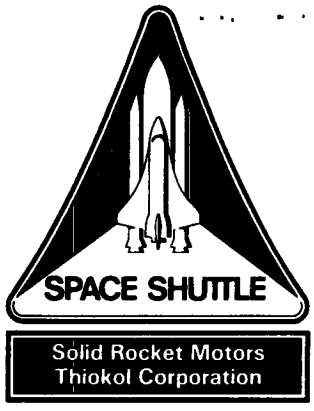


TWR - 17272, Vol. VI

# FLIGHT SET 360L001 (STS-26) IGNITER, POST FLIGHT, FINAL REPORT

5 APRIL 1990

**Prepared for:**

**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION**
**GEORGE C. MARSHALL SPACE FLIGHT CENTER**
**MARSHALL SPACE FLIGHT CENTER, ALABAMA 35812**

| | |
|---|---|
| **Contract No.** | NAS8-30490 |
| **DR. No.** | 5-3 Type 2 |
| **WBS.No.** | 4B102 10 03 |
| ECS No. | 1012 |

*Thiokol CORPORATION*
*SPACE OPERATIONS*

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FLIGHT SET 360L001 (STS-26)
IGNITER FINAL REPORT VOLUME VI

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## 1.0 INTRODUCTION

Space Transportation System (STS-26) was launched from KSC pad 39B on September 29 1988. Two of the Redesigned Solid Rocket Motors (RSRM) were part of the launch system and are designated RSRM-1A and RSRM-1B. Each of these motors were initiated by an 1U75164 igniter.

Following rocket motor separation and splashdown, the motors were recovered and towed to hanger AF for inspection and disassembly. This inspection was performed per Post Flight Engineering and Evaluation Plan (PEEP) TWR-16475, vol. VI, which outlines the basic evaluations to be performed at KSC Hanger AF.

## 2.0 OBJECTIVES

The objective of this report is to document the post flight condition of the Igniters and associated components.

The following objectives of TWR-17535 are addressed in this report. (Numbers in parenthesis identify CEI specification paragraphs)

Qualification Test Objectives by Inspection

H. Post flight inspection of all RSRM seals for evidence of blow-by or erosion (3.2.1.2).

T. Post flight inspection of seals for satisfactory operation within temperature range resulting from natural and induced environments (3.2.1.2.3.b, 3.2.1.3.4.b, 3.2.1.2.5.b).

AF. Post flight inspection of ignition system seals for evidence of hot gas leakage (3.2.1.4.6.a).

AG. Post flight inspection of igniter for evidence of debris formation or damage (3.2.1.4.13).

AH. Post flight inspection of insulation for required performance (3.2.1.8.1.1.f).

AI. Post flight inspection of insulation for required performance (3.2.1.8..1.1.e).

AM. Post flight inspection for thermal damage to igniter chamber or adapter metal parts (3.2.1.8.2).

AN. Post flight inspection of case, igniter ,S&A, OPT and igniter chamber pressure transducers for reusability (3.2.1.9.a, 3.2.1.9.d, 3.2.1.9.e, 3.2.1.8.3).

AS. Post flight inspection of identification numbers of reusable components for traceability (3.2.1.5)

## 3.0 APPLICABLE DOCUMENTS

1U75164 Igniter Rocket Motor, Modified

1U75165 Modified Ignition System, Fwd Seg Assy

TWR-16475 Vol VI Igniter Component, KSC Postfire Engineering Evaluation Plan

TWR-17198 Vol VI Post Fire Engineering Evaluation Comments (Igniter components)

## 4.0 SUMMARY/CONCLUSIONS

The overall performance of the igniter components was excellent. No damage or heat affected areas were noted.

The sealing elements of the igniter functioned as expected with no evidence of erosion or blowby.

The thermal protection system protected all areas adequately. No excessive erosion was noted.

Corrosion was found in the special bolt holes in the igniter chamber. The corrosion will not affect refurbishment of the chamber. Beginning with flight 5 grease has been added to the chamber holes to prevent this erosion.

## 5.0 RESULTS/DISCUSSION

### 5.1 SEALING SYSTEM

#### 5.1.1 Left Safe and Arm Device to Adapter

The grease application was not readily detectable on all surfaces. There was no grease on the seals. There was no evidence of hot gas past the primary seal on the safe and arm gasket. There was soot located intermittently on the aft side of the gasket and matching locations on the safe and arm from 125 to 195 degrees (70 degree arc), and from 200 to 270 degrees (70 degree arc). (Figure 1) The condition of the joint was nominal. There was no corrosion or damage found to the joint or gasket seals at disassembly. (Page B1 of Appendix B and Figure 2)

### 5.1.2 Left Igniter Chamber to Adapter

No blow holes were found in the putty, therefore, no soot reached the inner primary seal. No damage was observed on the gasket seals. Soot was found leading to the outer primary seal on the aft side of the inner gasket from 30 to 0 to 120 degrees (270 degree arc). All Stat-O-Seals from the inner joint bolts were damaged. It has been determined this damage occurred when the bolts were retorqued prior to disassembly of the igniter or during disassembly of the igniter. (Page B2 of Appendix B)

The grease was light and per design, however, there was light circumferential corrosion on the adapter plate, forward of the outer joint primary seal and in the region between the inner seal and outer seal. (Figure 3) There was corrosion on the tips of all transducer bolts and in the bottom of all transducer bolt holes located at 40, 100, 180, and 270 degrees. (Figure 4) This corrosion will not cause a refurbishment problem because it is not on the sealing surfaces.

### 5.1.3 Left Igniter Joint Adapter-to-Forward Dome

No evidence of hot gas leakage past the primary seal or damage on the joint or gasket seals was found. There was corrosion around the full circumference on the inside diameter of the forward dome boss and over the edge to the inside. Most of the corrosion was very light with a few heavier areas. None of the corrosion seen will affect the components ability to be refurbished. (Figure 5)

A putty blowhole was observed at 285 degrees, which was 1.625 inches wide at the entrance with 0.75 inch mid-width and 1.5 inch outlet width. (Figure 6)

On the aft face of the gasket there was soot to the primary seal from 220 to 310 degrees (90 degree arc). The majority of this soot was light. Heavier soot was found on the primary seal from 250 to 290 degrees (40 degree arc). Soot was over the edge of the forward face of the gasket approximately 0.10 inch from 270 to 300 degrees (60 degree arc). (Page B3 of Appendix B)

### 5.1.4 Right Safe and Arm to Adapter

No evidence of hot gas past the primary seal on the Safe and Arm gasket was found. Soot was found on the primary seal on the aft side of the gasket from 108 to 144 degrees (36 degree arc). Soot was barely detectable on the gasket and was more evident on the igniter adapter surface. (Figure 7)

The condition of the joint was nominal, as there was no grease on

the seals or corrosion on the retainer. No damage to the joint or gasket seals was observed. (Page B4 of appendix B)

### 5.1.5 Right Igniter Chamber-to-Adapter

No blow holes were found in the putty, therefore, no soot reached the inner primary seal. Light soot was found leading to the outer primary seal on the aft side of the inner gasket around the full circumference, and heavier soot was found from 30 to zero to 230 degrees (160 degree arc). (Figure 8)

All Stat- O-Seals from the inner joint bolts were damaged. It has been determined this occurred when the bolts were retorqued prior to disassembly of the igniter or during the disassembly of the igniter. No gasket seal damage was observed.

