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AIR FORCE SPECIAL WEAPONS CENTER
Air Force Systems Command
Kirtland Air Force Base
New Mexico

TECHNICAL REPORT NO. AFSWC-TR-69-13

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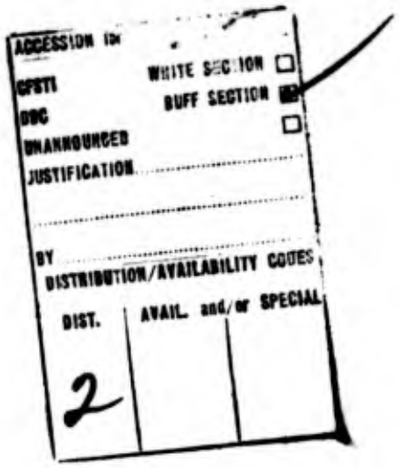

AIR FORCE SPECIAL WEAPONS CENTER
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R. L. Posey

TECHNICAL REPORT NO. AFSWC-TR-69-13

FOREWORD

This testing was performed under Program Element 6.54.02.21.F, Project 921A-9224-02144. Inclusive dates of testing were 13 June 1968 to 14 May 1969. This report was submitted in August 1969 by the Air Force Special Weapons Center Test Director, R. L. Posey (SWTVI). The Air Force Weapons Laboratory Project Officers were Lt Frank Connor (WLDM) and Lt Gordon Thorsvold (WLDM). The Aeronautical Systems Division Project Officer was Mr. Carl Beehler (ASWKG). Funds for this project were supplied by the Aeronautical Systems Division.

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This technical report has been reviewed and is approved.

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ABSTRACT

(Distribution Limitation Statement No. 2)

Environmental testing was conducted on five production phase MAU-12B/A Bomb Ejector Racks according to MIL-R-38953A (USAF) with authorized deviations. There was a major mechanical failure on one of the racks during the Life-Firing test. Two racks had operational failures during the Icing test. The ejection pistons on one of the racks retracted during every firing of the Life-Firing test; however, the ejection pistons on four racks retracted sporadically. There were no visible mechanical failures during the static test.

CONTENTS

SECTION I

INTRODUCTION

Sample testing had previously been performed on 34 MAU-12B/A Bomb Ejector Racks* manufactured by Oregon Technical Products under Contract AF 33(657)-13877. An extension to the production contract necessitated that testing be conducted on five additional MAU-12B/A Bomb Racks. This testing program tested these additional bomb racks.

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*Traylor, Mahlon E., Jr., Sample Testing of MAU-12B/A Bomb Ejector Rack, AFSWC-TR-68-4, Air Force Special Weapons Center, Kirtland AFB, NM, July 1968.

SECTION II

TEST PROCEDURE AND RESULTS

1. TEST ITEM

The MAU-12B/A Bomb Ejection Rack, Figure 1, is designed to carry either conventional or nuclear stores (weighing as much as the 5000-pound class stores) externally under a fighter-bomber. Two pairs of mutually coupled hooks allow for weapon lug spacing of either 14 or 30 inches. The payload can be forcibly ejected or allowed to fall free from the aircraft. The MAU-12B/A is compatible with a variety of store casings whose minimum external diameter is from 10.7 inches to a maximum of 33 inches. When forced ejection is used, the pistons that kick the weapon free of the aircraft retract into the rack, thus presenting a clean profile to the airstream. Another main feature of this bomb rack is the nuclear safety interlock, which must be actuated before the store can be released. The total weight of this rack is slightly less than 70 pounds.

Five MAU-12B/A Bomb Ejector Racks, serial numbers 07770, 08300, 08770, 09273, and 09773 were used for the tests. The racks were received from Oregon Technical Products.

2. TEST PLAN

Testing was to be conducted according to paragraphs 4.6.3, 4.6.6, 4.6.7.5, and 4.6.7.7 of MIL-R-38953A, 28 January 1965 with authorized deviations by the Air Force Weapons Laboratory (WLDM).

