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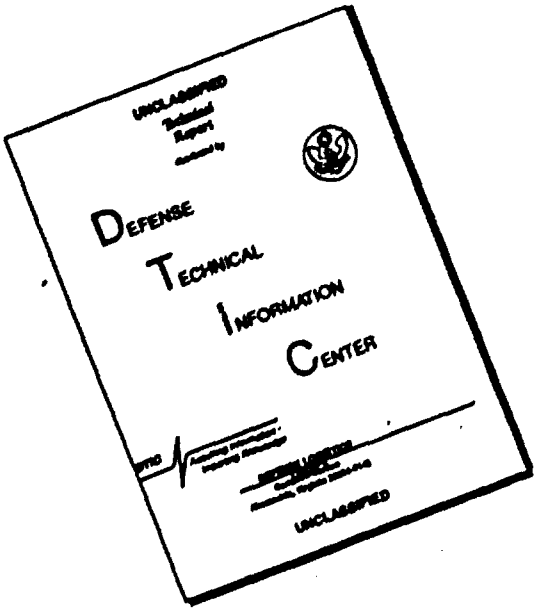

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TEST OF SHELL, HEP, T170E3 FOR 76mm GUN T91

TWENTY-FIRST REPORT ON PROJECT TA1-5002H (U)

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DEVELOPMENT AND PROOF SERVICES
ABERDEEN PROVING GROUND
MARYLAND

AUTHORITY: OCO ORDTA

RMBlack/bjw

PRIORITY : 1A

13 June 1956

TEST OF SHELL, HEP, T170E3 FOR 76mm GUN T91

TWENTY-FIRST REPORT ON PROJECT TA1-5002H

DATES OF TEST: November 1951 to 29 April 1953

OBJECT

To determine interior, exterior and terminal ballistic characteristics of Shell, HEP, T170E3, particularly in regard to determining armor defeating characteristics, target accuracy, and propelling charge development.

SUMMARY

The following tests of the 76mm, Shell, HEP, T170E3 were fired to determine the satisfactoriness of the round:

Rated maximum pressure of the shell.

Armor defeating characteristics against 3" and 4" armor plate.

1000 yd and 1500 yd vertical target accuracy tests.

Propellent granulation and ignition tests.

Tests of Inert fuzed T170E3 rounds to determine functioning characteristics of A3 filler when fired against armor plate.

(Reference 1st Memorandum Report Appendix A).

CONCLUSIONS

From results of the tests conducted with the Shell, HEP, T170E3 it was concluded that:

The shell will withstand chamber pressures of at least 30,000 psi.

The shell are reasonably accurate at ranges of 1000 and 1500 yards.

The shell will satisfactorily defeat (spall) 3" homogeneous armor at 0° and 60° obliquities but will not defeat 4" armor satisfactorily.

The shell filler (A3) will detonate and/or deflagrate on impact with armor when fired in inert fuzed shell T170E3.

RECOMMENDATION

It is recommended that the T170E3 (A3 Loaded) shell design be considered satisfactory for final engineering evaluation tests.

I INTRODUCTION

A. DISCUSSION

1. The Shell, HEP, T170E3 is patterned after the Shell, HEP, 76mm T169E1 except that the shell T170E3 is a one piece design and has a different rotating band.

2. The Shell, HEP, T169E1 previously tested at Aberdeen Proving Ground was a two piece design for the 76mm, M1A2, gun.

3. The Shell, HEP, T170E3 is designed to withstand a greater chamber pressure than the T169E1 shell. Therefore, greater muzzle velocities are expected to be attained with the T170E3 shell.

4. The one piece HEP shell of other calibers, 75mm and 90mm for instance, have previously been fired with results indicating that the one piece shell design is an improvement over the two piece design in those calibers. These tests are the first firing tests to be conducted on the one piece design of the 76mm Shell, HEP, T170E3.

B. REFERENCES

1. Authority for tests:

   a. Letter APG (c) 471/302 (Copies in Appendix B of F.R. No. P-51314)

   b. Letter APG (c) 471/804 (Copies in Appendix B of F.R. No. P-52674)

2. Fifth Report on Project TA1-5002H.

3. First Memorandum Report on Development of Shell, HEP, T170E3 for 76mm Gun T91 (Copy in Appendix A).

4. APG Firing Records P-50600, P-51314, P-55769, and P-52674 (Copies in Appendix B).

II DESCRIPTION OF MATERIEL

The materiel for test was the 76mm Shell, HEP, T170E3. All shell were assembled into complete rounds at APG and fired as received, except as noted in the firing records (Appendix B). Shell were received loaded with composition C3 (simulated) and A3 as well as inert loaded shell. The lots of the inert loaded shell were fuzed with inert BD, M91 fuzes. The lots of live loaded shell were fuzed with live and inert BD, M91 fuzes. Reference Appendix B, Firing Record No. P-51314 with Inclosure Photo Nos. A75966 and A73795.

III DETAILS OF TEST

A. PROCEDURE

1. First Phase of test (Reference Firing Record No. P-50600, Appendix B)

a. Six rounds of T170E3 inert shell (shell Lot No. 6715) were fired into sawdust box for recovery. Also 12 rounds were fired for ground impact recovery.

b. Ten test rounds (inert) were fired in conjunction with T64 (inert) rounds to 1000 yd. vertical target for accuracy and time of flight data as well as possible recovery.

c. Twenty-five test shell T170E3 (ammunition lot PA-E-6716) were fired against armor plate of 4 and 3 inch thickness placed 400 ft. from the gun and at 0° and 60° obliquities for armor defeating characteristics of A3 composition.

2. Second Phase of test (Reference Firing Record P-51314) Appendix B.

a. Fourteen inert test shell T170E3 were fired in conjunction with Shell, HE, T64 for 1000 yd. vertical target accuracy, time of flight and propellent gramulation tests. In these firings the matching velocity of the T64 and the T170E3 shell at 1000 yds. was calculated from the results obtained.

3. Third Phase of test (Reference Firing Record P-52674) Appendix B.

a. Twenty-four inert test rounds were fired for comparison of uniformity data obtained by using the 300 grain (10 1/4" length) T88E1 primer with bagged charges containing distance wadding.

b. Nineteen inert test rounds were fired for 1000 and 1500 yd. accuracy, time of flight and propellent ignition tests.

c. Fifteen test T170E3 shell, A3 loaded and with inert BD, M91 fuzes were fired against 3" armor plate to determine deflagration and/or detonation characteristics of the shell filler.

d. Five test T170E3 shell inert loaded and with inert BD, M91 fuzes were fired against armor plate (painted white) to determine configuration of a plastic filler on the plate.

4. Fourth Phase of test (Reference Appendix B) Firing Record P-55769.

a. Interior ballistic firings were conducted in which three types of primers were used for comparative uniformity data. These tests involved the use of Shell, HE, T64 (empty) which simulated the 10.0 lb. weight of the Shell, HEP, T170E3.

B. RESULTS

1. Inspection of recovered 76mm Shell, HEP, T170E3, Ammunition Lot PA-E-6715 fired as received for 1,000 yard accuracy, revealed that the BD, M91 Fuze (Inert) was a modified fuze (substandard) resulting in excessive deformation and breaking up of the shell in the gun tube at pressures of approximately 20,000 psi.

2. Limited recovery of shell from ground impact with Fuze, BD, M91 (Inert) indicated that the T170E3 shell will withstand a chamber pressure of at least 30,000 psi without unsatisfactory deformation of the shell. Reference sheet 3 of F.R. P-50600

3. The following results were obtained from firing the subject shell (A3 loaded, BD, M91 fuze) against armor plate.

NO. RDS. FIRED	ARMOR in. THICK	ARMOR OBLIQUITY deg.	AVG. STRIKING VELOCITY fps	RDS. SPALLING THE ARMOR OF RDS. CONS.	REMARKS
2	4	60	2472	0 of 2	Bulges
1	4	60	1996	0 of 1	Cracked bulge
1	4	60	1797	0 of 1	Bulge
1	4	60	1493	0 of 1	Bulge
4	3	60	2411	3 of 3	1 bad hit
4	3	60	1802	4 of 4	None
4	3	60	1403	4 of 4	None
3	3	0	1388	3 of 3	None
3	3	0	1798	2 of 2	1 bad hit
2	3	0	1440	2 of 2	None

NOTE: Charpy value of 4" plate was 61 ft lbs at -40°
Charpy value of 3" plate was 30.75 ft lbs at -40°

4. The following accuracy results were obtained from tests of the subject (Inert) Shell fired at ranges of 1000 and 1500 yds.

a. Lot PA-E-9207 with rotating band clearance value of .010 inch (diametrical): Reference sheet 4 of F.R. P-51314

NO. RDS. CONS.	SHELL TYPE	UNCORRECTED MUZZLE VEL. fps	ACCURACY, PROBABLE ERROR M VERT.	ACCURACY, PROBABLE ERROR M HORZ.	CALCULATED FORM FACTOR
6	T64	2425	.17	.34	1.146 G_1
10	T170E3	2535	.35*	.33	.964 G_1

* Center of impact 7.3 inches above the center of impact of the T64 Shell.

b. Lots PAE-9445 and 9554 Reference sheet 6 of F.R. P-52674

8	T170E3	2534	.27	.14	-
9	T170E3	2517	.15	.17	-

5. From the data above, BRL calculated the velocity of the T170E3 shell required to match the T64 shell at 1,000 yards range to be 2570 fps. However, the centers of impacts of the two shell in the accuracy tests indicates that the two shell will not match at a muzzle velocity of 2400 fps for the T64 shell and a muzzle velocity of 2570 for the T170E3 Shell.

6. The following uniformity data (pressure vel.) was obtained from the accuracy firings of the test T170E3 (Inert) shell.

RDS. CONS.	SHELL TYPE	SHELL AVG. WT. lbs.	MUZZLE VELOCITY fps CORRECTED MEAN	MD	MAX. DISP.	PRESS. psi/100 CORRECTED MEAN	MD	MAX. DISP.	PROPELLANT LOT NO.	PROPELLANT WT. oz.
9	T64	15.00	2415	4.00	16	266	4.56	18	12233	56.8
10	T170E3	9.94	2524	7.10	22	192	3.40	12	5566	45.0

Components (Test Rounds) T19, Cartridge Case
M58, (400 grain) Primer

REMARKS: Propellant was loose loaded w/o igniter or distance wadding. All rounds were flashless. A charge has not been recommended because of questionable matching velocity required.

7. The following results were obtained from firing the T170E3, A3 loaded shell with Inert, BD, M91 fuzes against 3" armor plate at 0° obliquity.

NO. RDS. FIRED	AVG. MUZZLE VEL. fps	RDS. WITH VISIBLE SHELL FLASH *	RDS. WITH CAMERA FLASH**	OTHER***
3	1362	0	0	3
5	1529	1	3	1
4	1651	2	1	1
3	1907	2	1	0

* A definite deflagration and/or low order detonation as observed by personnel near gun position and confirmed by photographs.

** A flash not visible to the eye, but plainly visible on the photographic film. These flashes appear on the film within .1 milliseconds of shell impact with the armor, and last for a period of at least 1.0 milliseconds indicating burning of the shell filler.

*** Very small or no flash observed on the photographic film.

(Reference Photograph Nos. A-83358 to A-83364)

NOTE: The above groups indicate that as the striking velocity increases the functioning intensity of the shell filler (A3) increases. This functioning is independent of any fuze action. There were no plate spalls on any rounds.

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a. From the results of the above armor plate firings it is indicated that the shell filler (A3) is being consistently ignited on shell impact with the armor plate when striking at velocities above approximately 1500 fps. It is believed that on striking the armor plate it is probably the wax component of the shell filler that is being ignited (within .1 mil sec.) possibly by sparks caused by metal to metal contact. However, the scattering of the filler particles into a dust may induce a flash burning. In either event indications are that the flash may develop into a more severe burning (deflagration) and disappears or continues the deflagration to such intensity that it becomes a low order detonation (or visa versa). It is believed that the increased heat generated on shell impact with a plate when fired at the higher velocities is responsible for the increase in the number of deflagrations and low order detonations, without plate spalling, observed at the 1900 fps velocities.

b. When firing the above shell with A3 filler and live BD, M91 fuzes at velocities above 1500 fps spalling of the armor plate is believed to be accomplished by the detonation of the fuze before the flash started on impact has had time to progress into deflagration or low order functioning as with inert fused shell.

8. The following uniformity data presents a summary of the results comparing the 300 grain T70 and the 150 grain M31A2 primers at -65°F.

SHELL TYPE	NO. OF RDS.	VELOCITY fps MEAN	MAX DISP	MD	PRESSURE psi MEAN	MAX	MD
T70	20	2263	47	6	17200	2500	600
M31A2	20	2265	25	10	17200	2700	500

IV CONCLUSIONS

A. From the results of the tests conducted with the Shell, HEP, T170E3 it is concluded that:

1. The shell will withstand chamber pressures of at least 30,000 psi.

2. The shell are considered reasonably accurate to a range of 1000 and 1500 yards.

3. The shell will not defeat 4 inch armor plate with a Charpy value of 61 ft-lbs. (at -40°) when placed at 60° obliquity and fired against at a striking velocity of 1493 to 2472 fps.

4. The shell will defeat 3" armor plate with a Charpy value of 30.75 ft. lbs. (at -40°) when placed at 60° obliquity and fired against at a striking velocity of 1403 to 2411 fps.

5. The shell will defeat 3" armor plate with a Charpy value of 30.75 ft. lbs. (at -40°) when placed at 0° obliquity and fired against at a striking velocity of 1388 to 1789 fps.

6. The shell filler (A3) will detonate and/or deflagrate on impact with 0° obliquity armor at velocities above 1500 fps when fired in inert fused shell T170E3.

7. A satisfactory propelling charge can be developed with M6 propellant to yield a velocity to match the T64 shell at 1,000 yard range and within the pressure limits of the shell.

8. Either the T70 primer or the 150 grain M31A2 (with screw head) is satisfactory for use with the T170E3 round.

V RECOMMENDATIONS

A. It is recommended that:

1. The T170E3, Shell design be considered satisfactory for final engineering evaluation tests.

2. A more satisfactory shell filler and/or fuze be developed. The filler should possess the general characteristics of conforming to the proper configuration on the armor plate at the time of detonation. Also the shell filler should be of a composition to prohibit its functioning on striking the armor plate until acted upon by the fuse.

Reno M. Black
RENO M. BLACK
Ord. Engineer

APPROVED:

Benjamin S. Goodwin
BENJAMIN S. GOODWIN
Assistant Director for
Engineering Testing
Development & Proof Services

H. A. Hechtol
H. A. HECHTOL
Chief,
Artillery Division

APPENDICES

APPENDIX A - First Memorandum Report on Development of Shell, HEP, T170E3 for 76mm Gun T91.

APPENDIX B - APG Firing Record Nos. P-50600, P-51714, P-52674, and P-55769.

APPENDIX C - Copy Letter APG (C) 471.4/216

Incl 5 to Ltr to Artin dtd 6/27/56

APPENDIX A

First Memorandum Report on Development of Shell, HEP, T170E3 for 76mm Gun T91.

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ORDNANCE CORPS
DEVELOPMENT AND PROOF SERVICES
ABERDEEN PROVING GROUND
MARYLAND

IN REPLY
REFER TO ORDBG-DP-AA Mr.R.B.Black/pow/6136

TO: Chief of Ordnance, Washington 25, D. C., ATTN: ORDTA

TITLE: First Memorandum Report on Development of Shell, HEP, T170E3 for 76mm Gun, T91 - Project No. TA1-5002H.

References: 00 471.13/30 (c)
00 471/1520 (76mm) (c)

1. Introduction

The T170E3 HEP Shell was designed for the 76mm T91 Gun and tests were conducted to determine the satisfactoriness of the round. The tests involved accuracy, flight characteristics, development of propelling charge, armor defeating characteristics and pressure limitations of the shell.

2. Results

a. Inspection of recovered 76mm Shell, HEP, T170E3, Ammunition Lot PA-E-6715 fired as received for 1,000 yard accuracy, revealed that the BD, M91 Fuze (Inert) was a modified fuze resulting in excessive deformation and breaking up of the shell in the gun tube at pressures of approximately 20,000 psi.

b. Limited recovery of shell from ground impact with Fuze, BD, M91 (Inert) indicated that the T170E3 shell will withstand a chamber pressure of at least 30,000 psi without unsatisfactory deformation of the shell.

c. The following results were obtained from firing the subject shell (A3 loaded, BD, M91 fuze) against armor plate.

NO. RDS. FIRED	ARMOR IN. THICK	ARMOR OBLIQUITY DEG.	AVG. STRIKING VELOCITY fps	RDS. SPALLING THE ARMOR OF RDS. CONS.	REMARKS
2	4	60	2472	0 of 2	Bulges
1	4	60	1996	0 of 1	Cracked bulge
1	4	60	1797	0 of 1	Bulge
1	4	60	1493	0 of 1	Bulge
4	3	60	2411	3 of 3	1 bad hit
4	3	60	1802	4 of 4	None
4	3	60	1403	4 of 4	None
3	3	0	1388	3 of 3	None
3	3	0	1798	2 of 2	1 bad hit
2	3	0	1440	2 of 2	None

NOTE: Charpy value of 4" plate was 61 at -40°
Charpy value of 3" plate was 30.75 at -40°

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TO: Chief of Ordnance
SUBJECT: First Memorandum Report on Development of Shell, HEP, T170E3 for 76mm Gun, T91 - Project No. TA1-5002H.

d. The following accuracy results were obtained from tests of the subject (Inert) Shell (Lot PA-E-9207) with rotating band clearance value of .010 inch (diametrical):

NO. RDS. CONS.	SHELL TYPE	UNCORRECTED MUZZLE VEL. fps	ACCURACY, PROBABLE ERROR VERT.	HORZ.	CALCULATION FORM FACTOR G_1
6	T64	2425	.17	.34	1.146
10	T170E3	2535	.35*	.33	.964

* Center of impact 7.3 inches above the center of impact of the T64 Shell.

e. From the data above, BRL calculated the velocity of the T170E3 Shell required to match the T64 Shell at 1,000 yards range to be 2570 fps. However, the centers of impacts of the two shell in the accuracy tests indicates that the two shell will not match at a muzzle velocity of 2400 fps for the T64 Shell and a muzzle velocity of 2570 for the T170E3 Shell.

f. The following uniformity data (pressure vel.) was obtained from the accuracy firings of the test T170E3 (Inert) Shell.

RDS. CONS.	SHELL TYPE	SHELL AVG. WT. lbs.	MUZZLE VELOCITY fps CORRECTED. MEAN	MD	MAX. DISP.	PRESSURE 1/100 CORRECTED MEAN	MD	MAX. DISP.	PROPELLANT LOT	CHG. WT. NO.	oz.
9	T64	15.00	2415	4.00	16	266	4.56	18	12233	56.8	
10	T170E3	9.94	2524	7.10	22	192	3.40	12	5566	45.0	

Components (Test Rounds) T19, Cartridge Case
M58, (400 grain) Primer

Remarks: Propellant was loose loaded w/o igniter or distance wadding. All rounds were flashless. A charge has not been recommended because of questionable matching velocity required.

g. The following results were obtained from firing the T170E3, A3 loaded shell with Inert, BD, M91 Fuzes against 3" armor plate at 0° obliquity.

NO. RDS. FIRED	AVG. MUZZLE VEL. fps	RDS. WITH VISIBLE SHELL FLASH*	RDS. WITH CAMERA FLASH**	OTHER***
3	1362	0	0	3
5	1529	1	3	1
4	1651	2	1	1
3	1907	2	1	0

Remark: There were no plate spalling or face impression on any rounds.

* A difinite deflagration and/or low order detonation as observed by personnel near gun position and confirmed by photographs.

** A flash not visible to the eye, but plainly visible on the photographic film. These flashes appear on the film within .1 mil second of shell impact with the armor, and last for a period of at lease 1.0 mil second indicating burning of the shell filler.

*** Very small or no flash observed on the photographic film.

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TO: Chief of Ordnance
SUBJECT: First Memorandum Report on Development of Shell, HEP, T170E3 for 76mm Gun, T91 - Project No. TA1-5002H

3. Remarks:

a. From the results of the above armor plate firings it is indicated that the shell filler (A3) is being consistently ignited on shell impact with the armor plate when striking at velocities above approximately 1500 fps. It is beleived that on striking the armor plate it is probably the wax component of the shell filler that is being ignited (within .1 mil sec.) possible by sparks caused by metal to metal contact. However, the scattering of the filler particles into a dust may induce a flash burning. In either event indications are that the flash may develop into a more severe burning (deflagration) and disappears or continues the deflagration to such intensity that it becomes a low order detonation (or visa versa). It is believed that the increased heat generated on shell impact with the plate when fired at the higher velocities is responsible for the increase in the number of deflagrations and low order detonations, without plate spalling, observed at the 1900 fps velocities.

b. When firing the above shell with A3 filler and live BD, M91 fuzes at velocities above 1500 fps spalling of the armor plate is believed to be accomplished by the detonation of the fuze before the flash started on impact has had time to progress into deflagration or low order functioning as with Inert fuzed Shell.

4. Conclusions:

a. From the results of the tests conducted with the Shell, HEP, T170E3 it is concluded that:

(1) The shell will withstand chamber pressures of at least 30,000 psi.

(2) The shell are satisfactorily accurate to a range of 1,000 yards.

(3) The shell will not defeat 4 inch armor plate with a charpy value of 61 (at -40°) when placed at 60° obliquity and fired against at a striking velocity of 1493 to 2472 fps.

(4) The shell will defeat 3" armor plate with a charpy value of 30.75 (at -40°) when placed at 60° obliquity and fired against at a striking velocity of 1403 to 2411 fps.

(5) The shell will defeat 3" armor plate with a charpy value of 30.75 (at -40°) when placed at 0° obliquity and fired against at a striking velocity of 1388 to 1798 fps.

(6) The shell filler is not satisfactory in its behavior on impact with the 0° obliquity armor plate at velocities above 1500 fps.

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TO: Chief of Ordnance
SUBJECT: First Memorandum Report on Development of Shell, HEP, T170E3 for 76mm Gun, T91 - Project No. TA1-5002H

(7) A satisfactory propelling charge was developed to yield a velocity to match the T64 shell at 1,000 yard range and within the pressure limits of the shell.

5. Recommendations

a. It is recommended that:

(1) Additional development work be done to improve the armor defeating characteristics of the Shell, HEP, T170E3.

(a) First, a more satisfactory shell filler should be developed. This filler should possess the general characteristics of conforming to the proper configuration of the armor plate at the time of detonation and of the proper composition to prohibit functioning of any degree on striking the armor plate until acted upon by the fuze.

(b) It is believed that until these conditions are met for the striking velocities desired in tank warfare the HEP Shell will be ineffective against the maximum plate thinkness, angles of attack and range of striking velocities for which the shell is believed to be capable.

APPROVED:

BENJAMIN S. GOODWIN
Acting Chief
Arms & Ammunition Division

RENO M. BLACK
Proof Director

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APPENDIX B

Firing Record No. P-50600 with Inclosures
- Letter APG (c) 471/302 with TPR 3219
- Data Card No. 58424 and 58425
- Copy Messageform, dated 6 Feburary 1952
- Report 51-L-231
- Photographs Nos. A75966, A76034, A73795, A74264, A74265 and A74659

Firing Record No. P-51314 with Inclosures
- Data Cards Nos. 58424 and 62108
- BRL Memo dated 24 April 1952
- Target Accuracy Graph of T170E3 Shell
- Messageform
- Propellent Curve

Firing Record No. P-52674 with Inclosures
- Target Accuracy Sheet
- Messageform to ORDTA
- Photographs A81514 thru A81518 and A83357 thru A83364
- Letter APG (c) 471/804 with 1st Ind. TPR-3418
- Data Cards Nos. 62545 and 62543

Firing Record No. P-55769 with Inclosure
- Copy of Letter APG 471.1/1321

DEVELOPMENT AND PROOF SERVICES
ABERDEEN PROVING GROUND, MARYLAND
FIRING RECORD

OBJECT OF TEST: To determine the Ballistic and Armor defeating characteristics of Shell, HEP, T170E3 for the 76mm Gun T91. (U)

DATES OF TEST: FROM: 14 Nov. 1951 TO: 9 Feb. 1952
FIRING RECORD NO: P-50600
SHEET 1 OF 8
O.O. FILE NO: 471.13/30 (c)
APG NO: (c) 471/302

DEVELOPMENT:
Project TA1-5002H

bjw

MATERIEL

Weapons:

(1) 76mm Gun, T91E3 No. 275 with 76mm Gun tube No. 24100 mounted on 90mm M1A1 carriage No. 4322.