### 5.1.6 Right Igniter Joint Adapter-to-Forward Dome

No evidence of hot gas leakage past the primary seal and was found and no seal damage was observed on the gasket. A putty blow hole was observed at 320 degrees. (Figure 9) It was 1.0 inch wide at the entrance and necked down to 0.625 inch at the exit. This blowhole is typical of what has been seen before. (Page B5 and B6 of appendix B)

On the aft face of the gasket, there was light soot to the primary seal from 162 to 252 degrees (90 degree arc), and heavier soot to the primary seal from 252 to 266 degrees (14 degree arc). The forward face showed intermittent soot to the primary seal from 240 to 340 degrees (100 degree arc), and light soot intermittent over the edge to the primary seal over the full circumference. (Figure 10)

Corrosion was found on the inside edge of the forward dome boss and outside edge. This corrosion has been seen in the past. The corrosion occurs when the gases from the motor fill the volume past the putty and when sea water enters this cavity. The corrosion seen at this time will not affect the components ability for refurbishment. (Figure 11 and 12)

No gasket seal damage was observed.

### 5.1.7 Special Bolts to Chamber

All eight special bolts showed no signs of heating or blowby past the seals. No signs of physical damage to the seals, bolt or igniter chamber area. Corrosion was observed on the bottom of all 8 special bolts (figure 13). This corrosion came from the igniter chamber. The bolts are made of corrosion resistant steel. This corrosion in the chamber is below the sealing surface area. None

of the corrosion seen will affect the bolts or bolt chambers ability for refurbishment. The corrosion is caused by combustion products and by salt water which is forced up the transducer pressure ports during splash down. This has been seen in the past.

All special bolts performed as predicted. RSRM 5 and subsequent flights will have added grease in this area to prevent corrosion.

### 5.2 Insulation

The thermal protection on both igniters performed as predicted. No abnormal hot spots or erosion was seen. The water from splash down washed the OD chamber insulation clean of char. The chamber ID insulation, the adapter insulation and initiator insulation had uniform layers of char. Char depths were typical.

The areas of the insulation which have the most heat affects were measured for thickness prior to flight and after flight. Figure A1 shows the location of the thickness measurements. Table AI, Insulation Thickness History, shows a summary of insulation char depth for all igniters tested in the RSRM program. Location #8 sees char depth that exceed the 1.5 required safety factor. This area of excessive charring is not a concern for safety. Waver # RVW579 R1 has been submitted and approved by NASA for this area only. Visual inspection of all RSRM igniter shows no excessive heating in this area. (Pages B7 and B8 of Appendix B)

### 5.3 Nozzle insert

The nozzle insert for each igniter remained firmly bonded in place and showed no excessive char depth. No structural damage or heat damage was seen on either nozzle insert. Both inserts performed as predicted. (Pages B9 and B10 of Appendix B)

## 6.0 METAL COMPONENTS

No structural damage was noted on any metal components. No bolts showed signs of yielding or damage. No yielding or damage was seen in the metal portion of the packing with retainer (1U75375). (Pages B11 and B12 of Appendix B)

### 6.1 ULTRASONIC PRELOAD OF BOLTS

The inner bolts (igniter chamber to adapter) were switched at KSC, prior to flight, to incorporate the ultrasonic preload measuring method. The bolts were loaded to 52-57 KPS.

Prior to removal, the bolts were checked for ultrasonic length and to see at what torque the bolts would move clockwise. After removal, the bolts were checked for ultrasonic preload. A comparison of pre torques and preloads vs. postfire torques and preloads is summarized in Table I. All torques and preloads are within excepted values and accuracy of the instruments.

## 7.0 IGNITION SYSTEM COMPONENT TEAM RECOMMENDATIONS

The Igniter System Components Program team has reviewed all observations presented in this document and determined that only two potential anomalies exist. These potential anomalies are listed below.

### 7.1 OBSERVATION

1. Blowholes in the outer joint putty on both the left and right igniters.

   Decision was to continue to use the present design.

### 7.2 MINOR ANOMALIES

1. None.

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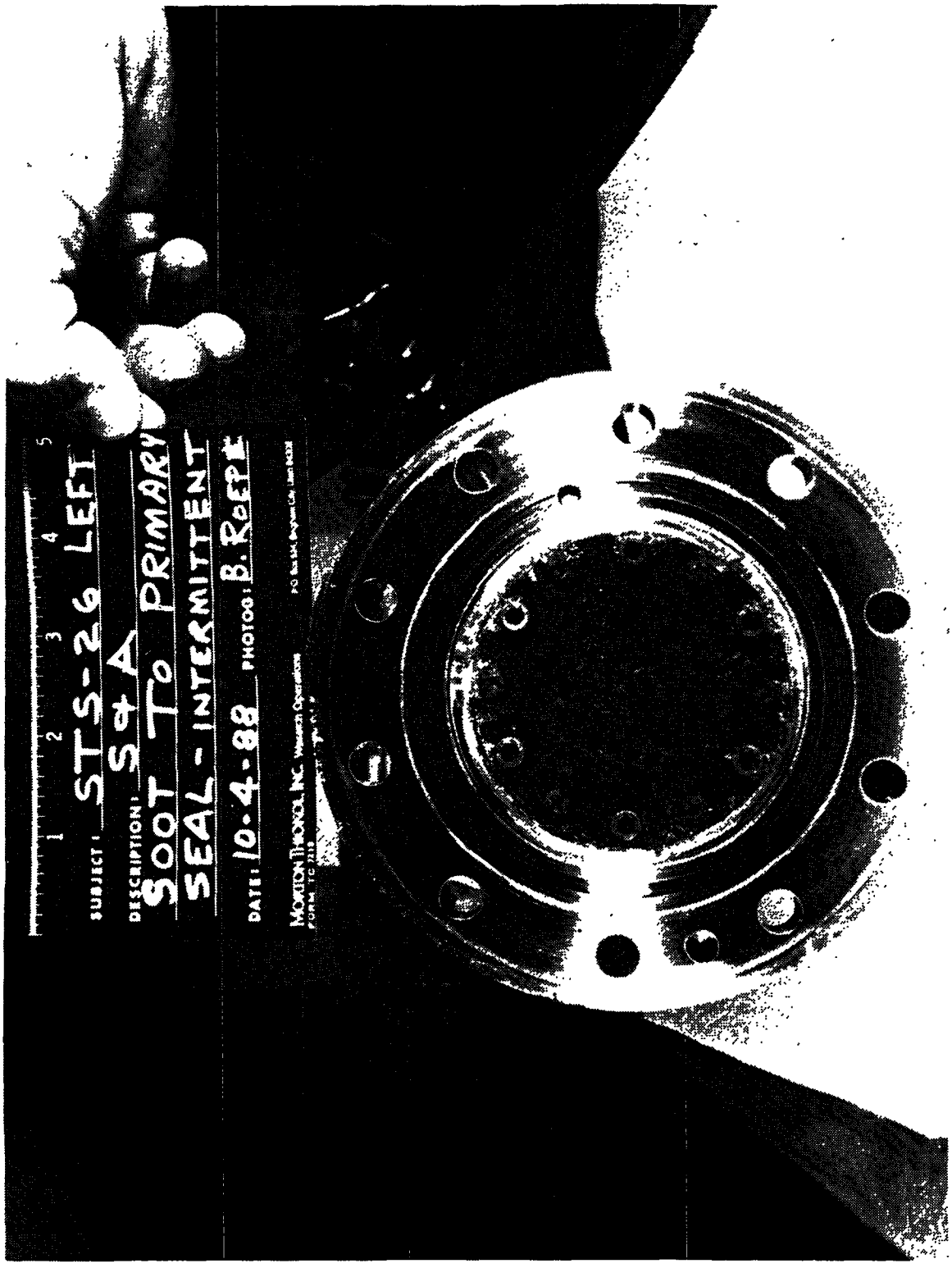


