### AD NUMBER

| AD006850 |

### CLASSIFICATION CHANGES

| TO:            | unclassified |
|               |              |
| FROM:          | confidential |

### LIMITATION CHANGES

| TO:            | Approved for public release; distribution is unlimited. |
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### AUTHORITY

28 Feb 1965 per DoDD 5200.10; NWC ltr dtd 4 Mar 1976
THIS REPORT HAS BEEN DECLASSIFIED AND CLEARED FOR PUBLIC RELEASE.

DISTRIBUTION A
APPROVED FOR PUBLIC RELEASE;
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U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

REPORT NO. 1092

TASK ASSIGNMENT HPG-Re3f-650-1-52

FINAL Report

GUN FIRING TEST OF WARHEAD;
SEMI ARMOR PIERCING 3000 LB. TI FOR MATADOR

Task Assignment HPG-Re3f-650-1-52

Copy No. 12

Classification
CONFIDENTIAL
SECURITY INFORMATION
Gun Firing Test of Warhead
Semi Armor Piercing 3000 lb. Tl for Matador

PART A

SYNOPSIS

1. Five (5) Warheads, SAP, 3000 lb. Tl, for Matador were submitted to Naval Proving Ground for ballistic test and evaluation of homogeneous steel armor penetration properties.

2. It is concluded that:

   a. The inert loaded Warhead, SAP, 3000 lb. Tl for Matador, fired at 1100 f/s striking velocity and 20° obliquity will penetrate nominal 2-1/4" homogeneous steel armor and remain in effective condition.

   b. At the same velocity and 0° or 20° obliquity, the warhead will fail against nominal 3-1/4" homogeneous steel armor.

   c. Failure of the warhead to penetrate the targets is attributed to the welds. In all cases, failure occurred at or originated at a weld.

   d. From the test results, the employment of a weldment as a SAP warhead appears to be impractical.
Gun Firing Test of Warhead
Semi Armor Piercing 3000 lb. Tl for Katador

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INTRODUCTION

1. AUTHORITY:

This test was conducted in accordance with references (a) and (b) as authorized by reference (c) and continued under reference (e).

2. REFERENCES:

a. CHORD, Dept. of Army, Conf ltr 00.471.94/163°(C)ORDTM - Record J. . ., Moseman/rrr/4587 of 21 Dec 1949
b. BUORD Conf ltr S75-1(42) (Re3f-MX-771)EJHL: fml
   Ser 5158 of 17 Jan 1950
c. BUORD Cohl ltr NP9 Re3f-EJHL: fml of 14 Mar 1950
d. BUORD Conf ltr Re3f-EJHL: fml S75-1(42) Ser 12999 of 17 Oct 1950
e. BUORD Conf ltr NP9 Re3f-EJHL: am Ser 24428 of 15 Aug 1951

3. OBJECT OF TEST:

The tests were conducted to determine the maximum homogeneous armor plate thickness that the Warhead, SAP, 3000 lb. Tl for Matador would penetrate at 20° obliquity and 1100 f/s striking velocity and remain in an effective condition.

4. PERIOD OF TEST:

   a. Date of Project Letter 14 March 1950
   b. Date Tests Commenced 21 July 1950
   c. Date Tests Resumed 13 February 1952
   d. Date Test Completed 21 February 1952
Gun Firing Test of Warhead  
Semi Armor Piercing 3000 lb. Tl for Matador

PART C

DETAILS OF TEST

5. DESCRIPTION OF ITEM UNDER TEST:

Warhead, SAP, 3000 lb. Tl for Matador was manufactured for the Army by the A. O. Smith Corp. and submitted for test with details of modification for gun firing as shown by Department of the Army Dwgs. TAM 3009 and TAM 3011. This modification did not stand up for gun firing and after the first test, the four (4) remaining warheads were sent to the Naval Gun Factory under reference (d) for remodification as shown by Department of the Army Dwgs. TAM 3090 and TAM 3091.

