199	2-7/8" Pent.	"	GU-2 2".990		14.70	Split, not effective	29°40'	2627	Inc.	1.07	68,000	133.9
4892	3".197	Clean hole	"	GU-3 2".991		14.70	Nose split, effective	30°10'	2755	Inc.	1.07	71,000	139.8

The M62 projectiles from both lots fired performed unreliably.

The VL min limit is estimated at (127%)(F=64,500) however an incomplete penetration was obtained at (133.9%)(F=68,000). One M62 projectile from each lot remained effective after impact however, in general the M62 projectiles were broken up at all velocities fired under the above conditions of test.



ARMOR AND PROJECTILE LABORATORY
NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

APL PLATE NO 626
MFG Carnegie 3#0 01."B"
MFG PLATE NO 3D-389 1/4 (+1)

NP9 [illegible]

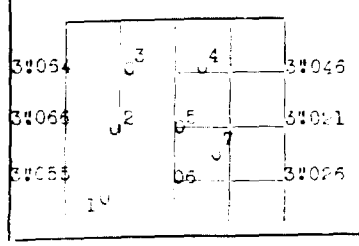
IMPACT DATA

MPG TENSILE STRENGTH (120,100) PSI

	PLATE			PROJECTILE									
IMPACT NO	THICKNESS	CONDITION	MFG MARK AND MOD	ORIGINAL DIAMETER	FINAL DIAMETER	MASS	CONDITION	OBLIQUITY	STRIKING VELOCITY	PENETRATION	E/D	STRIKING COEFFICIENT	VSK 7HH41
4893	3".047	Clean hole	Olds.3" Lk.29-2	CJ-9 2".990		13.00	Intact, effective	44°40'	2810	Cr.	1.03	52,600	107.1
4894	3".055	Clean hole	"	CJ-10 2".980		13.00	Base cracked, effective	45°00'	2730	Cr.	1.03	55,600	109.9
4895	3".059	2 5/8" rent.	"	CJ-1 2".981		13.00	Base cracked, effective	44°40'	2752	Inc.	1.03	56,300	104.3
4896	3".053	2½" Pent.	"	CJ-2 2".981		13.00	Base gouged, not effective	44°40'	2750	Inc.	1.02	56,300	104.6
4897	3".044	Clean hole	"	CJ-7 2".980		13.00	Base gouged, effective	44°40'	2900	Est. Cr.	1.02	59,500	110.5
4898	3".040	2½" Pent.	"	CJ-4 2".982		13.00	Base gouged, effective	44°45'	2774	Inc.	1.02	56,800	105.4
4899	3".035	H.B. on back	"	CJ-5 2".991		13.00	Base gouged, effective	44°40'	2701	Inc.	1.02	55,500	103.1

VL Min and VE Min= (103%) (V=55,600)

Projectiles Did Not Chatter At Velocities Up To (110%) (V=59,500)



ARMOR AND PROJECTILE LABORATORY
NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

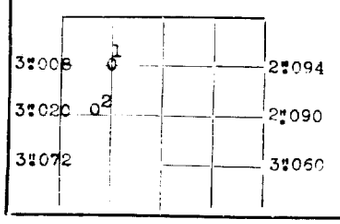
APL PLATE NO. 577
MFG Carnegie 3½ Cl. "B"
MFG PLATE NO. 3D-389 1/4

NPG 35469

IMPACT DATA

NPG TENSILE STRENGTH (A2) (120,300) PSI.

IMPACT NO.	PLATE THICKNESS	PLATE CONDITION	PROJECTILE MAG. MARK AND MOD.	PROJECTILE ORIGINAL DIAMETER	PROJECTILE FINAL DIAMETER	PROJECTILE MASS	PROJECTILE CONDITION	OBLIQUITY	STRIKING VELOCITY	PENETRATION	E/D	STRIKING COEFFICIENT	BHN 78841
4900	3".005	1 5/8" Pent.	Chev. 3" M52	PC-3 2".989		14.70	Shattered. Not Eff.	45°00'	2487	Inc. 1.01		54,100	101.1
4901	3".013	2 1/8" Pent.	" "	PC-4 2".987		14.70	Shattered. Not Eff.	45°40'	2649	Inc. 1.01		56,800	106.2
				VL Min. Limit= (>106%) (V=56,800)									
				Projectiles Broke Up At All Velocities Up To (106%)									



MEMORANDUM REPORT NO. 1-47

APPENDIX II

IMPACT PHOTOGRAPHS

3" M62 & 3" Mk. 29-2

vs

3" Class B Plate

at

30° & 45° obliquity

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NPG 35361 - APL Plate No. 673 (3"/0 Cl. "H" I.F. No. X90211 W.P. 1,700 psi va. 3" AP MK. 29-2 Projectiles at 30° Obliquity. From rear. See NPG 35373 for back view.