The detailed test plan was:

a. Icing Tests (Paragraph 4.6.7.5)

(1) Each rack was to be stabilized for 2 hours at a temperature of -70°F; the temperature and humidity then were to be raised to 100°F and 90 percent relative humidity until the frost disappeared; then the rack was to be stabilized for 2 hours at -70°F at which time the interlock was to be operated electrically and the hooks unlatched manually.

(2) A store was not to be used for this test.

b. Life Test (Paragraph 4.6.6)

(1) Each rack was to be subjected to 50 releases with a 2000-pound store using the 30-inch suspension hooks.

(2) Only orifices with 0.111-inch diameter settings were to be used.

(3) Two ARD 446-1 cartridges were to be used for each release.

(4) Each rack was to be cleaned, after each 25 firings, in accordance with Maintenance Technical Order 11B29-3-25-2.

(5) The reaction loads and the ejected store velocities were not to be determined.

c. Vibration Tests (Paragraph 4.6.7.7)

(1) Each rack was to be subjected to vibration testing along each of the three major mutually perpendicular axes as follows:

(a) Not loaded

(b) Loaded, safety lock locked

1. With a 250-pound store

2. With a 2000-pound store

(c) Loaded, safety lock unlocked

1. With a 250-pound store

2. With a 2000-pound store

(2) Each rack was to be subjected to four 30-minute, 10-2000-10 Hz logarithmic cycles for each of the five conditions listed in paragraph 2.c.(1).

(3) The input acceleration was to be determined by Figure 4 of MIL-R-38953A (USAF).

(4) The input acceleration was to be monitored on the simulated pylon near the front pylon-rack mounting pins.

(5) The 2000-pound store was to have a diameter of 22 inches and 250-pound store was to have a diameter of 9 inches.

d. Static-Load Tests (Paragraph 4.6.3)

(1) All static-load testing was to be accomplished with a 22-inch diameter, 2000-pound store on the 30-inch suspension hooks.

(2) The ultimate strength tests were to be conducted only after the yield strength testing had been completed.

(3) There was to be no testing using 14-inch suspension hooks.

The test plan was formulated to subject the MAU-12B/A to the tests in an increased order of severity and possibility of failure.

3. TESTING AND RESULTS

a. Icing Tests

Testing was conducted according to the test plan. The following operational discrepancies were noted:

(1) The safety interlock on serial number 08300 functioned, but the hooks could not be opened manually.

(2) The safety interlock on serial number 08770 failed to function.

At the request of the Air Force Weapons Laboratory Project Officers four different MAU-12B/A Bomb Racks were subjected to 11 icing tests each.* The production sample racks used from this test program were serial numbers: 08300, 08770, and 09273. During this series of icing tests, the safety interlock failed to function once on each of two racks. Also, the hooks on two other racks could not be opened manually on another test. It was determined that failure of a MAU-12B/A in the icing environment is random in nature and not inherent to a specific rack.

b. Life-Firing Test

Testing was conducted according to the test plan. The setup used for this test is shown in Figure 2.

The aft actuating rod, part number 64D13225, on serial number 07770 failed during firing 46 (Figure 3). During this firing the rack ejected the forward end of the store first causing the store to pitch nose down.

Material hardness tests revealed that the aft actuating rod had a hardness of Rockwell C-38 and the forward actuating rod had a hardness of Rockwell C-40. A material hardness of Rockwell C-36 to C-40 (160,000 to 180,000 psi ultimate tensile strength) is specified. Tensile tests conducted by the AFWL

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*Posey, R. L., Icing Tests of the MAU-12B/A Bomb Ejector Rack, AFSWC-TR-68-30, Air Force Special Weapons Center, Kirtland AFB, NM, December 1968.

Project Officer on similar actuating rods required 7,000 to 7,400 pounds to deform in a manner similar to the failure. Strain gages were attached to a forward actuating rod and to an aft actuating rod. These instrumented rods were assembled in serial number 07770 and the rack was fired five times. Another MAU-12B/A was also fired with strain gaged actuating rods. The maximum measured tensile force was 2,500 pounds. ARD-446-1 cartridges, from the lot used during the life-firing test, were tested and the breech pressures generated were from 18,000 to 20,000 psi which is typical for two ARD-446-1 cartridges. Since the AFWL Project Officer was unable to duplicate the failure and since AFWL has had no problems with this type failure in the field, AFWL anticipates no changes to the rack at this time.