6. DESCRIPTION OF TEST EQUIPMENT:

a. Gun: 24" Smooth Bore, Type A Mod 0, No. 235
b. Propellant: 5"/38 Smokeless Powder SPDN 9830 plus Black Cannon Powder
c. Targets: Various thicknesses of homogeneous armor plate

7. PROCEDURE:

Five (5) Warheads, SAP, 3000 lb. Tl for Matador were inert loaded with vermiculite-cement of specific gravity 1.62. These warheads were fired from a 24" smooth-bore gun against homogeneous steel armor plates of thicknesses from 2.1 to 4.06. The target plates were set at 0° and 20° obliquity. The armor targets were backed by a large sandpile which was used as a recovery medium. Each warhead was recovered and examined prior to firing the next round. Representatives of Bureau of Ordnance and the Department of the Army were consulted before firing each round to determine target thicknesses and test conditions.

8. RESULTS AND DISCUSSION:

The ballistic data are given in detail on Tables II through VI, Appendix (B), and are summarized in Table I, Appendix (A). The bronze bourrelet rings on the warhead as originally submitted for test broke down in the gun. The gun was damaged by scraping and gauging and the warhead struck the target plate at a large yaw angle. The test was considered invalid and the remaining warheads were sent to the Naval Gun Factory for a further modification of the bourrelet
Gun Firing Test of Warhead  
Semi Armor Piercing 3000 lb. T1 for Katador

rings to make them suitable for gun firing. Upon the return of the warheads from the Naval Gun Factory, testing was resumed. Round 2 was fired against 4\%06 armor at 872 f/s striking velocity and 20° obliquity. The warhead was rendered ineffective by this test, the forward nose section being broken off at the weld and the ogival after nose section cracked longitudinally back to and partially around the second circumferential weld. Round 3 was fired against 3\%25 armor at 1164 f/s striking velocity and 20° obliquity. This warhead was ineffective and in practically the same condition as Round 2. Round 4 was fired against 2\%19 armor at 1107 f/s striking velocity and 20° obliquity. This warhead was effective with no deformation. At the request of the Army representatives, Round 5 was fired against 3\%25 armor at 0° obliquity and 1104 f/s striking velocity. This warhead was ineffective being cracked open at the weld ground, the forward nose section and cracked longitudinally back to and partially around the circumferential weld.

PART D

CONCLUSIONS

9. It is concluded that:

a. The inert loaded warhead, SAP, 3000 lb. T1 for Matador, fired at 1100 f/s striking velocity and 20° obliquity, will penetrate nominal 2-1/4" homogeneous steel armor and remain in effective condition.

b. At the same velocity and 0° or 20° obliquity the warhead will fail against nominal 3-1/4" homogeneous steel armor.

c. Failure of the warhead to penetrate the targets in an effective condition is attributed to the welds. In all cases failure occurred at or originated at a weld.

d. From the test results, the employment of a weldment as a SAP warhead appears to be impractical.
Gun Firing Test of Warhead
Semi Armor Piercing 3000 lb. T1 for Hitador

The tests upon which this report is based were conducted by:
W. W. MEYERS, Plate Battery Officer
Terminal Ballistics Department

This report was prepared by:
W. W. MEYERS, Plate Battery Officer
Terminal Ballistics Department

This report was reviewed by:
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Terminal Ballistics Department
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Terminal Ballistics Batteries Officer
Terminal Ballistics Department
W. E. ROBERTSON, Lieutenant Commander, USN
Terminal Ballistics Officer
Terminal Ballistics Department
C. C. HAMBLE, Director of Research, Ordnance Group