B.I. No.	"e"	"e"	I.V.(f.s.)	%	Pene.	Proj. Cond.
4872	3"212	30°00'	2367	113	A.I.F. 6"	Base Cracked, not eff.
4873	3"209	29°30'	2428	116	Cp.	Base Cracked off, not eff.
4874	3"206	29°40'	2571	123	Cp.	Nose Cracked, eff.
4875	3"211	30°00'	2642	126	Cp.	Nose Cracked, eff.
4876	3"212	30°20'	2747	130	Cp.	Nose Cracked, eff.
4877	3"212	30°10'	2655	126	Cp.	Intact, eff.
4878	3"207	30°10'	2817	134	Cp.	Intact, eff.
4879	3"209	30°20'	2879	137	Cp.	Intact, eff.
4880	3"211	30°20'	2920	139	Cp.	Intact, eff.

15, 17 Sept. 1947

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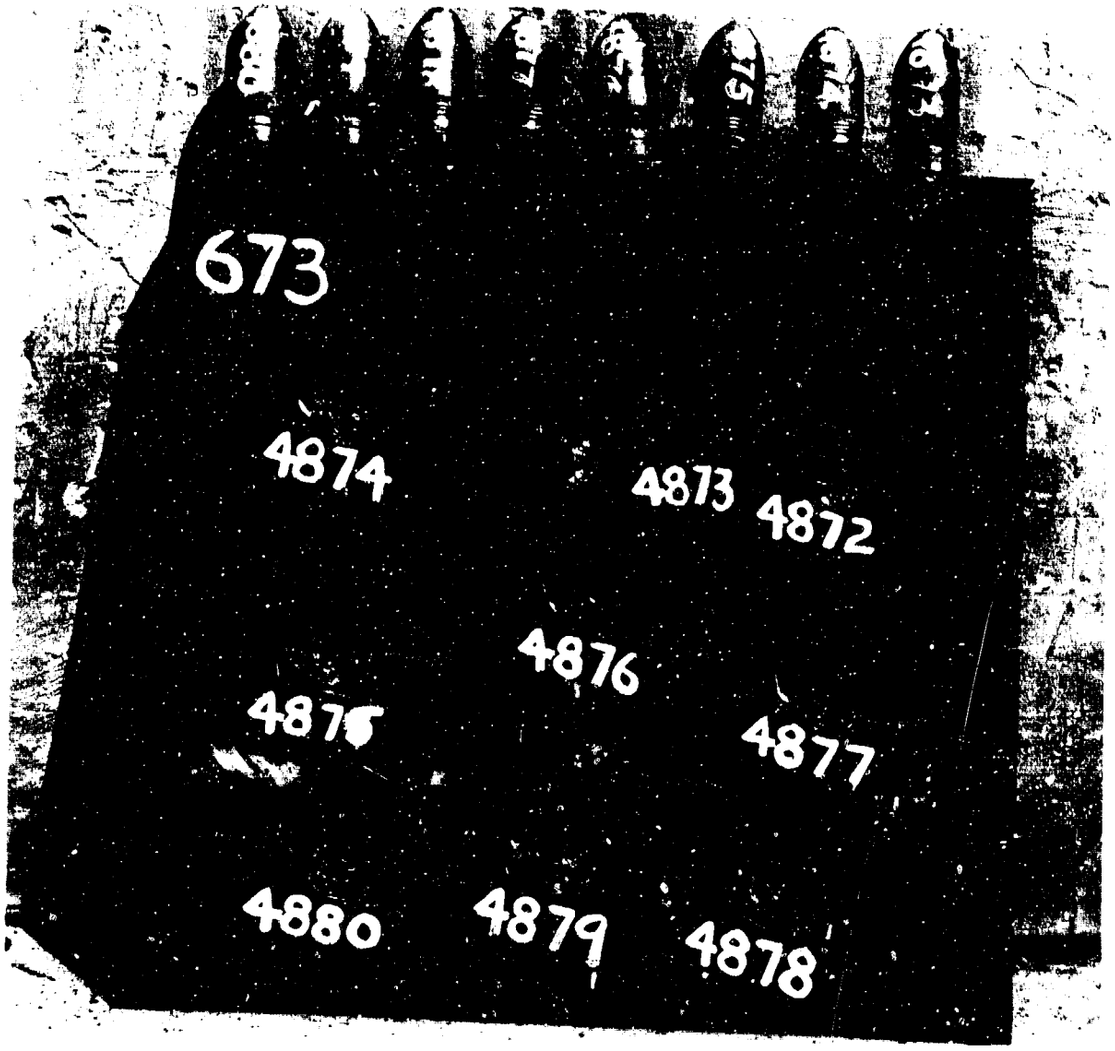

