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NPG REPORT NO. 202

Static Fragmentation of Controlled Fragmentation
Experimental Loadings

PART A

SYNOPSIS

1. Six rounds of modified 5¹/₄ Cal. illuminating projectiles, three with shaped charge liners and three without, were statically detonated for measurement of mass distribution to determine the ability of the shaped charge liner to produce break-up along lines transverse to the axis of the projectile.

2. From examination of the collected fragments and of the mass distribution data, it is concluded that the liner used exercised no control over the fragmentation. ✓

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PART B

INTRODUCTION

1. AUTHORITY:

- a. BuOrd Conf. ltr NP9(Re2c) to NPG dated 26 May 1948.
- b. BuOrd Conf. ltr NP9(Re2c) to NPG dated 16 June 1948.

2. REFERENCES:

- a. BuOrd Conf. ltr NT3-2(Re2c) to NMD Yorktown, Virginia dated 11 May 1948.
- b. BOSO 317756.

3. OBJECT OF TEST:

- a. Six rounds of modified 5"/54 illuminating projectiles Mk. 48, three with shaped charge liners and three without, were statically detonated with measurement of mass distribution to determine the ability of the shaped charge liner to produce break-up along the length of the projectile.

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-----PART CDETAILS OF TEST

4. DESCRIPTION OF ITEMS UNDER TEST:

a. Three rounds of Mk. 48 5"/54 Cal. illuminating projectiles modified as shown in Appendix (A), Figure 1 and three rounds of similar shape and loading without the shaped charge liner were received under references (a) and (b).

b. The projectiles were closed at the upper end with a layer of paper and contained a fuze cavity too small to accommodate any standard fuze or booster. To detonate the projectiles a booster was improvised by rolling a cylinder of Comp. C (.08 lbs.) in aluminum foil and inserting it in the projectile cavity. A Hercules Electric Engineers Blasting Cap was inserted 3/4" into the Comp. C to initiate the detonation. All rounds detonated high order.

5. PROCEDURE AND RESULTS:

a. The determination of mass distribution was made using the Proving Ground's open pit technique with water as the collecting medium. The projectiles were supported in canvas slings and suspended from a gallows in a horizontal position with the sides of the pit subtending an angle of 60° at the center of the projectile. Thus for each round one-sixth of the beam spray was collected, and this amounted to approximately 13% of the total mass. No attempt was made to collect other than the beam spray for this test. Photographs of the fragments collected are included as Appendix (B) and detailed data are given in Appendix (C).

6. DISCUSSION:

a. An examination of the fragments collected indicated that the shaped liner was not effective in breaking the fragments along the length of the projectile. Some of the longer fragments were grooved slightly adjacent to the liner grooves, but not sufficiently to cause them to break. A photograph of a few fragments showing these grooves is included as Appendix (B), Figure 4. The ones selected for the picture were those showing the deepest grooving.

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b. An examination of the two mass distributions indicated that there was no significant difference between them.

PART D

CONCLUSIONS

7. From examination of the collected fragments and of the mass distribution data, it is concluded that the liner used exercised no control over the fragmentation.

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U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