(1) The forward ejection piston of serial number 07770 failed to retract automatically during firings 14, 42, and 45.

(2) The rear ejection piston of serial number 07770 failed to retract automatically during firings 38 through 46.

(3) Both ejection pistons on serial number 08300 failed to retract automatically during firings 27 through 50.

(4) The forward piston on serial number 08770 failed to retract automatically during firings 26 through 34 and the rear piston failed to retract automatically during firings 26 and 48.

(5) The hooks on serial number 08770 relatched after the store was ejected on firings 39 and 47.

(6) The forward piston on serial number 09273 failed to retract automatically during firing 25.

c. Vibration Test

Testing was conducted according to the test plan. Figure 4 shows an unloaded MAU-12B/A setup for testing along the vertical axis. Figure 5 shows an MAU-12B/A loaded with a 2000-pound store setup for testing along the longitudinal axis.

Serial number 07770 was not tested due to the failure of the aft actuating rod during the life-firing test. The following failures were noted with the other racks:

(1) Several screws in the shackle spacer bars came loose as serial number 08300 was being subjected to testing along the longitudinal axis with a 250-pound store. This deficiency could be detected because the hooks were difficult to open. All testing along the vertical and longitudinal axes had been completed except with a 2000-pound store along the longitudinal axis. The AFWL Project Officer retightened the screws and the test was completed with no visible failures.

(2) Several screws in the shackle spacer bars came loose as serial number 09773 was being subjected to testing along the vertical axis with a 250-pound store. All testing had been completed except testing along the vertical axis with a 2000-pound store. The AFWL Project Officer retightened the screws and the testing was completed with no visible failures.

d. Static Load

Figure 6 shows the setup used for the Condition I static load test. Testing was conducted according to the test plan. The loads were applied according to the appendix of the Technical Report entitled, "Sample Testing of MAU-12B/A Bomb Ejection Rack" (AFSWC-TR-68-4)*. Serial number 07770 was not subjected to the static load test because of the failure during the life-firing test. There were no visible mechanical failures during the test. It was noted that after very loading condition, the sway brace pads had to be loosened before the hooks could easily be opened manually. Tests conducted by SWTVI on one rack have shown that a torque of approximately 900 lb-in was required to open the hooks after the sway brace pads had been tightened. After a simulated flight load is applied to the store, 1500-1600 lb-in of torque is required to open the hooks without loosening the sway brace pads.

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*Traylor, Mahlon E., Jr., Sample Testing of MAU-12B/A Bomb Ejector Rack, AFSWC-TR-68-4, Air Force Special Weapons Center, Kirtland AFB, NM, July 1968.

SECTION III

CONCLUSIONS AND RECOMMENDATIONS

1. CONCLUSIONS

a. During the icing test, the safety interlock would not function on one rack and the safety interlock functioned but the hooks could not be opened manually on another rack.

b. The aft actuating rod on serial number 07770 failed during firing 46 of the life firing test.

c. Screws in the shackle spacer bars on two racks came loose during the vibration test and had to be retightened before the test could be completed.

d. The ejection pistons on four of the racks retracted sporadically during the life-firing test. The ejection pistons on one rack retracted during every firing of the life-firing test.

e. The hooks on one rack relatched on two different occasions after the store had been ejected.

f. There were no visible mechanical failures during the static test.

2. RECOMMENDATIONS

a. Serial number 08770 should be examined to determine if some manufacturing deficiency allowed the hooks to relatch after the store had been ejected.

b. Before use in the field the 14-inch suspension hooks should be subjected to vibration and static load testing.