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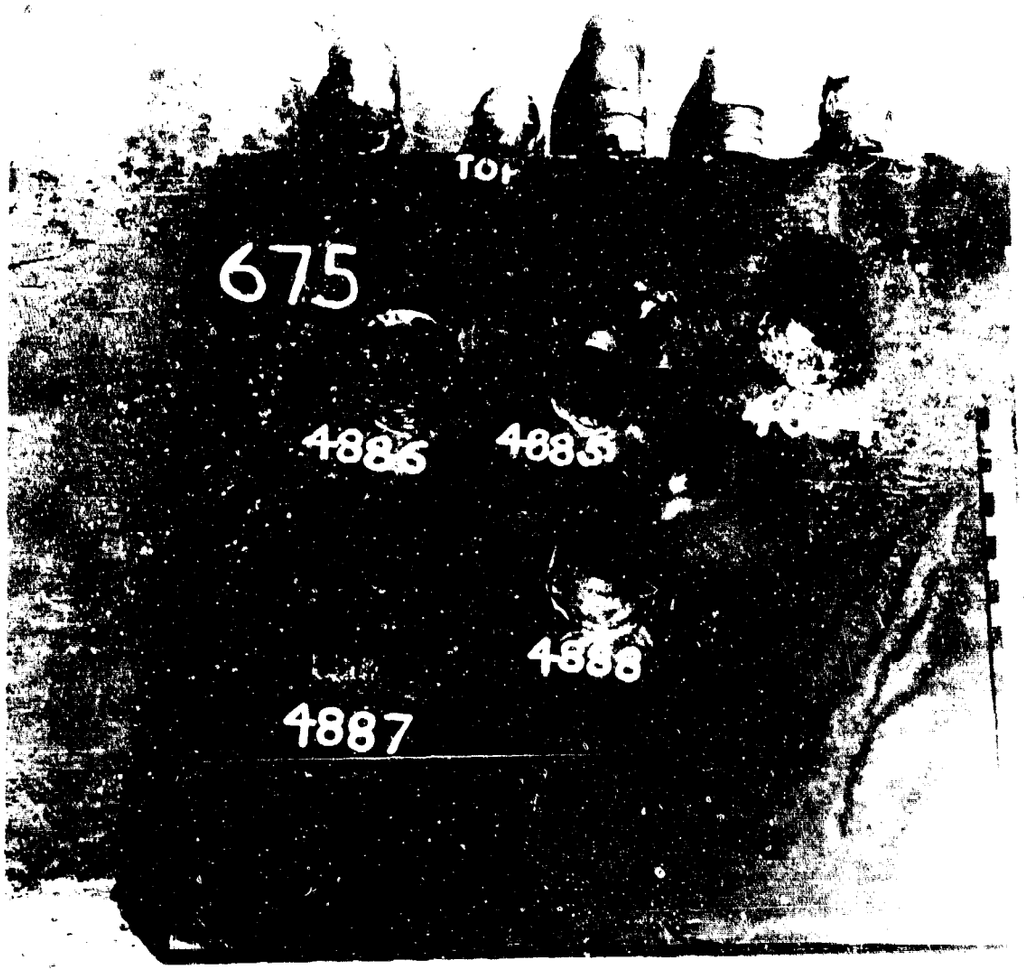
NPG 34373 - APL Plate No. 673 (AP0-21, "B" C.I. No. X4621) BACK VIEW. See NPG 35361 for front view and data on impacts 4872-80 APL.
.5, 17 Sept. 1947

NP9 35437 - APL Plate No. 675 (3TO Cl. "B" C.I. No. X9021) T.S. 120,800 psi vs. 3" AP M62 and 3" Mk. 29-2 AP Projectiles at 30° Obliquity. FRONT VIEW. See NP9 35438 for back view.

B.I. No.	"e"	"θ"	S.V.(f.s.)	%	Pene.	Proj. Cond.
4884 APL	3T207	30°10'	2423	123	Inc. 3-1/2"	Split, not eff.
4885	3T209	30°10'	2522	128	Comp. B.I.P.	Broken, split, not eff.
4886	3T211	30°10'	2649	134	Comp.	Broken, split, not eff.
4887 Mk.29-2	3T197	30°10'	2606	125	Comp.	Intact, eff.
4888	3T204	30°20'	2740	137	Comp.	Broken, split, not eff.