Final Report

on

Static Fragmentation of Controlled Fragmentation

Experimental Loadings

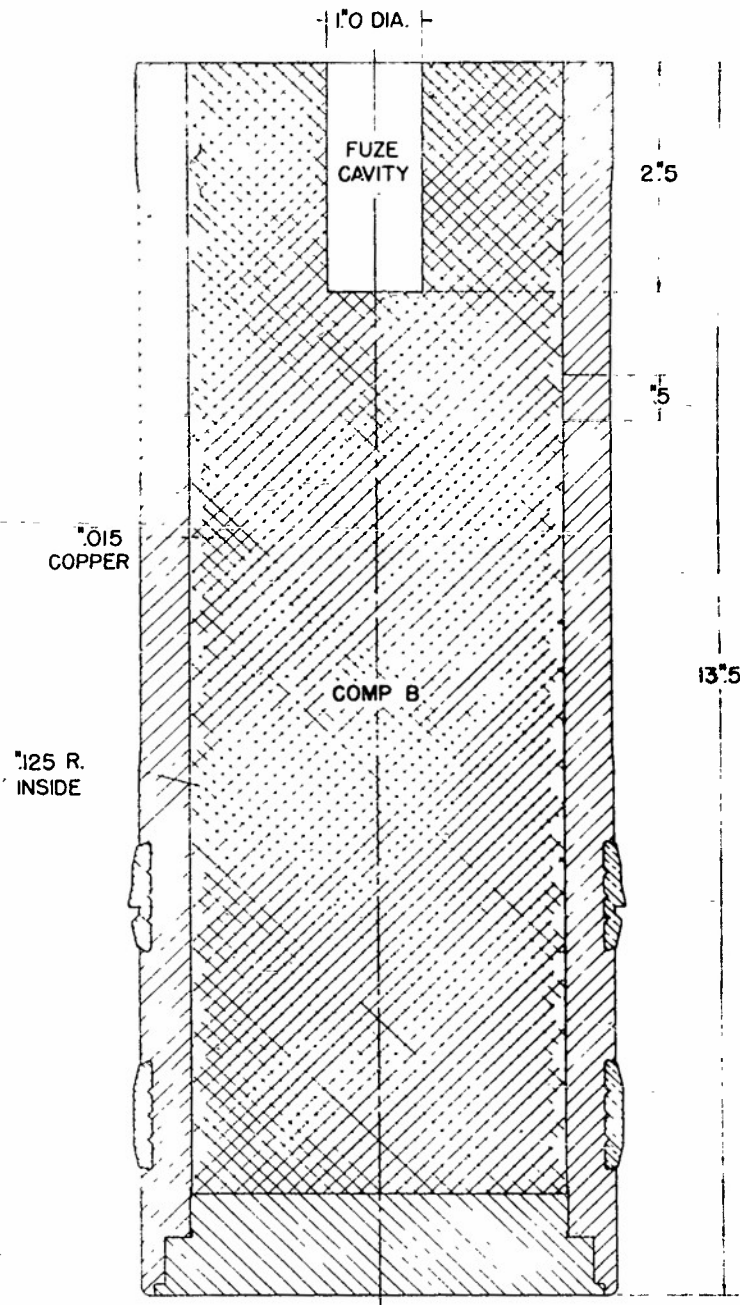
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MODIFIED 5" PROJECTILE (ILL.) MK.48 MOD.0

LOADING DIAGRAM FOR CONTROLLED FRAGMENTATION EXPERIMENT

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5" HC Ex 26

SEGMENTATION CHARGES

ROUND 7 3

0-2.5	GMS.	0-2.5	GMS.	0-2.5	GMS.
5.63	PCS.	1103	PCS.	664	PCS.
0.67	LBS.	0.79	LBS.	1.07	LBS.

2.5-5	GMS.	2.5-5	GMS.	2.5-5	GMS.
95	PCS.	93	PCS.	91	PCS.
0.65	LBS.	0.63	LBS.	0.82	LBS.

5-10	GMS.	5-10	GMS.	5-10	GMS.
58	PCS.	54	PCS.	35	PCS.
0.86	LBS.	0.80	LBS.	0.67	LBS.

10-20	GMS.	10-20	GMS.	10-20	GMS.
39	PCS.	26	PCS.	25	PCS.
1.02	LBS.	0.81	LBS.	0.88	LBS.

20-40	GMS.	20-40	GMS.	20-40	GMS.
73	PCS.	74	PCS.	77	PCS.
0.71	LBS.	0.88	LBS.	0.65	LBS.

40-80	GMS.	40-80	GMS.	40-80	GMS.
2	PCS.	3	PCS.	2	PCS.
0.19	LBS.	0.35	LBS.	0.20	LBS.

