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U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

REPORT NO. 1143

BOMBS AND ASSOCIATED COMPONENTS

65th Partial Report

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COLD WEATHER TESTING OF BOMB, EX 14 MOD 0 (FIRE-1000 LBS)

FINAL Report

Copy No. 11

Task Assignment NPG-Re3c-321-1-53

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Cold Weather Testing of Bomb, Ex 14 Mod 0 (Fire-1000 lbs)

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PART A

SYNOPSIS

1. This is a final report on the cold weather test of the Ex 14 Mod 0 Fire Bomb.

2. This test was performed to determine the effects, if any, of low temperatures in assembling and consequent sealing of the bomb.

3. It is concluded that:

a. This bomb can be assembled almost as fast at -65°F as it can at +80°F by trained Ordnancemen.

b. The sealing of the bomb is unsatisfactory for service use when assembled at -65°F.

4. It is recommended that:

a. The present bomb not be assembled at temperatures below -20°F.

b. The present "O" ring seals and filler cap seals be made of a material that will withstand shock at -65°F.

c. The tape covering the end of nose and tail sections be left off.

d. Leak tests be conducted on a bomb assembled at room temperature and stowed at -65°F.

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PART B

INTRODUCTION

1. AUTHORITY:

This test was conducted under Task Assignment No. NPG-Re3c-321-1-53 authorized by reference (a) and in accordance with enclosure (1) of reference (b).

2. REFERENCES:

a. BUORD Conf ltr Re3c-BEK:mp NP9 Ser 42777 of 29 July 1952
b. BUORD Conf ltr Re3c-REN:gg NP9 Ser 54447 of 1 April 1953
c. NPG Conf Report No. 1085 of 3 February 1953

3. BACKGROUND:

Preliminary fit, flight, assembly, catapult and arrested landing, bomb ejector, and drop tests have been conducted with the Ex 14 Mod 0 Fire Bomb and are the subject of reference (c).

4. OBJECT OF TEST:

The purpose of this test is to determine the effects, if any, of low temperatures in the assembling and consequent sealing of the bomb.

5. PERIOD OF TEST:

a.	Date of Project Letter	1 April 1953
b.	Date Material Received	9 April 1953
c.	Date Commenced Test	16 April 1953
d.	Date Completed Test	17 April 1953

6. REPRESENTATIVE PRESENT:

R. E. Niederstrasser Bureau of Ordnance

PART C

DETAILS OF TEST

7. DESCRIPTION OF ITEM UNDER TEST:

The Ex 14 Mod 0 Fire Bomb used for this test was similar to the bomb used and reported in reference (c), with the exception that removable lock pins were supplied and used. It was originally intended that these lock pins would allow the bomb to be disassembled and returned to the manufacturer. Figure 1 is a view of the bomb in its collapsed shipping configuration. Figure 2 is an assembled view of the bomb.

8. DESCRIPTION OF TEST EQUIPMENT:

a. The cold weather test was performed in the Altitude Chamber of the Aviation Ordnance Department. This chamber is a standard Navy type modified to permit firing through ports in one end. The main chamber is 12 feet in diameter and 18 feet in length on the inside. The actual floor working area that was free of other equipment was 18 by 5 feet. The air lock is seven (7) feet in diameter and six (6) feet in length with a door opening 56 inches in diameter. The temperature range for this chamber is -67°F to ambient. Pressure range is atmospheric to 1.7 p.s.i. (50,000 feet altitude). There is no humidity control.

b. To enter the cold chamber it was required that each individual wear the following standard Naval Aviation winter type clothing:

(1) Winter Flying Suits, wool backed, nylon, Stock No. R37 S 5349-42

(2) Winter Flying Boots, Stock No. R37 B 4214

(3) Face Masks, knitted, Stock No. R37 M 143

(4) Gloves, Intermediate, leather, five (5) finger type with wool inner lining, Stock Nos. R37 G 2505-30 and R37 G 2500-30.

9. PROCEDURE:

a. The bomb as received was in a wooden crate for security and handling purposes. This crate was not considered a part of the test; therefore, the bomb was removed and placed in the Altitude Chamber. This test facility was used because the large gun test room and utility test room were both unavailable.

b. The bomb was allowed to "soak" in the Altitude Chamber for four (4) hours, the last two (2) of which were at -65°F. Cold weather clothing of standard Naval Aviation winter issue was worn by every person in the cold chamber. The same two (2) Ordnancemen, 1st class, that assembled the bomb reported in reference (c) also assembled the bomb used in this test.