17, 18 Sept. 1947

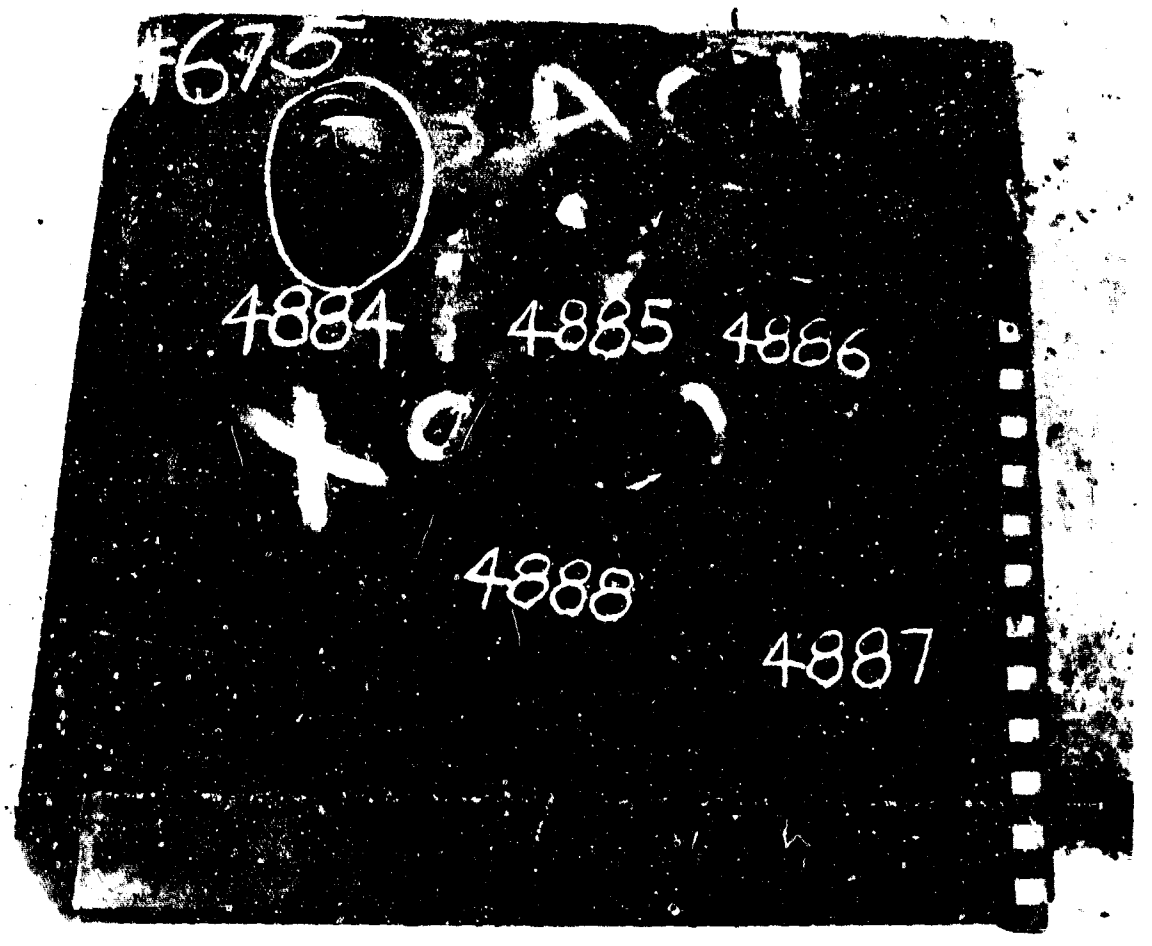
UNCLASSIFIED



NP9 35438 - APL Plate No. 675 (3"0 Cl. "B"C.I. No. X9021) BACK VIEW. See NP9 35437 for front view and data on impacts 4884-88 APL.
17, 18 Sept. 1947

[redacted]

UNCLASSIFIED



NP9 35439 - APL Plate No. 675 (320 Cl. "B" C... No. X9C21) T... [illegible]
3" AP M62 and 3" Mk. 29-2 AP Projectiles at 30° Obliquity. FRONT VIEW. See [illegible]
for back view.

B.I. No.	"e"	"θ"	S.V.(f.s.)	%	Pene.	Proj. Cond.
4884 APL	3₹207	30°10'	2423	123	Inc. 3-1/2"	Split, not eff.
4885	3₹209	30°10'	2522	128	Comp.B.I.P.	Broken, split, not eff.
4886	3₹211	30°10'	2649	134	Comp.	Broken, split, not eff.
4887 Mk.29-2	3₹197	30°10'	2606	125	Comp.	Intact, eff.
4888	3₹204	30°20'	2740	137	Comp.	Broken, split, not eff.
4889	3₹203	29°40'	2618	133	Comp.	Body cracked, eff.
4890	3₹200	29°40'	2496	127	Inc. 2-3/4"	Split, not eff.
4891	3₹199	29°40'	2627	134	Inc.	Split, not eff.
4892	3₹197	30°10'	2755	140	Comp.	Nose split, eff.