APPROVED: J. F. BYRNE
Captain, USN
Commander, Naval Proving Ground

E. A. RUCKNER
Captain, USN
Ordnance Officer
By direction
Final Report

on

Task Assignment NPG-Re3f-650-1-52

Final Report

on

Gun Firing Test of Warhead

Semi Armor Piercing 3000 lb. T1 for Matador

Project No.: NPG-Re3f-650-1-52
Copy No.: 12
No. of Pages: 6

Date: FEB 28 1953

CONFIDENTIAL
SECURITY INFORMATION
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<th>Impact No.</th>
<th>Target thickness inches</th>
<th>Target obliquity degrees</th>
<th>Striking Velocity feet per second</th>
<th>Pressure tons per square inch</th>
<th>Penet.</th>
<th>Through Opening</th>
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</thead>
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<td>7/21/50</td>
<td>34972</td>
<td>4706</td>
<td>20</td>
<td>1000</td>
<td>773</td>
<td>2.8</td>
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<tr>
<td>2/13/52</td>
<td>39640</td>
<td>4706</td>
<td>20</td>
<td>1100</td>
<td>872</td>
<td>C</td>
<td>21&quot; x 46&quot;</td>
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<td>2/15/52</td>
<td>39654</td>
<td>3725</td>
<td>20</td>
<td>1100</td>
<td>1164</td>
<td>3.6</td>
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<td>2/19/52</td>
<td>39656</td>
<td>2719</td>
<td>20</td>
<td>1100</td>
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</tr>
<tr>
<td>2/21/52</td>
<td>39682</td>
<td>3725</td>
<td>0</td>
<td>1100</td>
<td>1104</td>
<td>-</td>
<td>C 22&quot; x 23&quot;</td>
</tr>
</tbody>
</table>

Warhead broke up in gun-Gun damaged-Plate pushed from butts by yawed warhead.

Warhead not effective-Nose section broken off at weld-Body cracked open to and broken open at weld aft of ogive section.

Warhead not effective-Nose section broken off at weld-Body cracked open to and broken open at weld aft of ogive section.

Warhead effective and intact-No deformation.

Warhead not effective-Cracked around weld at nose section-Cracked longitudinally back to forward support band.
**Butt Firing**

U.S. Naval Proving Ground

Dahlgren, Va. 194

**Object:** Ballistic Test of Guided Missile Warhead

**Impact No.** 31972

**Impact Date** 7-21-50

**Butt No.** F

---

### PLATE

- **Gauge:** 9.75
- **Class:** 0
- **Maker:** Midvale
- **No.:** 8443
- **Group:** M121
- **Contract:** 10180157
- **Date received:** 16 June 1942
- **Dimensions:** 14.1 x 11.5 x 1.79 x 3.58
- **No. of impact on plate:** 3
- **Thickness at impact:** 7/8
- **OBLIQUITY:** 20°
- **Impact dimensions:**
  - PENETRATION
  - Flaking front
  - Flaking back
  - Dist. from top, bottom
  - Dist. from right, left
  - Dist. from nearest impact
  - Dish
  - Spur
  - Cracks - Bulge
  - Button (Thrown)(Started)
  - Through Opening

### PROJECTILE

- **Caliber:** 240°
- **Maker:** A.O. Smith
- **Type:** Guided Missile Warhead
- **Lot No.:** A0564
- **Year of Specification:** –
- **Mark:** Mod. 71
- **Date received:** 6-8-50
- **Capped or uncapped:** Uncapped
- **Weight (capped):** 3261
- **Weight (uncapped):** 7700
- **Length (uncapped):**
- **Fuze:** None
- **Filler:** Vermiculite
- **Flight by screen:**
- **Condition after firing:**
  - EFFECTIVE or INEFFECTIVE

---

### BALLISTIC DATA

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<tr>
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<th>1. Desired</th>
<th>2. Oerlikon</th>
<th>3. Chronograph</th>
<th>4. Limit, estimated for this thickness of impact</th>
<th>5. Actual, adjusted to nominal gauge, (Adjusted from column 4)</th>
<th>6. Limit, for nominal gauge, based on this impact only.</th>
<th>7. Limit, for nominal gauge, established from column 6 and previous impacts</th>
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<td>723</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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</table>

---

**Remarks:**

- **Pressure:** 28
- **Powder Temp.:** 76°

---

**CONFIDENTIAL**

**Security Information**

---

**TABLE II**

**APPENDIX B**

Acceptance or Rejection recommended

- **N.P.G. Photo. No.:** Sun 34" 235 Type A Mod. 0

---
### Butt Firing

**U.S. Naval Proving Ground**

Dahlgren, Va. 2-13-52

**Butt No.**  F

---

**OBJECT**

Ballistic Test of Warhead, SAP, 3000 lb. Tl for Matador vs. 4" Class B Armor at 20° Obliquity.