Figure 1. MAU-12B/A Bomb Ejector Rack

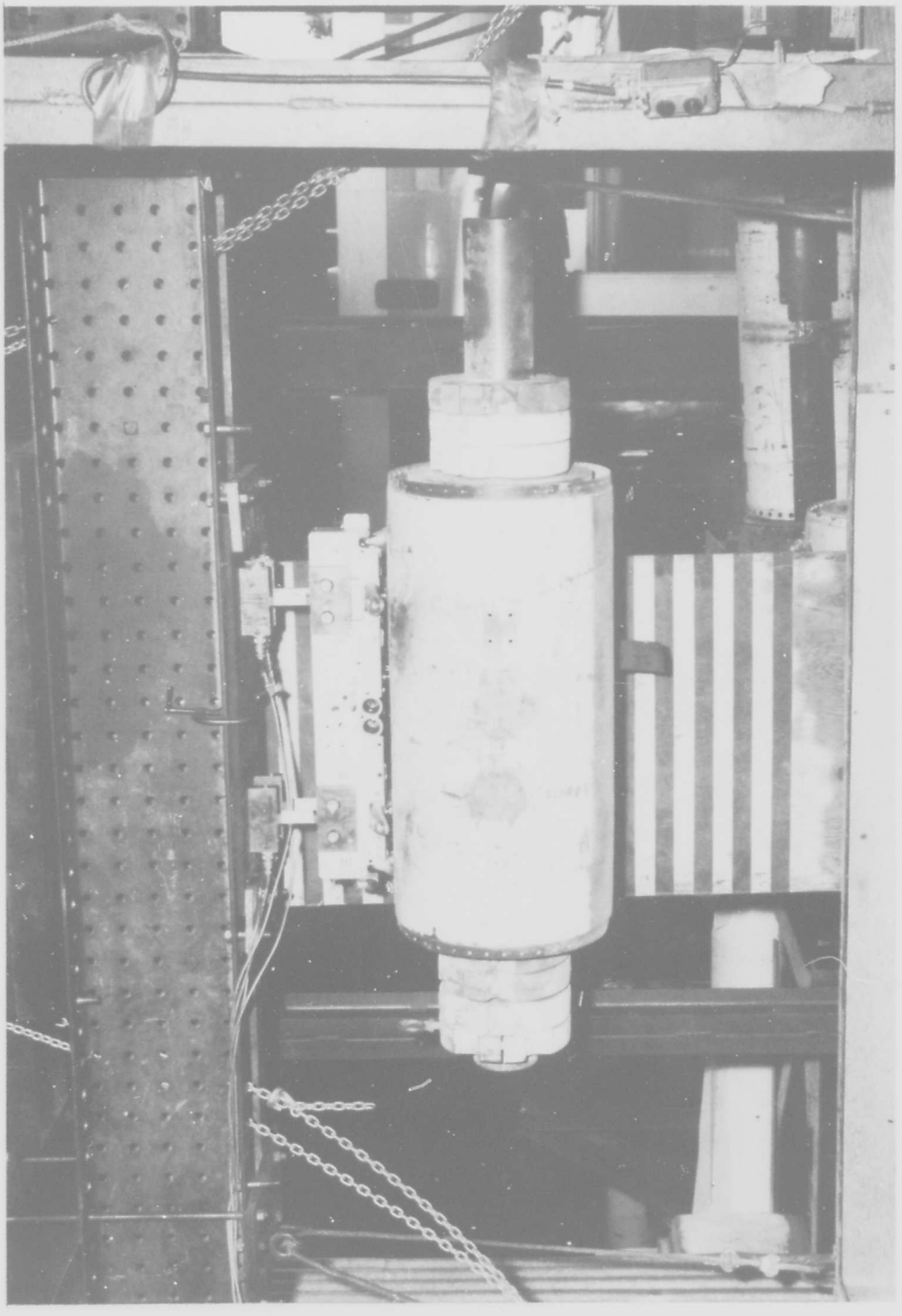

Figure 2. Test Setup for Life-Firing Test