EXP. WT. 8.25 8.25 8.50
 TOTAL WT. PROJ. 41.25 41.18 41.40
 EXPLOSIVE COMP. B

FRAG No. 1182 1183 1184
 NP9 37476
 PHOTO TAKEN 12-2-48

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Figure 2

5" HC Ex 26

CONTROLLED
WITHOUT

FRAGMENTATION
LINERS

Round	GMS.	PCS.	LBS.	Round	GMS.	PCS.	LBS.	Round	GMS.	PCS.	LBS.
0-2.5	494	0.55		0-2.5	452	0.54		0-2.5	1073	0.76	
2.5-5	95	0.54		2.5-5	124	0.65		2.5-5	126	0.80	
5-10	79	1.05		5-10	75	1.05		5-10	79	1.05	
10-20	30	0.88		10-20	23	0.63		10-20	30	0.87	
20-40	12	0.73		20-40	20	1.20		20-40	13	0.72	
40-80	2	0.19		40-80	3	0.28		40-80	3	0.23	

EXP. WT. 8.88 8.88 8.63
 TOTAL WT. PROJ. 40.92 41.02 40.73

EXPLOSIVE COMP B

FRAG No 1179-1180-1181

NP9 57473

PHOTO TAKEN 12-1-48

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Figure 3

NPC-37585 - Projected charge projectile liner.
shaped by shaped charge projectile liner.
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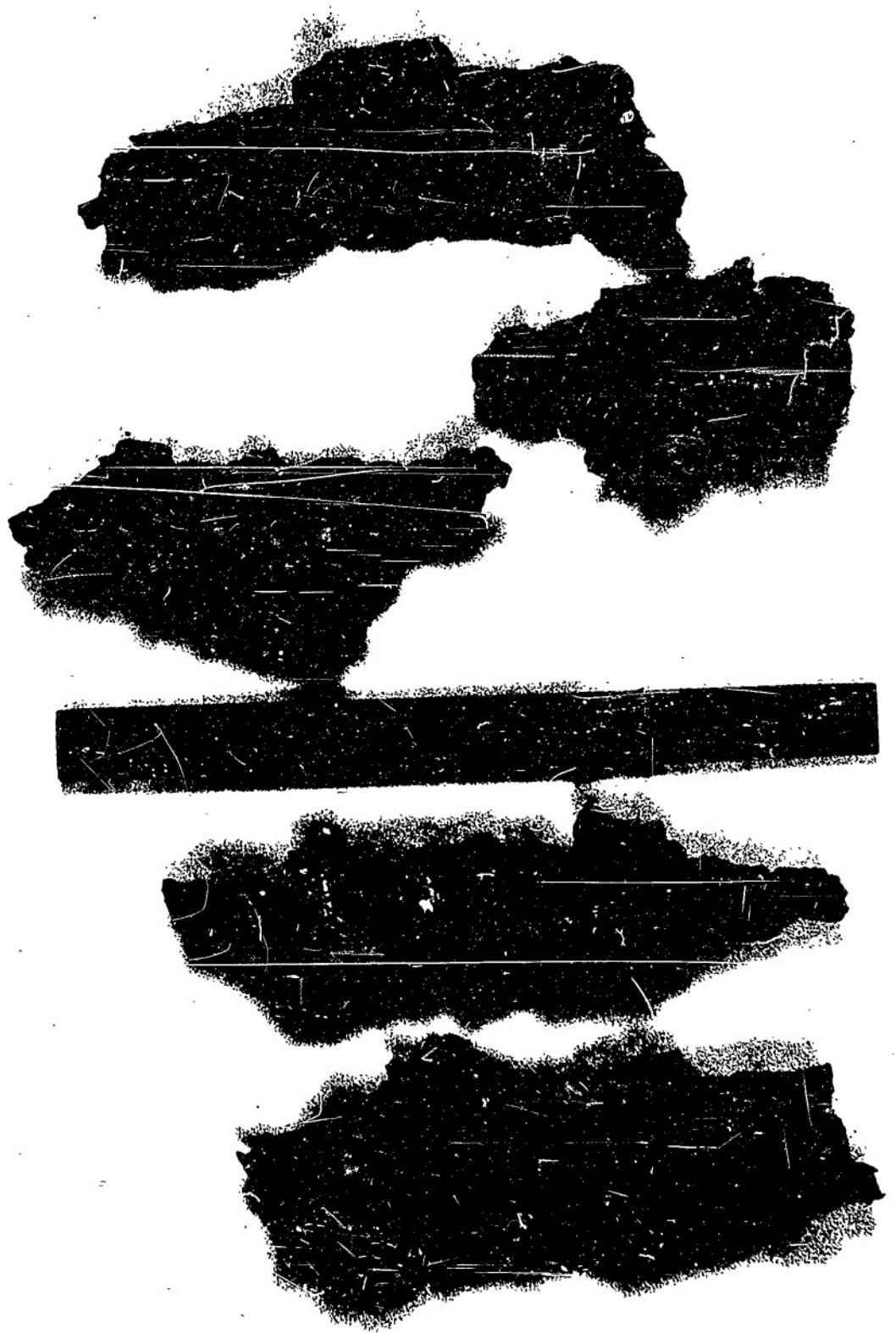