(2) 76mm Gun, T91E3 No. 5 with 76mm Gun tube No. 24565 mounted on fixed APG pedestal mount.

(3) 76mm Gun T91E3, No. 426 with T91E3 Tube No. 25181 mounted on Modified 90mm M1 mount.

(4) 76mm Gun T91 No. 3 with T19E3 Tube No. 25183 mounted on fixed APG pedestal mount.

Armor Plate:

(1) Rolled Homogeneous 4-inch plate No. 012854 with BHN value of 283, Charpy V notch value of 61 ft lbs at -40°.

(2) Rolled Homogeneous 3-inch plate No. 09784A with BHN value of 291, Charpy V notch value of 30.75 ft lbs at -40°.

Ammunition:

Test:

(1) 76mm Shell, HEP, T170E3 (Inert) with Fuze BD, M62A1 (Inert rejects). Ammunition Lot PA-E-6715 (Fired for recovery and time of flight as received from PA)

(2) 76mm Shell, HEP, T170E3, (A3 loaded) with Fuze BD, M62A1 Ammunition Lot PAE-6716 (fired as received from PA against armor plate)

(3) 76mm Shell, HEP, T170E3, (A3 loaded) re-assembled with Fuze BD M91 (Inert) at APG. Ammunition Lot PA-E-6716 (Fired for recovery).

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FIRING RECORD NO: P-50600
SHEET 2 OF 8

Stock:

PROPELLANT:

(1) Propellent, MP, M1, Lot RAD-9308 for 57mm Gun (Web .0295").

(2) Propellant, MP, M6+1, Lot C-RAD-2001 (Web .0368").

(3) Propellent, MP, M6 Lot OKL-16050 (Web .0330").

Shell: 15.00 lb. Shell, HE, T64 with Fuze PD, M51A5, for 90mm Gun. Inert loaded with barium sulphate, red lead and paraffin. Metal parts Lot CSP-1-35.

Case: Cartridge, T19E1, 76mm, various lots. (New)

Primer: 400 grain, Percussion, M58 Lot 73-10 and KOP-SR-106.

ROUND-BY-ROUND DATA

The following T170E3 rounds were fired from 76mm Tube No. 24565 into sawdust for recovery. Date Fired: 14 November 1951.

TUBE RD. NO.	PROJECTILE SAMP NO.	PROJECTILE LOT NO.	PROJECTILE WT. lbs.	PROPELLANT LOT NO.	PROPELLANT CHG. WT. oz.	INST. VEL. fps	PRESSURE psi/100 (1)	PRESSURE psi/100 (2)	REMARKS
1*	4	6715	9.92	2001	56	2571	191	196	Round hole in chip board.
2	5	6715	9.95	2001	64	2842	253	240	Recovered (Ref. Photos. A74265, A74264)
3	6	6715	9.94	2001	72	3129	321	312	Yaw observed.
4	7	6715	9.96	2001	76	Lost**	366	365	Shell broke up in gun tube.
5	8	6715	9.92	2001	68	Lost	281	276	Shell broke up in gun tube.
6	10	6715	9.94	2001	62	Lost	235	237	Recovered Ref. Photo A74659.

* Tube No. 24565 was a new tube (proof rounds fired unknown).
** Velocity coil damage by shell fragaments.

Remarks: A chip board target was placed on the front end of the sawdust recovery box to indicate shell yaw. (400 ft. from Gun). Muzzle flash was noted on tube round Nos. 2 and 6; no unburned powder was observed in the tube. The breaking up of the shell (tube round Nos. 4 and 5) did not damage the gun tube. NOTE: The breaking up of the shell was later contributed to rejected base fuzes (see accuracy and time of flight tests). Reference photograph Nos. A74659, A74265, A74264, A75966, A76034 and A73795. Sample No. 4 was difficult to chamber in the gun tube.

FIRING RECORD NO: P-50600
SHEET 3 OF 8

The following T170E3 rounds were fired from 76mm Gun tube No. 25181 for recovery from ground impact (8100 yds). Date Fired: 25 Jan. 1952.

TUBE RD. NO.	PROJECTILE SAMP NO.	PROJECTILE LOT NO.	PROJECTILE WT. lbs.	PROPELLANT LOT NO.	PROPELLANT CHG. WT. oz.	QUAD. ELEV. M	PRESSURE psi/100 (1)	PRESSURE psi/100 (2)	REMARKS
166	1A	6716	9.82	16050	55	410	210	214	HO on field (short)
167	2A	6716	9.73	16050	55	420	214	219	HO on field (100 yd. short)
168	1B	6715	9.95	16050	55	430	222	226	Not observed.
169	4A	6716	9.95	16050	55	430	222	221	Reported short of field.
170	5A	6716	9.94	16050	58	430	243	244	Reported over field.
171	2B	6715	9.89	16050	58	430	228	232	Not heard.
172	3A	6716	9.90	16050	60	420	256	242	HO center of field.
173	6A	6716	9.92	16050	60	420	261	263	Believed short of field.
174	7A	6716	9.99	16050	60	420	267	270	Reported over field.
175	8A	6716	9.99	16050	62	380	280	289	On field (Recovered)
176	9A	6716	9.82	16050	64	370	290	302	Long on field (Recovered)
177	10A	6716	10.00	16050	66	355	331	331	Reported over field.

REMARKS: Sample Nos. 1B and 2B were Inert loaded T170E3 shell with Inert BD, M62A1 Fuzes. Samples Nos. 1A, 2A and 3A were A3 loaded T170E3 shell with line BD, M62A1 Fuzes. All other rounds were A3 loaded T170E3 shell re-assembled at APG with BD, M91 Inert fuzes.

Samples Nos. 8A and 9A were recovered. Reference photograph No. A75966.
Velocities were not taken on any rounds.
Muzzle flash was not observed on any rounds.
No unconsumed propelling powder was observed in the gun tube.
All rounds chambered and fired satisfactorily.

The improvised gun mount for the T91 tube did not provide for sighting equipment and the laying of the piece was difficult. However, all projectiles with live fuzes (spotting rounds) were observed to hit consistently on the field indicating stability of those rounds. Possibly the inert rounds hit on the recovery field but were difficult to observe.

From these tests it is indicated that the A3 filled T170E3 Shell will withstand a chamber pressure of 30,000 psi satisfactorily. However, previous firings of HEP shell indicates that the simulated C4 filled shell will not withstand as much chamber pressure as will the A3 loaded shell.

The following rounds were fired from the 76mm T91 Gun for accuracy and time of flight.

Date Fired: 1 Feburary 1952
High-Velocity Range.

Distances: Gun Muzzle to Target = 2990.0 ft.
Gun Muzzle to 1st Coil = 95.52 ft.
Between Coils = 48.35 ft.

Metro data was taken at the gun position by the Metro Section (APG).

Shell HE, T64 for 76mm Gun (Reference Rds.) and Shell HEP-T170E3 (Test Rds.)

TUBE RD. NO.	PROJECTILE TYPE	PROJECTILE WT. lbs.	PROPELLANT LOT NO.	PROPELLANT CHG. WT. oz.	TIME FIRED	SUPER-ELEV. fps	COIL TIME**	INST. VEL. fps	MUZZLE VEL. fps	PRESS. psi/100	TIME OF FLIGHT sec.	DISP. MEAS. (ins.) VERT.	DISP. MEAS. (ins.) HORZ.	REMARKS
13	T64	14.99	12223	56.8	1332	12	2090	2313	2323	Not Taken	Missed	—	—	Under Target
14	T64	14.99	12223	56.8	1341	14	2049	2362	2372	"	1.30669	Disregarded		Good hit (Low to Left)
15	T64	14.99	12223	56.8	1355	15	2045	2364	2374	"	1.30462	85	68	
16	T170E3	9.92	16050	55.0	1403	15	1801	2685	—	216	1.27971	153	50	
17	T170E3	9.95	16050	52.0	1419	15	1871	2584	—	203	1.31715	140	60	
18	T64	14.99	12223	56.8	1330	15	2052	2356	2366	Not Taken	Lost	77	69	
19	T64	14.99	12223	56.8	1432	15	2048	2361	2371	"	1.30517	77	60	
20	T64	14.99	12223	56.8	1435	15	2043	2367	2377	259	1.30331	85	64	
21	T64	14.99	12223	56.8	1437	15	2041	2369	2379	254	1.30231	85	51	
22	T64	14.99	12223	56.8	1440	15	2049	2360	2370	266	1.30922	80	67	
23	T64	14.99	12223	56.8	1444	15	2037	2374	2384	248	1.29739	69	70	
24	T64	15.00	12223	56.8	1445	15	2050	2359	2369	258	1.30869	Disregarded		(Fired before sighting)
25	T64	14.99	12223	56.8	1450	15	2053	2355	2365	Not Taken	1.31019	68	57	
26	T170E3	9.83	16050	52.0	1454	15	1863	2595	—	195	1.31166	162	66	
27	T170E3	9.90	16050	52.0	1459	15	Lost	Lost	—	191	—	—	—	Shell broke up in gun tube.
28	T170E3	9.90	16050	52.0	1537	15	1903	2541	—	189	Missed	—	—	Shell tumbled (fell short)*
29	T170E3	9.80	16050	52.0	1542	15	1887	2562	—	189	1.33956	141	48	Yaw observed.
30	T170E3	9.92	16050	52.0	1544	15	1887	2562	—	193	1.34291	127	48	Excessive shell yaw observed.
31	T170E3	9.92	16050	52.0	1549	15	1906	2537	—	186	1.80391	28	69	12" oblong shell hole in target.
32	T170E3	9.91	16050	55.0	1554	15	1804	2680	—	215	Lost	158	63	Yaw observed.
33	T170E3	9.91	16050	48.0	1555	15	1811	2670	—	212	Missed	—	—	Shell tumbled (fell short)*

** Mil sec. X 100

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* Two shell recovered at target site revealed that inadequate base fuzes allowed gun chamber gasses to enter the shell and excessively expand the shell causing the shell to be erratic in flight and break up in the gun tube. (Reference Photograph No. A76034)

NOTE: All dispersion measurements were taken from the left edge and bottom of the 15x15 ft. target.

REMARKS:

These data were presented to the Firing Table Branch of the Ballistic Research Laboratories with the precaution that only the data obtained from firing the T64 HE shell were valid.

Subsequent examination of the two recovered shell from the accuracy firings revealed that in addition to the two spanner wrench indents the fuze had two other holes that extended through the fuze to the shell filler. These holes permitted the chamber gasses to pass into the shell body breaking up one shell in the gun tube and excessively expanding other shell resulting in very erratic shell flight. (Reference Photo No. A76034.

It was recommended by messageform to OCO (dated 6 Feb. 1952). That additional inert solid filled (simulated A3) HEP, Shell, T170E3 with Inert fuze BD, M91, be sent to APG for accuracy and propelling charge establishment tests.

From these firings it is indicated that in establishing a propelling charge for the A3 loaded T170E3 Shell a propelling powder, M6, (Web .030) MP, similar to Lot RAD-16216, would yield the muzzle velocity required to match the T64 shell at 1000 yards range and within the pressure limits of the shell. The muzzle flash noted on 50% of the rounds fired in these tests using powder lot 16050 (Web .0330) may also be eliminated by using the smaller web propellant.

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FIRING RECORD NO: P-50600
SHEET 6 OF 8

The following rounds were fired against armor from 76mm T91 Tube No. 24100.
Date Fired: 9 February 1952

TUBE RD. NO.	TIME OF FIRING	PROPELLING CHARGE WT. oz.	STRIKING VELOCITY fps	ARMOR PLATE	FUNCTIONING
904	1002	50.0	2455	4" at 60°	90° Crack Bulge
905	1014	50.0	2489	4" at 60°	Small Bulge
906	1025	37.0	1996	4" at 60°	120° Crack Bulge
907	1036	32.0	1797	4" at 60°	Small Bulge
908	1048	24.0	1493	4" at 60°	Small Bulge
909	1109	48.5	2408	3" at 60°	Spall, 7x7x7/8"
910	1126	48.5	2405	3" at 60°	Spall, 7 1/8x7 1/4x1 1/4"
911	1138	48.5	2413	3" at 60°	Spall, 7 1/4x6 1/4x1"
912	1145	48.5	2419	3" at 60°	Bad Hit Spall
913	1311	32.25	1807	3" at 60°	Spall, 8x6 1/2x1"
914	1323	32.25	1799	3" at 60°	Spall, 8x6 1/2x1 1/4"
915	1327	32.25	1798	3" at 60°	Spall, 8 1/4x6x1"
916	1340	32.25	1800	3" at 60°	Spall, 9 3/4x7 1/2x1 1/8"
917	1346	22.0	1401	3" at 60°	Spall, 1 3/4x5 1/2x1"
918	1349	22.0	1403	3" at 60°	Spall, 9x5 1/2x1"
919	1358	22.0	1407	3" at 60°	Spall, 8 3/4x6 1/4x1"
920	1403	22.0	1400	3" at 60°	Spall, 7 3/4x6 1/2x1"
921	1427	22.0	1383	3" at 0°	Spall, 7x7 3/4x3/4"
922	1435	22.0	1387	3" at 0°	Spall, 6x6 1/2x1 1/4"
923	1445	22.0	1392	3" at 0°	Spall, 7 1/4x7 1/2x1/2"
924	1455	32.25	1798	3" at 0°	Spall, 8x8 1/2x3/4"
925	1503	32.25	1796	3" at 0°	Spall, 8x8x1/2"
926	1508	32.25	1800	3" at 0°	Bad Hit Spall
927	1515	17.0	1245	3" at 0°	Spall, 7x7x1/2"
928	1520	17.0	1236	3" at 0°	Spall, 6 3/4x6 3/4x1/2"

REMARKS:

Propellant, MF[illegible], M1, Lot RAD-9308 (Web .0295) was used in firing all rounds.

The available supply of armor at APG did not permit the selection of armor with the specified Charpy values of 50 ft. lbs at -40°.

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SUMMARY

From the results of these firings the following summary is presented.

Recovery Tests:

Samples of Shell, HEP, T170E3 (Inert) ammunition Lot PA-E-6715 were fired at pressures of 19,400 to 36,600 psi for sawdust recovery. Results were invalid because of inadequate fuzing of the shell. Samples of Shell, HEP, T170E3 (A3 loaded) ammunition Lot PA-E-6716 were fired at pressures of 21,200 psi to 33,100 psi. Two shell fired at chamber pressures of 28,400 and 29,600 psi (recovered from ground impact) indicated that the A3 filled shell will withstand these pressures satisfactorily.

Accuracy and Time of Flight Tests:

Due to the inadequate fuzing of the T170E3 projectiles used in these firings the data is considered invalid.

Distortion of the test shell when fired resulted in very erratic flight of the test shell.

FIRING RECORD NO: P-50600
SHEET 8 OF 8

Armor Plate Tests: Ammunition Lot PAE-6716

ROUNDS FIRED	ARMOR THICK in.	ARMOR OBLIQUITY deg.	AVG. STRIKING VELOCITY fps	ROUNDS SPALLING PLATE OF ROUNDS CONSIDERED	REMARKS
2	4	60	2472	0 of 2	Bulges
1	4	60	1996	0 of 1	Cracked bulge
1	4	60	1797	0 of 1	Bulge
1	4	60	1493	0 of 1	Bulge
4	3	60	2411	3 of 3	1 Bad Hit
4	3	60	1802	4 of 4	None
4	3	60	1403	4 of 4	None
3	3	0	1388	3 of 3	None
3	3	0	1798	2 of 2	1 Bad Hit
2	3	0	1440	2 of 2	None

This firing record forms a part of Twenty-First Report on Project TA1-5002H.

APPROVED:

H. A. Bechtol
H. A. BECHTOL
Chief,
Artillery Division

H. B. Anderson
H. B. ANDERSON
Chief, Artillery
Ammunition Branch

Reno M Black
RENO M. BLACK
Proof Director

INCLOSURES:

1. OO File 471.13/30(c)
2. Data Card No. 58424 and 58425
3. Report 51-L-231
4. Photograph Nos. A75966, A76034, A73795, A74264, A74265 and A74659
5. Copy - Messageform dated 6 Feburary 1952

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RING RECORD NO: P-50600
Inclosure No. 2

O.O. 471.13/30(c) 1st Ind ERCaponi/bjw/53401
ATTN: ORDTA
ORDTBB-T 471.1211/176
APG (c) 471/302

Dept Army, Ord O, Washington 25, D. C.

TO: Commanding General, Aberdeen Proving Ground, Maryland

1. This correspondence authorizes your Proving Ground to conduct tests of Shell, HEP, T170E3 in Gun, 76-mm, T91, requested in Test Program Request No. 3219 under Project TA1-5002H.

2. Your attention is called to paragraph 10c of the inclosed TPR which requests an accuracy and time of flight test at 1000 yards against a vertical target. Upon completion of test in paragraph 10a, it is requested that an optimum charge be selected to yield a muzzle velocity that will match Shell, HE, T64 (MV 2400 fps) at 1000 yds. It is estimated that the muzzle velocity required for the match will be approximately 2550 fps. The accuracy test is to be conducted using the muzzle velocity required for the match. This test may also serve as a velocity uniformity test for the established charge.

3. Your attention is called further to paragraph 10b of the inclosed TPR which requests plate tests. It is requested that the tests be modified as follows:

Test No.	No. Rds.	Plate Thickness/Obliquity	Striking Velocity
1	4	4"/60°	2400 fps
2	4	4"/60°	1800 fps
3	4	4"/60°	1400 fps
4	4	4"/0°	1400 fps
5	2	4"/0°	1800 fps
6	3	3"/0°	1800 fps

If the 4" plate is not defeated, repeat the test using 3" plate. If tests 1, 2, and 3 are successful, fire remaining shell under same conditions to substantiate data.

4. Tests may be altered at the discretion of the proof director. Costs may be charged to RAD Order ORDTA 1-12235.

BY COMMAND OF MAJOR GENERAL FORD:

/s/ John C. Raaen, Jr.
/t/ JOHN C. RAAEN, Jr.
Maj, Ord Corps
Assistant

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n/c (2 copies w/d)

CC
Picatinny Arsenal

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ORDNANCE CORPS
PICATINNY ARSENAL
DOVER, NEW JERSEY

IN REPLY
REFER TO: ORDBB-T 471.1211/176
APG (c) 471/302

PMRusso/bjw/2194

SUBJECT: Test Program Request No. 3219 for Shell, HEP, 76mm, T170E3

TO: Chief of Ordnance
Dept of the Army
Washington 25, DC
ATTENTION: ORDTA

1. The following shell will be shipped to Aberdeen Proving Ground during the week of 16 July 1951.

No. of Shell	Designation	Lot Number
35	Shell, HEP, 76mm, T170E3 w/Fuze BD, M62A1	PA-E 6716
25	Shell, HEP, 76mm, T170E3, inert loaded, w/Fuze, BD, M62A1, inert loaded	PA-E 6715

2. Enclosed, in triplicate, is Picatinny Arsenal Test Program Request No. 3219 covering firing of the above shell. The Proving Ground has been advised that final instructions for this test will be supplied by the Chief of Ordnance.

FOR THE COMMANDING OFFICER:

/s/ C. R. Dutton
/t/ C. R. DUTTON
Col, Ord Corps
Assistant

1 Incl
1. TPR No. 3219 (in trip)

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P'Russo/bjw/2194
Test Program Request No. 3219
Picatinny Arsenal, Dover, NJ
17 July 1951

APG (c) 471/302 Incl 1

1. Material for Test:

Number of Shell	Designation	Lot Number
35	Shell, HEP, 76mm, T170E3, w/Fuze, BD, M62A1	PA-E-6716
25	Shell, HEP, 76mm, T170E3, Inert Loaded, w/Fuze, BD, M62A1, Inert Loaded	PA-E-6715

2. Project Authority:

a. Project No. TA1-5002H

b. Order No. (RAD ORDTA 1-12145-1)

3. Arsenal Expenditure Order No.

153-87

4. Object of Development or Experiment:

Long range program for development of armor defeating ammunition.

5. History Sketch:

The Shell, T170E3 is patterned after the Shell, HEP, 76mm, T169E1 previously fired at Aberdeen Proving Ground, excepting that the Shell, T170E3 is of a one piece design and has a different rotating band. The subject shell is the first of the T170, HEP Shell series for the 76mm, T91 and T94 Guns, to be tested.

6. Description in Detail of Improvements Made Since Last Proving Ground Test:

No other tests on subject shell have been made.

7. Local Tests:

No local tests on subject shell have been made.

8. Object of Test:

To determine the maximum pressure shell can withstand without engraving bourrelet, effectiveness against armor plate, accuracy and time

TPR No. 3219 (contd)

of flight at most effective spalling velocity.

9. Precautions in Handling and Testing:

The usual precautions in handling live loaded shell should be observed.

10. Recommended Test Program:

a. Recovery Test:

It is requested the 10 each Shell, HEP, 76mm, T170E3, Lot No. PA-E-6715 be fired for recovery as follows: Fire 2 each Shell, T170E3 at 26,500 psi. The remaining shell are to be fired at increased pressures. The increment of pressure to be at the discretion of Aberdeen Proving Ground, until there is evidence of shell failure.

b. Plate Test:

It is requested that the following Shell, HEP, 76mm, T170E3, Lot No. PA-E-6716 be fired against homogenous armor plate having charpy value of approximately 50 ft.-lb. at -40°F.

Number of Rounds	Plate Thickness	Striking Velocity	Angle of Obliquity
4	3"	1400	0°
4	3"	1400	60°
4	3"	1800	0°
4	3"	1800	60°
4	3"	2200	0°
5	3"	2200	60°
5	3"	2400	0°
5	3"	2400	60°

c. Accuracy Tests:

It is requested the 15 each Shell, HEP, 76mm, T170E3, Lot No. PA-E-6715 be fired against a vertical target at 1,000 yards for accuracy and time of flight. The striking velocity at which shell are to be fired should be that striking velocity which results in the maximum number of spalls as indicated in the above plate test.

11. Reference:

Letter from Chief of Ordnance to Picatinny Arsenal, 26 August 1950, O.O. 471/137(c) (ORDBB 471.14/975.94).

TPR No. 3219 (contd)

12. Coordination:

Chief of Ordnance

Aberdeen Proving Ground

Picatinny Arsenal

/s/ C. R. Dutton
/t/ C. R. DUTTON
Col, Ord Corps
Assistant

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LABORATORY SERVICE DIVISION
PHYSICAL TEST LABORATORY REPORT

ORDBG-DFC

TEST OF:

Three (3) 76 mm G Inert Comp. C-3 Shell, T170E3 W/Fuze, BD, M62A1 Inert, Lot PA-E-6715, Before Firing.

Report No. 51-L-231

Sheet 1 of 1

Date of Test 8 Nov. 1951

Report Complete 28 Nov. 1951

Conducted for A & A Division

Mr. R. Black

Project No. TA1-5002

Work Order No. 1023-1-8-1

References O.P.M. 40-31

Para. 4 & 5

OBJECT OF TEST:

To determine the weight, center of gravity, moments of inertia and critical physical measurements of subject shells.

TEST PROCEDURE:

1. Instrumentation:
Torsion pendulum; scope; test masses; electric stop clock: center of gravity trough: parallel blocks; weighing scale; micrometer calipers; height gauge.

2. Procedure:

a. Bourrelet diameters and the total lengths of the shells were measured and dimensions were recorded.

b. All the shells were weighed and their weights recorded.

c. The shells were placed in a specially constructed trough, which was previously balanced on parallel blocks. The shells were then balanced in the trough and the distances from the base to the center of gravity were measured.

d. The moments of inertia of the three (3) shells were determined by measuring the periods of rotation on the torsion pendulum.

RESULTS:

	Shell Numbers 1	2	3
Weight (lbs.)	9.97	9.92	9.83
Center of Gravity (Ins. from Base)	4.01	4.03	4.03
Moments of Inertia- Axial (lb.-in.^{2})	12.9034	12.9034	12.7447
- Transverse	94.6426	94.6426	95.0396
Total length (Ins.)	11.408	11.422	11.435
Diameter of Bourrelet (Ins.)- Vert.	2.990	2.992	2.993
Hor.	2.990	2.992	2.993

For method of computing moments of inertia see Appendix I.

1 Incl
Appendix I

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Approved: _____
J. M. McKinley,
Chief,
Physical Test Laboratory.

Signed: _____
D. Lee Seagle,
Measurements Section.