10. RESULTS AND DISCUSSION:

a. After the bomb had been allowed to "soak" at -65°F, the Ordnancemen and cameramen entered the cold chamber. At the start of the assembly test, the chamber temperature had risen to -63°F and by the end of the test the temperature was -60°F. This was caused by the refrigeration equipment and the circulating fan being shut off during the test so that normal voice communication was audible.

b. Very little difficulty was encountered in assembling the bomb sections as the winter clothing did not hinder the hammer motion required to drive the lock pins and fins in place. Figures 3 and 4 are views of the Ordnancemen assembling the bomb. The tape covering the lock pin pockets did not have to be removed before driving the pins in place; however, the tape covering the end of the nose and tail sections had to be removed before the nose and tail wind caps could be inserted. This tape appeared to be an unnecessary hindrance as it is inside the shipping ends during shipment and is difficult to remove with gloves on.

c. After approximately 13 minutes, the bomb was completely assembled with the exception of the rear filler cap seal. (Reference (c) reported nine (9) minutes were required for assembly, after several practice assemblies had been made on a summer day). The rubber seal was so stiff that it could not be inserted. As a matter of interest, the seal was thrown on the steel deck, whereupon it shattered. From this evidence, it was felt that the circumferential "O" ring seals could have shattered from the hammer blows in driving the lock pins in place as they are adjacent. Further examination of

the bomb at this time revealed that there were pieces of the drive pins laying inside the bomb. The Ordnancemen stated that they could not tell when the pins had bottomed in the lock pin pockets and it was evident that the removable pins had broken through the pockets and in some cases the pins had also broken. The removable pins are approximately 5/8 of an inch longer than the standard pins and are thus longer than the pockets are deep.

d. Because of the damage to the lock pin pockets, it was considered inadvisable to conduct a test on the sealing characteristics of the bomb inside the Altitude Chamber. The bomb was removed from the chamber, allowed to return to ambient temperature, and filled with water. When the bomb was full, it leaked 130 lbs of water in five (5) minutes, or approximately three (3) gallons per minute. Figure 5 shows the water leakage with the bomb half full and Figure 6 shows the leakage at the forward joint with the bomb full. During this portion of the test, the drive pins were checked for tightness and it was found that five (5) of the pins securing the tail section were loose and could easily be withdrawn. Measurements of the drive pins were made and it was discovered that the removable type drive pins were .020 to .025 inches thinner than the non-removable type normally supplied. The drawings specified a slot $.245^{+.000}_{-.010}$ inches wide in the pocket, whereas the removable type pins were only .235 to .240 inches thick. Thus there exists the possibility of a no interference fit. This may have been designed to facilitate removal of the pins; however, under the conditions the bomb was assembled, it is felt that this materially contributed to the fracturing of the pockets by the pins striking the bottom without any side resistance. Figures 7 and 8 show the damaged pockets.

e. At the conclusion of the water tight integrity test, the bomb was cut open and the circumferential "O" ring seals removed and inspected. As shown in Figure 9 the seals suffered considerable damage and would not have held water. It could not be determined what portion of the leakage reported in the preceding paragraph was caused by the damaged "O" ring seals as the pockets and seals are adjacent. Portions of these "O" ring seals were subjected to a simple bend and hammer test at various temperatures. It was found that the seals could withstand bending at -35°F and would fracture at -40°F. In addition, it was found that they would withstand hammer blows at -10°F and would fracture at -15°F. Inasmuch as the "O" ring seals are not hit directly in assembly, it is felt that they would withstand assembly at temperatures down to -20°F.

PART D

CONCLUSIONS

11. It is concluded that:

a. This bomb can be assembled almost as fast at -65°F as it can at +80°F by trained Ordnancemen.

b. The sealing of the bomb is unsatisfactory for service use when assembled at -65°F.

PART E

RECOMMENDATIONS

12. It is recommended that:

a. The present bomb not be assembled at temperatures below -20°F.

b. The present "O" ring seals and filler cap seals be made of a material that is flexible and will withstand shock at -65°F.

c. The tape covering the end of the nose and tail sections be left off.

d. Leak tests be conducted on a bomb assembled at room temperature and stored at -65°F.

Cold Weather Testing of Bomb, Ex 14 Mod 0 (Fire-1000 lbs)

- -

The tests upon which this report is based were conducted by:
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NPG REPORT NO. 1143

U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

Sixty-Fifth Partial Report

on

Bombs and Associated Components

- -

Final Report

on

Cold Weather Testing of Bomb, Ex 14 Mod 0 (Fire-1000 lbs)