Figure 4

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Static Fragmentation of Controlled Fragmentation
Experimental Loadings

TABLE I

MASS DISTRIBUTION DATA

MODIFIED 5" MK. 48 S. S. PROJECTILES WITH SHAPED CHARGE LINERS

Wt. Group (grams)	No. Fragments				Weight (lbs.)			
	Rd. 1	Rd. 2	Rd. 3	Avg.	Rd. 1	Rd. 2	Rd. 3	Avg.
0-2.5	563	1103	661	776	0.69	0.79	1.07	0.85
2.5-5	95	93	91	93	0.65	0.63	0.82	0.70
5-10	58	54	35	49	0.86	0.80	0.67	0.78
10-20	39	26	25	30	1.02	0.81	0.88	0.90
20-40	13	14	11	13	0.71	0.88	0.65	0.75
40-80	2	3	2	2	0.19	0.35	0.20	0.25
Totals	770	1293	825	963	4.12	4.26	4.29	4.23
Wt. of Empty Projectile					33.00	32.93	32.90	
Percentage Recovered					12%	13%	13%	
Wt. of Comp. B					8.25	8.25	8.50	

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APPENDIX C

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Static Fragmentation of Controlled Fragmentation
Experimental Loadings

TABLE II

MASS DISTRIBUTION DATA

MODIFIED 5" MK. 48 S. S. PROJECTILES WITHOUT LINER

Wt. Group (grams)	No. Fragments				Weight (lbs.)			
	<u>Rd. 1</u>	<u>Rd. 2</u>	<u>Rd. 3</u>	<u>Avg.</u>	<u>Rd. 1</u>	<u>Rd. 2</u>	<u>Rd. 3</u>	<u>Avg.</u>
0-2.5	494	452	1093	679	0.55	0.54	0.76	0.62
2.5-5	95	124	126	115	0.54	0.65	0.80	0.66
5-10	79	73	57	70	1.05	0.85	0.85	0.92
10-20	30	23	30	31	0.88	0.63	0.89	0.80
20-40	12	20	13	15	0.73	1.20	0.72	0.88
40-80	2	3	2	2	0.19	0.28	0.23	0.23
Totals	712	695	1321	912	3.94	4.15	4.25	4.11
Wt. of Empty Projectile					32.04	32.14	32.10	
Percentage Recovered					12%	13%	13%	
Wt. of Comp. B					8.88	8.88	8.63	

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APPENDIX C

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