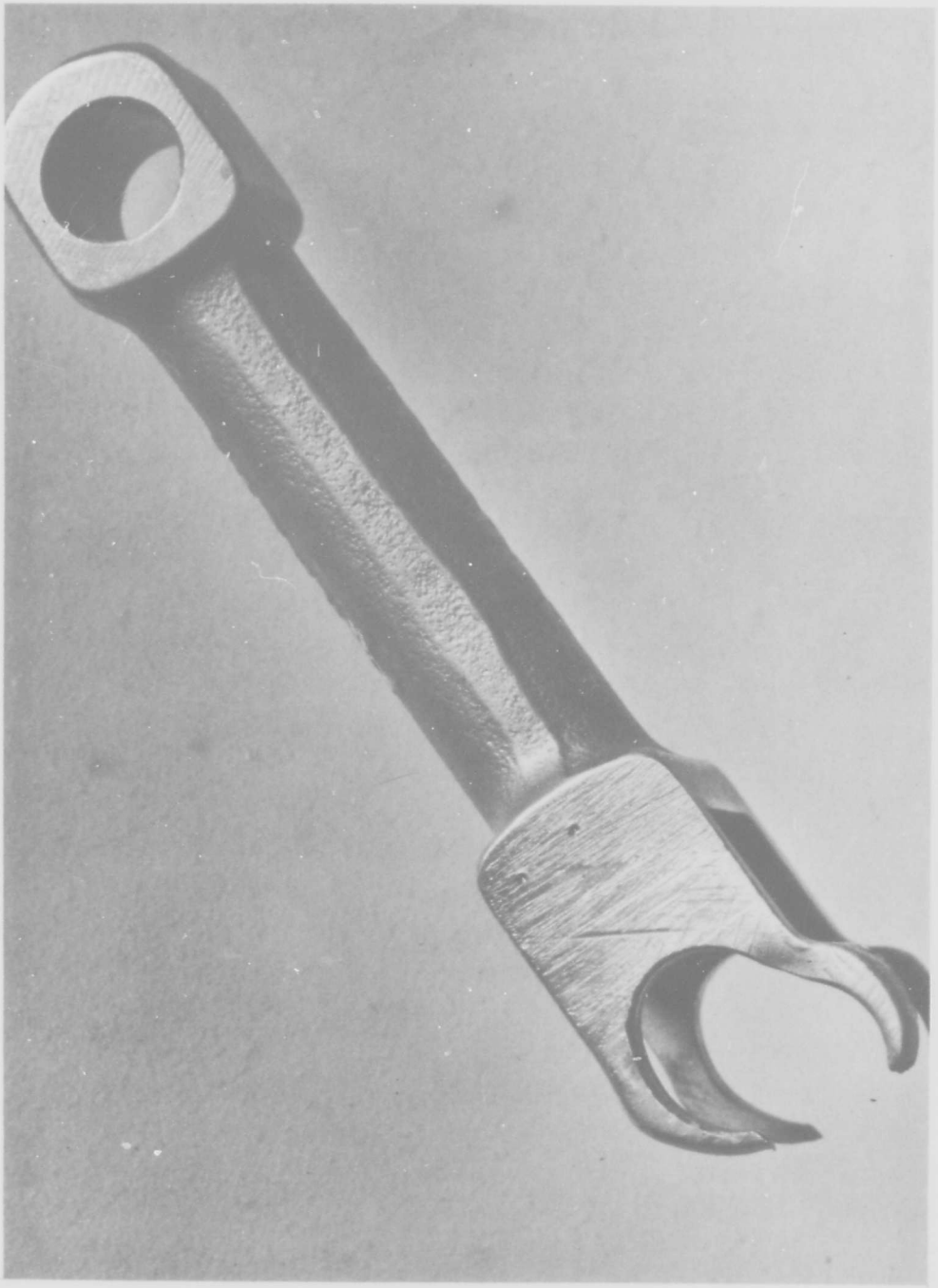

Figure 3. Aft Actuating Rod Failure