76 mm G Inert Comp. G-3 Shell, T170E3 W/Fuze, BD, M62A1 Inert Lot PA-5-6715

Axial

$I_H = K t^2_{ML} - I_{ML}$

$I_H = K t^2_{MS} - I_{MS}$

$I_H = K(46.7124) - 8.5915$

$I_H = K(28.8369) - 4.1931$

$17.6755K = 4.3984$

$K = .24884161$

$I_H = (.24884161)(46.7124) - 8.5915$

$I_H = 11.6742 - 8.5915$

$I_H = 3.0827$

$I_H = (.24884161)(28.8369) - 4.1931$

$I_H = 7.1758 - 4.1931$

$I_H = 2.9827$

$I_P = K t^2_P - I_H$

$I_P = (.24884161)(63.8401) - 3.9827$

$I_P = 15.8861 - 3.9827$

$I_P = 12.9034$

Key:

I_M = Moment of Inertia, Test Mass
I_P = Moment of Inertia, Projectile
I_H = Moment of Inertia, Holder
t = Time of Swing, Test Mass
t_P = Time of Swing, Projectile
K = Constant

76 mm (Inert Comp. C-3 Shell, T170E3 W/Fuze, BD, M62A1 Inert Lot HA-E-6715

Transverse

$I_H = K\,t^2_{ML} - I_{ML}$

$I_H = K\,t^2_{MS} - I_{MS}$

$I_H = K\,(410.8729) - 98.1430$

$I_H = K\,(177.1561) - 39.9833$

$233.7168K = 58.1597$

$K = .24884689$

$I_H = (.24884689)(410.8729) - 98.1430$

$I_H = 102.2444 - 98.1430$

$I_H = 4.1014$

$I_H = (.24884689)(177.1561) - 39.9833$

$I_H = 44.0847 - 39.9833$

$I_H = 4.1014$

$I_P = K\,t^2 - I_H$

$I_P = [illegible]\,(396.8064) - 4.1014$

$I_P = 98.7140 - [illegible].014$

$I_P = 4.[illegible]26$

Appendix I

FIRING RECORD NO: P-50600
Inclosure No. 1

6 FEBRUARY 1952

MAIL MAIL

CG, APG, MD.

CHIEF OF ORDNANCE
WASHINGTON 25, D. C.

ATTN: MR. E. R. CAPONI

CO, PICATINNY ARSENAL, DOVER, NEW JERSEY, ATTN: ORDBB-T

INSPECTION OF RECOVERED 76MM SHELL, HEP, T170E3, INERT LOADED, (AMMUNITION LOT PA-E-6715) FIRED AS RECEIVED FOR ACCURACY AS OUTLINED IN TPR 3219 REVEALED THAT THE BD FUZE INERT WAS A MODIFIED FUZE.

IN ADDITION TO THE TWO SPANNER WRENCH INDENTS THIS FUZE HAS TWO HOLES IN THE BASE THAT EXTENDS THROUGH THE FUZE TO THE SHELL FILLER. THESE HOLES PERMITTED THE CHAMBER GASES TO PASS INTO THE SHELL BODY BREAKING UP ONE SHELL IN THE GUN TUBE AND EXCESSIVELY EXPANDING OTHER SHELL RESULTING IN VERY ERRATIC SHELL FLIGHT AT APPROXIMATELY 2600 FPS VELOCITY AND 19000 PSI PRESSURE.

RECOMMEND ADDITIONAL INERT SOLID FILLED (SIMULATED A3) HEP, SHELL, T170E3 WITH INERT M91 FUZE (DWG. 73-2-239) BE PREPARED AND FIRED FOR ACCURACY AND PROPELLING CHARGE ESTABLISHMENT END ORDBG-DPD BLACK.

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EMBlack/asp

ORDBG-DPD 6136

JOHN D. ARMITAGE, COLONEL, ORD CORPS
CHIEF, ARMS & AMMUNITION DIVISION

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DEVELOPMENT AND PROOF SERVICES
ABERDEEN PROVING GROUND, MARYLAND
FIRING RECORD

OBJECT OF TEST: Accuracy and Time of Flight of Shell, HEP-T, 76mm, T170E3. (U)

DATE OF TEST: 14 April, 1952
FIRING RECORD NO: P-51314
SHEET 1 OF 5
O.O. FILE NO: 471.13/30 (c)
APG FILE NO: (c) 471/302
W.O. NO: 1023-198-1

DEVELOPMENT - ORDTA
Project TA 1-5002H
Related Firing Record No. P-50600

bjw

MATERIEL

Gun, 76mm, T91E3, No. 820
Tube, 76mm, T91E3, No. 24959
Mount, Proof No. 1

AMMUNITION

Reference Rounds

Shell, HE, T64, Inert, Lot MVD-1-5
Propellant, MP, M6, Lot OKL-12233-43, Web .0368 in., Charge Wt. 56.8 oz.
Fuze, PD, M51A5, Inert, Lot JA-2-8
Primer, Perc., 400 grain, M58, Lot PA-73-21
Case, Cart., T19, various Lots, washed and resized

Test Rounds

Shell, HEP-T, T170E3, Inert, Lots PA-E-9207 (PA-E-6715 w/APG Inert Fuze, Rds. 26 and 27)
Propellant, MP, M6, Lot PA-E-5566, Web .0291 in.
Fuze, BD, M62A1, Inert, Lots unknown
Primer, Perc., 400-grain, M58, Lot PA-73-21
Case, Cart., T19, various Lots, washed and resized

FACILITIES

Camera and counter chronographs, Time of Flight screen.

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ROUND-BY-ROUND DATA

The following rounds were fired at Barricade 1 on 14 April, 1952, with 76mm T91 Gun.
Distances: Gun to 1st Coil - 75.15 ft, Between Coils - 74.75 ft, Gun Muzzle to Target - 2990.4 ft.
Shell, HE, T64 for 76mm Gun (Reference Rds) and Shell, HEP-T170E3 (Test Rounds)

TUBE RD. NO.	PROJECTILE TYPE	PROJECTILE WT. lbs.	PROPELLANT LOT NO.	PROPELLANT CHG. WT. oz.	TIME FIRED	SUPER ELEV. ∡	COIL TIME	INST. VEL. fps	MUZZLE VEL. fps	PRESS. psi/100	TIME OF FLIGHT** sec.	DISP. MEAS. inches* VERT.	DISP. MEAS. inches* HORZ.	REMARKS
4	T64	15.02	12233	56.8	1030.	15	3186	2345	2355	264	Missed	—	—	Short of Target
5	T64	15.01	12233	56.8	1102	18	3110	2405	2415	260	—	—	—	Wide - Gun Reset
6	T64	15.01	12233	56.8	1111	18	3103	2410	2420	262	—	—	—	Wide - Gun Reset
7	T64	15.00	12233	56.8	1127	18	3088	2421	2431	270	—	—	—	Wide - Gun Reset
8	T64	14.98	12233	56.8	1154	18	3097	2414	2424	272	1.27996	97	45	
9	T64	15.00	12233	56.8	1200	18	3093	2416	2426	270	1.27861	72	60	
10	T64	14.99	12233	56.8	1204	18	3093	2418	2428	278	1.28001	82	37	
11	T64	15.00	12233	56.8	1253	18	3094	2417	2427	275	1.20531	109	46	
12	T64	15.00	12233	56.8	1320	18	3093	2418	2428	273	1.27728	121	54	
13	T64	15.00	12233	56.8	1327	18	3092	2419	2429	276	1.27808	110	37	
14	T170E3	9.95	5566	45.0	1408	18	2999	2493	2521	190	1.36320	123	48	See Target Accuracy Graph Inclosed
15	T170E3	9.98	5566	45.0	1411	18	2973	2513	2541	198	1.35186	136	23	
16	T170E3	9.89	5566	45.0	1440	18	2984	2505	2533	194	1.36003	91	64	
17	T170E3	9.90	5566	45.0	1444	18	2989	2501	2529	190	1.35791	99	46	
18	T170E3	9.94	5566	45.0	1448	18	2971	2516	2544	202	1.35870	126	82	
19	T170E3	9.92	5566	45.0	1450	18	2976	2513	2541	200	1.35277	102	55	
20	T170E3	9.91	5566	45.0	1452	18	2969	2517	2545	201	1.35130	100	64	
21	T170E3	9.96	5566	45.0	1455	18	2988	2503	2531	197	1.36163	79	77	
22	T170E3	9.94	5566	45.0	1458	18	2993	2498	2526	194	1.36669	114	44	
23	T170E3	9.92	5566	45.0	1505	18	2981	2508	2536	198	1.35705	99	35	
24	T170E3	9.99	5566	47.25	1527	—	2894	2583	2611	218	Not Taken	Not Taken		
25	T170E3	9.94	5566	47.25	1530	—	2892	2585	2613	216	" "	"	"	
26	T170E3	10.05	5566	40.5	1532	—	3190	2344	2371	169	" "	"	"	
27	T170E3	9.92	5566	40.5	1534	—	3204	2333	2360	164	" "	"	"	

** Distance was 2915.25 ft.

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FIRING RECORD NO: P-51314
SHEET 2 OF 5

REMARKS

1. Prior to firing, three sample rounds checked on Detroit Testing Machine for band clearance. Indenter used measured 5/16 in. square, load applied was 6500 lb. Average band clearance value was .010 in, mean [redacted] .0053 in.

2. No muzzle flash observed on any test round.

3. No igniter pad used.

4. At charge weight of 45.0 oz. case filled to within 10 in. of top of case.

5. All rounds crimped with eight 7/8 in. crimps.

SUMMARY

1. Accuracy Data

The following accuracy data is presented as a result of the subject firings:

SHELL TYPE	NO. RDS. CONSIDERED	UNCORRECTED MUZZLE VEL. fps	PROB. ERROR-M VERT.	PROB. ERROR-M HORIZ.	CALCULATION FORM FACTOR
T64	6	2425	.17	.34	1.146 G_2
T170E3	10	2535	.35	.33	.964 G_1

2. Uniformity Data

The following uniformity data is presented. All rounds corrected for presence of two M3 pressure gages, and T170E3 rounds are further corrected to an average weight of 9.94 lbs.

SHELL			CORRECTED VEL. - fps			CORRECTED PRESSURE psi/100			PROPELLENT	
TYPE	NO. OF RD. CONS.	AVG. WT - lb.	MEAN	MEAN DEV.	MAX. DISP.	MEAN	MEAN DEV.	MAX. DISP.	LOT	CHG. WT. oz.
T64	9	15.00	2415	4.00	16	266	4.56	18	12233	56.8
T170E3	10	9.94	2524	7.10	22	192	3.40	12	5566	45.0

FIRING RECORD NO: P-51314
SHEET 4 OF 5

3. Recommended Charge

SHELL TYPE	SHELL WT.-lb.	PROPELLENT LOT	PROPELLENT CHG. WT.-oz.	MUZZLE VEL.-fps	PRESSURE psi
T170E3	10.00	PA-E-5566	46.37	2570	20400

OBSERVATIONS

Ten control rounds of HE, T64 were fired at an average corrected velocity of 2415 fps and pressure of 26600 psi. The propellant charge was 56.8 oz. of Lot OKL-12233. The first round was disregarded, and the other nine rounds were fired at a superelevation of 18 mils. The calculated probable error was .17 mils vertical, .34 mils horizontal.

Ten test rounds of HEP, T170E3 were fired for uniformity and accuracy, using 45.0 oz. of Propellent, Lot PA-E-5566. Superelevation for all rounds was 18 mils. The calculated probable error was .35 mils vertical, .33 mils horizontal. Corrected average velocity was 2524 fps, the corresponding pressure being 19,200 psi.

Two test rounds of HEP, T170E3 were fired using 47.25 oz. of Propellant, Lot PA-E-5566. Average uncorrected velocity was 2612 fps, the corresponding pressure being 21,700 psi.

Two test rounds of HEP, T170E3 were fired using 40.5 oz. of Propellant, Lot PA-E-5566. Average uncorrected velocity was 2338 fps, the corresponding pressure being 16,600 psi.

From these firings (Time of Flight Data) the Ballistic Research Laboratory calculated a muzzle velocity of 2570 fps for the T170E3 shell to match the HE, T64 shell (2400 fps M.V.) at 1000 yards range. However, the actual centers of impacts of the accuracy groups in this test indicates that at a muzzle velocity of 2535 fps the T170E3 shell will impact 7.3 in. above the T64 shell fired at a muzzle velocity of 2425 fps. It is therefore recommended that further firings be conducted before a charge be recommended for procurement. On the basis of these firings however, the following charge is tentatively recommended:

FIRING RECORD NO: P-51314
SHEET 5 OF 5

RECOMMENDED CHARGE

SHELL TYPE	SHELL WT. - lb.	PROPELLANT LOT NO.	PROPELLANT CHG. WT. - oz.	MUZZLE VEL. - fps	PRESSURE psi/100
T170E3	10.00	PA-E-5566	46.37	2570	204

This firing record forms a part of Twenty-First Report on Project TA1-5002H.

APPROVED:

H. A. BECHTOL
Chief,
Artillery Division

H. B. ANDERSON
Chief, Artillery
Ammunition Branch

E. L. SIMPSON
1st Lt. Ord Corps
Proof Director

INCLOSURES:

1. Data Cards Nos. 58424 and 62108
2. BRL Memo dated 24 April 1952
3. Target Accuracy Graph of T170E3 Shell
4. Messageform
5. Propellant Curve

COPY

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OFFICE MEMORANDUM ..... UNITED STATES GOVERNMENT

COdom/vs/8145

TO : Director, D and PS
Attn: Lt. E. L. Simpson

DATE: 24 April 52

FROM : Director, BRL

SUBJECT: Form factors of 76mm Shell, HE, T64 and HEP-T, T170E3.

1. The subject ammunition was fired at a 1000 yd vertical target time of flight screen by Lt. E. L. Simpson on 14 April 1952. The firing was analyzed by BRL and the following results were obtained.

Shell	Obs. Wt. lbs.	Inst. Vel. f/s	Inst. Dist. ft.	Form Factor	Drag Function
HE T64	14.994	2416.28	112.53	1.146	$G_{2.1}$
HEP-T, T170E3	9.931	2506.45	112.53	.964	G_1

2. The HEP-T, T170E3 should match the HE T64 at 1000 yards and 2400 f/s muzzle velocity when fired at 2570 f/s muzzle velocity.

3. For a muzzle velocity of 2570 f/s the HEP-T, T170E3 will have the following remaining velocities.

Range - yds	Remaining Velocity f/s
500	2200
1000	1864
1500	1564
2000	1312

CC
Mr. H. P. Hitchcock, BRL
Mr. Frank Hutchins, D and PS

/s/ James S. Brierley
/t/ JAMES S. BRIERLEY
Lt Colonel, Ord Corps
Assistant to Director
Ballistic Research Laboratories

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CG APG MD

MAIL MAIL

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CHIEF OF ORDNANCE
DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C.

ATTN: ORDTA

CO, PICATINNY ARSENAL, DOVER, N. J., ATTN: ORDBB-T

SUBJECT: TESTS OF SHELL HEP, T170E3, LOT PA-[illegible]-9207

THE FOLLOWING RESULTS WERE OBTAINED FROM RECENT TESTS OF THE SUBJECT SHELL WITH A MEAN ROTATING BAND CLEARANCE VALUE OF .010 INCH (MEAN DEVIATION .005)

REFERENCE FIRING RECORD NO. P-51314:

ACCURACY

NO. RDS. CONSIDERED	SHELL TYPE	UNCORRECTED MUZZLE VEL.	PROBABLE ERROR M VERT	HORZ	CALCULATED FORM FACTOR
6	T64	2425	.17	.34	1.146 G_2
10	T170E3	2535	.35	.33	.964 G_1

UNIFORMITY DATA (PRESSURE-VELOCITY)

NO. RDS. CONSIDERED	SHELL TYPE	AVG. WT. lbs.	VEL. FPS. CORR* MEAN	M D	MAX DISP	PRESS/100 CORR. MEAN	M D	MAX DISP	PROPELLANT LOT	CHG WT
9	T64	15.00	2415	4.00	16	266	4.56	18	12233	56.8 oz.
10	T170E3	9.94	2524	7.10	22	192	3.40	12	5566	45.0 oz.

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* - CORRECTED TO AN AVERAGE SHELL WEIGHT OF 9.94 POUNDS AND FOR PRESENCE OF GAUGES.

REMARKS: PROPELLANT LOADED LOOSE IN T19 CARTRIDGE CASE CONTAINING THE 400 GRAIN M58 PRIMER. PROJECTILES WERE CRIMPED TO CARTRIDGE CASE. ALL TEST ROUNDS WERE FLASHLESS USING PROPELLANT, M6, (WEB .029 INCH) LOT PA-E-5566 WHEN FIRED FROM THE NEW T91E3 GUN TUBE.

FROM THESE FIRINGS (TIME OF FLIGHT DATA) THE BALLISTIC RESEARCH LABORATORIES CALCULATED A MUZZLE VELOCITY OF 2570 FPS FOR THE T170E3 TO MATCH THE T64 HE SHELL (2400 FPS) AT 1000 YARDS RANGE. HOWEVER, THE ACTUAL CENTERS OF IMPACTS OF THE ACCURACY GROUPS IN THESE TESTS INDICATES THAT AT A 2535 FPS MUZZLE VELOCITY THE T170E3 SHELL WILL IMPACT 7.3 INCHES ABOVE THE T64 SHELL FIRED AT 2425 FPS MUZZLE VELOCITY. (PREVIOUS TESTS ALSO INDICATED 2570 FPS MUZZLE VELOCITY WAS IN EXCESS TO MATCH THE T64 AT 1000 YARDS.)

IT IS RECOMMENDED THAT 20 ADDITIONAL INERT LOADED T170E3 HEP SHELL BE FIRED TO SUBSTANTIATE THE MUZZLE VELOCITY REQUIRED TO MATCH THE T64 SHELL BEFORE THE FOLLOWING RECOMMENDED CHARGE IS PROCURED:

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RECOMMENDED CHARGE

SHELL		PROPELLANT		MUZZLE	PRESSURE
TYPE	WT. lbs.	LOT NO.	CHG WT OUNCES	VELOCITY, fps	psi
T170E3	10.00	PA-E-5566	46.37	2570	204

THE MAXIMUM PRESSURE THE T170E3 SHELL WILL WITHSTAND HAS NOT BEEN SUCCESSFULLY DETERMINED BECAUSE OF IMPROPER TEST SHELL BANDING AND/OR FUZING. HOWEVER, TESTS HAVE INDICATED THE SHELL WILL WITHSTAND AT LEAST 29000 PSI. (REFERENCE FIRING RECORD NO. P-50600) END ORDBG-DP-AA BLACK

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RHBlack/asp

ORDBG-DP-AA 6136

JOHN D. ARMITAGE, COLONEL, ORD CORPS

CHIEF, ARMS & AMMUNITION DIVISION

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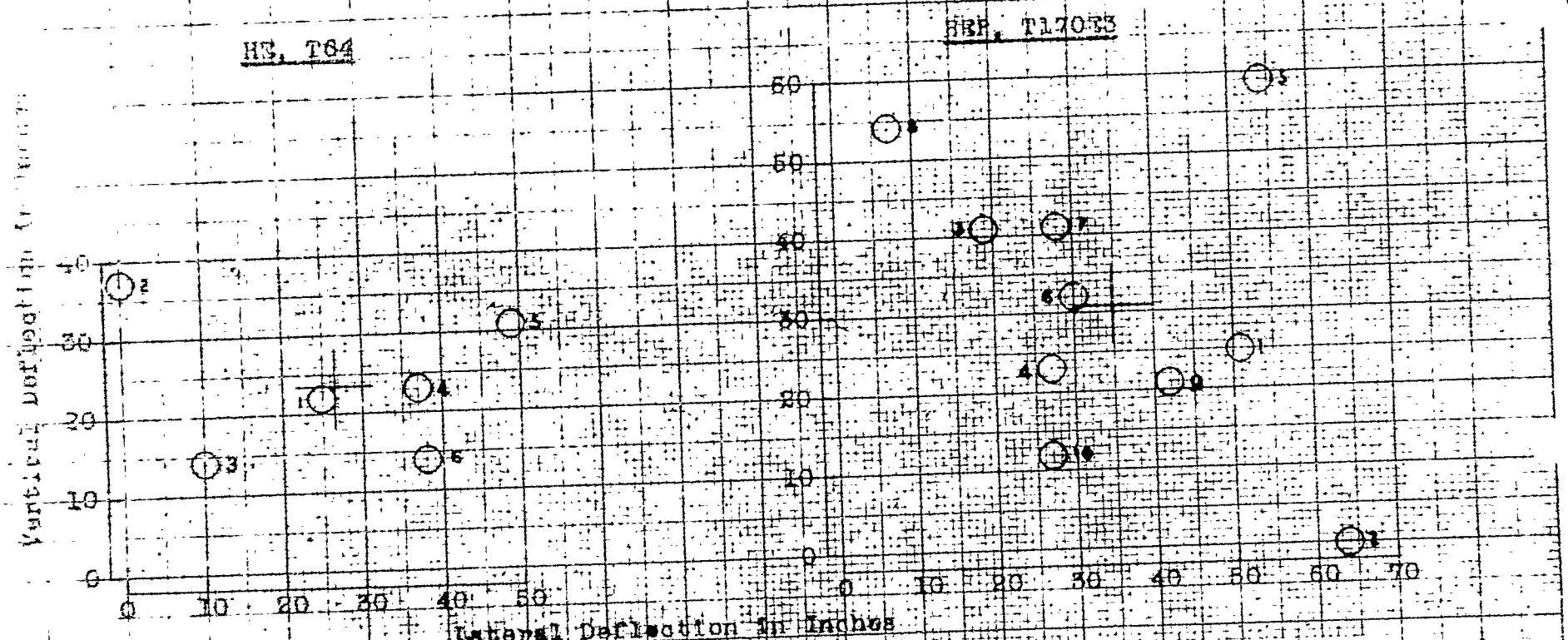
TARGET ACCURACY FOR SHELL, HE, T64 and HEP, T170E3
Fired from 76 mm Gun, T91E3

Date fired: 14 April 52

Range: 1000 yds.



Vertical P.E.: .17 mils.
Lateral P.E.: .35 mils.

Vertical P.E.: .34 mils.
Lateral P.E.: .53 mils.

DR&A Sect, A&A Div, D&PS
28 April 52

DEVELOPMENT AND PROOF SERVICES
ABERDEEN PROVING GROUND, MARYLAND
FIRING RECORD

OBJECT OF TEST: To conduct accuracy, critical striking velocity required to detonate explosive filler and propellent tests of 76mm Shell, HEP, T170E3. (U)

DATES OF TEST: 14 Aug. 52 to 29 April 53
FIRING RECORD NO: P-52674
SHEET 1 OF 6
OO FILE NO: 471/1520 (76mm) (c)
APG (c) 471/804
W.O. NO: 2023-145-0

Project TA1-5002H
DEVELOPMENT ORDTA

bjw

MATERIEL

GUN: 76mm T91E3 NO. 845
TUBE: 76mm T91E3 No. 24239 w/o muzzle brake
76mm T91E3 No. 25277 w/o muzzle brake
MOUNT: APG Proof mount.
Proof mount 8" Howitzer with 155mm Gun Recoil
M3 No. 1676 (Accuracy Rounds)

AMMUNITION

Test

Shell, HEP, 76mm T170E3 (Inert loaded) Lot PAE-9445
HEP, 76mm T170E3 (Inert loaded) Lot PAE-9554
Shell, HEP, 76mm T170E3 (A3 loaded) Lot PAE-9443

Stock

PROPELLENT: M6, MP, Lot PA-E-6131
FUZE: BD, M91 Inert loaded integral w/test shell
FUZE: BD, M91 live loaded integral w/test shell
CASE: Ctg., T19 Various lots (washed and resized)

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FIRING RECORD NO: P-52674
SHEET 2 OF 6

ROUND-BY-ROUND DATA

The following rounds were fired from the 76mm Gun T91E3 (Tube No. 24239) for development of propelling charge for the Shell HEP T170E3. (2600 fps) 18 Aug. 52

Warming and Reference Rounds +70°

TUBE RD. NO.	SHELL TYPE	SHELL PAE-LOT NO.	SHELL WT. lbs.	PROPELLANT LOT NO.	PROPELLANT CHG. WT. oz.	CALIBRA MUZZLE VEL. fps	PRESSURE psi/100 (1)	PRESSURE psi/100 (2)	PRESSURE psi/100 AVG.	TIME FIRED	IGNITION SYSTEM *
45	T64	Stock	15.0	12233	56.80	2399	Not Taken			1324	(A)
46	T64	"	15.0	12233	56.80	2401	"	"		1331	(A)
47	T64	"	15.0	12233	56.80	2402	"	"		1336	(A)
Charge Wt. establishment round. (M58 primer loose loaded)											
48	T170E3	9554	10.04	6131	44.0	2598	225	227	226	1339	(A)
(Group X) Uniformity and 105% chg. series (101/4" 300-gr. T88E1 primer w/dist wad.) +70°											
49	T170E3	9445	9.98	6131	44.0	2615	240	231	236	1434	(B)
50	T170E3	9445	10.00	6131	44.0	2616	231	239	235	1440	(B)
51	T170E3	9445	10.04	6131	44.0	2611	246	247	246	1442	(B)
52	T170E3	9445	10.04	6131	44.0	2610	236	241	238	1445	(B)
53	T170E3	9445	10.02	6131	44.0	2608	230	230	230	1448	(B)
54	T170E3	9445	10.04	6131	44.0	2605	231	236	234	1451	(B)
55	T170E3	9445	10.00	6131	44.0	2608	227	242	234	1454	(B)
56	T170E3	9445	10.00	6131	46.2	2699	263	275	269	1458	(B)
57	T170E3	9445	10.06	6131	46.2	2694	269	255	262	1500	(B)
(Group Y) Uniformity and 105% Chg. Series (300-gr. T88E1 primer, Bagged chg.) +70°											
58	T170E3	9554	10.02	6131	46.2	2635	234	235	234	1504	(C)
59	T170E3	9445	10.02	6131	44.0	2556	218	210	214	1510	(C)
60	T170E3	9554	10.00	6131	44.0	2555	215	217	216	1512	(C)
61	T170E3	9554	10.00	6131	44.0	2554	213	219	216	1516	(C)
62	T170E3	9554	10.00	6131	44.0	2552	215	219	217	1519	(C)
63	T170E3	9554	10.07	6131	44.0	2542	219	219	219	1521	(C)
64	T170E3	9554	10.06	6131	44.0	2543	210	207	208	1526	(C)
65	T170E3	9554	10.06	6131	44.0	2543	225	212	218	1529	(C)
66	T170E3	9554	10.00	6131	46.2	2637	235	239	237	1532	(C)
Reference and uniformity series (400-gr. M58 primer loose loaded) +70°											
67	T170E3	9554	10.04	6131	44.0	2578	Not Taken			1537	(A)
68	T170E3	9554	10.04	6131	44.0	2592	"	"		1539	(A)
69	T170E3	9554	10.04	6131	44.0	2587	"	"		1542	(A)
70	T170E3	9554	10.04	6131	44.0	2581	"	"		1544	(A)
71	T170E3	9554	10.04	6131	44.0	2583	"	"		1545	(A)

* (A) T88E1 primer (Graduated ignition holes in body) cut off to an overall length of 10 3/4 inches and re-threaded for the closing plug loaded with 300 grains of Grade A1 black powder assembled with screw type head.