17, 18, 22 Sept. 1947

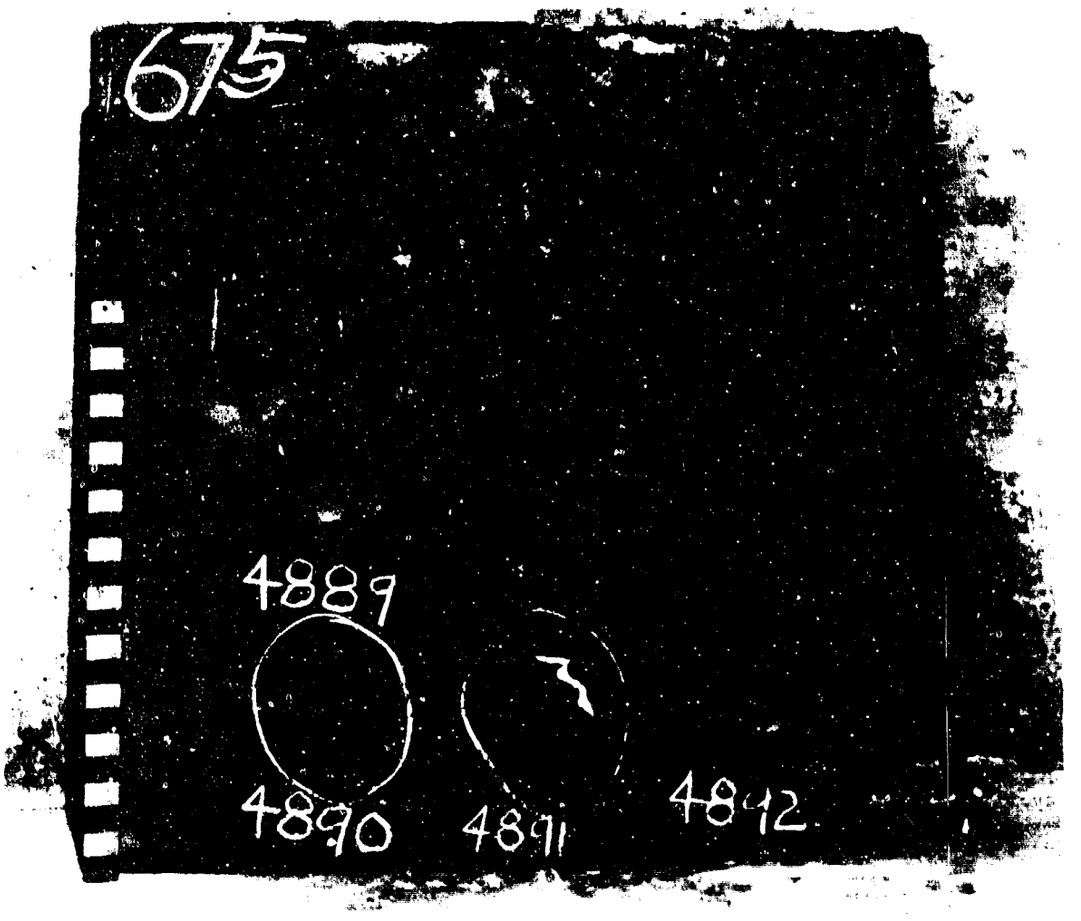
[redacted]

UNCLASSIFIED

NPV 35446 - APL Plate No. 675 (370-21."B" C.I. No. A9(41) BACK VIEW. See NPV 35439 for front view and data on impacts 4884-92 APL.
FT, 13, 22 Sept. 1947

[redacted]

UNCLASSIFIED



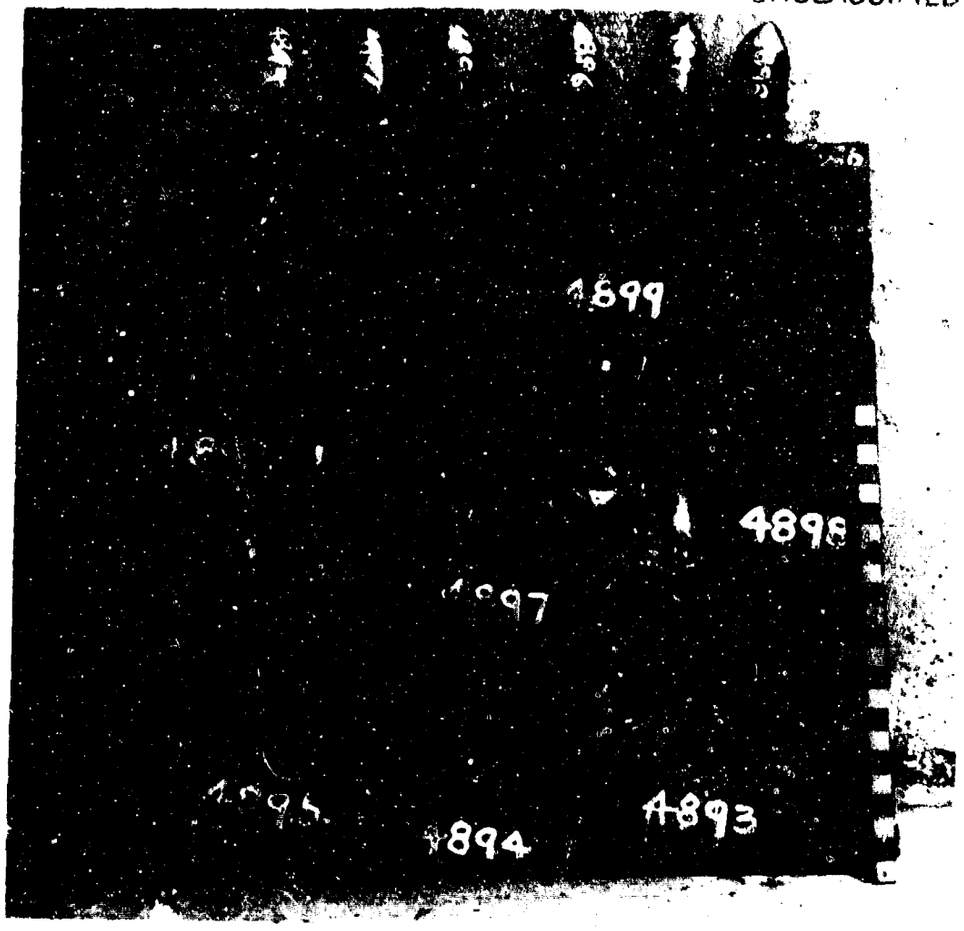
NPS 12441 - APL Plate No. 676 (350 C). "B" C.I. No. BD 389 [illegible] vs. 3" Mk. 29-2 AP Projectiles at 45° Obliquity. FRONT VIEW. [illegible] back view.