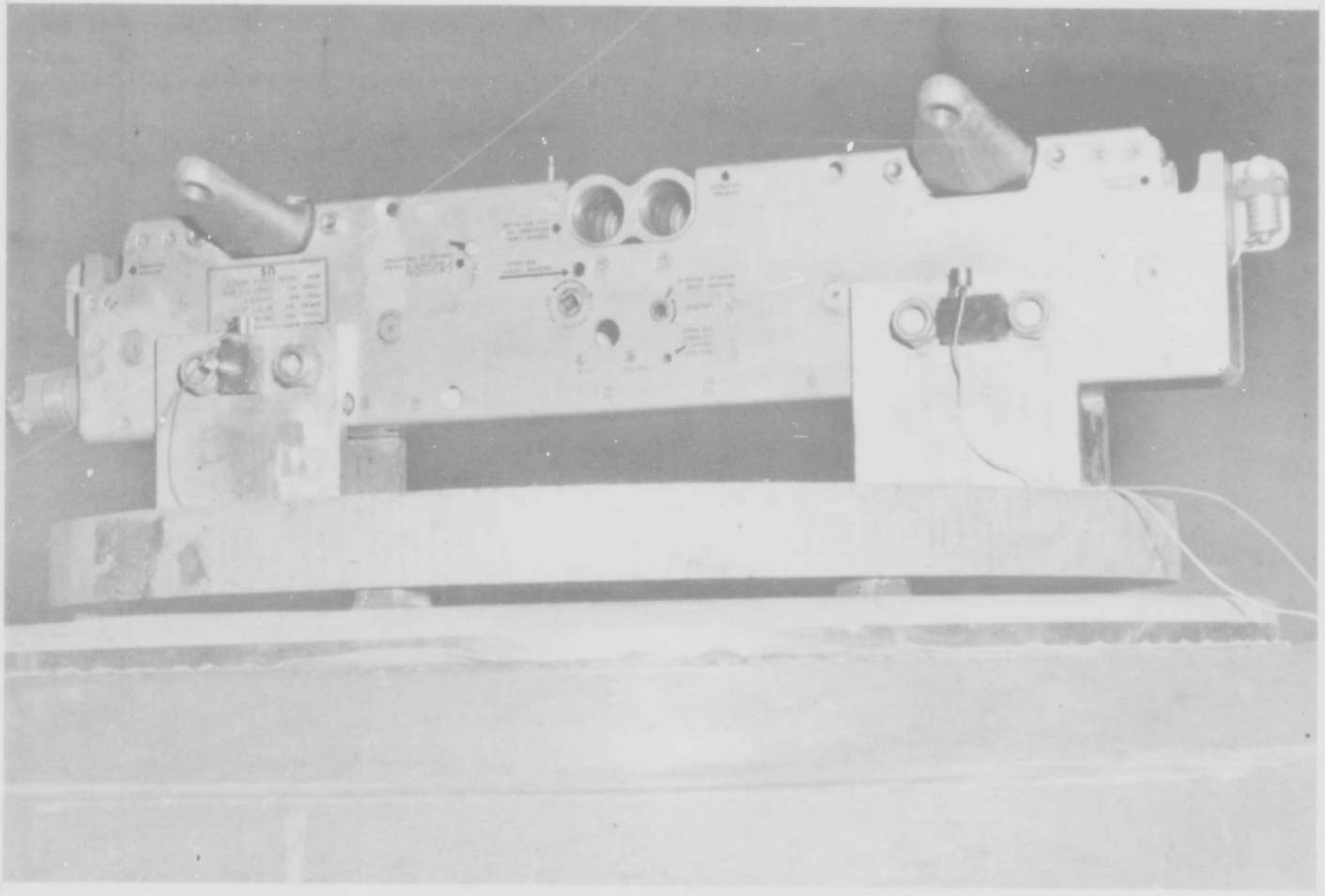

Figure 4. An Unloaded MAU-12B/A Setup for Vibration Testing Along the Vertical Axis