(B) 300 grain T88E1 primer, propellant bagged in 3 inch diameter grade E silk bag.

(C) 400 grain M58 primer, propellant loose in cart case.

REMARKS: All rounds were crimped with 4 each 1 inch stab crimps.

All rounds were flashless with a medium amount of muzzle smoke.

The rounds (58-66) assembled with the bagged charges gave evidence of producing a considerable amount of smoke at the breech of the gun when the block was opened approximately 30 sec. after firing.

NOTE: A manually operated breech was used in these firings.

FIRING RECORD NO: P-52674
SHEET 4 OF 6

ROUND-BY-ROUND DATA

Time of flight firings of Shell HEP, T170E3 for 76mm Gun T91

Azimuth 25° 18' At 1000-yd. target Date Fired 29 April 1953
Between coils 49.99 ft.
Distances: Gun muzzle to target 2984.03 ft. Gun muzzle to 1st Coil 105.45 ft.

Boresight 4.6 mils

TARGET RD. NO.	SHELL WT. lbs.	SUPER-ELEV. mils	TIME OF FIRING	TIME OF FLIGHT sec.**	COIL TIME ms	INSTRUMENTAL VELOCITY fps *	TYPE OF PRIMER	REMARKS
11	10.01	9.4	2012	Missed	19.73	2534	T88E1	Missed - Fell short
12	10.03	13.4	2019	1.33478	19.86	2517	T70	
13	10.04	13.4	2021	1.32158	19.67	2541	T88E1	
14	10.05	13.4	2023	1.33315	19.85	2518	T70	
15	10.02	13.4	2025	1.31979	19.62	2548	T88E1	
16	10.01	13.4	2028	1.32997	19.80	2525	T70	
17	10.01	13.4	2030	1.31253	19.58	2553	T88E1	
18	10.05	13.4	2032	1.32552	19.78	2527	T70	
19	10.03	13.4	2034	1.31826	19.65	2544	T88E1	

* Note that velocities average higher for T88E1 primer.

At 1500 yd. Target

Distances: Gun muzzle to target 4484.05 ft. Gun muzzle to 1st Coil 105.45 ft.
Between coils 50.02 ft. Azimuth 25° 18' Boresight Elevation 2.6 mils

20	9.98	19.4	2137	Missed	19.81	2525	T70	Missed - Fell short
21	10.04	22.4	2152	2.32515	19.94	2509	T70	
22	Not Fired	-	-	-	-	-	-	This round was removed for APG display
23	10.03	22.4	2156	2.31819	19.87	2517	T70	
24	10.02	22.4	2159	Missed	19.90	2514	T70	Nicked top of target elev. lowered 1 mil
25	9.98	21.4	2203	2.31773	19.84	2521	T70	
26	10.00	21.4	2205	2.31273	19.85	2520	T70	
27	10.04	21.4	2207	2.30415	19.83	2522	T70	
28	9.99	21.4	2210	2.30251	19.80	2526	T70	
29	10.02	21.4	2213	2.30306	19.87	2517	T70	
30	10.01	21.4	2215	2.32385	19.91	2512	T70	

Reference Target Accuracy Data (Inclosure I)

** Time of flight distance was 2878.58 ft. and 4378.60 ft.

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REMARKS

Some of the round-by-round data obtained from firings conducted in accordance with the inclosed TPR 3814, was not available to include in this firing record as round-by-round data. However, from available tabulations, photographs and correspondence sufficient data is available to adequately analyze the results of the tests. (Reference Inclosures)

SUMMARY

The following tabulation presents a summary of the rounds fired against armor.

1. To determine the critical velocity at which the shell will function without fuse action (A3 loaded shell with Inert BD191 Fuse).

NO. RDS. FIRED	AVG. STRIKING VEL. fps	NO. RDS. WITH VISIBLE FLASH *	NO. RDS. WITH CAMERA FLASH **	OTHER ***
3	1362	0	0	3
5	1529	1	3	1
4	1651	2	1	1
3	1907	2	1	0

* A definite deflagration and/or low order detonation as observed by personnel near gun position 400 ft. from gun and confirmed by photographs.

** A flash not visible to the eye, but plainly visible on the high speed photo. These flashes appear on the film within .1 mil second of shell impact with armor and last for a period of at least 1.0 mil second indicating burning of the shell filler.

*** Very small or no flash observed on photographic film.

REMARK: There were no plate spalling or face impressions on any rounds.

2. To determine the configuration (spread) of the shell filler (Inert loaded shell and fuse).

NO. RDS. FIRED	AVG. STRIKING VELOCITY fps	SPREAD OF FILLER
2	1052	Reference inclosed photo Nos. A81514 and A81515
3	1937	Reference inclosed photo Nos. A81516 , 17 and 18

FIRING RECORD NO: P-52674
SHEET 6 OF 6

A summary of the accuracy tests are as follows:

RDS. CONSIDERED	RANGE yds.	PROBABLE ERROR VERTICAL mils	PROBABLE ERROR LATERAL mils
8	1000	.27	.14
9	1500	.15	.17

A summary of the propellent and primer tests conducted in conjunction with these tests is contained in the inclosed messageform to OCO ORDTA.

This firing record forms a part of Twenty-first Report on Project TA1-5002H.

APPROVED:

H. A. BECHTOL
Chief,
Artillery Division

H. B. ANDERSON
Chief, Artillery
Ammunition Branch

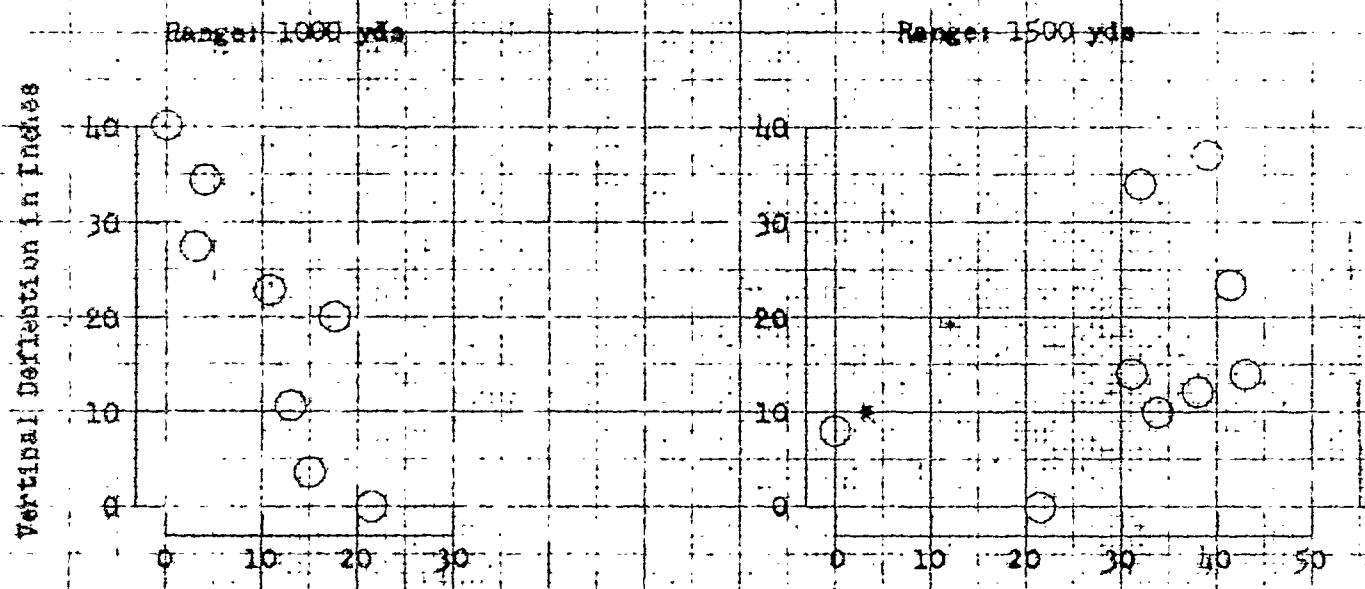
Reno M Black
for
WM. J. FURLOW
Proof Director

INCLOSURES:

1. Target Accuracy Sheet
2. Copy of messageform to ORDTA
3. Photographs A81514 thru A81518 and A83357 thru A83364
4. Letter APG (C) 471/804 with TPR-3418
5. Ammo Data Card Nos. 62543 & 62545

TARGET ACCURACY FOR SHELL, HEP, T170E3
Fired from 76 mm Gun, T91

Date fired: 29 April 1953



Vertical P.E.: .27 mils
Lateral P.E.: .14 mils

Vertical P.E.: .15 mils
Lateral P.E.: .17 mils
Lateral P.E.: .09 mils (Omitting *)

Anal Sect, A&M Div, D&PS
8 May 53 JES

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CG, APG, MD. UNCLASSIFIED

MAIL MAIL

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OOFORD, WASHINGTON 25 D.C.

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ATTN: ORDTA

CHAMBERLAIN CORP., WATERLOO, IOWA
PICATINNY ARSENAL, DOVER, N.J.

THE FOLLOWING SUMMARY PRESENTS THE RESULTS OF RECENT FIRINGS OF THE SHELL, HEP, T170E3 FROM THE 76MM T91E3 GUN FOR PROPELLING CHARGE DEVELOPMENT AND SHELL ACCURACY.

PRIMER DEVELOPMENT FOR PROPELLING CHARGE

FROM BRL STATIC BURNING TESTS OF VARIOUS PRIMERS THE 19" LONG 300 GRAIN T88E1 PRIMER (VARIOUS SIZE FLASH HOLES) WAS SELECTED TO BE USED WITH A BAGGED PROPELLING CHARGE AND A T88E1 300 GRAIN PRIMER MODIFIED BY CUTTING OFF THE PRIMER TUBE TO A LENGTH OF 10½" WAS SELECTED TO USE WITH A DISTANCE WADDING PROPELLING CHARGE.

UNIFORMITY SERIES AT + 70°F TEMPERATURE

SHELL		PROPELLANT			CORRECTED			PRESSURE (AVG)		
TYPE	WT LB	LOT	CHG WT OZS	LOADED	MV FPS	MD	MAX DISP	PSI/100	MD	MAX DISP
T170E3	10.0	6131	44.0	BAGGED	2541	3.71	10	211	2.57	11
T170E3	10.0	6131	44.0	DIST WAD	2602	2.86	8	232	3.29	16

FROM THE ABOVE RESULTS THE CHARGE WEIGHT TO YIELD 2600 FPS WAS CALCULATED TO BE 45.54 OZ. AND 43.96 OZ. FOR THE BAGGED THE DISTANCE WADDING CHARGES RESPECTIVELY.

UNIFORMITY SERIES AT -65°F TEMPERATURE

SHELL		PROPELLANT			CORRECTED			PRESSURE (AVG.)		
TYPE	WT.	LOT	CHG.WT.OZS.	LOADED	MV FPS	MD	MAX DISP	PSI/100	MD	MAX DISP
T170E3	10.0	6131	45.54	BAGGED	2525	4.71	20	180	34.00	155
T170E3	10.0	6131	43.96	DIST WAD	2437	8.50	30	154	16.38	56

MAX DISPERSION CONSIDERING INDIVIDUAL GAUGES (2 EA. RD.) WAS 23,200 PSI.

RECOMMENDED CHARGE

SHELL		PROPELLANT			MUZZLE	PRESSURE
TYPE	WT. LBS.	LOT	CHG.WT.OZS.	CHG. ASSEMBLY*	VEL. FPS	PSI
T170E3	10.00	PA-E-6131	43.96	DIST WADDING	2600	23,100

*-PROPELLING CHARGE WAS ASSEMBLED IN THE T91E1 CHARGE CASE WITH DISTANCE WADDING CONSISTING OF A CARDBOARD DISC PLACED AROUND THE PRIMER AND ON TOP OF THE PROPELLANT. ALSO CARDBOARD TUBING WAS PLACED ON TOP OF THE DISC EXTENDING TO THE BASE OF THE ASSEMBLED PROJECTILE. THE

IGNITION SYSTEM WAS A 300 GRAIN MODIFIED (CUT OFF) T88E1 PRIMER WITH A SCREW TYPE HEAD AND CLOSING PLUG.

REMARKS: THE 10-7/8 INCH LONG (INCLUDING SCREW TYPE HEAD) T88E1 PRIMER WHEN ASSEMBLED TO THE T91E1 CARTRIDGE CASE EXTENDED APPROXIMATELY 3/8 INCH ABOVE THE 43.96 OZ. CHARGE (INCLUDING 2 MED. CAL. M3 GAUGES) AND TO MORE NEARLY MAINTAIN PRIMER FLASH HOLE AND PROPELLING CHARGE RELATIONSHIP AN ALTERNATE PRIMER LENGTH OF APPROXIMATELY 10-1/4 INCHES IS RECOMMENDED. IN USING THE 10-1/4 INCH LENGTH PRIMER IT IS RECOMMENDED THAT THE FLASH HOLES BEGIN 1-3/4 INCHES FROM THE HEAD END OF THE PRIMER TUBE TO INCLUDE THE 22 FLASH HOLES (3 sizes) DESIRED. NO DIFFICULTY IS ANTICIPATED IN LOADING 300 GRAINS OF BLACK POWDER IN THE 10-1/4 INCH LONG PRIMER. HOWEVER, BEFORE A LOADING AUTHORIZATION IS ISSUED OR STANDARDIZATION WORK STARTED FOR THE ABOVE ROUND IT IS RECOMMENDED THAT 40 EACH T170E3 (INERT) SHELL BE SHIPPED TO APG FOR USE IN FIRING COMPARISON TESTS OF THE MODIFIED T88E1 AND THE SCREW HEAD M28B2 (T70) PRIMERS. IF THE T70 PRIMER PERFORMS AS WELL AS THE PROPOSED MODIFIED T88E1 PRIMER ITS USE WOULD BE PREFERRED.

UNCLASSIFIED

ACCURACY

THE T170E3 SHELL 1000 YARD UNCORRECTED ACCURACY PROBABLE ERROR WAS APPROXIMATELY 2 MIL WHEN FIRED AT -65° TEMPERATURE FROM A NEW T91E3 TUBE. DETAILS OF THE RESULTS ARE CONTAINED IN FIRING RECORD NO. P-52674 END ORDBG-DP-AA BLACK

UNCLASSIFIED 4 4

Mr. RMBlack/pew

T. F. COLLERAN

ORDBG-DP-AA 6136

DIRECTOR, DEVELOPMENT & PROOF SERVICES

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ORDTA 1st Ind
00 471/1520 (76-mm) (C)
ORDBB-TE3 471.14/975-795
SUBJECT: Test Program Request No. 3418 (Project TA1-5002H)
APG (C) 471/804

DA, ORD O, Washington 25, D. C.

TO: CG, Aberdeen Proving Ground, Md.

1. This correspondence authorizes your proving ground to conduct tests of Shell, HEP, T170E3 in 76-mm Gun, T91 as outlined in Test Program Request No. 3418 under Project TA1-5002H.

2. Test procedure may be altered at the discretion of the proof director. Costs may be charged to RAD ORDTA 2-1174.

BY COMMAND OF MAJOR GENERAL FORD:

/s/ R. E. Rayle, Jr
/t/ R. E. RAYLE, Jr
Lt Col, Ord Corps
Assistant

3 Encls: (in trip)
1, 2, 3, - 1 cy w/d

cc: Picatinny Arsenal

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ORDNANCE CORPS
PICATINNY ARSENAL
DOVER, NEW JERSEY

IN REPLY
REFER TO:

ORDBB-TE3 471.14/975-795
APG (C) 471/804

SUBJECT: Test Program Request No. 3418 (Project No. TA1-5002H)

TO: Chief of Ordnance
Dept of the Army
Washington 25, D. C.

ATTENTION: ORDTA

Test Program Request No. 3418, pertaining to Shell, HEP, T170E3, for 76mm Gun, is inclosed, in quadruplicate. Aberdeen Proving Ground has been notified that final action is to await approval from the Office, Chief of Ordnance.

FOR THE COMMANDING OFFICER:

D. N. Beaman
for C. W. CLARK
Colonel, Ord Corps
Assistant

3 Incl
1.-2 Amm Data Cards
Nos. 62545, -43
(in quad)
3. TPR No. 3418 (in quad)

CC
APG ORDBG-DPD w/incl 3
Chamberlain Corp,
Waterloo, Iowa, w/incl 3

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Incl 31 APG (c) 471/804
RJTarr/ejw/2194
Picatinny Arsenal, Dover, NJ
Test Program Request No. 3418
26 May 1952

1. Material For Test:

25 Shell, HEP, T170E3, Inert, w/Fuse, BD, M91, Inert, for 76mm Gun.
Lot No. PA-E-9445

25 Shell, HEP, T170E3, Comp A3 Loaded, w/Fuse, BD, M91, Inert, for 76mm Gun.
Lot No. PA-E-9443

2. Project Authority:

a. Project No.: TA1-5002H

b. Order No.: RAD Order ORDTA 1-12212

3. Arsenal Expenditure Order No.:

153-24

4. Object of Development or Experiment:

To investigate HEP Shell as a means of defeating armor.

5. History Sketch:

The Shell, T170E3, is patterned after the Shell, HEP, 76mm, T169E1, previously fired at Aberdeen Proving Ground, except that the Shell T170E3 is of a one-piece design and has a different rotating band. The subject shell is the second of T170 HEP Shell Series for the 76mm T91 and T94 Guns to be tested.

6. Description in Detail of Improvements Made Since Last Proving Ground Test:

No improvements have been made since last Proving Ground test.

7. Local Tests:

No local tests on subject shell have been made.

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8. Object of Test:

To determine accuracy, critical striking velocity to detonate explosive filler, and shell filler spreading characteristics on impact with plate.

9. Precautions in Handling and Testing:

The usual precautions in handling live loaded shell should be observed.

10. Recommended Test Program:

a. Accuracy Test -

It is requested that thirty each (30) Shell, HEP, 76mm T170E3, be fired as follows against a vertical target for accuracy and time of flight, using service velocity (2570 ft/sec) -

(1) - 10 Shell each, inert loaded, Lot No. PA-E-9445, at 1500 yards

(2) - 10 Shell each, inert loaded, Lot No. PA-E-9445, at 2000 yards

(3) - 10 Shell each, live loaded, Lot No. PA-E-9443, at 2000 yards

b. Plate Test -

It is requested that fifteen (15) Shell, HEP, 76mm T170E3, Lot PA-E-9443, be fired against 3" homogeneous armor plate, 0° angle of obliquity, having a charpy value of approximately 50 ft - lb at -40°F to determine the critical velocity at which shell will function high order without fuze action. It is suggested firing be started with striking velocity of 1000 ft/sec and increased or decreased at 200 ft/sec increments until a change in shell functioning is observed.

c. Shell Filler Spread Test -

It is requested that the following inert loaded Shell, HEP, 76mm T170E3, Lot PA-E-9445, be fired at 400 ft against 3" homogeneous armor plate having charpy value of approximately 50 ft — lb at -40°F. Paint plate white before each firing and photograph face of plate after each firing to record spead of shell filler.

(1) - 2 Shell each at 1000 ft/sec striking velocity

(2) - 3 Shell each at 2000 ft/sec striking velocity

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TPR No. 3418 (contd) 26 May 1952

11. Reference:

Ltr, 26 August 1952, OO 471/137 (c), ORDBB 471.14/975-94

12. Coordination:

Chief of Ordnance
Aberdeen Proving Ground
Picatinny Arsenal
Chamberlain Corporation,
Waterloo, Iowa.

D. R. Beeman
for C. W. CLARK
Colonel, Ord Corps,
Chief, Technical Division

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DEVELOPMENT AND PROOF SERVICES
ABERDEEN PROVING GROUND, MARYLAND
FIRING RECORD

OBJECT OF TEST: To Develop Primer for Cartridge, HEP, T170E3, for 76 mm Gun, T91. (U)

DATE OF TEST 31 March 1953
FIRING RECORD NO. F-55769
SHEET 1 OF 7
OO FILE NO. 471/4348
APG FILE NO. 471/1325
W.O.NO. 2023-145-0

DEVELOPMENT: Project TA1-5008H

dlr

MATERIEL

GUN: 76 mm T91, No. 478.

TUBE: 76 mm T91, No. 24241.

AMMUNITION

PROJECTILE: 76 mm, HE T64, Weight 15.00 pounds, (Solid Fill-loaded) various Lots.

76 mm, HE T64, Weight 10.95 pounds, (Empty) various lots.

PROPELLANT: NP, M1, Lot 6131, Web .029.

PRIMER: Percussion, 300 grain, T70 (Modified M28B2 w/screw head).

150 grain, (M31A2 with screw head).

65 grain (M31A2 with screw head).

CASE: Cartridge, 76 mm T19E1B1, Lot NS-I-7.

NOTE: Distance Wadding was used with all rounds.

FIRING RECORD NO. P-55769
SHEET 2 OF 7

ROUND-BY-ROUND DATA

Projectile Weight 15.00 lbs. Primer Percussion, 300 Grain, T70. Fired at Minus 65°F Temp

TUBE RD NO.	TEST RD NO.	PROR CHG OZS	AVG PROJ WT LBS	AVG PRESS. psi	MV fps	REMARKS
165	1	44	15	17900	2001	Grey/White Smoke No muzzle flash observed.
166	2	44	15	16000	2019	do.
167	3	44	15	18000	2010	do.
168	4	44	15	20900	2014	do.
169	5	44	15	19400	2003	do.
170	6	44	15	14600	2009	do.
171	7	44	15	15400	2015	do.
172	8	44	15	19900	2014	do.
173	9	44	15	15400	2021	do.
174	10	44	15	16200	2017	do.
175	11	44	15	20500	2005	do.
176	12	44	15	19400	2019	do.
177	13	44	15	19600	2011	do.
178	14	44	15	18100	2011	do.
179	15	44	15	18700	2017	do.
180	16	44	15	13900	2001	do.
181	17	44	15	20500	2017	do.
182	18	44	15	17400	2011	do.
183	19	44	15	18900	2017	do.
184	20	44	15	17800	2014	do.

Projectile Weight 15.00 lbs. Primer, Percussion, 150 Grain, M31A2 (Mod) Fired at Minus 65°F temp.