Project No.: NPG-Re3c-321-1-53

Date: JUN 29 1953

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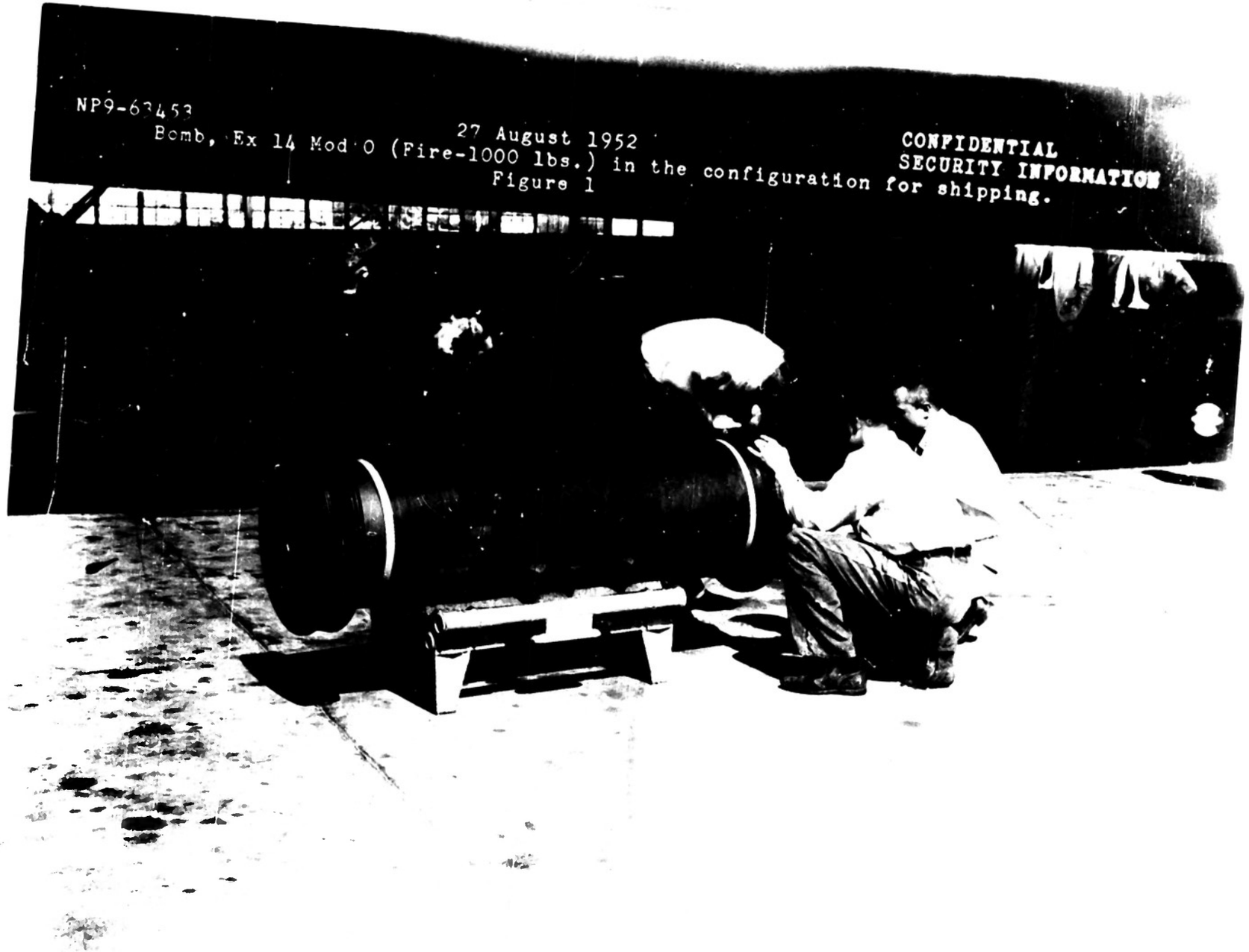

NP9-63453

27 August 1952

Bomb, Ex 14 Mod 0 (Fire-1000 lbs.) in the configuration for shipping.

Figure 1

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NP9-60454

27 August 1952

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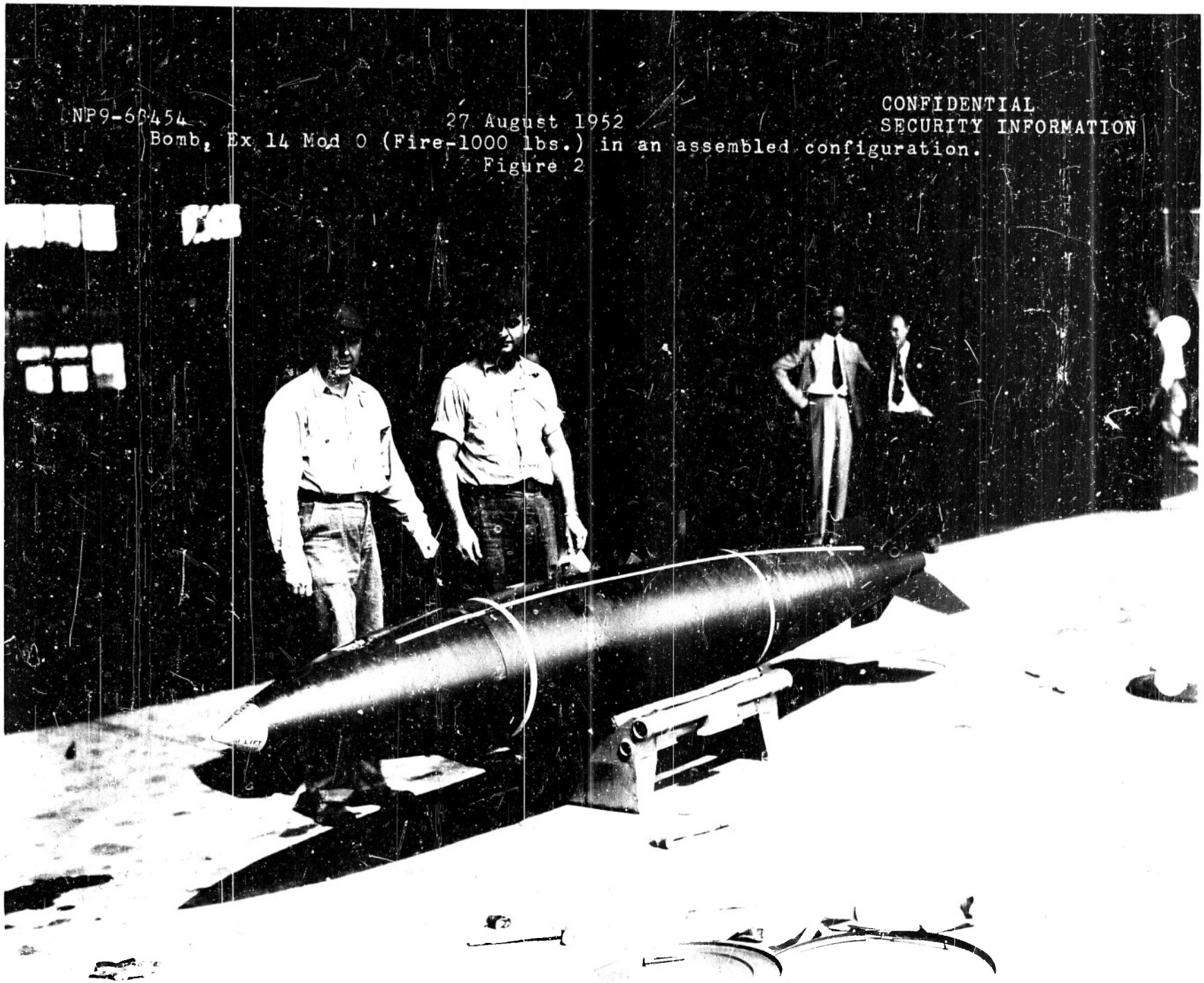
Bomb, Ex 14 Mod 0 (Fire-1000 lbs.) in an assembled configuration.
Figure 2