Figure 1. Safe and Arm Soot to Primary Seal Left Motor

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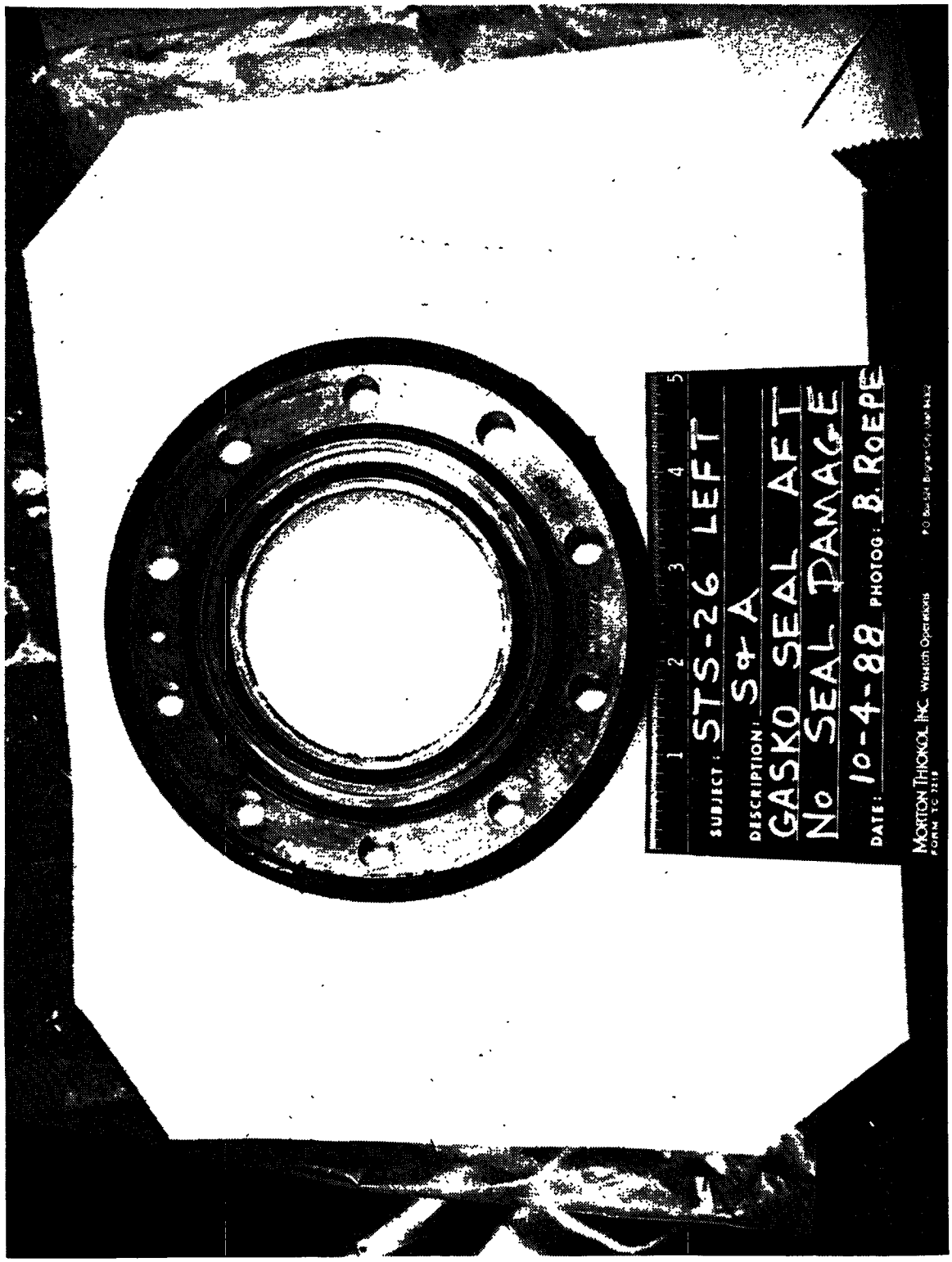


Figure 2. Safe and Arm Gasko Seal Left Motor

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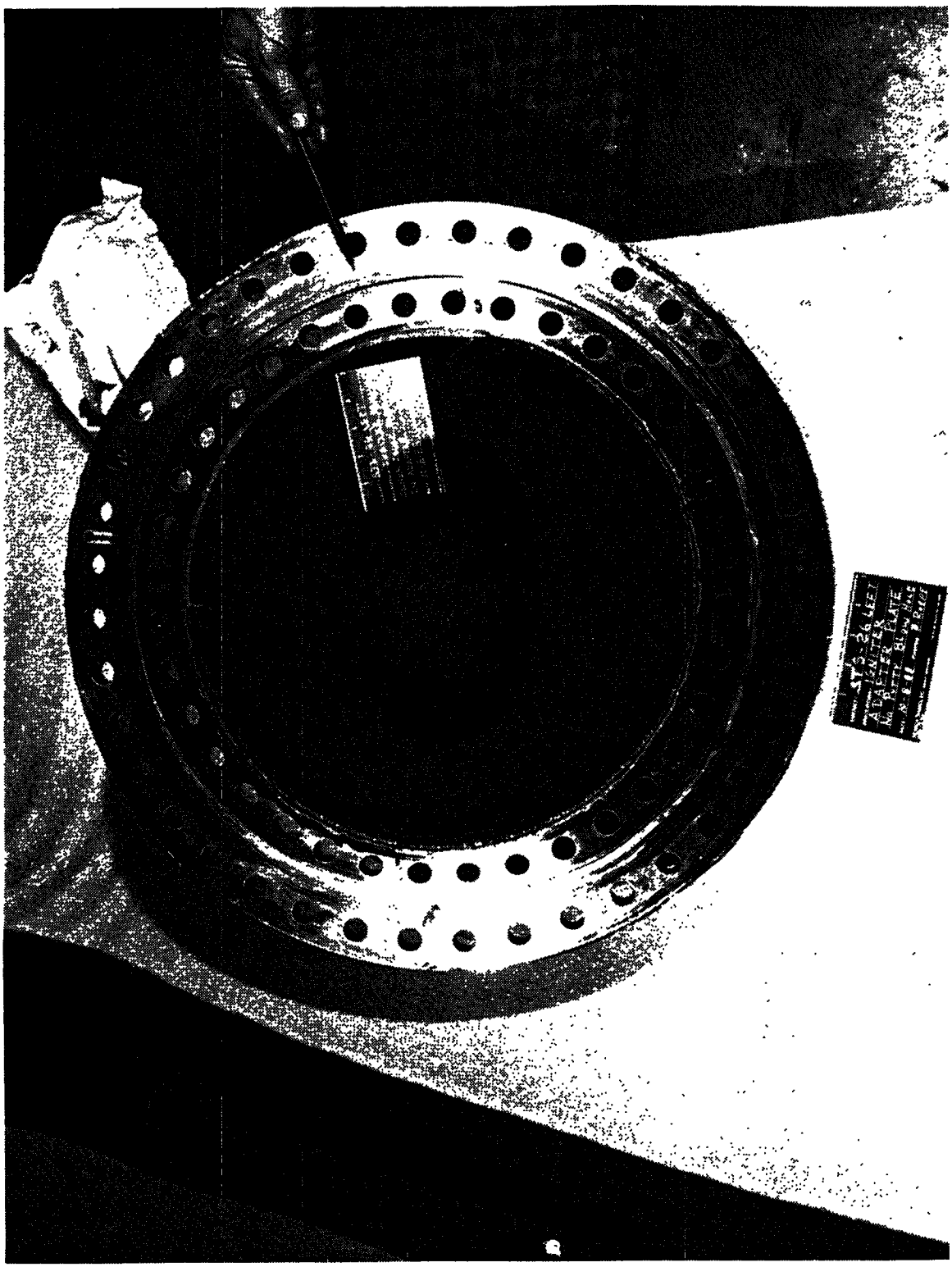