185	1	44	15	16400	2008	Grey/white smoke muzzle flash
186	2	44	15	17700	2018	Grey/white smoke no muzzle flash observed
187	3	44	15	17700	2016	do.
188	4	44	15	16800	2011	do.
189	5	44	15	20100	1988	do.
190	6	44	15	19800	2006	do.
191	7	44	15	18600	1979	do.
192	8	44	15	18400	2004	do.
193	9	44	15	19600	1997	do.
194	10	44	15	22000	2002	do.
195	11	44	15	16300	2015	do.
196	12	44	15	16800	2010	do.
197	13	44	15	17100	2010	do.
198	14	44	15	18200	2012	Grey/white smoke muzzle flash observed
199	15	44	15	17800	2015	Grey/white smoke no muzzle flash observed
200	16	44	15	18300	2014	do.

FIRING RECORD NO. P-55769
SHEET 3 OF 7

TUBE RD NO.	TEST RD NO.	PROP. CHG OZS	AVG PROJ WT LBS	AVG PRESS. psi	MV fps	REMARKS
201	17	44	15	18600	2020	Grey/white smoke no muzzle flash observed
202	18	44	15	21600	2014	do.
203	19	44	15	20400	2014	do.
204	20	44	15	22000	2012	do.
Projectile Weight 15.00 lbs. Primer, Percussion 65 grain M31A3 (Mod) Fired at minus 65°F Temp						
205	1	44	15	16800	2021	Grey/white smoke, flash, hang fire approx .5 sec.
206	2	44	15	17100	2016	do.
207	3	44	15	20400	2017	do.
208	4	44	15	18100	2017	do.
209	5	44	15	17100	2014	do.
210	6	44	15	21600	2021	do.
-	7	44	15	-	-	Round failed to fire three attempts
211	8	44	15	14700	2021	Grey/White smoke, flash, hangfire approx .25 sec.
212	9	44	15	15900	2020	do.
213	10	44	15	18000	2019	do.
214	11	44	15	15900	2017	do.
-	12	44	15	-	-	Round failed to fire three attempts
215	13	44	15	17500	2004	Grey/white smoke, flash hang fire approx .25 secs.
216	14	44	15	17700	2013	do.
-	15	44	15	-	-	Round failed to fire three attempts
217	16	44	15	18200	2017	Grey/white smoke, flash, hang fire
218	17	44	15	18900	2002	do.
219	18	44	15	17200	2001	do.
220	19	44	15	17300	2019	do.
221	20	44	15	20300	1997	do.

FIRING RECORD NO. P-55769
SHEET 4 OF 7

VELOCITY UNIFORMITY DATA

PRIMER TYPE	NO. OF ROUNDS	MEAN fps	MAX. DISPERSION fps	MAX. DISPERSION %	MEAN DEVIATION fps.
300 Grain T70	20	2010	20	.99	5
150 Grain M31A2 *	20	2008	41	2.04	7
65 Grain M31A2*	17	2012	24	1.19	7

*With screw type primer head.

PRESSURE UNIFORMITY DATA

PRIMER TYPE	NO. OF ROUNDS	MEAN psi	MAX DISPERSION fps	MAX DISPERSION %	MEAN DEVIATION psi
300 Grain T170	20	17900	6300	.34	1730
150 Grain M31A2*	20	18700	5700	.30	1585
65 Grain M31A2*	17	17800	6900	.38	1085

*With screw type primer head.

SUMMARY

The 15 lbs shell, HE, T64 used in the first test did not simulate the weight of the Shell, HEP, T170E3. The test was refired using a modification of the Shell, HE, T64 which simulated the weight of the Shell, HEP, T170E3 more closely (reference following round-by-round data.

FIRING RECORD NO. P-55769
SHEET 5 OF 7

Primer Percussion, 300 Grain, T70. Fired at Minus 65°F Temp.

TUBE RD NO.	TEST RD NO.	PROP. CHG OZS	AVG PROJ WT LB	AVG PRESS. psi	MV fps	REMARKS
441	1	44	10.95	17700	2235	Grey/white smoke no muzzle flash observed
442	2	44	10.95	16900	2270	do.
443	3	44	10.95	16000	2259	do.
444	4	44	10.95	17100	2266	do.
445	5	44	10.95	18200	2261	do.
446	6	44	10.95	17800	2268	do.
447	7	44	10.95	18200	2271	do.
448	8	44	10.95	18000	2266	do.
449	9	44	10.95	16500	2259	do.
450	10	44	10.95	15900	2258	do.
451	11	44	10.95	17600	2272	do.
452	12	44	10.95	16700	2255	do.
453	13	44	10.95	17600	2264	do.
454	14	44	10.95	17500	2265	do.
455	15	44	10.95	17500	2282	do.
456	16	44	10.95	18400	2265	do.
457	17	44	10.95	16300	2256	do.
458	18	44	10.95	16600	2262	do.
459	19	44	10.95	16700	2262	do.
460	20	44	10.95	17400	2259	do

Primer Percussion, 150 Grain M31A2 (Modified) Fired at -65°F Temp.

461	1	44	10.95	17000	2252	do.
462	2	44	10.95	17100	2253	do.
463	3	44	10.95	17200	2277	do.
464	4	44	10.95	17800	2252	do.
465	5	44	10.95	17400	2261	do.
466	6	44	10.95	17900	2276	do.
467	7	44	10.95	17700	2256	do.
468	8	44	10.95	17500	2265	do.
469	9	44	10.95	15400	2262	do.
470	10	44	10.95	17500	2257	do.
471	11	44	10.95	16300	2252	do.
472	12	44	10.95	16600	2245	do.
473	13	44	10.95	16600	2255	do.
474	14	44	10.95	15900	2252	do.
475	15	44	10.95	17300	2249	do.
476	16	44	10.95	17300	2260	do.
477	17	44	10.95	18000	2269	do.
478	18	44	10.95	17900	2273	do.
479	19	44	10.95	17100	2277	do.
480	20	44	10.95	17900	2260	do.

FIRING RECORD NO. P-55769
SHEET 6 OF 7

Primer, Percussion, 65 Grain, M31A2 (Modified) fired at minus 65°F Temp.

TUBE RD NO.	TEST RD NO.	PROP. CHG OZS	AVG PROJ WT LBS	AVG PRESS. psi	MUZ VEL fps	REMARKS
-	1	44	10.95	-	-	Round failed to fire after 3 attempts
-	2	44	10.95	-	-	do.
-	3	44	10.95	-	-	do.
-	4	44	10.95	-	-	do.
-	5	44	10.95	-	-	do.

VELOCITY UNIFORMITY DATA

	NO. OF ROUNDS	MEAN fps	MAX DISPERSION fps	MAX DISPERSION %	MEAN DEVIATION fps
T70 300 Grain	20	2263	47	2.08	6
M31A2* 150 Grain	20	2265	25	1.10	10

PRESSURE UNIFORMITY DATA

	NO. OF ROUNDS	MEAN fps	MAX DISPERSION psi	MAX DISPERSION %	MEAN DEVIATION psi
T70 300 Grain	20	17200	2500	.15	600
M31A2* 150 Grain	20	17200	2700	.16	500

*with screw type primer head.

FIRING RECORD NO. P-55769
SHEET 7 OF 7

SUMMARY

All test rounds were fired at minus 65° at approx. 1° elevation. There were no misfires or hangfires with either the 300 grain or 150 grain primers.

The primers were taken out of the cases and examined. There were no splits or ruptures of the primer bodies.

The five 65 grain primers misfired. Three attempts were made to fire each primer. The 65 grain primers tests were cancelled.

The misfired primers in each case produced a weak flash which scorched the propellant but failed to ignite the charge.

OBSERVATIONS

Indications are that the 65 grain Modified M31A2 primer is unsatisfactory for the T170E3 round.

The test results further indicate that either the T70 primer or the 150 grain M31A2 (with screw head) is satisfactory for use with the T170E3 round. For loading purposes the 150 grain M31A2 with the screw head is considered more desirable.

APPROVED:

For B. S. GOODWIN
Acting Chief,
Arms & Am Div.

E. A. BECHTOL
Chief, Ammunition Branch

W. J. FURLOW
Proof Director

INCLOSURE: APG 471.1/1321, 000 to APG
DISTRIBUTION: Chief of Ordnance, Washington 25, D.C., Attn: ORDTA - 2 copies
ORDTX-AR - 1 copy

Commanding Officer, Picatinny Arsenal, Dover, N. J. - 3 copies
Technical Information Branch, Aberdeen Proving Ground, Md - Original and 1 copy

RESTRICTED

TO INSURE PROMPT ATTN
IN REPLYING REFER TO:
OD NO.471/4345 (76mm)
ATTN. OF
ORDKA
APG 471.1/1321

WAR DEPARTMENT
OFFICE OF THE CHIEF OF ORDNANCE
WASHINGTON, D. C.

DMJaehman/mct/74961

SUBJECT: Primer for Cartridge, HEP, T17E3, for 76-MM Gun, T91

TO : Commanding General

Aberdeen Proving Ground, Maryland

REFERENCES: a. Letter to APG, 22 December 1952, subject as above.

b. Messageform, 24 December 1952, file APG 471.1/1310.

c. Telephone conversation with Mr. H. B. Anderson, 30 December 1952

1. This confirms Reference "c". It was agreed as being unnecessary to conduct so extensive a firing program as is recommended in Reference "b".

2. The plan of development outlined in paragraph 4 of Reference "a", should be followed. Emphasis should be placed on recommending at the earliest possible date, a primer and propelling charge that can be released immediately for production, even though it may be possible to make subsequent improvements.

3. If you do not have enough Shell, HEP, T17E3 for such firing as may be required, it is suggested that proof projectiles be improvised by modification of the T21E, the Shell, HE, T64 or other components which are available.

BY COMMAND OF MAJOR GENERAL FORD:

/s/ BRUCE K. ANDERSON
Assistant

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RESTRICTED

APPENDIX C

Copy 1st Ind APG (C) 471.4/216

O
P
Y

ORDBG-DPS-AA 1st Ind Mr. RWBlack/bjw/6136
APG (c) 471.4/216
OO 471/2488 (76mm) (c)
SUBJECT: Primer for Cartridge, HEP, T170E3, for 76mm Gun, T91

Ord Corps, Aberdeen Proving Ground, Maryland

TO: Chief of Ordnance, Department of the Army, Washington 25, D.C.
ATTN: ORDTA

1. In the limited development firings of the T70 Primer and the T91 Primer (Mod. T88E1) 300 grain of black powder was used. Both primers were of the same length (approx. 10-3/4 inches). However, when loading the cartridge case with the assessed propelling charge weight for the HEP, T170E3 round the (Mod. T88E1) primer protruded approximately 3/8 inch above the propelling charge (loose loaded). Therefore the recommended length of the T91 Primer was 10-1/4 inches.

2. The T70 Primer with a bag loaded propelling charge and the T170E3 Shell has been fired at various temperatures in comparison with the modified T88E1 Primer assembled with a loose (distance wadded) propelling charge.

3. The results indicate that both rounds were satisfactory. However, the T91 Primer was recommended primarily because of the slightly better pressure uniformity at -65°F temperature, the elimination of the bag propellant loading and the opportunity to shorten the primer length.

4. Had the T70 Primer been fired with distance wadding at -65° temperature as was the modified T88E1 Primer, it is believed that the results would have been very similar. The T70 Primer which is almost full of black powder has been fired extensively in various weapons with chamber pressures greater than the pressure required for the HEP Shell without serious known malfunctions.

5. It is believed that the T91 Primer with 250 grains of black powder and, if necessary, with slightly larger flash holes would be satisfactory for the low pressure HEP, T170E3 round.

6. If and when Aberdeen Proving Ground is supplied with T91 Primers comparative tests will be conducted to determine the satisfactoriness of the T91 Primer as designed.

7. However, until extensive firing tests can be conducted to develop or determine a more satisfactory primer for the T170E3 HEP round, it is believed that from a functioning standpoint the T70 Primer can be recommended as a substitute to expedite the loading of the T170E3 round.

70

ORDBG-DPS-AA 1st Ind (Cont)
AFG (c) 471.4/236
OO 471/2488 (76mm) (c)
SUBJECT: Primer for Cartridge, HEP, T170E3, for 76mm Gun, T91

8. It is possible that a primer similar to the T74 Primer will function even more satisfactorily than the T91 or the T70 Primer. A Primer of this relatively short length would also eliminate any possibility of the primer protruding above the propelling charge even if it is decided to reduce the granulation of the propellant to bring the chamber pressure closer to the rated maximum pressure of the T170E3 HEP Shell. Therefore, in the near future the T70 Primer and the T74 (M31A2 w/screw head) are to be fired at various temperatures to determine which of the primer designs is the more satisfactory.

FOR THE COMMANDING GENERAL:

ELI E WHITE
Col, Ord Corps
Acting Director
Development & Proof Services

Russo 2194

EXPERIMENTAL AMMUNITION DATA CARD

NO 58424

T. P. R. NO.	KIND CONFIDENTIAL Shell, Inert, 76MM, T170E3, W/Fuze, Inert, BD, M62A1 for T91 Gun				AMM. LOT NO. PA-E-6715
SPEC. NO.					QUANTITY IN LOT
	DRG. DATE OR REV.	ALLOT. ADVICE	PROJECT NO. TA1-5002H	RAD OR EPO NO.	QUANTITY IN SHIPMENT
F. A. X. O.	PROP. CHARGE	EXPECTED M. V.	EXPECTED PRESSURE	ASSEMBLED BY PA	DATE OF ASSEMBLY Sept., 1951

REMARKS: Packed: Improvised. Ring gaged 100%.

Empty Wt. Ave.	Loaded Wt. Ave.	Density Ave.	Complete Wt. Ave.
[illegible]	8.00	1.58	9.93

[illegible]ed in accordance with Dwg. P-81830, Rev. 9-11-50

[illegible]	Shell, HEP	Filler	Fuze, BD,				
	76MM,	Comp C-3	M62A1				
	T170E3	Dummy	(Inert)				
[illegible]	Unk	Unk	73-2-168				
[illegible]	Unk	Unk	10-1-45				
	Chamberlain	Unk	PA				
	1951	Unk	1951				
	Unk	Unk	None				

PREPARED BY Francis Ryane
Loading Br., Ind.
DIVISION

CONFIDENTIAL

PICATINNY ARSENAL
DOVER, NEW JERSEY

CERTIFIED TO BY: R. VanOrden A, INSPECTOR
Inspection
DIVISION

Russo-2194

EXPERIMENTAL AMMUNITION DATA CARD

NO 58425

T. P. R. NO.	KIND Confidential Shell, HEP, 76MM, T170E3, w/Fuze, BD, M62A1 for T91 Gun				AMM LOT NO PA-E-6716
SPEC. NO.					QUANTITY IN LOT 35
DRG. NO. P-81830	DRG. DATE OR REV. 9-11-50	ALLOT ADVICE	PROJECT NO. TA1-5002H	RAD OR EPO NO	QUANTITY IN SHIPMENT 35
F. A. X. O. 153-106	PROP. CHARGE	EXPECTED M. V.	EXPECTED PRESSURE	ASSEMBLED BY PA	DATE OF ASSEMBLY September, 1951

REMARKS: Packed: 5 Shell/wood box. Empty weight of Shell Max. 5.60, Min. 539., Wt of charge 1.80 max. 1.74 min., Wtl as fired 9.85 max. 9.72 min. Density 1.64 max. 1.60 min.

Shell ring gaged and shell X-Rayed 100%.

COMPONENT	Shell, HEP,	Filler	Fuze, BD,
KIND	76MM, T170E3	Comp. A3	M62A1
		Harrisite	HE, Loaded
DRG. NO.	Unk		Unk
DRG. DATE OR REV.	Unk		Unk
MFG'D BY	Chamberlain	Wabash	Arkansas Ord. Plant
DATE	1951		9-44
LOT NO.	Unk	WAB-5-114	AOP-1-62

PREPARED BY Dora K. Ciepiela
Loading Br., Ind.
DIVISION

PICATINNY ARSENAL
DOVER NEW JERSEY

CERTIFIED TO BY: J. A. Nystrand, INSPECTOR
Inspection
DIVISION

CONFIDENTIAL

[illegible] AMMUNITION DATA CARD [illegible] 62108

CONFIDENTIAL

[illegible] (Inert) with Fuze, BD, M91 Inert for [illegible]

[illegible]	[illegible]	[illegible]	PROJECT NO. TA1-9002H	[illegible] ORDTA-2-1137	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible] PA	DATE OF ASSEMBLY March, 1952

[illegible] Packed [illegible] Shell/wood [illegible] in accordance with Dwg. [illegible]1830, Rev. 9-11-50. Ring Gaged & Chamber [illegible] Hydroelectrical Chemical Co., 10% Celite Mfg. Johns [illegible]

(See reverse side)

[illegible]	Shell, [illegible]		*Filler	Fuze, BD,			
[illegible]	[illegible]		Inert	M91			
[illegible]	[illegible]		Comp. A-3	Inert			
[illegible]	[illegible]-213		90/10	73-2-239			
[illegible]	7-31-51			11-17-50			
[illegible]	Chamberlain			PA			
[illegible]	1951			1951			
[illegible]	Unk			PA-E-7870			

CONFIDENTIAL

[illegible] Francis Duane

Loading Br., Ind.
DIVISION

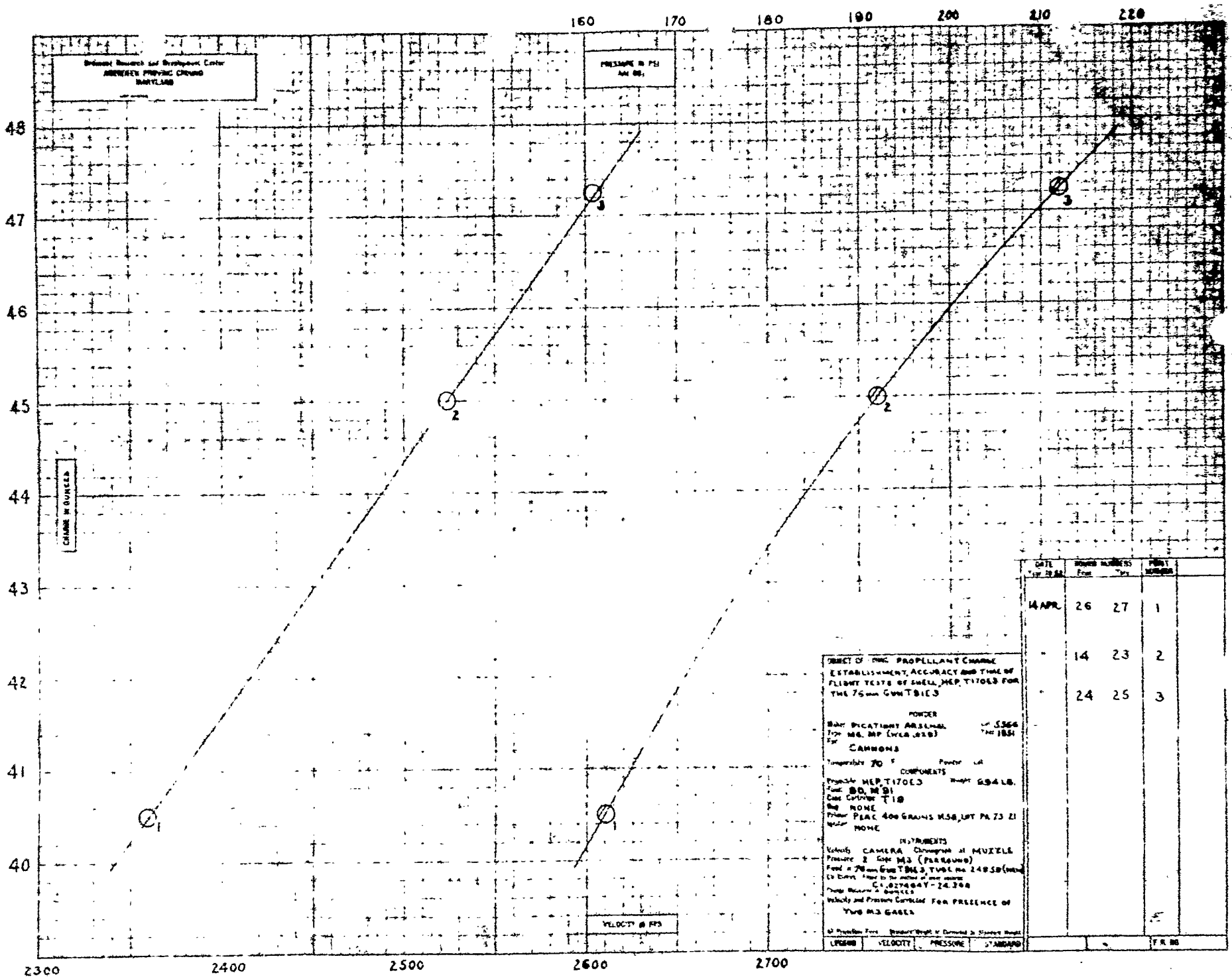
CERTIFIED TO BY: E.A. Chegwidden, INSPECTOR

PICATINNY ARSENAL
DOVER, NEW JERSEY

Inspection D
DIVISION

Card No. 62108

Wt. Empty	Wt. Loaded & Fuzed.
5.47	9.95
5.40	9.88
5.47	9.92
5.38	9.91
5.43	9.96
5.48	9.90
5.49	9.93
5.45	9.91
5.40	9.87
5.48	9.97
5.46	9.97
5.52	9.95



Ordnance Research and Development Center
ABERDEEN PROVING GROUND
MARYLAND
PRESSURE IN PSI
CHARGE IN OUNCES
VELOCITY IN FPS
160
170
180
190
200
210
220
48
47
46
45
44
43
42
41
40
2300
2400
2500
2600
2700
1
2
3
DATE
ROUND NUMBERS
From
To
POINT NUMBER
14 APR.
26
27
1
14
23
2
24
25
3
OBJECT OF FIRING PROPELLANT CHARGE ESTABLISHMENT, ACCURACY AND TIME OF FLIGHT TESTS OF SHELL, HEP, T170E3 FOR THE 76mm GUN T81E3
POWDER
Maker PICATINNY ARSENAL
Type M6, MP (WCA .028)
For CANNONS
Temperature 70 F
Powder Lot
COMPONENTS
Projectile HEP, T170E3
Weight 694 LB.
Fuel BD, M91
Case Carrier T18
Bag NONE
Primer PERC 400 GRAINS M58, LOT PA 73 21
Igniter NONE
INSTRUMENTS
Velocity CAMERA Chronograph at MUZZLE
Pressure 2 Gage M3 (PERSONNEL)
Fuel in 76mm GUN T81E3, TUBE No 24858 (MEN)
Cu Curve Fitted to the method of user assume
C1.027464Y - 24.368
Charge Measured 4 OUNCES
Velocity and Pressure Corrected FOR PRESENCE OF
TWO M3 GAGES
LEGEND
VELOCITY
PRESSURE
STANDARD
F.R. NO.

Russo 2194 **EXPERIMENTAL AMMUNITION DATA CARD** NO 58424

T. F. R. NO.	KIND				AMM. LOT NO.
	CONFIDENTIAL Shell, Inert, 76MM, T170E3, W/Fuze, Inert, BD, M62A1 for T91 Gun				PA-E-6715
SPEC. NO.					QUANTITY IN LOT
	DRG. DATE OR REV.	ALLOT. ADVICE	PROJECT NO.	RAD OR EPO NO.	QUANTITY IN SHIPMENT
			TA1-5002H		
P. A. X. O.	PROP. CHARGE	EXPECTED M. V.	EXPECTED PRESSURE	ASSEMBLED BY	DATE OF ASSEMBLY
				PA	Sept., 1951

REMARKS: Packed: Improvised. Ring gaged 100%.

Empty Wt. Ave.	Loaded Wt. Ave.	Density Ave.	Complete Wt. Ave.
5.52	8.00	1.58	9.93

Loaded in accordance with Dwg. P-81830, Rev. 9-11-50

COMPONENT	Shell, HEP	Filler	Fuze, BD,				
KIND	76MM,	Comp C-3	M62A1				
	T170E3	Dummy	(Inert)				
DRG. NO.	Unk	Unk	73-2-168				
DRG. DATE OR REV.	Unk	Unk	10-1-45				
MFG'D BY	Chamberlain	Unk	PA				
DATE	1951	Unk	1951				
LOT NO.	Unk	Unk	None				

PREPARED BY Francis Ryane — Loading Br., Ind. DIVISION

CONFIDENTIAL

PICATINNY ARSENAL DOVER, NEW JERSEY

CERTIFIED TO BY: R. VanOrden A, INSPECTOR — Inspection DIVISION

Russo-2194 **EXPERIMENTAL AMMUNITION DATA CARD** NO 58425

T. F. R. NO.	KIND				AMM LOT NO
SPEC. NO.	Confidential Shell, HEP, 76MM, T170E3, w/Fuze, BD, M62A1 for T91 Gun				PA-E-6716
					QUANTITY IN LOT 35
DRG. NO.	DRG. DATE OR REV.	ALLOT ADVICE	PROJECT NO.	RAD OR EPO NO	QUANTITY IN SHIPME
P-81830	9-11-50		TA1-5002H		35
P. A. X. O.	PROP. CHARGE	EXPECTED M. V.	EXPECTED PRESSURE	ASSEMBLED BY	DATE OF ASSEMBLY
153-106				PA	September, 19

REMARKS: Packed: 5 Shell/wood box. Empty weight of Shell Max. 5.60, Min. 5.39., Wt of charge 1.80 max. 1.74 min., Wtl as fired 9.85 max. 9.72 min. Density 1.64 max. 1.60 min

Shell ring gaged and shell X-Rayed 100%.