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NP9-63455 16 April 1953

Bomb, Ex 14 Mod 0 (Fire-1000 lbs.) being assembled inside altitude chamber at -65°F.

Figure 3

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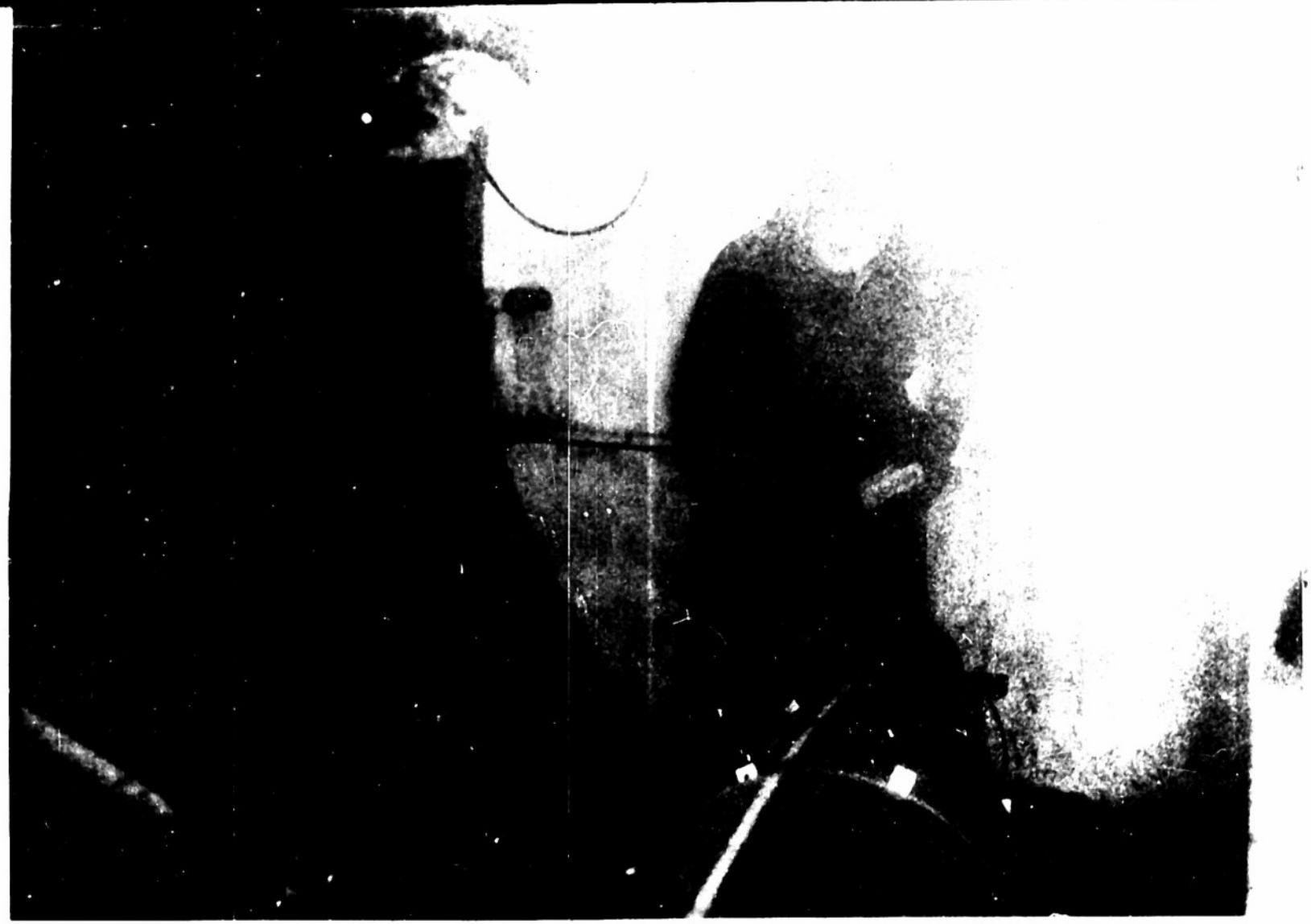
NPG-63456 16 April 1953

Bomb, Ex 14 Mod 0 (Fire-1000 lbs.) being assembled inside altitude chamber at -65°F.