B.I. No.	"e"	"o"	S.V.(f.s.)	%	Pene.	Proj. Cond.
4893 APL	37047	44°40'	2810	107	Comp.	Intact, eff.
4894	37055	45°00'	2730	103	Comp.	Base Cracked, eff.
4895	37059	44°40'	2752	104	Inc. 2-5/8"	Base Cracked, eff.
4896	37053	44°40'	2750	104	Inc. 2-3/4"	Base gouged, not eff.
4897	37044	44°40'	2900 (est.)	111	Comp.	Base gouged, eff.
4898	37040	44°45'	2772	106	Inc. 2-3/4"	Base gouged, eff.
4899	37035	44°40'	2701	103	SIP 2-5/8"	Base gouged, eff.

22, 23 Sept. 1947

[redacted]

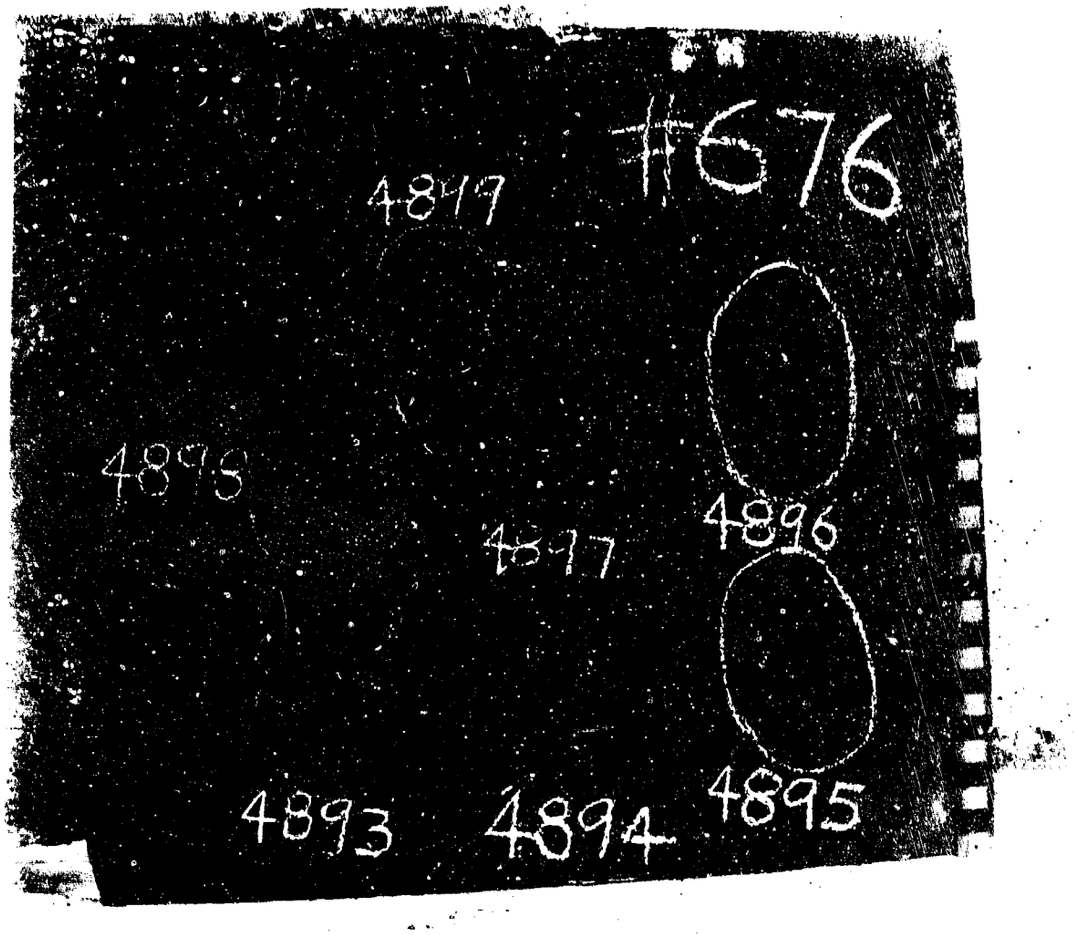
UNCLASSIFIED



NP9 35442 - APL Plate No. 676 (3"C Cl. "B" C.I. No. BD 389 1/4) BACK VIEW. See NP9 35441 for front view and data on impacts 4893-99 APL.
22, 23 Sept. 1947