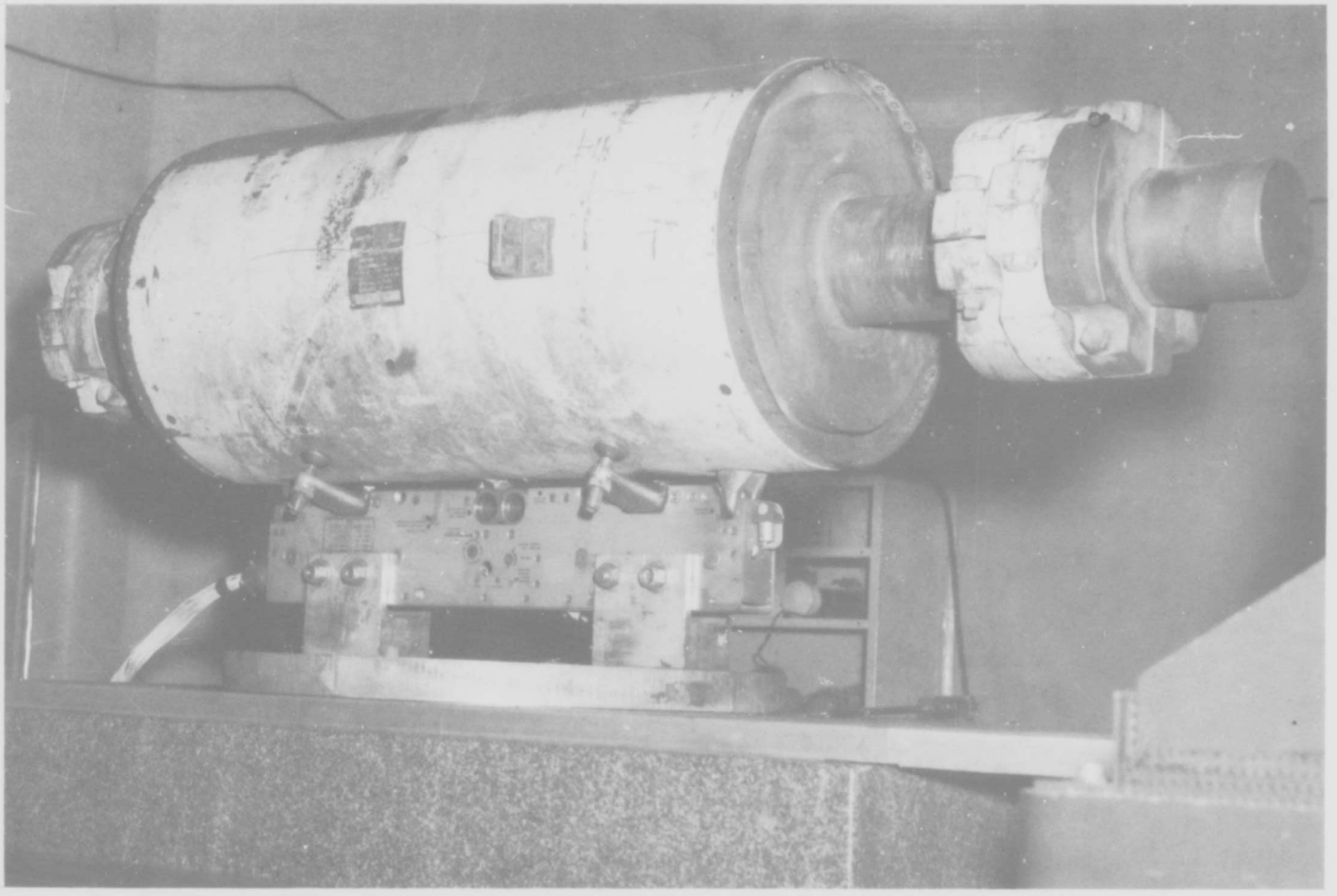

Figure 5. MAU-12B/A Setup for Vibration Testing Along the Longitudinal Axis with a 2000-Pound Store