Figure 4



NP - 457 17 April 1953 CONFIDENTIAL
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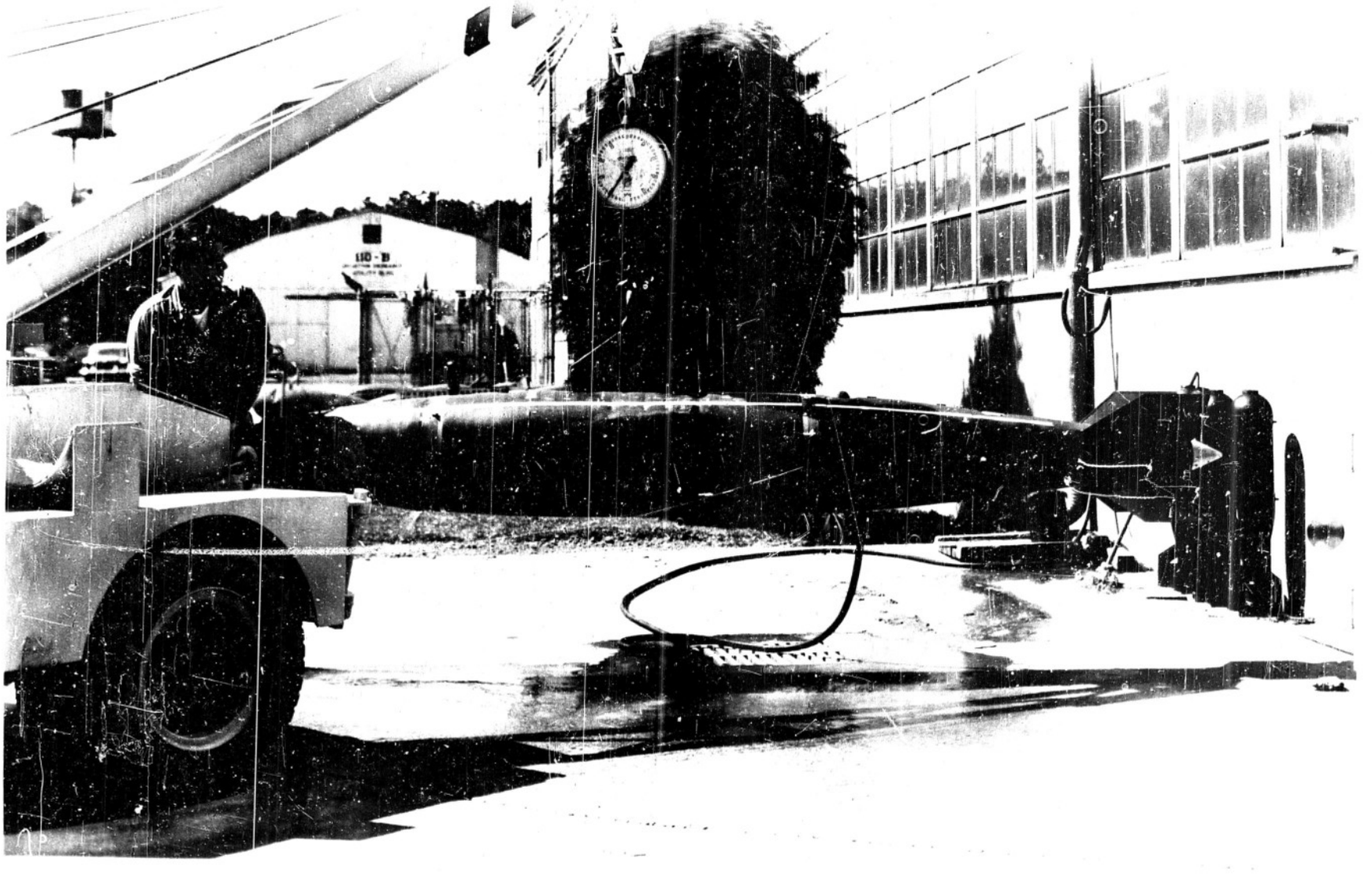
Bo , Ex 14 Mod 0 (Fire-1000 lbs.). View shows water leakage with bomb half full.
Figure 5