COMPONENT	Shell, HEP,	Filler	Fuze, BD,		
KIND	76MM, T170E3	Comp. A3	M62A1		
		Harrisite	HE, Loaded		
DRG. NO.	Unk		Unk		
DRG. DATE OR REV.	Unk		Unk		
MFG'D BY	Chamberlain	Wabash	Arkansas Ord. Plant		
DATE	1951		9-44		
LOT NO.	Unk	WAB-5-114	AOP-1-62		

PREPARED BY Dora K. Ciepiela — Loading Br., Ind. DIVISION

PICATINNY ARSENAL DOVER NEW JERSEY

CERTIFIED TO BY: J. A. Nystrand, INSPEC — Inspection DIV

DRG. NO.	DRG. DATE OR REV.	ALLOT. ADDR.	PROJECT NO.	RAC OR LPO NO.	QUANTITY IN SHIPMENT
*			TA1-5002H		
P. A. X. O.	PROP. CHARGE	EXPECTED M. V.	EXPECTED PRESSURE	ASSEMBLED BY	DATE OF ASSEMBLY
153-[illegible]				PA	Sept., 1951

REMARKS: Packed: [illegible]

Empty Wt. Ave.	Loaded Wt. Ave.	Density Ave.	Complete Wt. Ave.
5.59	8.00	1.58	9.93

*Loaded in accordance with Dwg. P-81830, Rev. 9-11-50

COMPONENT	Shell, HEP	Filler	Fuze, BD
KIND	70MM,	Comp C-3	M62A1
	T170E3	Dummy	(Inert)
DRG. NO.	Unk	Unk	73-2-168
DRG. DATE OR REV.	Unk	Unk	10-1-45
MFG'D BY	Chamberlain	Unk	PA
DATE	1951	Unk	1951
LOT NO.	Unk	Unk	None

CONFIDENTIAL

PREPARED BY: Francis Ruane
Loading Br., Ind.
DIVISION

CERTIFIED TO BY: R. VanOrden INSPECTOR
Inspection
DIVISION

PICATINNY ARSENAL
DOVER, NEW JERSEY

[illegible] 21[illegible] [illegible]NTAL AMMUNITION [illegible] CARD NO. 62108

T. P. S. NO.	KIND				ASM. LOT NO.
	CONFIDENTIAL Shell, HEP, T170E3 (Inert) with Fuze, BD, M91 Inert for 76MM Gun				PA-E-9207
[illegible] NO.					QUANTITY IN LOT 12
DRG. NO. [illegible]	DRG. DATE OR REV.	ALLOT. ADVICE	PROJECT NO. TA1-5002H	RAD OR EPO NO. ORDTA-2-1137	QUANTITY IN SHIPMENT
P. A. X. O. 13-43/9	PROP. CHARGE	EXPECTED M. V.	EXPECTED PRESSURE	ASSEMBLED BY PA	DATE OF ASSEMBLY March, 1952

REMARKS: Packed: 5 Shell/wood box.
Loaded and Assembled in accordance with Dwg. P-81830, Rev. 9-11-50. Ring Gaged & Chamber gaged 100%. *Filler: 90% PCN, Mfgr. Hydroelectrical Chemical Co., 10% Celite Mfg. Johns Manville.

(See reverse side)

COMPONENT	Shell, HEP,		*Filler	Fuze, BD,			
[illegible]	76MM,		Inert	M91			
	T170E3		Comp. A-3	Inert			
DRG. NO.	J7577-213		90/10	73-2-239			
DRG. DATE OR REV.	7-31-51			11-17-50			
[illegible] BY	Chamberlain			PA			
DATE	1951			1951			
LOT NO.	Unk			PA-E-7870			

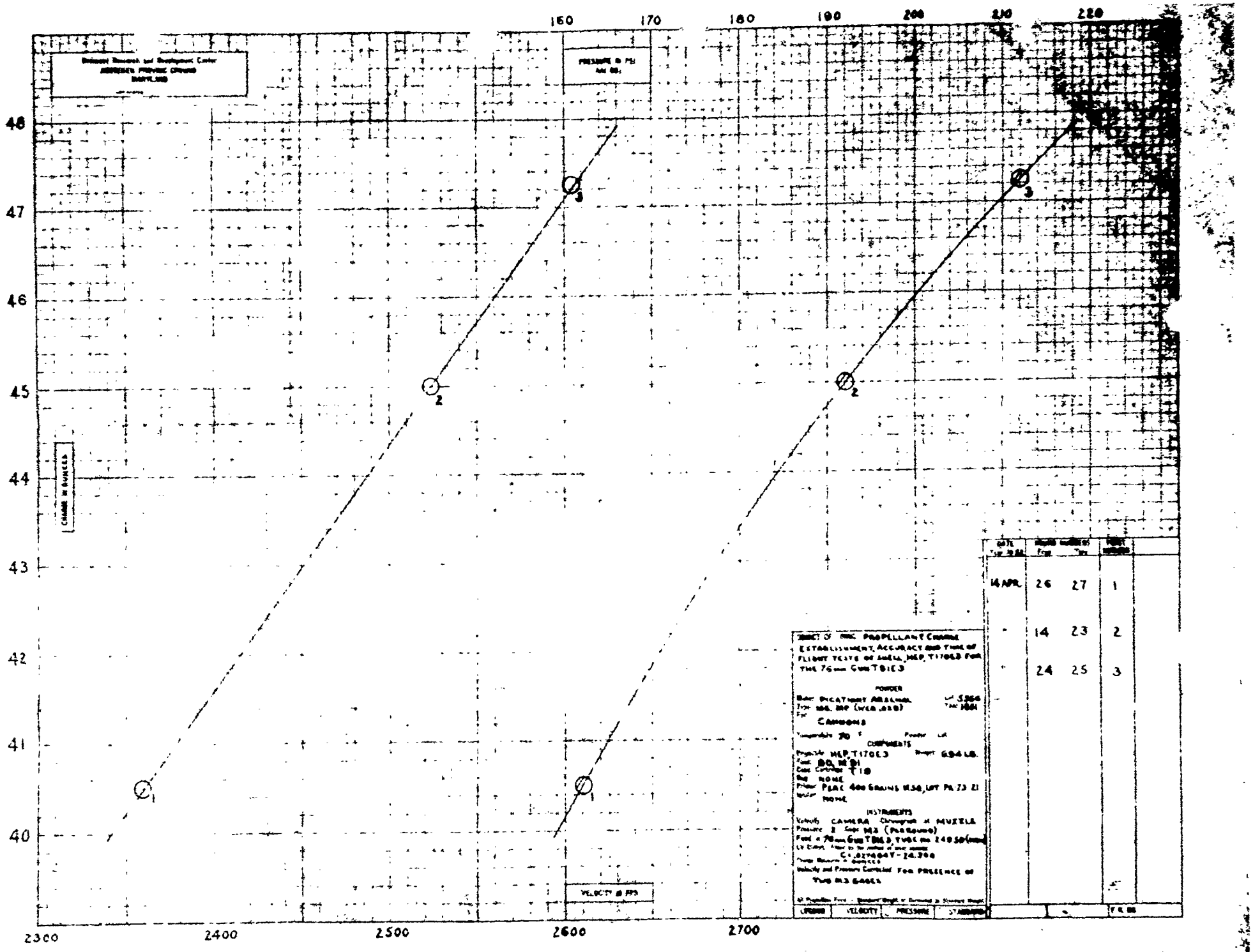
CONFIDENTIAL

PREPARED BY Francis Ruane
Loading Br., Ind.
DIVISION

CERTIFIED TO BY: E.A. Chegwidden INSPECTOR
PICATINNY ARSENAL
DOVER, NEW JERSEY
Inspection D
DIVISION

Card No. 62108

Shell No.	Wt. Empty	Wt. Loaded & Fuzed.
1	5.47	9.95
2	5.40	9.88
3	5.47	9.92
4	5.38	9.91
5	5.43	9.96
6	5.48	9.90
7	5.49	9.93
8	5.45	9.91
9	5.40	9.87
10	5.48	9.97
11	5.46	9.97
12	5.52	9.95



160
170
180
190
200
210
220
48
47
46
45
44
43
42
41
40
2300
2400
2500
2600
2700
CHARGE IN OUNCES
VELOCITY IN FPS
PROPELLANT CHARGE
ESTABLISHMENT, ACCURACY AND TIME OF
FLIGHT TESTS OF SHELL, HEP, T170E3 FOR
THE 76mm GUN T81E3
POWDER
PICATINNY ARSENAL
CANNONS
COMPONENTS
HEP, T170E3
NONE
INSTRUMENTS
CAMERA
MUZZLE
FOR PRESENCE OF
TWO M3 GAGES
14 APR.
26
27
1
14
23
2
24
25
3

[illegible]MENTAL AMMUNITION DATA CARD

NO. 62543

CONFIDENTIAL

AMM. LOT NO. PA-E-9443

Shell, HEP, T170B3, With Fuze, BD, M91, Inert, For .76[illegible] Gun
Ballistic Sample

QUANTITY IN LOT 25

[illegible]	[illegible] DATE OR REV.	ALLOT. ADVICE	PROJECT NO	RAD OR EPO NO	QUANTITY IN SHIPMENT
[illegible]77-212	7-[illegible]-51		TA1-5002h		25
[illegible]	PROP. CHARGE	EXPECTED M. V.	EXPECTED PRESSURE	ASSEMBLED BY	DATE OF ASSEMBLY
				PA	May, 1952

[illegible]: Packed: In accordance with PX-89-1061. Ring gaged chamber gaged and x-rayed [illegible]100%. Shell numbered from 1-25 inclusive.
Note weights on reverse side.

(Over)

[illegible]	Shell, [illegible]	Filler	Fuze, BD,
	76[illegible], T170B3	Comp. A3	M91 Inert
[illegible]	J-7577-213		Unk
[illegible] DATE OR REV.	7-31-51		Unk
[illegible]	Chamberlain	Wabash	None
[illegible]	1951	1945	1951
[illegible]	[illegible]-1034	WAB-3-114	None

CONFIDENTIAL

[illegible] BY: Dora K. Ciepiela
Loading Br., Ind.
DIVISION

PICATINNY ARSENAL
DOVER, NEW JERSEY

CERTIFIED TO BY: J. K. Nystrand, INSPECTOR
Inspection
DIVISION

Card No. 62543

[illegible] No.	Empty Wt.	As Fired Wt.	Shell No.	Empty Wt.	As Fired Wt.
1	5.54	10.04	13	5.54	10.04
2	5.54	10.04	14	5.51	10.01
3	5.52	10.01	15	5.55	10.05
4	5.57	10.06	16	5.53	10.04
5	5.55	10.06	17	5.53	10.03
6	5.54	10.01	18	5.4[illegible]	10.0[illegible]
7	5.56	10.06	19	5.5[illegible]	10.01
8	5.51	10.02	20	5.5[illegible]	10.03
9	5.52	10.01	[illegible]	[illegible]	10.02
10	5.45	10.00	[illegible]	[illegible]	[illegible]
11	5.51	10.03	[illegible]	5.54	10.05
12	5.54	10.03	[illegible]	5.54	10.03
			[illegible]	5.54	10.02

Tarr-2194

EXPERIMENTAL AMMUNITION DATA CARD

NO. 62545

T.P.E. NO.	KIND				ANN. LOT NO.
	CONFIDENTIAL				PA-E-9645
SPEC. NO.	Shell, HEP, 76MM, T170E3, Inert With Fuze, BD, M91 Inert. Ballistic Sample				QUANTITY IN LOT 50
DRG. NO. None	DRG. DATE OR REV. None	ALLOT. ADVICE	PROJECT NO. TA1-5003M	RAD OR EPO NO.	QUANTITY IN SHIPMENT 50
P.A.X.O. 153-24/13	PROP. CHARGE	EXPECTED M.V.	EXPECTED PRESSURE	ASSEMBLED BY PA	DATE OF ASSEMBLY April, 1952

REMARKS: Packed: 2 Shell/wood box.
Ring gaged and chamber gaged 100%.

(See Reverse Side)

COMPONENT	Shell, HEP,	Filler	Fuze, BD,				
KIND	T170E3	Inert	M91 Inert				
	76MM	Comp. A3					
DRG. NO.	Unk	88/10/2	73-2-239				
DRG. DATE OR REV.	Unk		11-17-50				
MFG'D BY	Chamberlain		PA				
DATE	1951		1952				
LOT NO.	1034		PA-E-9326				

E A Chegwidden

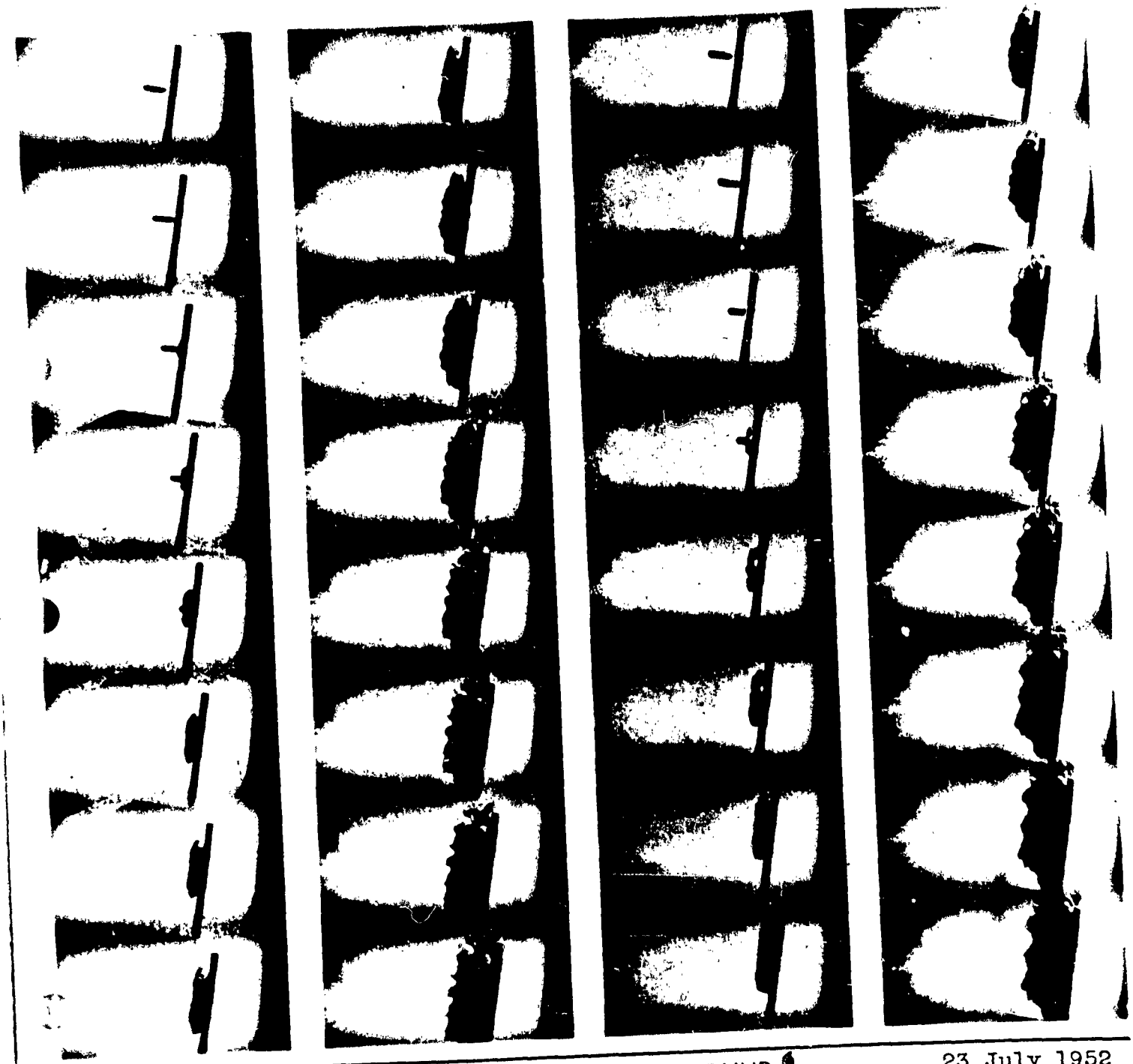
PREPARED BY Dora K. Ciepiela
Loading Br., Ind.
DIVISION

CONFIDENTIAL
CERTIFIED TO BY: E. A. Chegwidden, INSPECTOR
Inspection
Incl 1 APL(c) 471/804
DIVISION

PICATINNY ARSENAL
DOVER, NEW JERSEY

Shell No.	Empty Wt.	[illegible] fired wt.	Shell No.	Empty Wt.	[illegible] fired wt.
1	6.17	9.99	[illegible]	6.18	10.01
2	6.14	9.95	27	6.20	10.02
3	6.18	10.01	28	6.22	10.03
4	6.20	10.02	29	6.22	10.04
5	6.22	10.04	30	6.16	9.98
6	6.20	10.00	31	6.16	9.99
7	6.19	10.01	32	6.21	10.03
8	6.17	9.99	33	6.22	10.03
9	6.21	10.03	34	6.25	10.06
10	6.14	9.94	35	6.18	10.00
11	6.22	10.04	36	6.20	10.03
12	6.19	10.02	37	6.24	10.05
13	6.20	10.01	38	6.22	10.03
14	6.22	10.04	39	6.19	10.02
15	6.21	10.08	40	6.18	9.99
16	6.19	10.01	41	6.19	10.02
17	6.15	9.99	42	6.21	10.03
18	6.16	9.99	43	6.20	10.05
19	6.17	9.99	44	6.15	9.96
20	6.15	9.95	45	6.20	10.01
21	6.19	10.01	46	6.20	10.01
22	6.18	10.01	47	6.18	10.01
23	6.18	10.03	48	6.20	10.03
24	6.13	9.97	49	6.21	10.03
25	6.20	10.03	50	6.12	9.97

CONFIDENTIAL

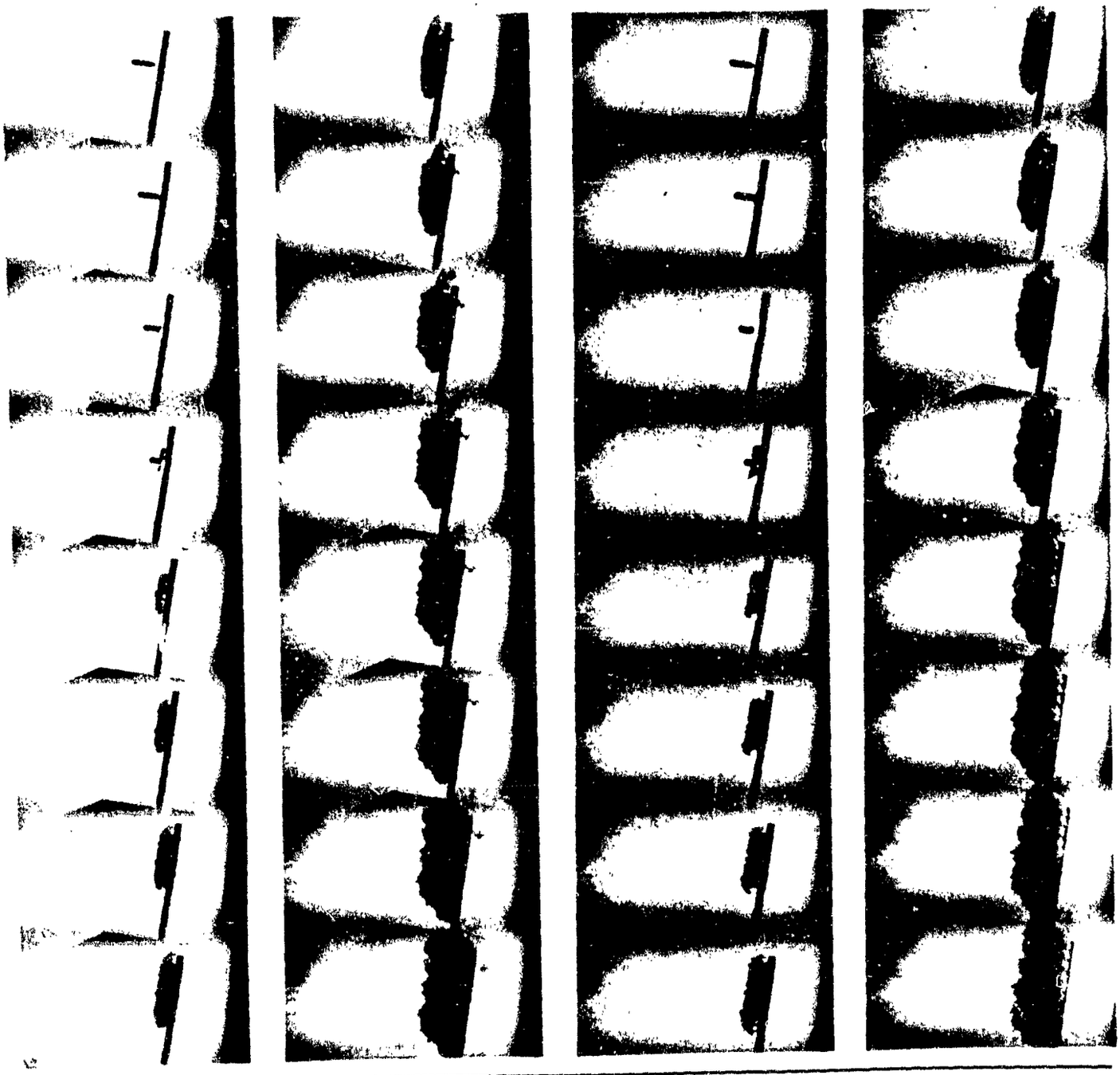


23 July 1952

A83357 CONFIDENTIAL ABERDEEN PROVING GROUND

Project No. TA1-5002H. Shell, HEP, T170E3, A3 Filler, Inert Fuze, Amm.
Lot PAE-9443, Fired against 3" Plate at 0° Obliquity.
Left to Right: Tube Round No. 66. Striking velocity: 1483 f/s.
Tube Round No. 67. Striking velocity: 1591 f/s.