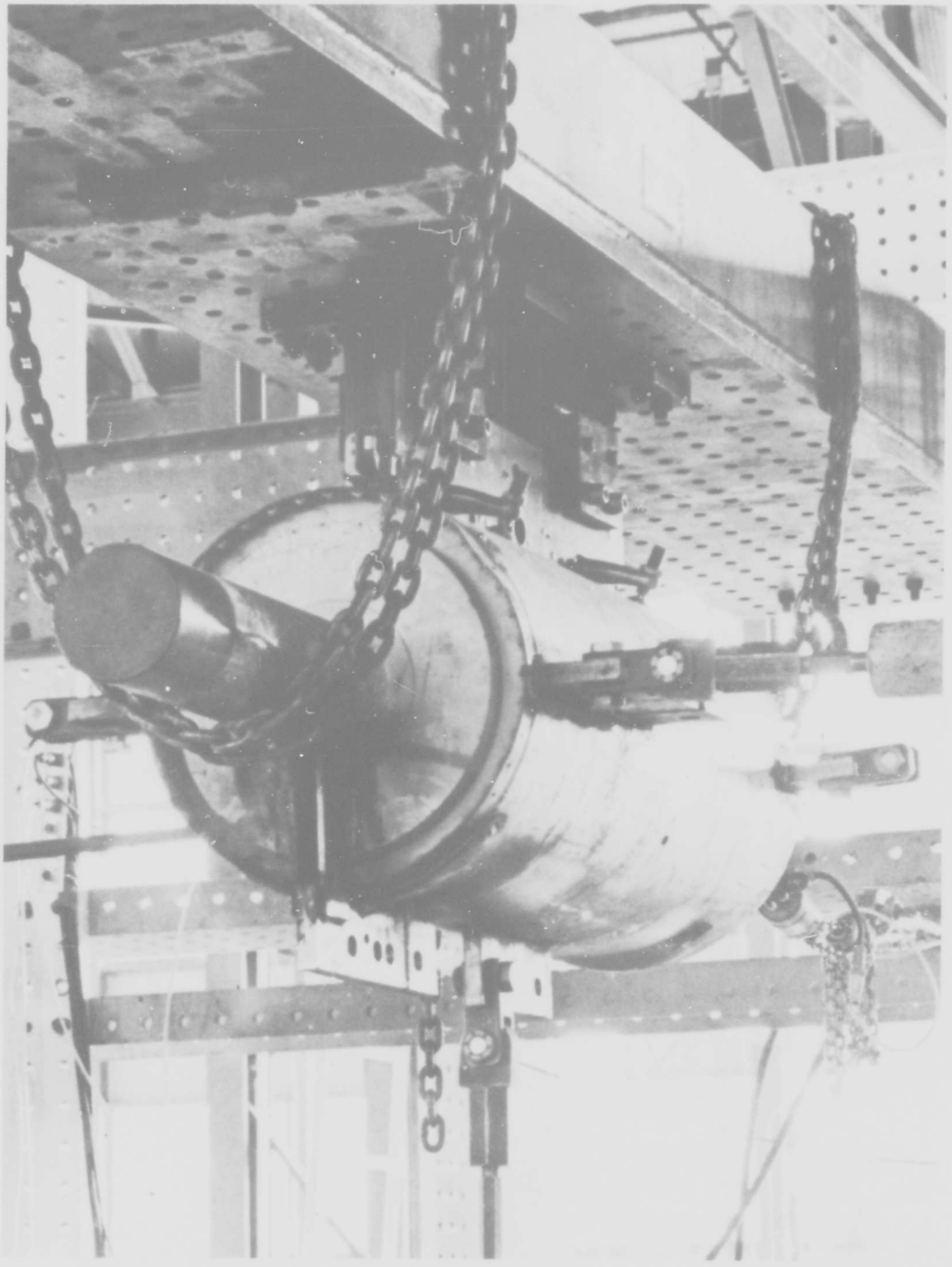

Figure 6. MAU-12B/A Setup for the Condition I Static Load Test

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13. ABSTRACT

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Environmental testing was conducted on five production phase MAU-12B/A Bomb Ejector Racks according to MIL-R-38953A (USAF) with authorized deviations. There was a major mechanical failure on one of the racks during the Life-Firing test. Two racks had operational failures during the Icing test. The ejection pistons on one of the racks retracted during every firing of the Life-Firing test; however, the ejection pistons on four racks retracted sporadically. There were no visible mechanical failures during the static test.

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