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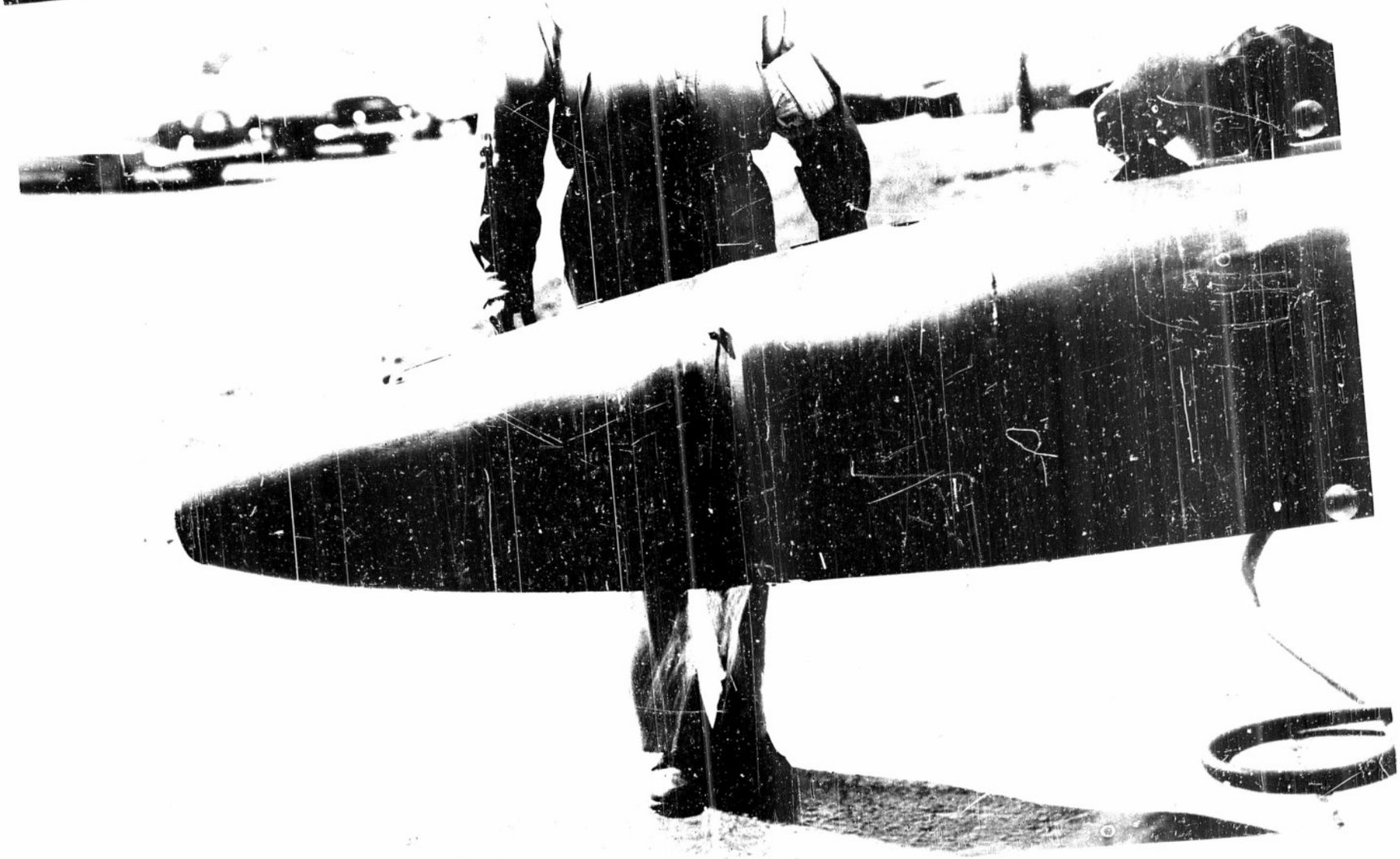
17 April 1953