Figure 3. Igniter Adapter Plate Corrosion Left Motor

Figure 4. Igniter Transducer Bolt Corrosion

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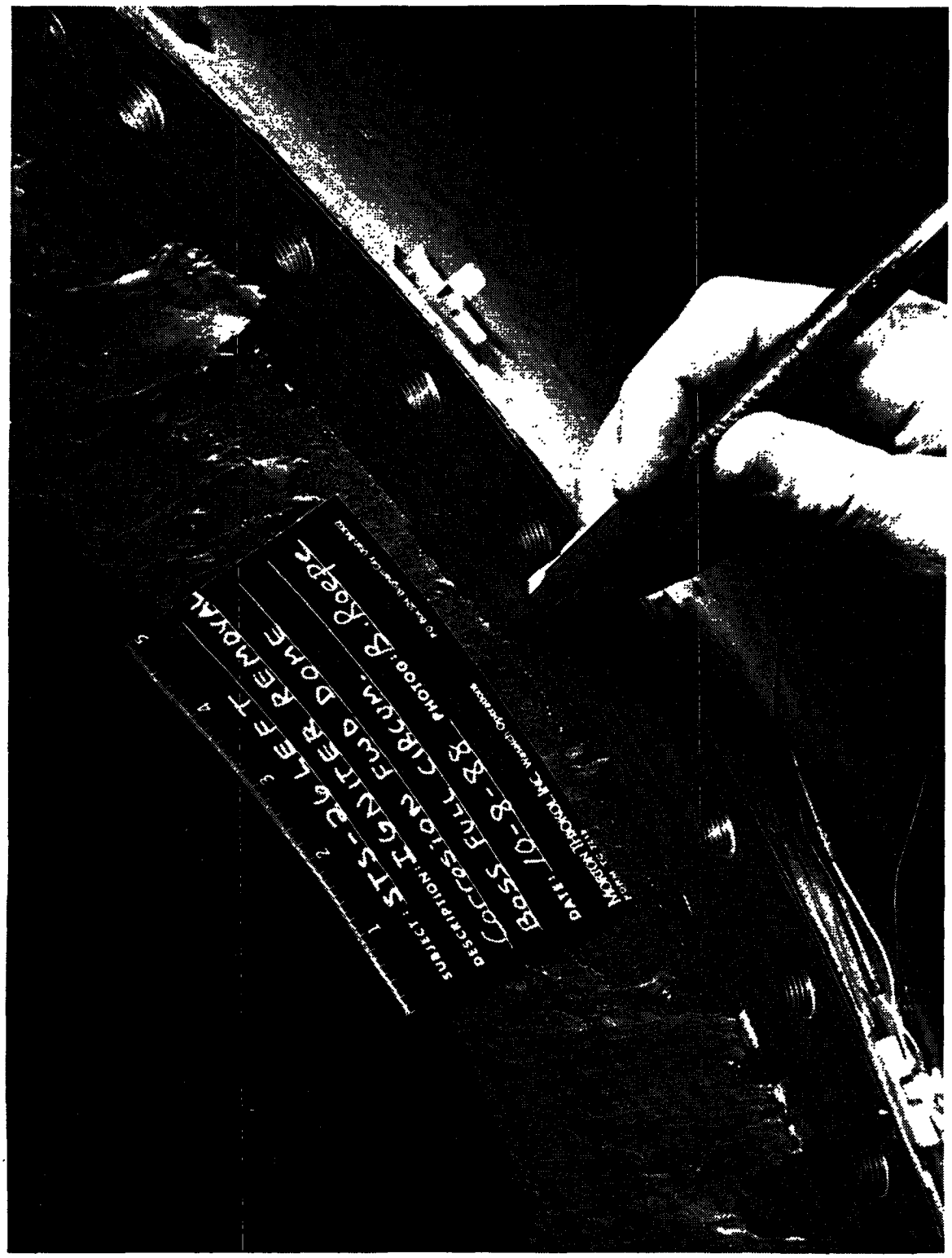


Figure 5. Igniter Forward Dome Boss Corrosion Left Motor

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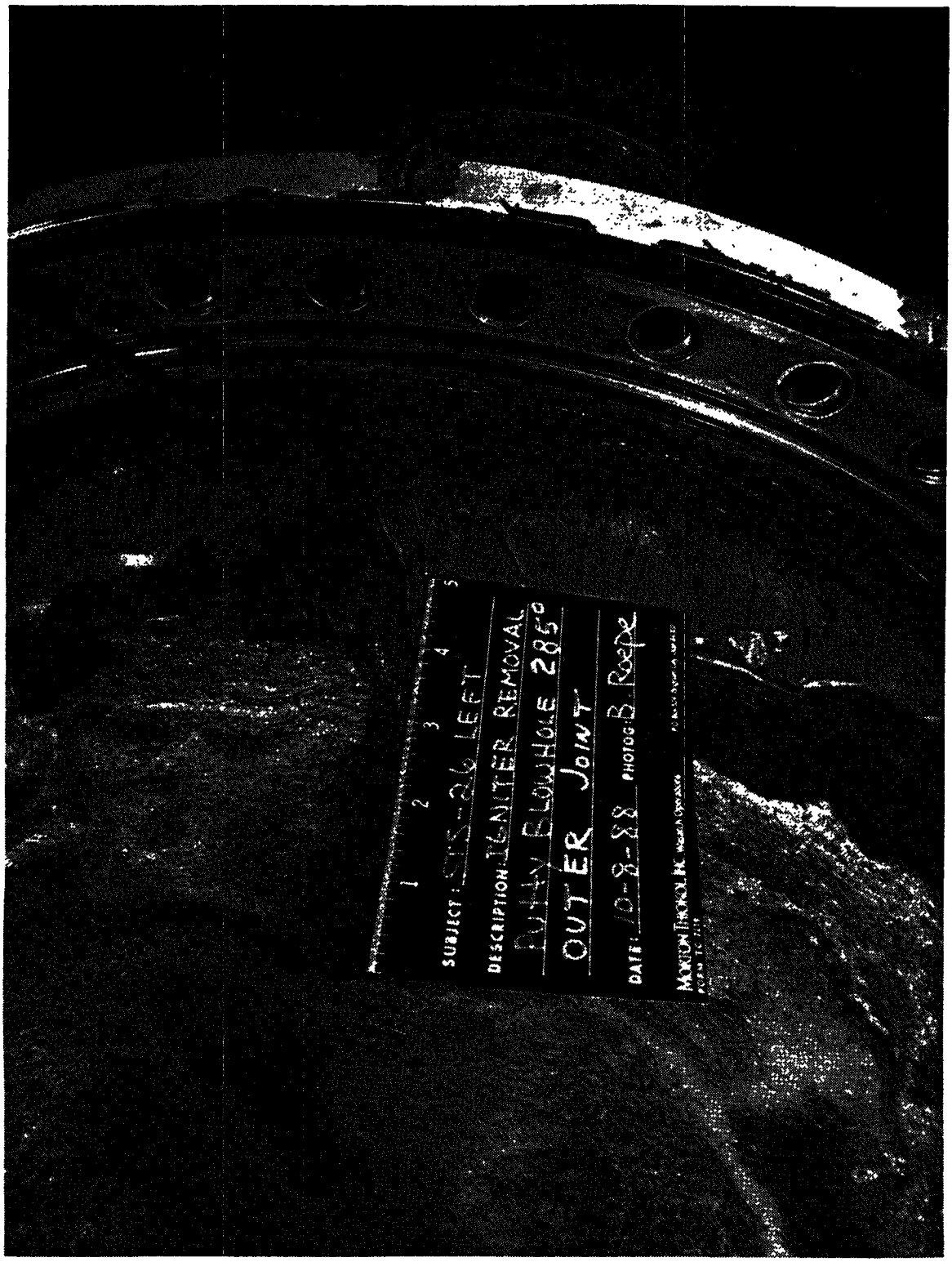