[redacted]

UNCLASSIFIED



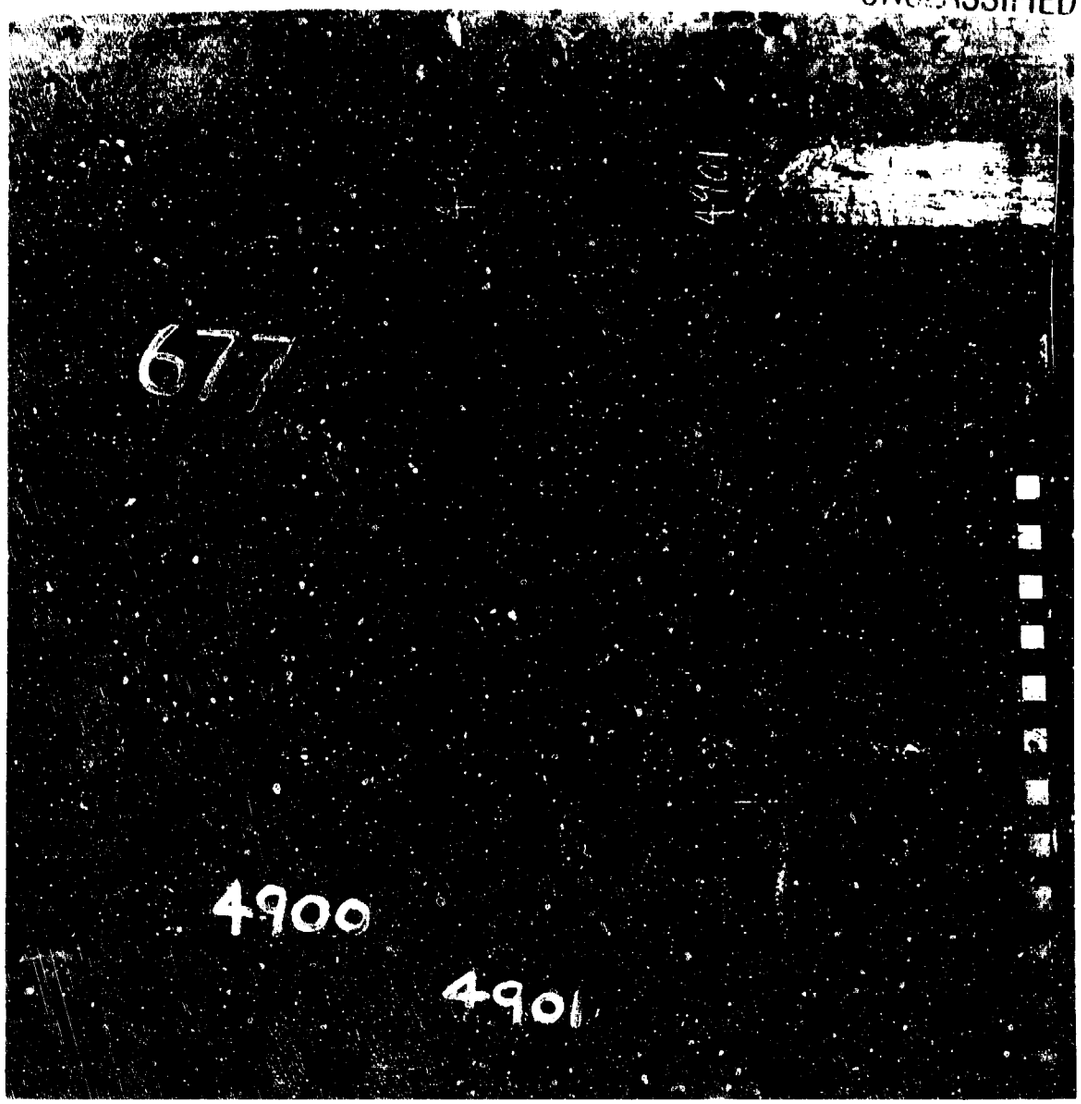
NP9 35485 - APL Plate No. 677 (3"C Cl. "B" C.I. No. BD 389-1/4) T.S. 120,300 psi vs. 3" M62 AP Projectiles at 45° Obliquity. FRONT VIEW. See NP9 35486 for back view.

B.I. No.	"e"	"Θ"	S.V.(f.s.)	%	Pene.	Proj. Cond.
4900 APL	3".005	45°00'	2487	101	Inc.	Shattered, not eff.
4901	3".013	45°40'	2649	106	Inc.	Shattered, not eff.