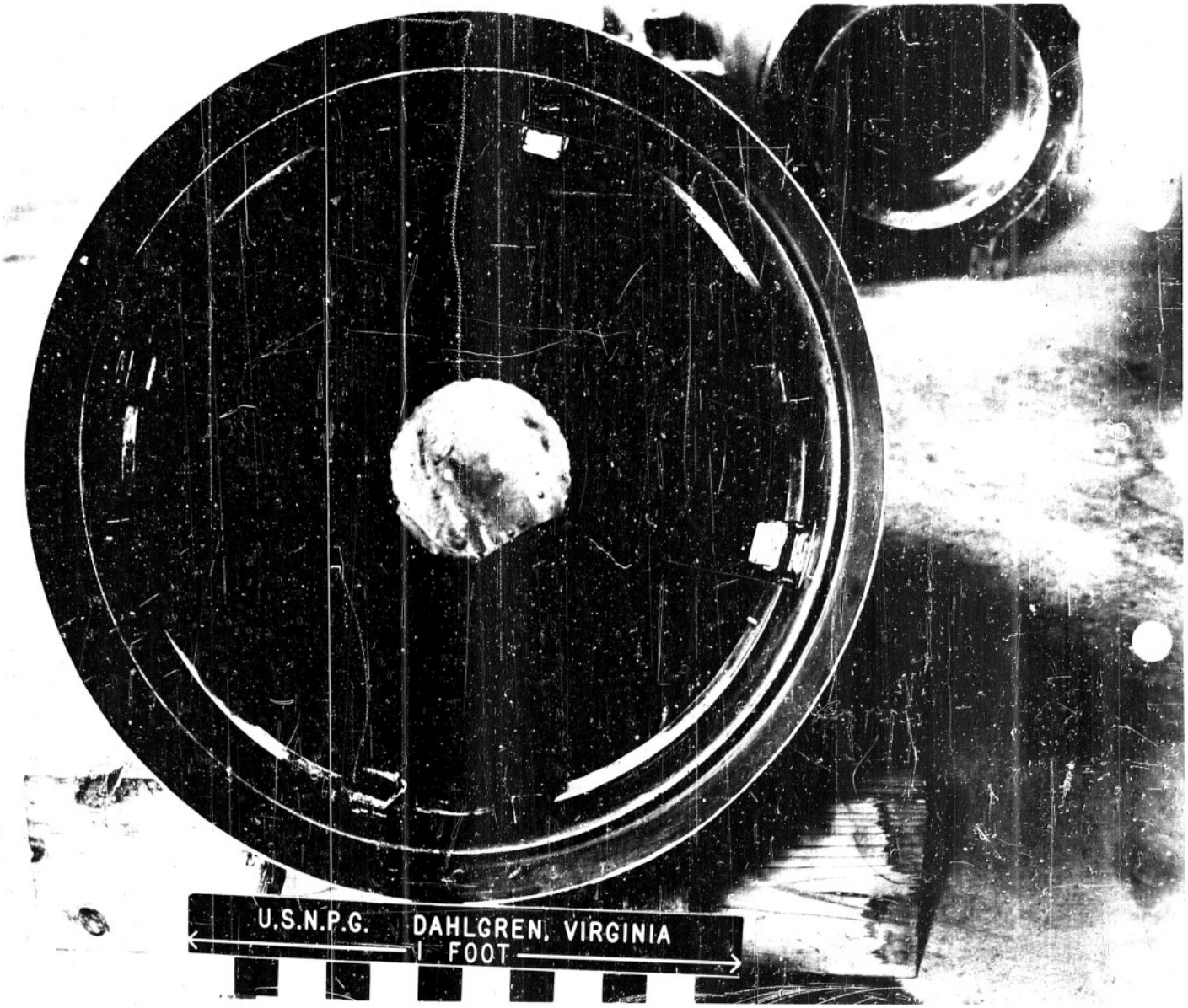
Ex 14 Mod 0 (Fir -1000 lbs.). View shows water leakage at forward joint with



NP -33459 17 April 1953 CONFIDENTIAL SECURITY INFORMATION

Bomb, Ex 14 Mod 0 (Fire-1000 lbs.). View shows damaged pockets in nose section.

Figure 7



NP9-63460 17 April 1953

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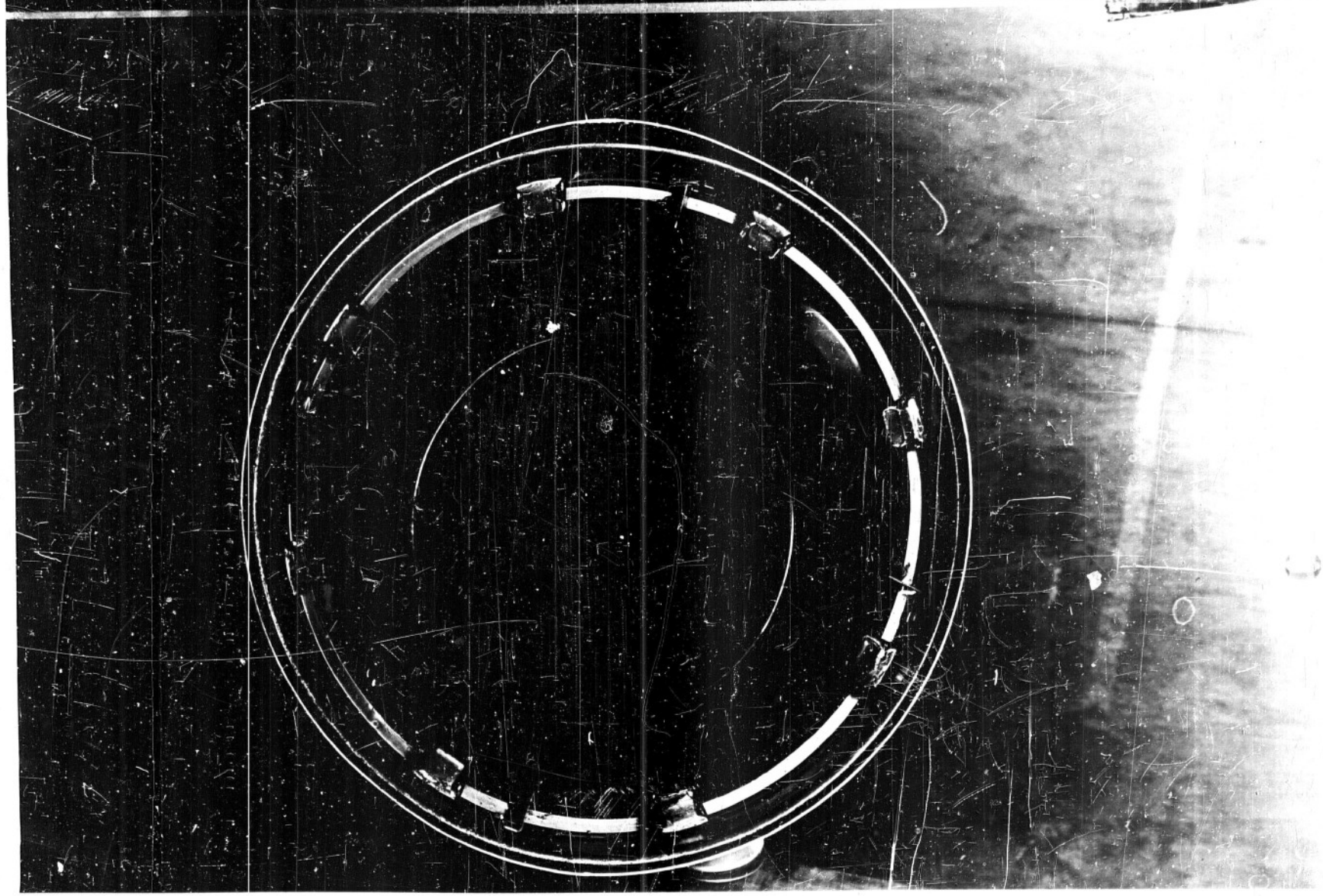
Bomb, Ex 14 Mod 0 (Fire-1000 lbs.). View shows damaged pockets in after section.