Figure 6. Igniter Putty Blowhole Left Motor

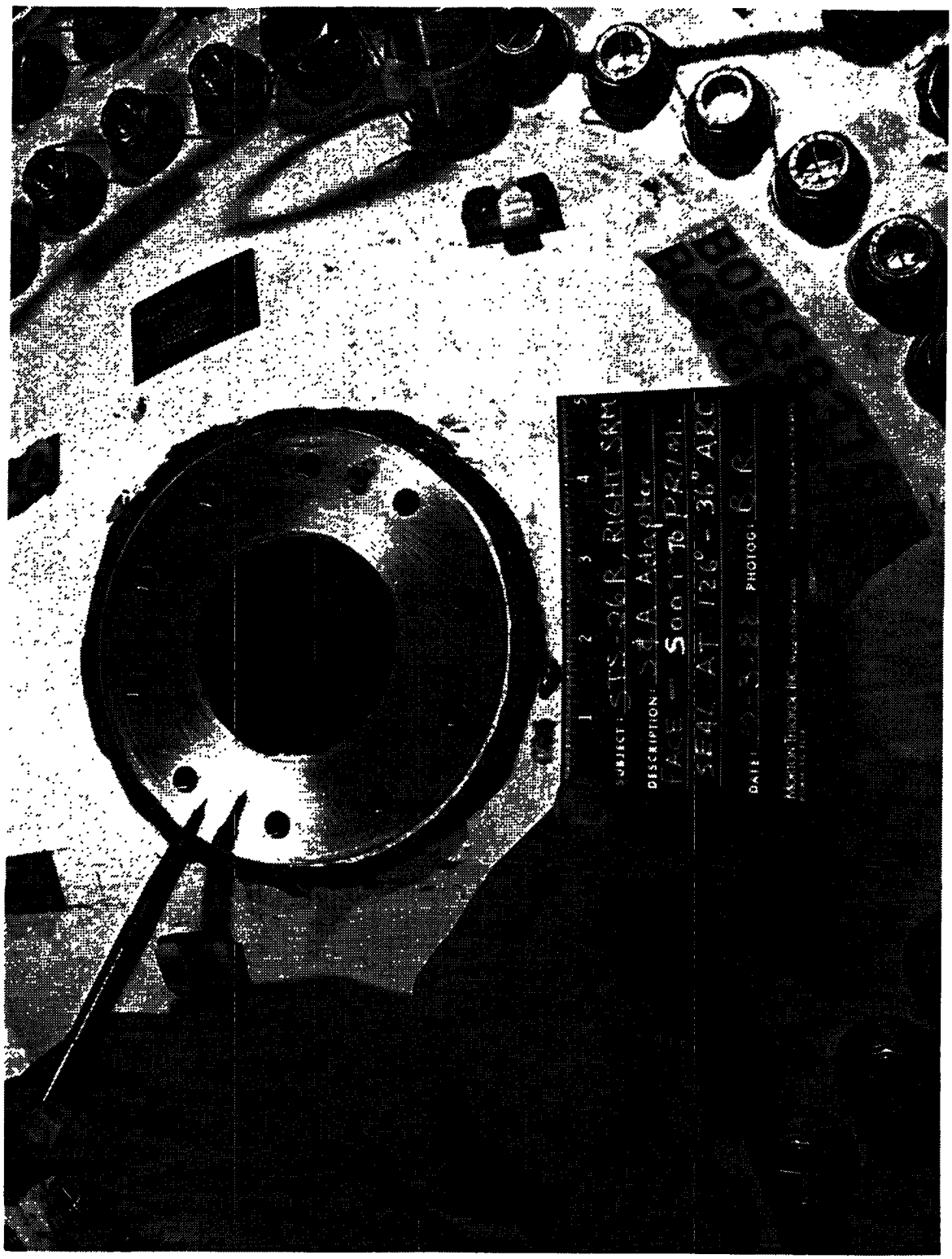


Figure 7. Safe and Arming Adapter Soot Right Motor

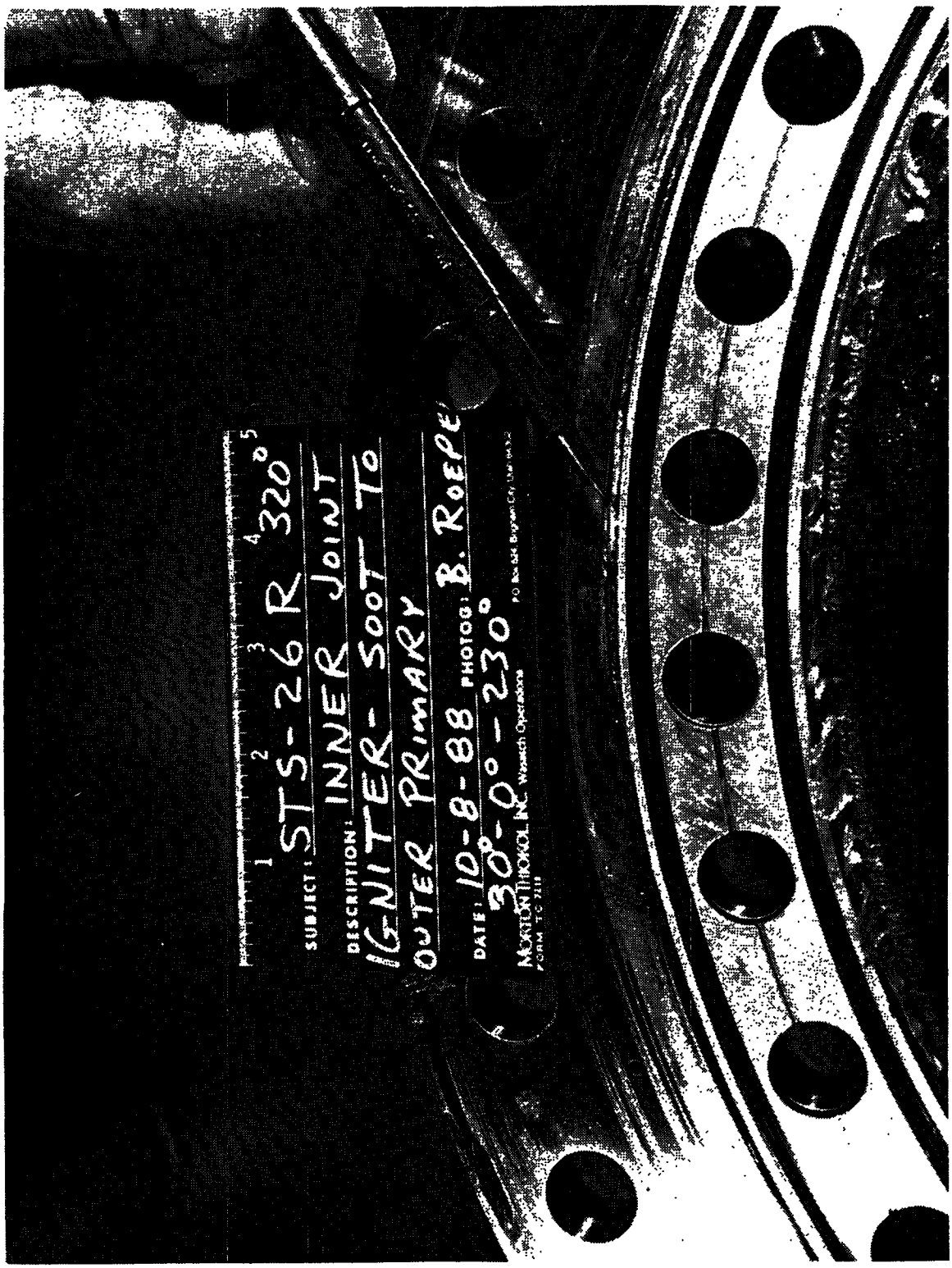


Figure 8. Igniter Inner Joint Soot Right Motor

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Figure 9. Igniter Putty Blowhole Right Motor