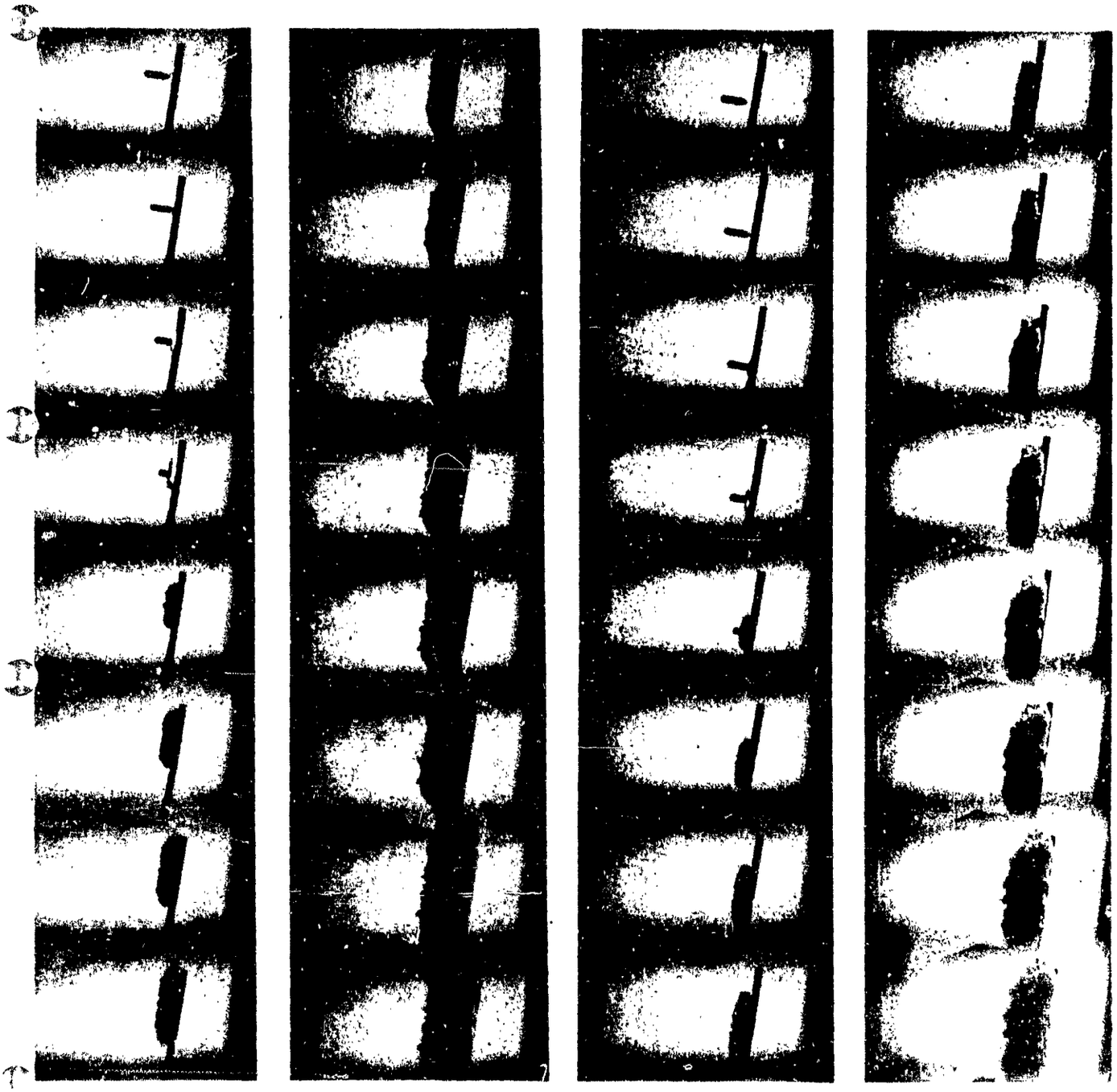
CONFIDENTIAL



A83358 CONFIDENTIAL ABERDEEN PROVING GROUND 23 July 1952

Project No. TA1-5002H. Shell, HEP, T170E3, A3 Filler, Inert Fuze, Amm.
Lot PAE-9443, Fired against 3" Plate at 0° Obliquity.
Left to Right: Tube Round No. 68. Striking velocity: 1544 f/s.
Tube Round No. 69. Striking velocity: 1524 f/s.

CONFIDENTIAL



A83359 CONFIDENTIAL ABERDEEN PROVING GROUND 23 July 1952

Project No. TA1-5002H. Shell, HEP, T170E3, A3 Filler, Inert Fuze, Amm. Lot PAE-9443, Fired against 3" Plate at 0° Obliquity.

Left to Right: Tube Round No. 70. Striking velocity: 1377 f/s.
Tube Round No. 71. Striking velocity: 1350 f/s.

CONFIDENTIAL

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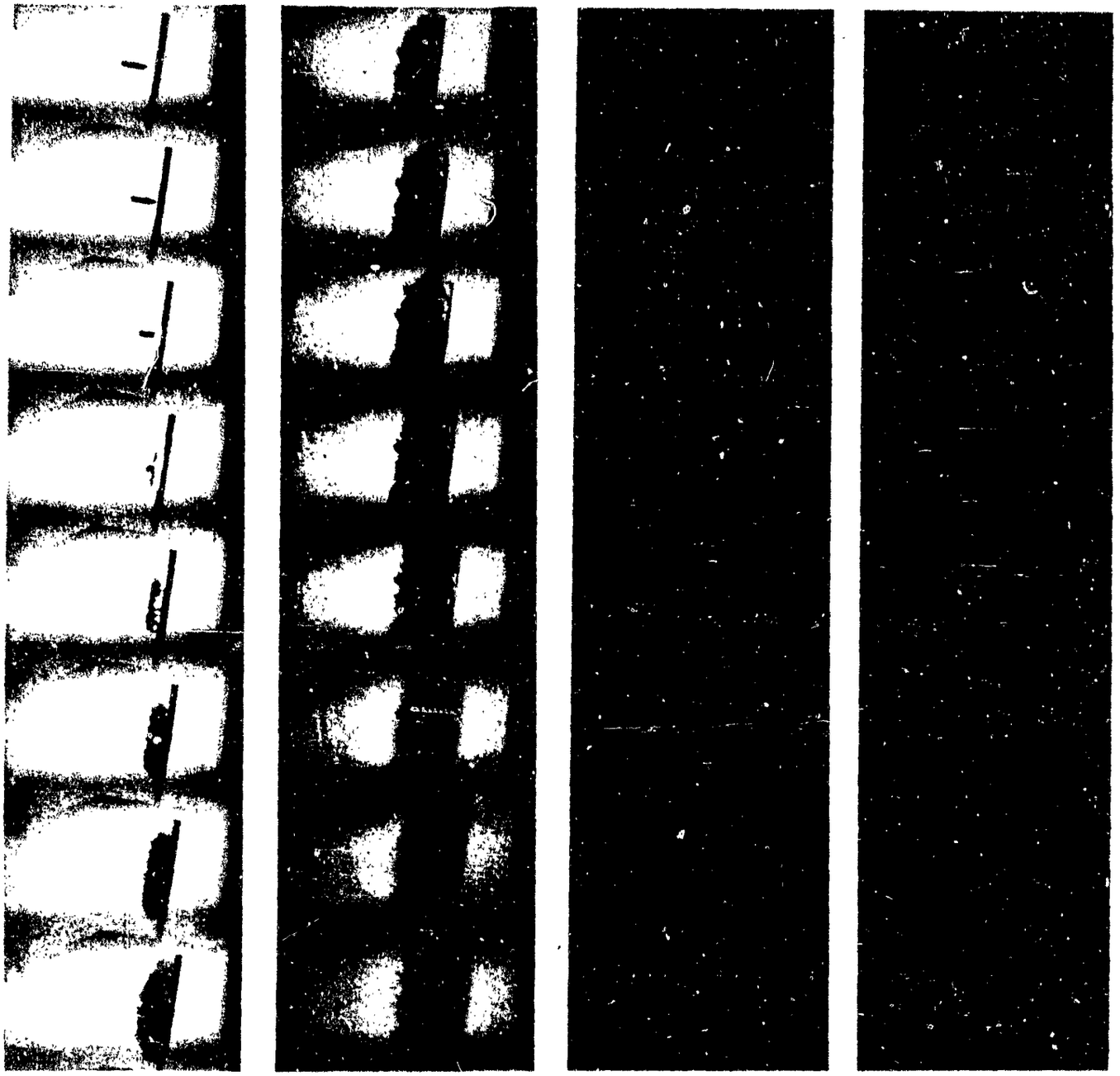

A83360 CONFIDENTIAL ABERDEEN PROVING GROUND 23 July 1952

Project No. TA1-5002H. Shell, HEP, T170E3, A3 Filler, Inert Fuze, Amm. Lot PAE-9443, Fired against 3" Plate at 0° Obliquity.

Left to Right: Tube Round No. 72. Striking velocity: 1665 f/s.
Tube Round No. 73. Striking velocity: 1670 f/s.

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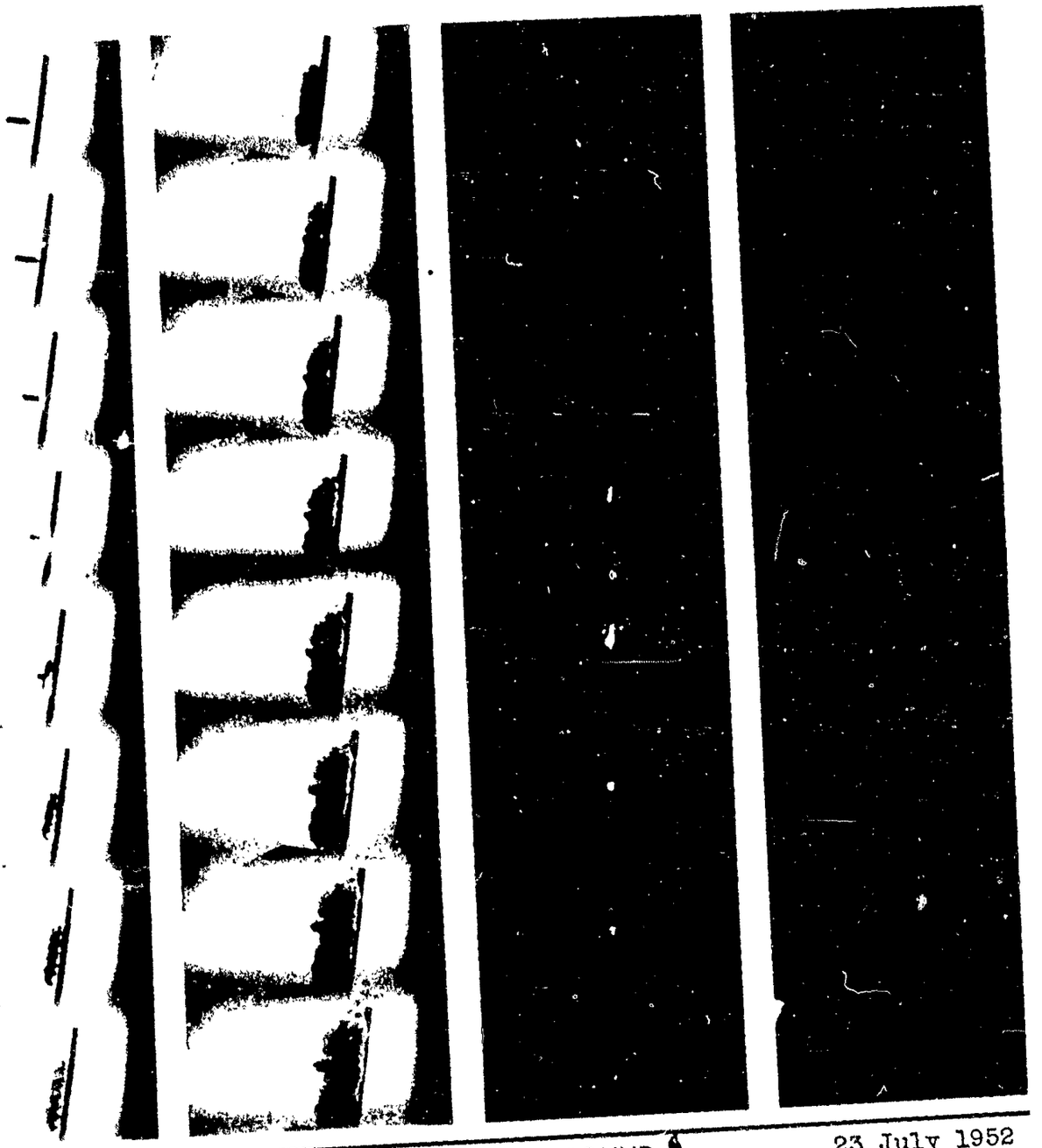

A83361 CONFIDENTIAL ABERDEEN PROVING GROUND 23 July 1952

Project No. TA1-5002H. Shell, HEP, T170E3, A3 Filler, Inert Fuze, Amm.
Lot PAE-9443, Fired against 3" Plate at 0° Obliquity.
Left to Right: Tube Round No. 74. Striking velocity: 1676 f/s.
Tube Round No. 75. Striking velocity: 1359 f/s.

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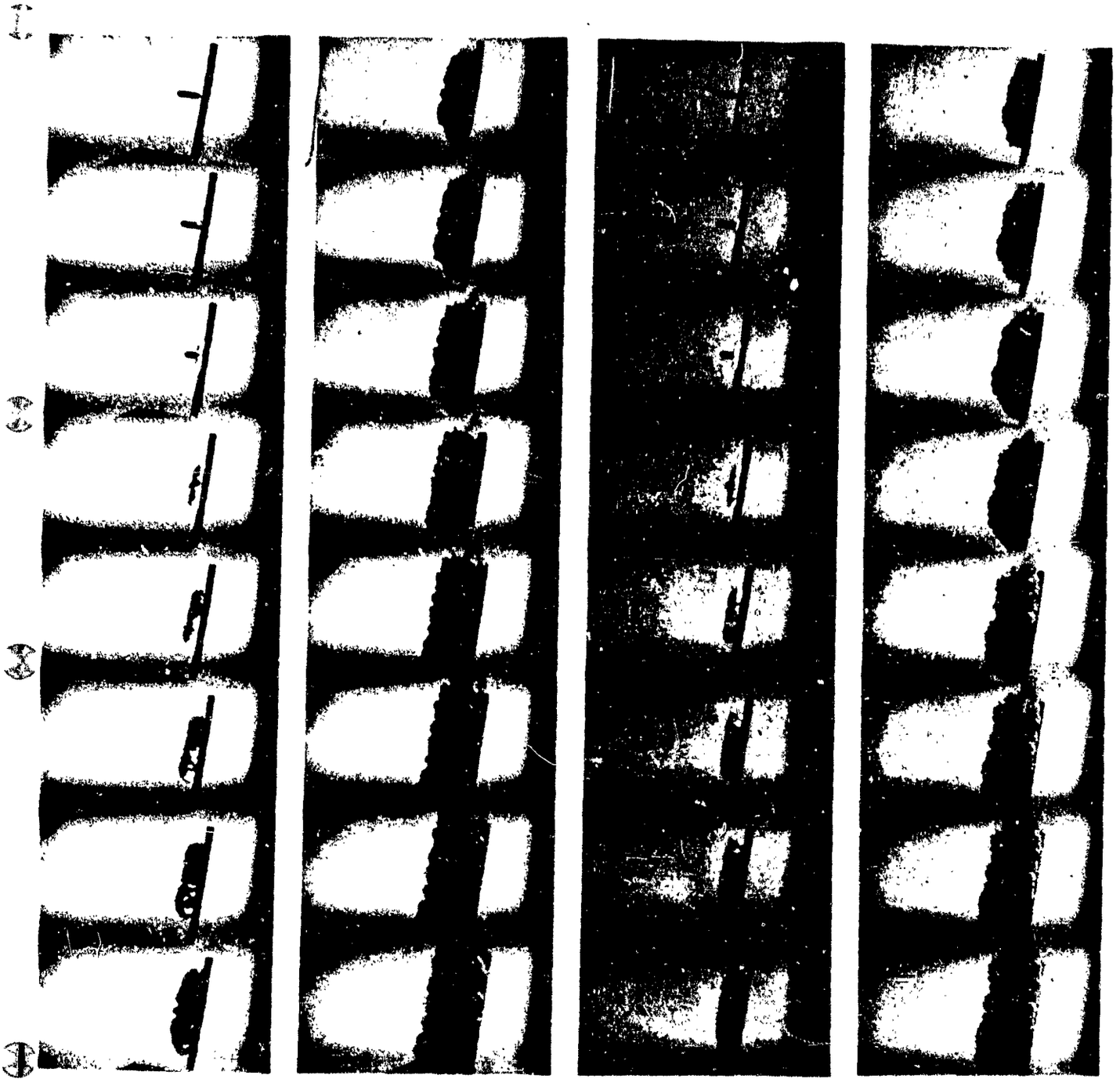

A83362 CONFIDENTIAL ABERDEEN PROVING GROUND 23 July 1952

Project No. TA1-5002H. Shell, HEP, T170E3, A3 Filler, Inert Fuze, Amm. Lot PAE-9443, Fired against 3" Plate at 0° Obliquity.

Left to Right: Tube Round No. 76. Striking velocity: 1912 f/s
Tube Round No. 77. Striking velocity: 1911 f/s.

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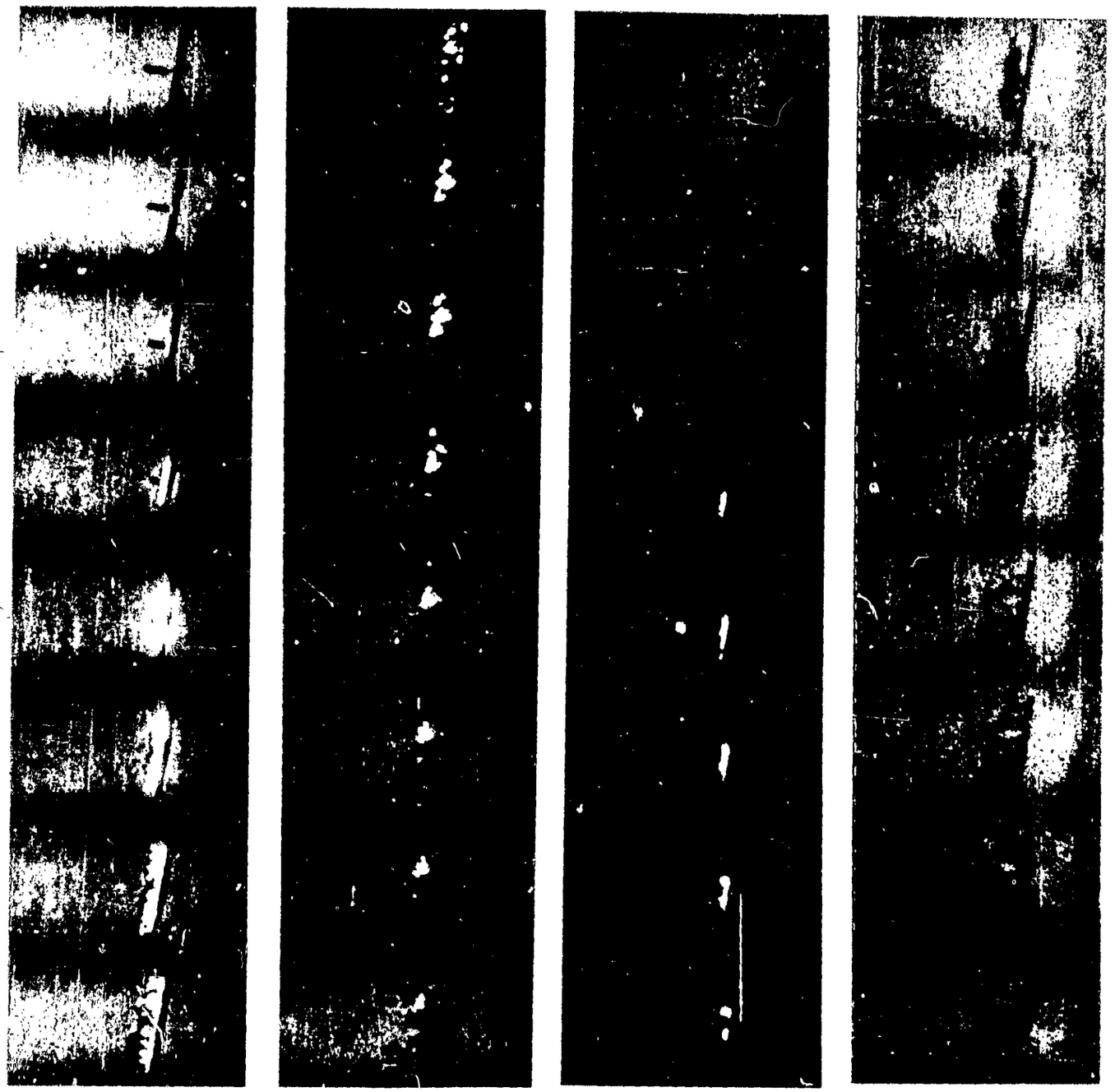

A83363 CONFIDENTIAL ABERDEEN PROVING GROUND 23 July 1952

Project No. TA1-5002H. Shell, HEP, T170E3, A3 Filler, Inert Fuze, Amm. Lot PAE-9443, Fired against 3" Plate at 0° Obliquity.

Left to Right: Tube Round No. 78. Striking velocity: 1897 f/s.
Tube Round No. 79. Striking velocity: 1537 f/s.

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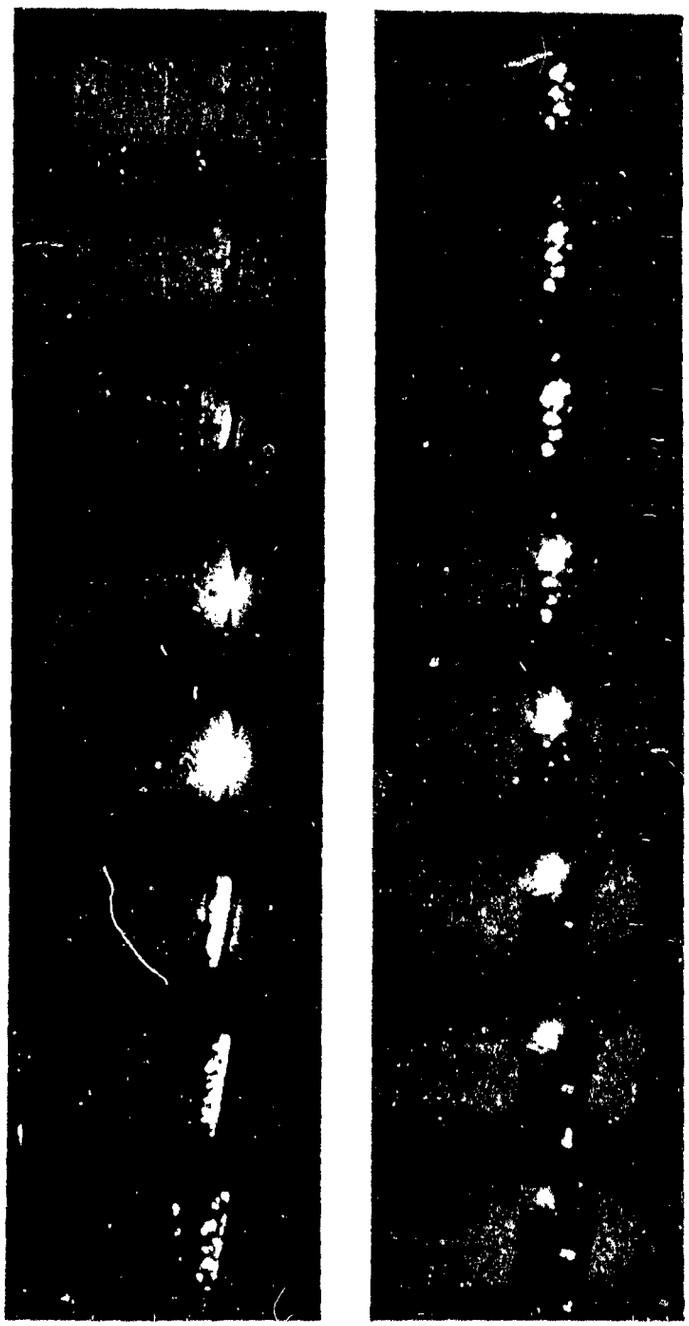

A83364 CONFIDENTIAL ABERDEEN PROVING GROUND 23 July 1952

Project No. TA1-5002H. Shell, HEP, T170E3, A3 Filler, Inert Fuze, Amm. Lot PAE-9443, Fired against 3" Plate at 0° Obliquity.
Tube Round No. 80. Striking velocity: 1556.