---

**REFERENCE N.P.G. LETTER** Report No. 1692

---

**PLATE**

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<tr>
<td>Maker</td>
<td>Midvale</td>
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<tr>
<td>No.</td>
<td>11715</td>
</tr>
<tr>
<td>Group</td>
<td>M-283</td>
</tr>
<tr>
<td>Contract</td>
<td>Nord-5341</td>
</tr>
<tr>
<td>Date received</td>
<td>22 May 1945</td>
</tr>
<tr>
<td>Dimensions</td>
<td>119&quot; x 330&quot;</td>
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<tr>
<td>No. of impact on plate</td>
<td>9</td>
</tr>
<tr>
<td>Thickness at impact</td>
<td>4.06&quot;</td>
</tr>
<tr>
<td>OBLIQUITY</td>
<td>20°</td>
</tr>
<tr>
<td>Impact dimensions</td>
<td>23&quot; x 48&quot;</td>
</tr>
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</table>

**PROJECTILE**

| Caliber | 23.219 |
| Maker | A. O. Smith |
| Type | Warhead |
| Lot No. | AOS-3 |
| Year of Specification | -- |
| Mark | -- |
| Mod. | -- |
| No. | 6 |

**DATE received**

Gapped or uncapped

**Weight (uncapped)** 3141.9#

**Length (uncapped)** 75715

**Fuze** None

**Filler** Vermiculite

**Flight by screen**

Condition after firing:

- **IN有效**: Nose section broken off at weld
- **IN有效**: Bomb body cracked apart and broken out at weld at 0.25" ahead section

---

### BALLISTIC DATA

<table>
<thead>
<tr>
<th>All limits are for this plate and this obliquity only.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desired</td>
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<tr>
<td>Aver.</td>
</tr>
<tr>
<td>Chronograph</td>
</tr>
<tr>
<td>Limit, estimated for this thickness of impact.</td>
</tr>
<tr>
<td>Actual, adjusted to nominal gauge.</td>
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<tr>
<td>Limit, for nominal gauge, based on this impact only. (Adjusted from column 6)</td>
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<tr>
<td>Limit, for nominal gauge, established from column 6 and previous impacts.</td>
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<tr>
<td>Striking velocity (f.s.)</td>
</tr>
</tbody>
</table>

---

**REMARKS**

9 Limit shots only

---

**TABLE III**

**APPENDIX B**

---

**CONFIDENTIAL Security Information**

Acceptance or Rejection recommended

Wm. W. MEYERS, lh

Ord. Eng. GS-12

1x2 New

---

**N.P.G. Photo. No.**

GJN: 24" Smoothbore Type A Mod 0 #235
Butt Firing
U. S. Naval Proving Ground
Dahlgren, Va. 2-15-52 194

OBJECT. Ballistic Test of Warhead, SAP, 3000 lb. TL for Matador

REFERENCE N. P. G. LETTER Report No. 1092 DATED

PLATE

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<tr>
<td>Maker</td>
<td>Carnegie</td>
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<tr>
<td>No.</td>
<td>TT542 Group C751-322</td>
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<td>Contract</td>
<td>-</td>
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<tr>
<td>Date received</td>
<td>16 June 1945</td>
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<tr>
<td>Dimensions</td>
<td>121″ x 335″</td>
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<td>No. of impact on plate</td>
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<td>Thickness at impact</td>
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<td>OBLIQUITY</td>
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<td>Impact dimensions</td>
<td>24″ x 38″</td>
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<td>PENETRATION</td>
<td>Complete</td>
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<tr>
<td>Flaking front</td>
<td>0</td>
</tr>
<tr>
<td>Flaking back</td>
<td>0</td>
</tr>
<tr>
<td>Dist. from top, bottom</td>
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<td>Dist. from right, left</td>
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<td>Dist. from nearest impact</td>
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<tr>
<td>Dish</td>
<td>6″</td>
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<tr>
<td>Spur</td>
<td>11″</td>
</tr>
<tr>
<td>Cracks - Bulge</td>
<td>0</td>
</tr>
<tr>
<td>Button (Thrown) (Starter)</td>
<td>Through Opening 22″ x 33″</td>
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</tbody>
</table>