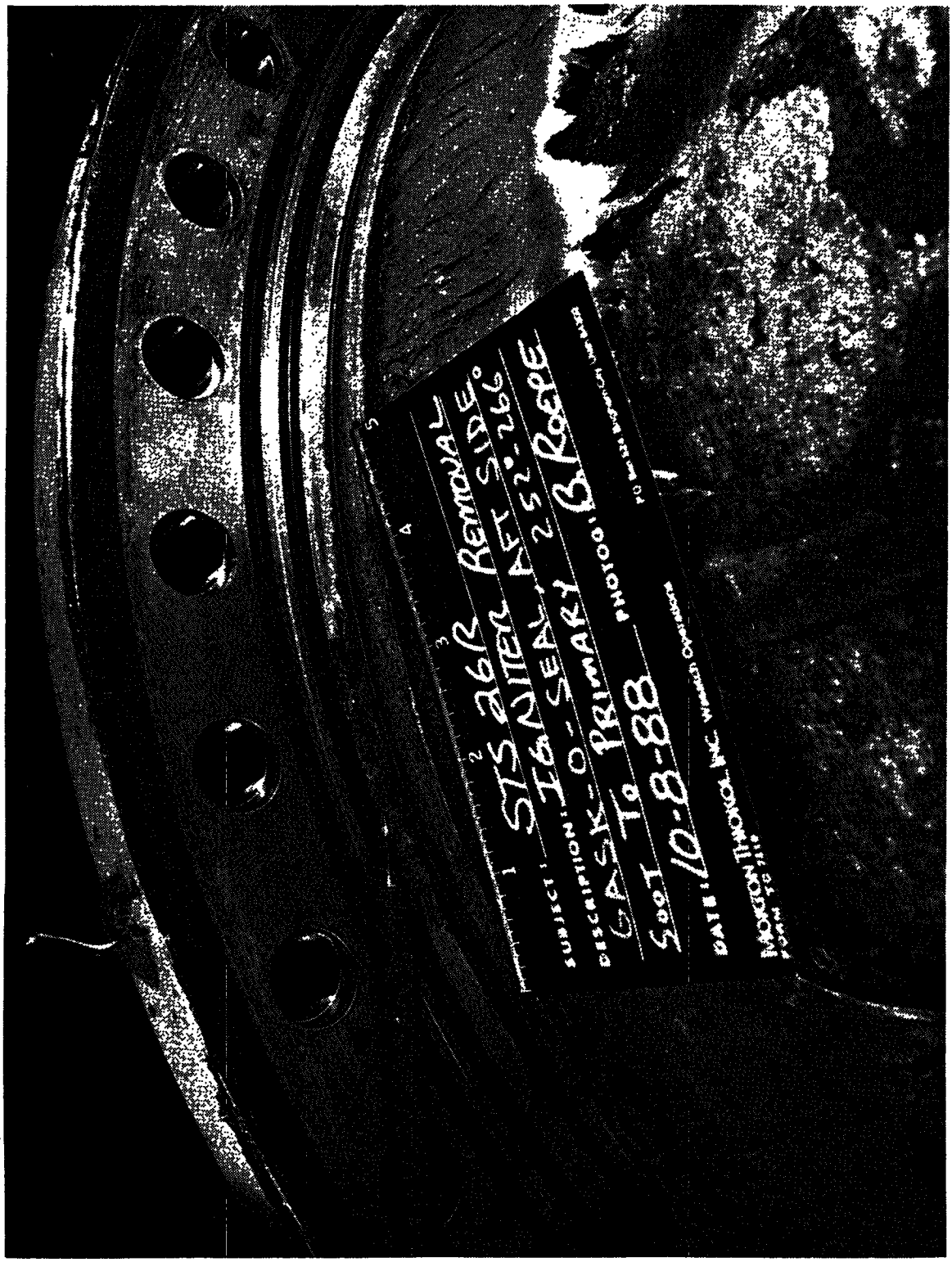



Figure 10. Igniter Gask-O-Seal Soot Right Motor

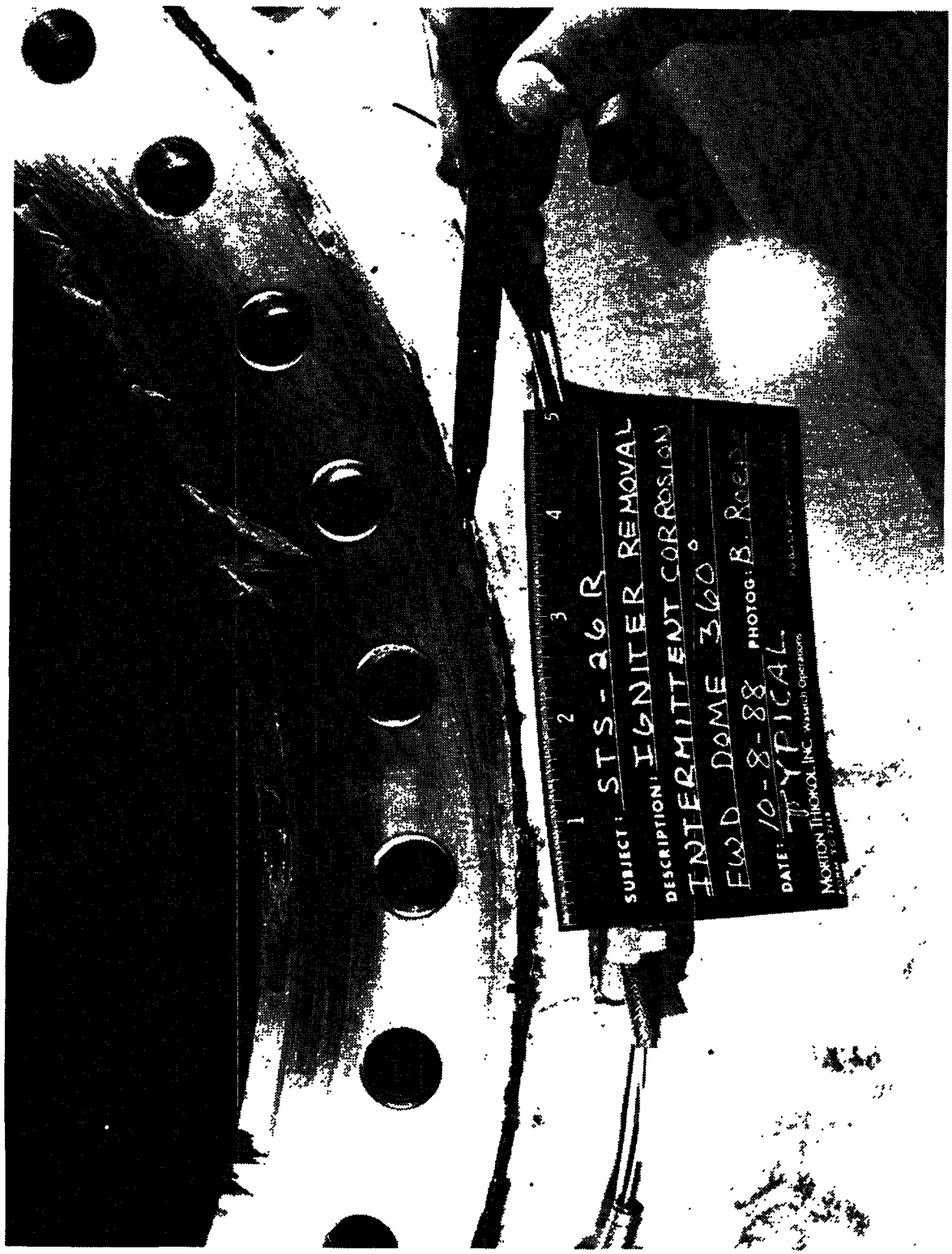



Figure 11. Forward Dome Corrosion Right Motor

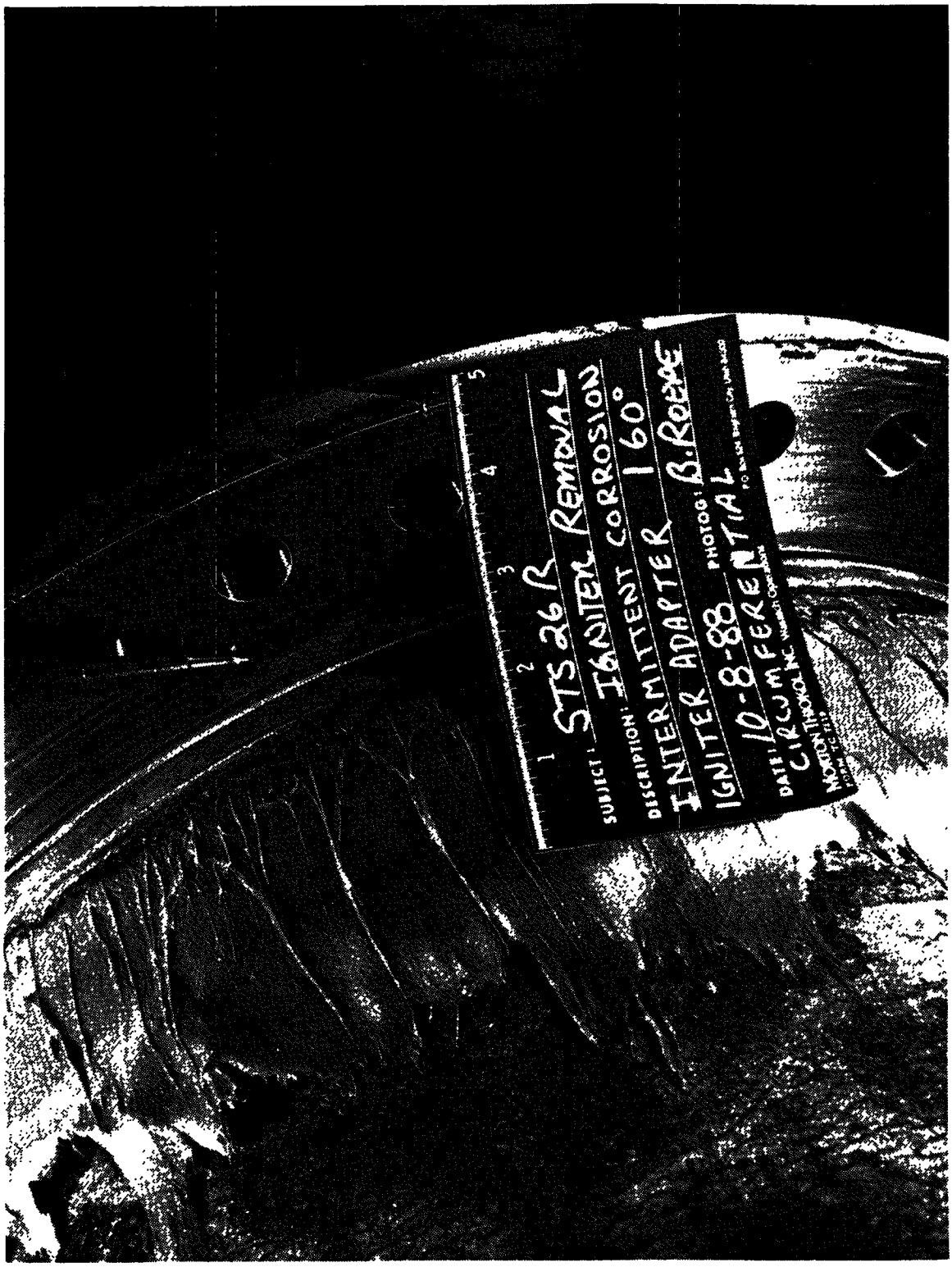



Figure 12. Igniter Adapter Corrosion Right Motor

Figure 13. Special Bolt Corrosion

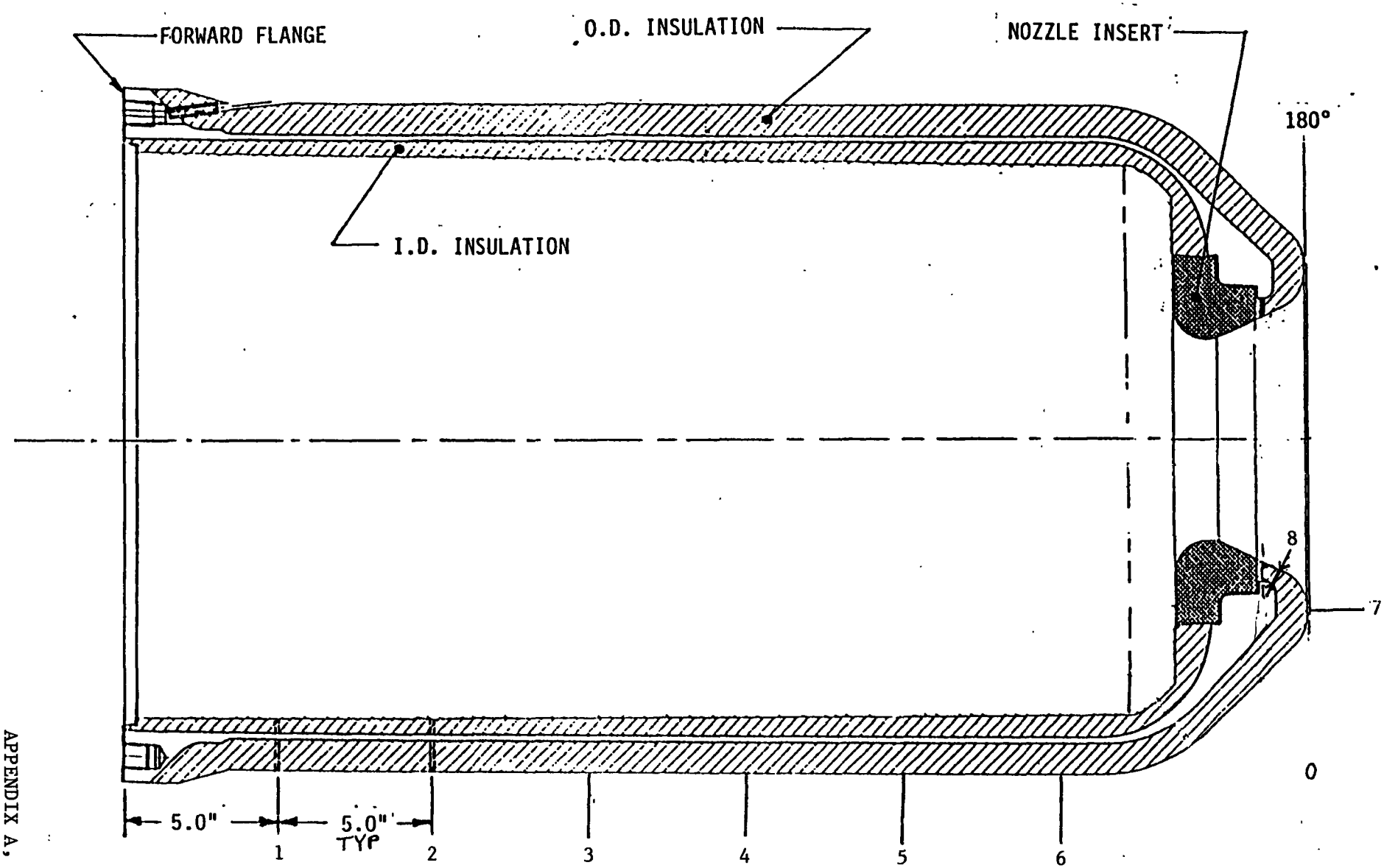
## FLIGHT 1 IGNITER BOLT MEASURMENTS

### RIGHT MOTOR

| INNER BOLTS | | | | OUTER BOLTS | | LEFT MOTOR INNER BOLTS | | | |
|---|---|---|---|---|---|---|---|---|---|
| DEGREE LOCAT. | TORQUE | LOAD | RATIO | DEGREE LOCAT. | TORQUE | DEGREE LOCAT. | TORQUE | LOAD | RATIO |
| 0 | 430 | 49888 | 116. | 0 | 275 | 0 | 460 | 54482 | 118. |
| 10 | 450 | 52185 | 115. | 9 | 250 | 10 | 520 | 52185 | 100. |
| 20 | 410 | 55247 | 134. | 18 | 225 | 20 | 460 | 56013 | 121. |
| 30 | 410 | 52915 | 129. | 27 | 225 | 30 | 390 | 59075 | 151. |
| 50 | 470 | 53716 | 114. | 36 | 280 | 50 | 430 | 50654 | 117. |
| 60 | 440 | 50654 | 115. | 45 | 270 | 60 | 500 | 52951 | 105. |
| 70 | 460 | 52185 | 113. | 54 | 320 | 70 | 490 | 49123 | 100. |
| 80 | 520 | 52185 | 100. | 63 | 280 | 80 | 470 | 59841 | 127. |
| 90 | 440 | 55247 | 125. | 72 | 330 | 90 | 450 | 56779 | 126. |
| 110 | 500 | 47581 | 95.1 | 81 | 300 | 110 | 410 | 55247 | 134. |
| 120 | 515 | 56779 | 110. | 90 | 275 | 120 | 450 | 53716 | 119. |
| 130 | 460 | 55247 | 120. | 99 | 300 | 130 | 460 | 49123 | 106. |
| 140 | 530 | 52185 | 98.4 | 108 | 310 | 140 | 480 | 53716 | 111. |
| 150 | 430 | 52185 | 121. | 117 | 280 | 150 | 460 | 49888 | 108. |
| 160 | 440 | 53716 | 122. | 126 | 280 | 160 | 440 | 53716 | 122. |
| 170 | 505 | 56013 | 110. | 135 | 315 | 170 | 470 | 58310 | 124. |