Figure 8



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Bomb, Ex 14 Mod 0 (Fire-1000 lbs.). View shows damaged "O" ring seals.
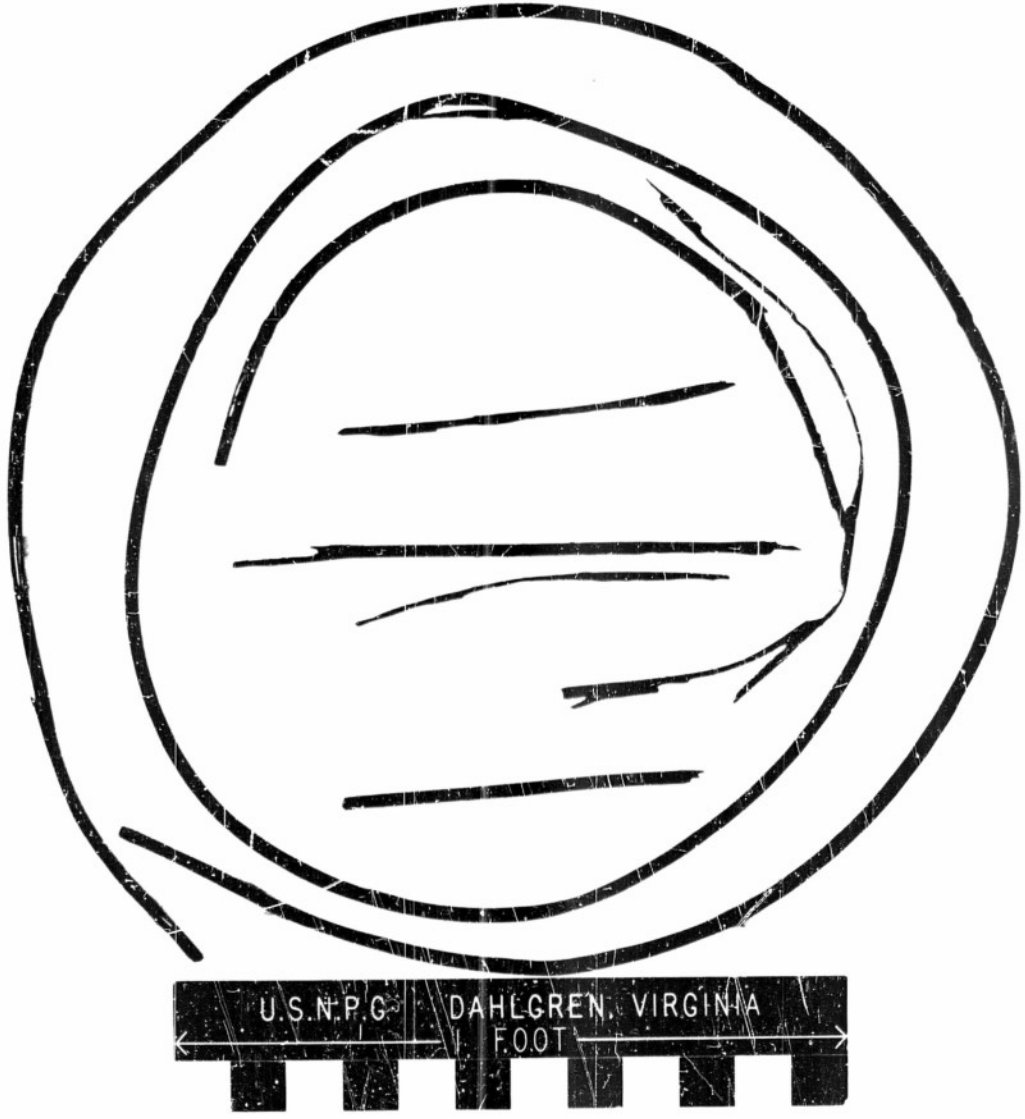
Figure 9