PROJECTILE

| Caliber | 2379057 |
| Maker | A. O. Smith |
| Type | Warhead |
| Lot No. | AOS-5 |
| Year of Specification | - |
| Mark | Mod. No. 5 |
| Date received | - |
| Weight (uncapped) | 3014.0# |
| Length (uncapped) | 79715 |
| Fuze | None |
| Filler | Vermiculite |
| Flight by screen | Condition after firing: EFFECTIVE or INEFFECTIVE |
| Nose section broken off at weld - Bomb body cracked open to and broken open at weld aft of ogive Section |
| Cracks - Bulge | 0 |

BALLISTIC DATA

| Striking velocity (f.s.) | 1164 |

REMARKS

Wt. of Chg: 160# .9530-14″ Std. Silk Bag
Used 3- 5# B, P. Boosters

CONFIDENTIAL

Security Information

Acceptance or Rejection recommended

GUN: 24″ Smoothbore Type A Mod 0 #235
**Butt Firing**

**OBJECT**

Ballistic Test of Matador Warhead 3000 lb. CAP T1

**IM.ACTNO.** 39656

**FILE NO.** 2-19-52

**U.S. Naval Proving Ground**

Dahlgren, Va. 2-19-52 194

**REFERENCE N.P.G. LETTER** 1692 DATED

---

**PLATE**

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**PROJECTILE**

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<td>Lot No.</td>
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<td>Year of Specification</td>
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<td>Mark</td>
<td>Mod.</td>
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</table>

**IMPACT DATE**

2-19-52

**U.S. Naval Proving Ground**

**Gauge received**

June 22, 1943

**Dimensions**

92-1/8" x 201-1/8"

**No. of impact on plate**

3

**Thickness at impact**

2719

**OBLIQUITY**

20°

**Impact dimensions**

25" x 26"

**PENETRATION**

Complete

**Flaking front**

0

**Flaking back**

0

**Dist. from top, bottom**

52"

**Dist. from right, left**

78"

**Dist. from nearest impact**

43"

**Dish**

5"

**Spur**

9"

**Cracks - Bulge**

0

**Button (Thrown)**

Through Opening 24" x 24-1/2"

---

**BALLISTIC DATA**

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<th>NOTE:</th>
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<th>2-</th>
<th>3-</th>
<th>4-</th>
<th>5-</th>
<th>6-</th>
<th>7-</th>
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<td></td>
<td></td>
<td></td>
<td></td>
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</table>

**REMARKS**

Powder Charge - 150# SPDN-9830 with 3 - 5# B. P. Boosters

CONFIDENTIAL

Security Information

Acceptance or rejection recommended

**APPENDIX B**

GUN: 24" Smoothbore Type A Mod 0 #235
**Butt Firing**

U.S. Naval Proving Ground  
Dahlgren, Va.  2-21-52  194

**OBJECT.** Ballistic Test of Warhead SAP, 3000# Tl Matador Bomb

---

**REFERENCE N.P.G.**  
**PLATE**

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**PROJECTILE**

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**IMPACT NO.** 39682  
**IMPACT DATE** 2-21-52  
**BUTT NO.** F

---

**BALLISTIC DATA**

<table>
<thead>
<tr>
<th>Note:</th>
<th>1-1 - Desired</th>
<th>2-2 - Cardiograph</th>
<th>3-3 - Chronograph</th>
<th>4-4 - Mean penetration</th>
<th>5-5 - Actual estimated penetration by impact</th>
<th>6-6 - Limit, based on average range of 15 shots, with individual allowance for this projectile</th>
<th>7-7 - Limit, for normal range, established from volume 4 and previous impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>All limits are for this plate and this obliquity only.</td>
<td>Mean</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Striking velocity (fps)</td>
<td>1104</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

**REMARKS**

Chg. 150# SPDN-9830, with 3-5# B.P. Boosters  
Avg. Pressure - 3.6

**CONFIDENTIAL Security Information**

Acceptance as rejection recommended

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**APPENDIX B**

**GUN:** 24" Smoothbore, Type A Mod 0 #235
Impact 39682, Warhead, SAP, 3000 lb. T1 for Matador, after impact against 3925 Class B plate at 20° obliquity and 1104 ft./sec. striking velocity.
Front View

39682

39682
CONFIDENTIAL

Gun Firing Test of Warhead
Semi Armor Piercing 3000 lb. T1 for Matador

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APPENDIX C
Gun Firing Test of Warhead
Semi Armor Piercing 3000 lb. T1 for Matador

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