| 190 | 490 | 72091 | 147. | 144 | 265 | 190 | 410 | 54482 | 132. |
| 200 | 430 | 53716 | 124. | 153 | 290 | 200 | 410 | 48357 | 117. |
| 210 | 460 | 56013 | 121. | 162 | 300 | 210 | 440 | 54482 | 123. |
| 220 | 490 | 51419 | 104. | 171 | 300 | 220 | 460 | 50654 | 110. |
| 230 | 490 | 55247 | 112. | 180 | 300 | 230 | 450 | 57544 | 127. |
| 240 | 470 | 55247 | 117. | 189 | 280 | 240 | 440 | 57544 | 130. |
| 250 | 440 | 50654 | 115. | 198 | 330 | 250 | 470 | 53716 | 114. |
| 260 | 505 | 53716 | 106. | 207 | 280 | 260 | 390 | 60707 | 155. |
| 280 | 470 | 53716 | 114. | 216 | 290 | 280 | 420 | 48357 | 115. |
| 290 | 430 | 55247 | 128. | 225 | 295 | 290 | 410 | 56013 | 136. |
| 300 | 450 | 56779 | 126. | 234 | 300 | 300 | 410 | 55247 | 134. |
| 310 | 420 | 51419 | 122. | 243 | 280 | 310 | 490 | 50654 | 103. |
| 320 | 400 | 52185 | 130. | 252 | 290 | 320 | 390 | 56013 | 143. |
| 330 | 470 | 51419 | 109. | 261 | 295 | 330 | 430 | 55247 | 128. |
| 340 | 440 | 54482 | 123. | 270 | 270 | 340 | 450 | 51419 | 114. |
| 350 | 550 | 53951 | 98.0 | 279 | 330 | 350 | 500 | 58310 | 116. |
| | | | | 288 | 280 | | | | |
| | | | | 297 | 270 | SPEC. BOLTS | | | |
| | | | | 306 | 280 | 40 | 290 | | |
| | | | | 315 | 280 | 100 | 260 | | |
| | | | | 324 | 320 | 180 | 270 | | |
| | | | | 333 | 270 | 270 | 260 | | |
| | | | | 342 | 290 | | | | |
| | | | | 351 | 270 | | | | |

Torque = the force required to turn the bolts clockwise
Load = the preload on the bolts as measured ultrasonically.
Ratio = load/torque

# APPENDIX A




Post Test Plug Positioning For Insulation Measurements

FIGURE A1

IGNITER INSULATION HISTORY