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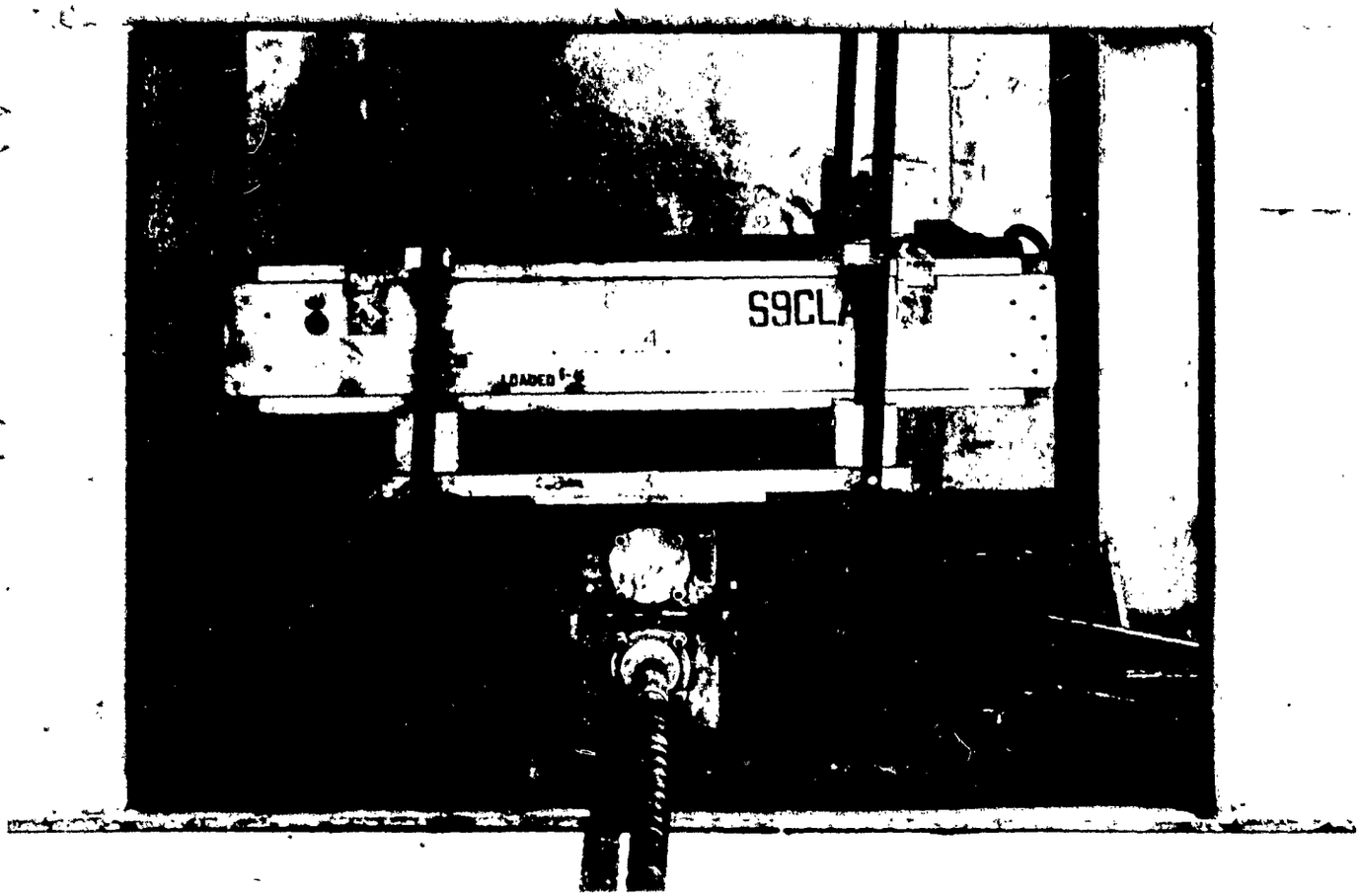

A73795 RESTRICTED ABERDEEN PROVING GROUND 7 June 1951

Typical Setup for Simulating Various Transportation Vibrations.

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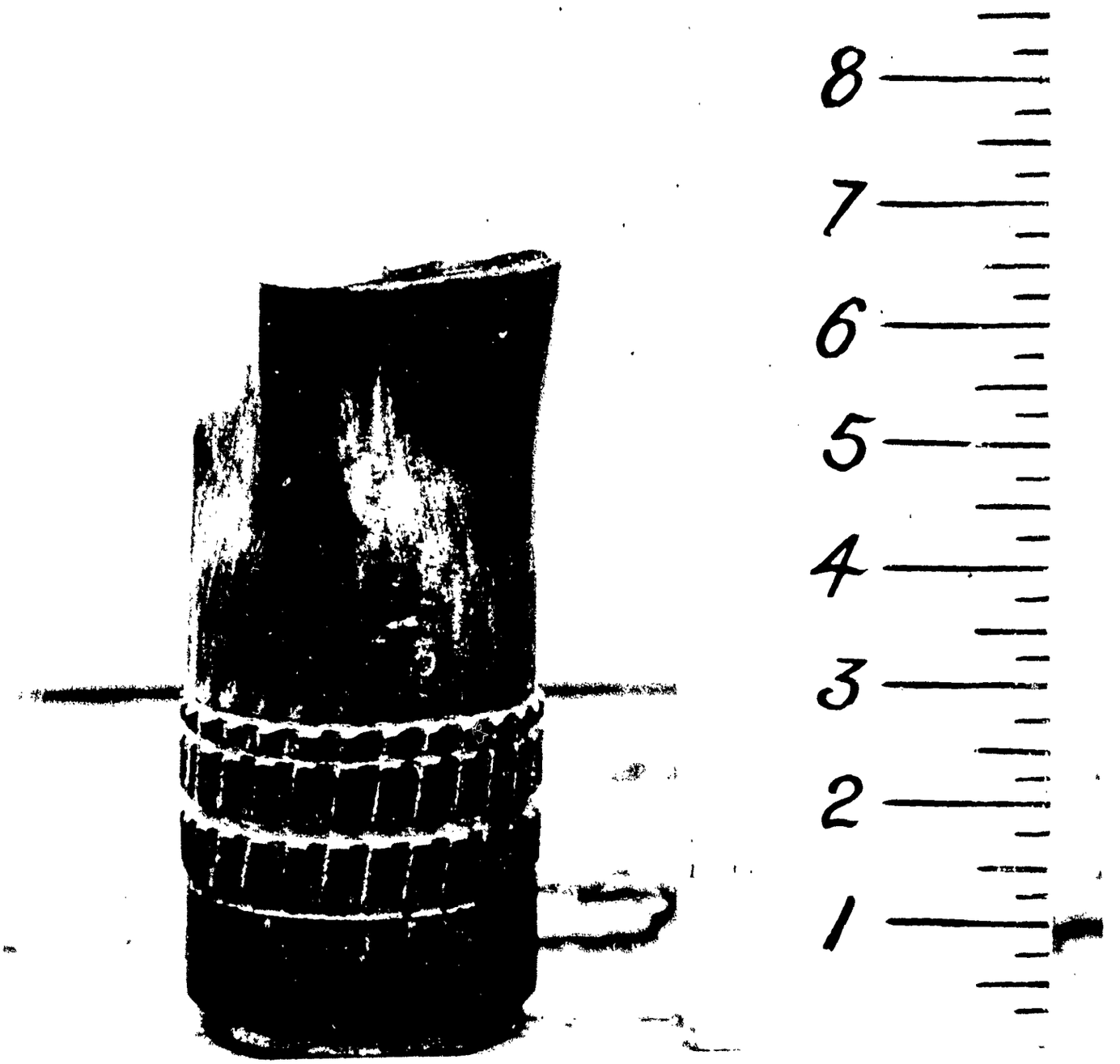

A74264 CONFIDENTIAL ABERDEEN PROVING GROUND 26 November 1951
Project No. TA1-5002H. 76mm Shell, HEP, T170E3 Fired From 76mm Gun, T91 at a Chamber Pressure of 24,600 psi. (Inst. Vel. approximately 2842 fps.) Recovered From Sawdust.

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A74265 CONFIDENTIAL ABERDEEN PROVING GROUND 26 November 1951
Project No. TA1-5002H. 76mm Shell, HEP, T170E3 Fired From 76mm Gun, T91 at a Chamber Pressure of 24,600 psi. (Inst. Vel. approximately 2842 fps.) Recovered From Sawdust.

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A74659 CONFIDENTIAL ABERDEEN PROVING GROUND 26 November 1951
Project No. TA1-5002H. 76mm Shell, HEP, T170E3 Fired From 76mm Gun, T9
at a Chamber Pressure of 23600 psi. (Inst. Vel. Approximately 2774 fps
Recovered from sawdust.

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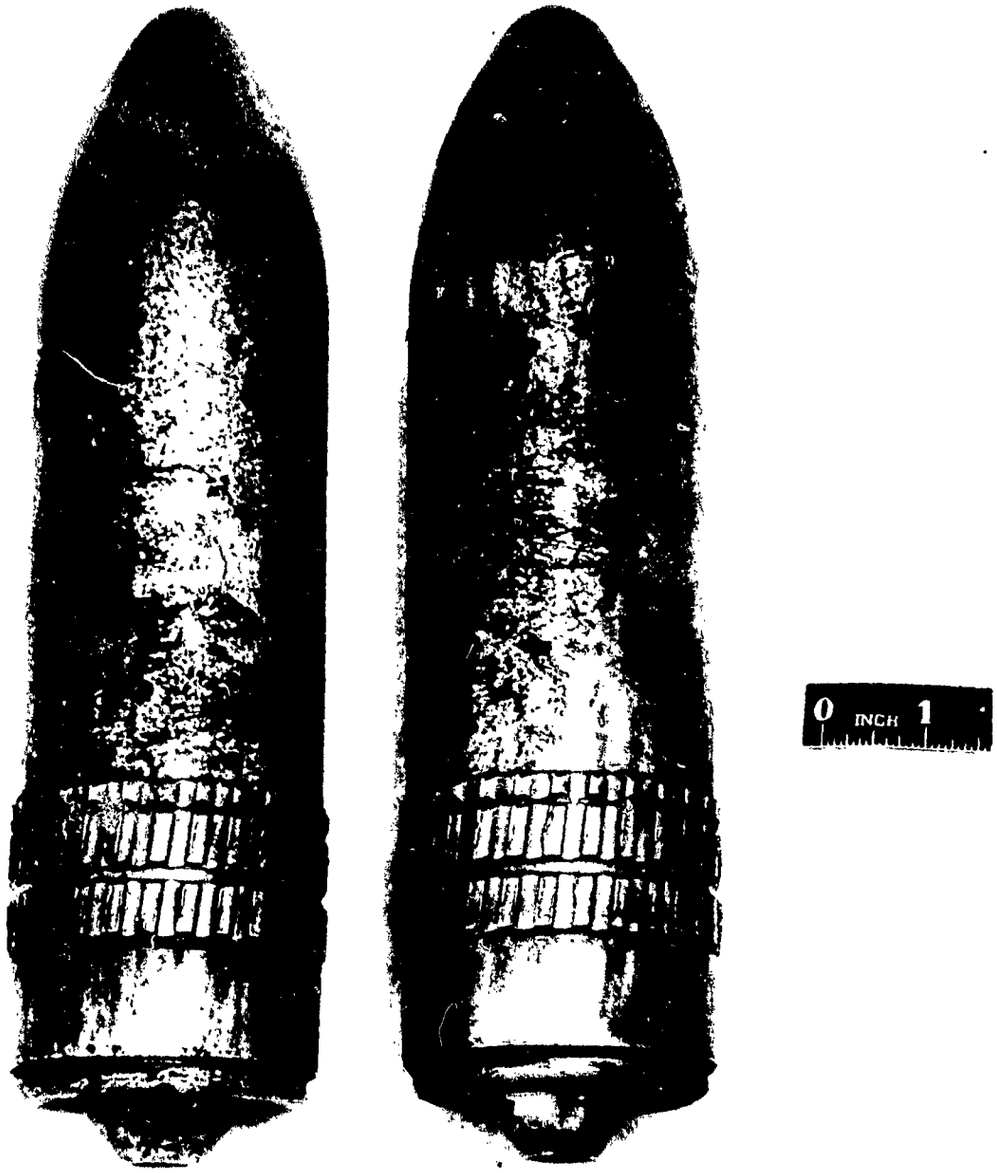

A75966 CONFIDENTIAL ABERDEEN PROVING GROUND 31 January 1952

Project No. TA1-5002H. Projectile, 76mm, HEP, T170E3.
Ammunition Lot No. PA-E-6716 (A3 loaded with inert M91 fuze) recovered from ground impact after being fired from 76mm, T91 gun at a chamber pressure of 28,400 and 29,600 psi.

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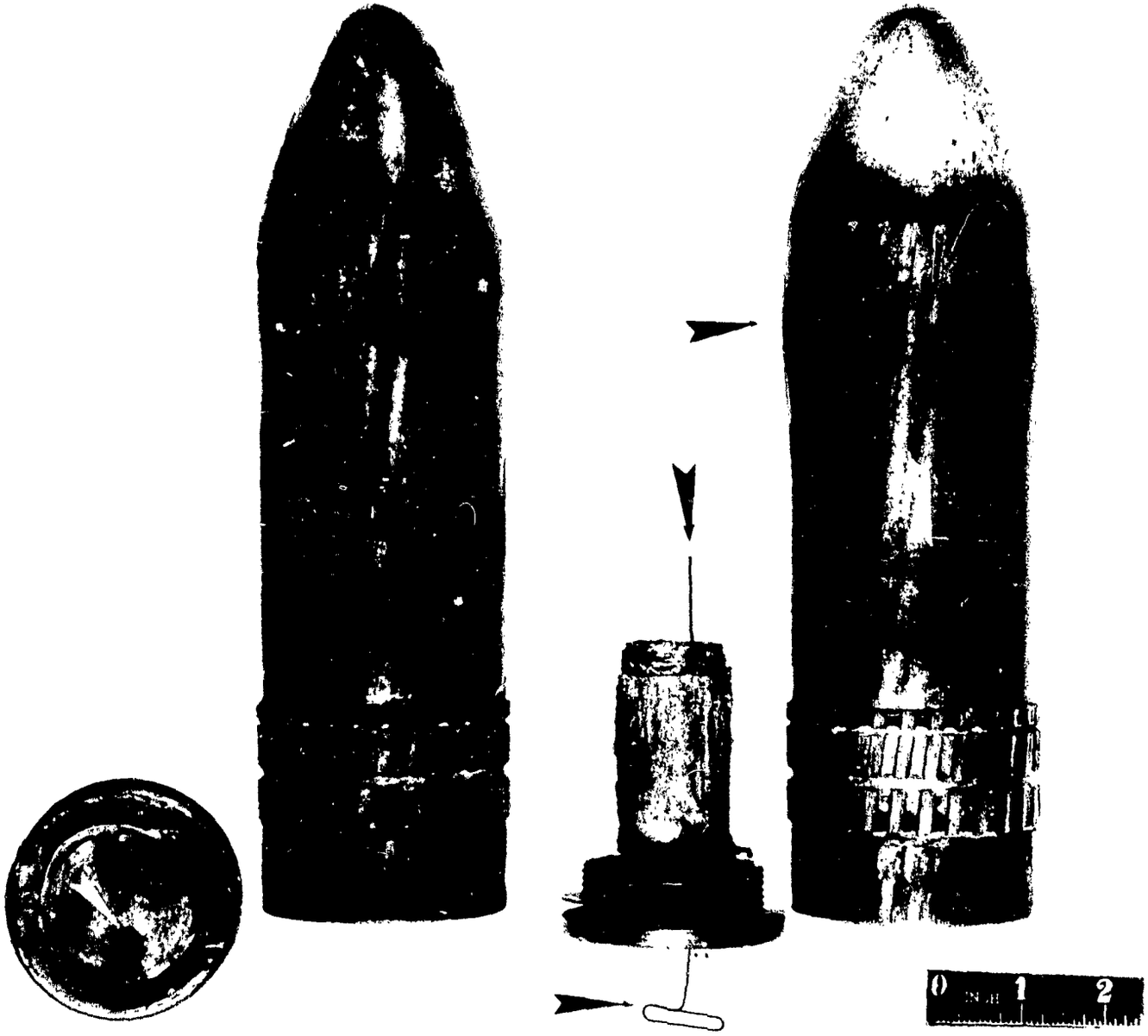

A76034 CONFIDENTIAL ABERDEEN PROVING GROUND 5 January 1952

Project No. TA1-5002H. 76mm Shell, HEP, T170E3, Inert Loaded (Ammunition Lot PA-E-6715.

Fired at a chamber pressure of approximately 19,000 psi and recovered from ground impact. NOTE: Holes in the B. D. Fuze permitted gun chamber gases to pass into shell body and expand the shell, resulting in erratic flight of the shell in accuracy tests.

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A81514 CONFIDENTIAL § ABERDEEN PROVING GROUND § 14 August 1952

Project No. TA1-5002H. Shell, 76mm, HEP-T, Inert, T170E3, W/Fuze, Inert, BDM91.

Ammunition Lot PAE-9445, fired against 3" homogeneous armor, painted white, at 0° obliquity. Striking velocity: 998 f/s. Tube round No. 172.

CONFIDENTIAL

A81515 CONFIDENTIAL § ABERDEEN PROVING GROUND § 14 August 1952

Project No. TA1-5002H. Shell, 76mm, HEP-T, Inert, T170E3, W/Fuze, Inert, BDM91.

Ammunition Lot PAE-944E, fired against 3" homogeneous armor, painted white, at 0° obliquity. Striking velocity: 1107 f/s. Tube round No. 173.

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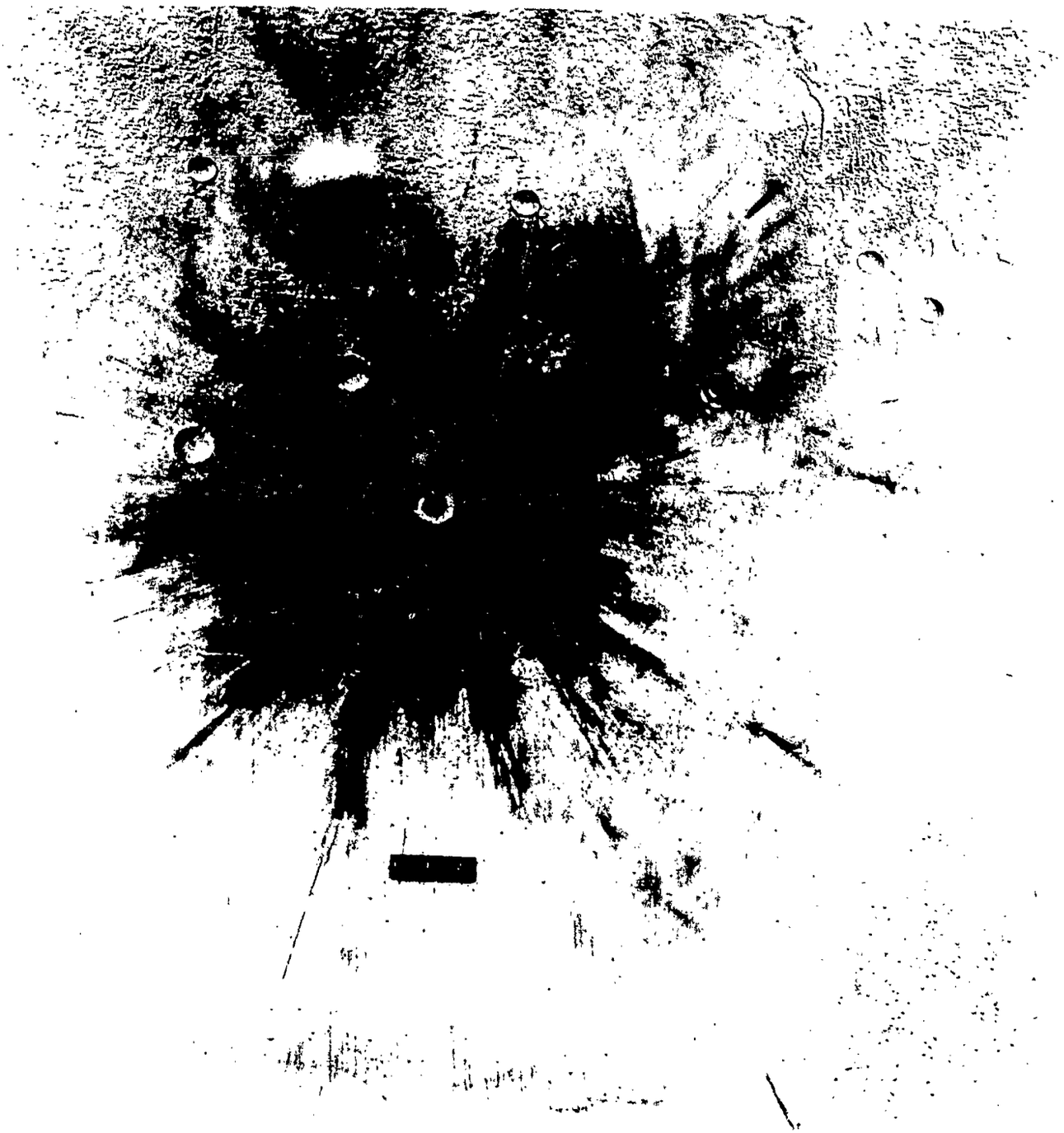

A81516 CONFIDENTIAL ABERDEEN PROVING GROUND 14 August 1952

Project No. TA1-5002H. Shell, 76mm, HEP-T, Inert, T170E3, W/Fuze, Inert, BDM91.

Ammunition Lot PAE-9445, fired against 3" homogeneous armor, painted white, at 0° obliquity. Striking velocity: 1854 f/s. Tube round No. 174.

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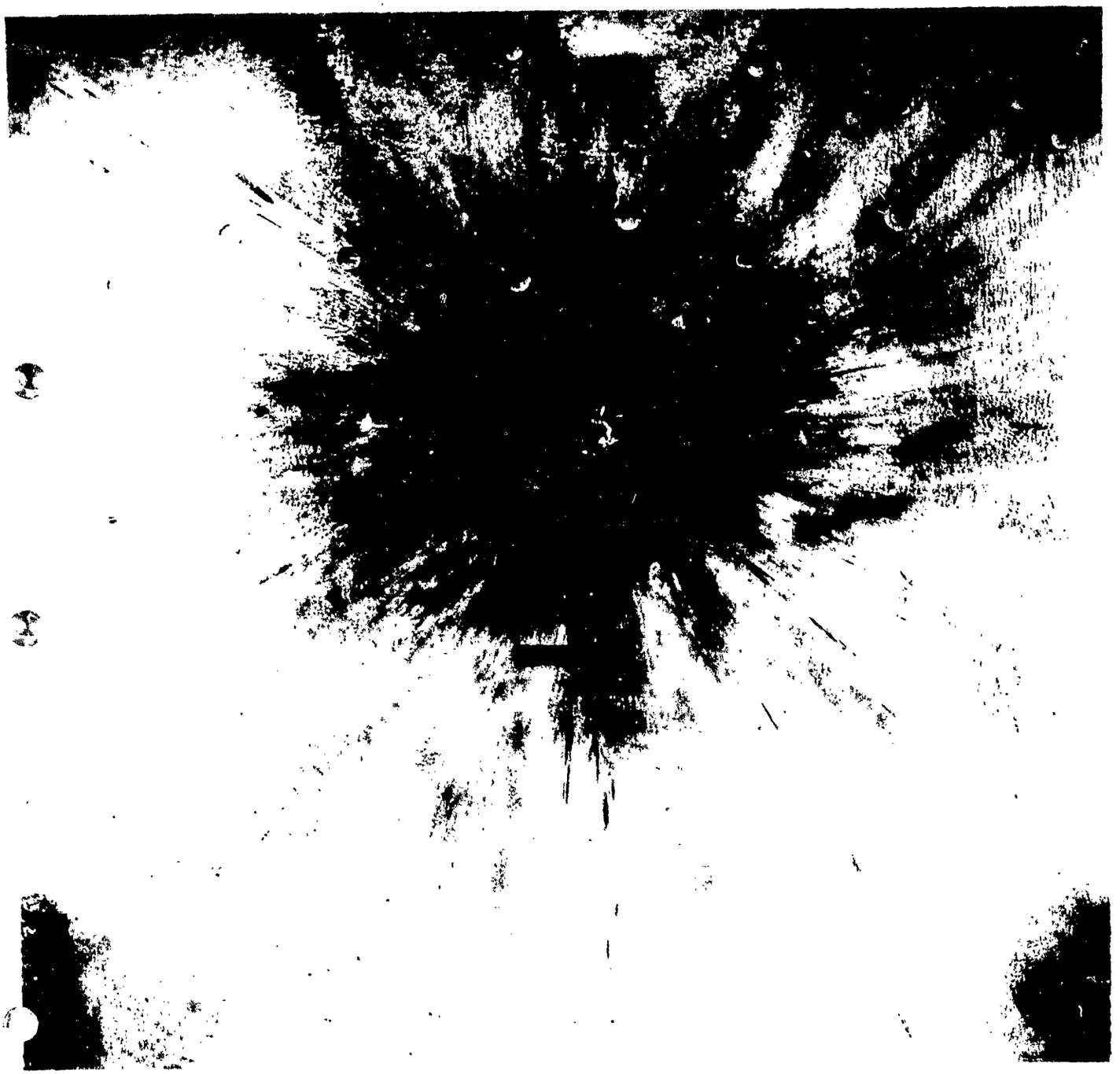

A81517 CONFIDENTIAL ABERDEEN PROVING GROUND 14 August 1952

Project No. TA1-5002H. Shell, 76mm, HEP-T, Inert, T170E3, W/Fuze, Inert, BDM91.

Ammunition Lot PAE-9445, fired against 3" homogeneous armor, painted white, at 0° obliquity. Striking velocity: 2013 f/s. Tube round No. 175.

CONFIDENTIAL

A81518 CONFIDENTIAL ABERDEEN PROVING GROUND 14 August 1952

Project No. TA1-5002H. Shell, 76mm, HEP-T, Inert, T170E3, W/Fuze, Inert BDM91.

Ammunition Lot PAE-9445, fired against 3" homogeneous armor, painted white, at 0° obliquity. Striking velocity: 2013 f/s. Tube round No. 176.

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