24 Sept. 1947

[redacted]

UNCLASSIFIED



NP9 35486 - APL Plate No. 677 (3"0 Cl. "B" C.I. No. 389-1/4) BACK VIEW. See NP9 35485 for Front View and data on impacts 4900-01 APL.
24 Sept. 1947

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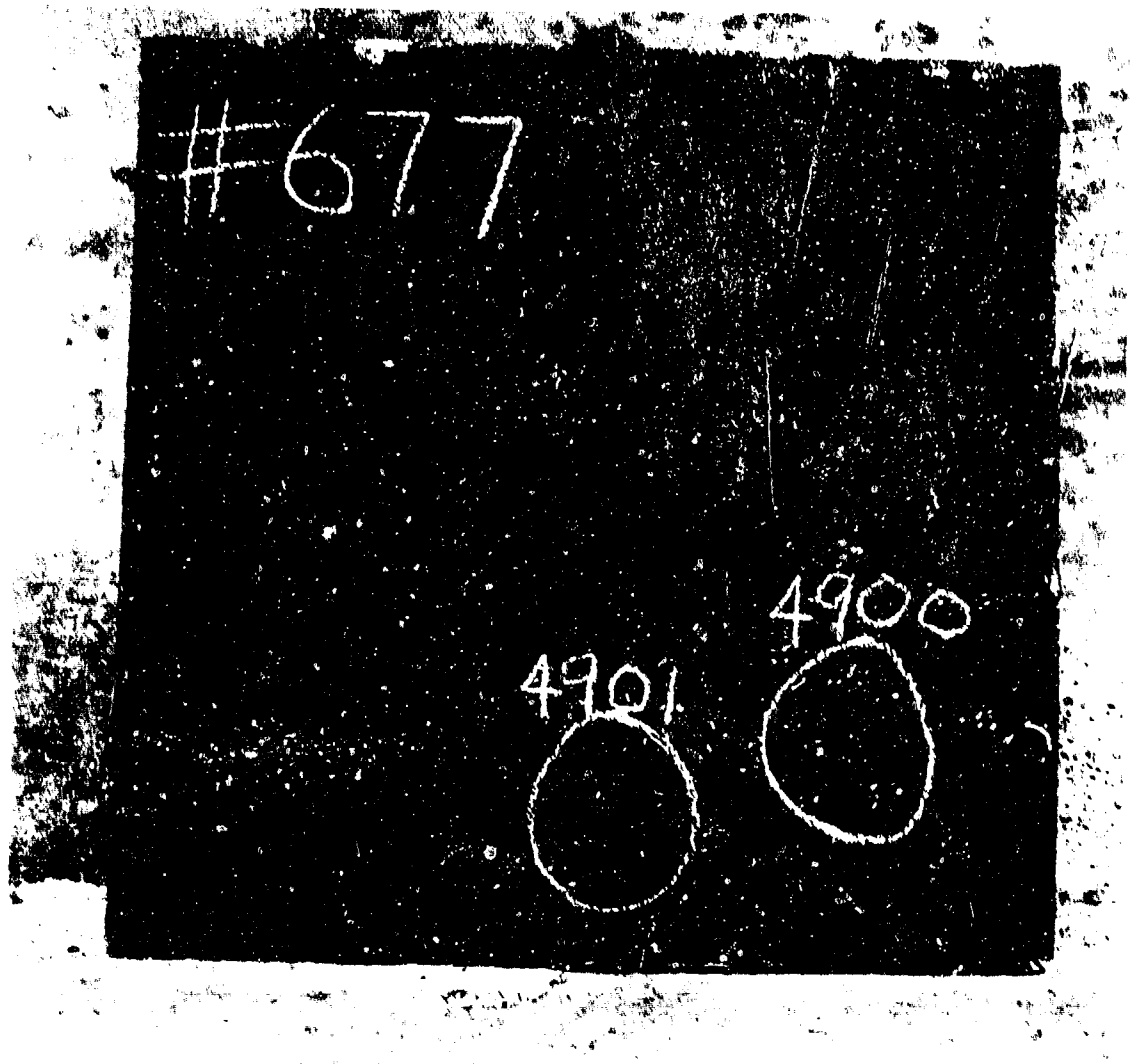

MEMORANDUM REPORT NO. 1-47

APPENDIX III

LOCAL DIRECTIVES

MEMORANDUM REPORT NO. 1-47

C O P Y

U. S. NAVAL PROVING GROUND

DAHLGREN, VIRGINIA

15 September 1947

PROJECT TL-3212-1.2

Directive for Tests Nos. 1 and 2.

1. In order to gain more information concerning the behavior of presently available 3" AP projectiles as a preliminary to evolving new designs, it is desired to test the 3" AP Mk. 29-2 and 3" AP M62 projectiles against Class A and Class B armor, with particular attention to the highest striking velocities obtainable.

2. Until the completion of this series of tests, the procedure to be followed in firing will be to determine the limit on the plate, increase the velocity in approximately 200 f.s. steps to the maximum attainable, then fire additional rounds as necessary to explore the "shatter region" more fully. The 3"/50 gun and Mk. 29-2 and M62 projectiles will be used.

3. Test No. 1 will be fired under the following conditions: 3" Class B plate, of approximately 120,000 psi tensile strength, at 30° obliquity. Test No. 2 will be fired under the same conditions, except that the obliquity will be 45°.

J. G. FRANKLIN
Armor Officer

Copy to: BO, XO, TO, TL(3), TK.

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