| MOTOR | LOCATION | PRE FIRE THICKNESS | | | | | | | | POST FIRE THICKNESS | | | | | | | | FACTOR OF SAFETY | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| DM-9 | 0 DEGREES | 1.04 | 1.01 | 1 | 1 | 1.1 | 1.03 | 1.1 | 0.4 | 0.807 | 0.843 | 0.76 | 0.764 | 0.736 | 0.781 | 0.775 | 0.128 | 4.46 | 6.04 | 4.16 | 4.23 | 3.02 | 4.13 | 3.38 | 1.47 |
| | 180 DEGREES | 0.99 | 1.01 | 1 | 0.98 | 1.02 | 1.04 | 1.07 | 0.4 | 0.872 | 0.816 | 0.787 | 0.796 | 0.762 | 0.731 | 0.761 | 0.142 | 8.38 | 5.20 | 4.69 | 5.32 | 3.95 | 3.36 | 3.46 | 1.55 |
| QM-6 | 0 DEGREES | 1.039 | 1.03 | 1.021 | 1.021 | 0.992 | 1.097 | 1.064 | 0.415 | 0.838 | 0.848 | 0.93 | 0.8 | 0.777 | 0.768 | 0.969 | 0.183 | 5.16 | 5.65 | 11.2 | 4.61 | 4.61 | 3.33 | 11.2 | 1.78 |
| | 180 DEGREES | 0.99 | 0.987 | 1.009 | 1.011 | 1.006 | 1.026 | 1.003 | 0.405 | 0.799 | 0.82 | 0.838 | 0.738 | 0.759 | 0.722 | 0.96 | 0.182 | 5.18 | 5.91 | 5.90 | 3.70 | 4.07 | 3.37 | 23.3 | 1.81 |
| QM-7 | 0 DEGREES | 1.091 | 1.068 | 1.052 | 1.054 | 1.046 | 1.106 | 1.049 | N/A | 0.818 | 0.808 | 0.817 | 0.823 | 0.837 | 0.763 | 0.892 | INCOR 0.624 | 3.99 | 4.10 | 4.47 | 4.56 | 5.00 | 3.22 | 6.68 | N/A |
| | 180 DEGREES | 1.045 | 1.058 | 1.047 | 1.054 | 1.144 | 1.011 | 1.059 | N/A | 0.805 | 0.798 | 0.793 | 0.826 | 0.75 | 0.782 | 0.91 | 0.733 | 4.35 | 4.06 | 4.12 | 4.62 | 2.90 | 4.41 | 7.10 | N/A |
| QM-8 | 0 DEGREES | 1.073 | 1.028 | 1.009 | 1.025 | 1.031 | 1.01 | 1.055 | 0.404 | 0.832 | 0.781 | 0.763 | 0.69 | 0.708 | 0.752 | 0.678 | INCOR 0.468 | 4.45 | 4.16 | 4.10 | 3.05 | 3.19 | 3.91 | 2.79 | N/A |
| | 180 DEGREES | 1.078 | 1.023 | 1.025 | 1.026 | 1.025 | 1.01 | 1.068 | 0.471 | 0.89 | 0.746 | 0.781 | 0.746 | 0.737 | 0.773 | 0.703 | 0.47 | 5.73 | 3.69 | 4.20 | 3.66 | 3.55 | 4.26 | 2.92 | N/A |
| PV-1 | 0 DEGREES | 1.055 | 1.085 | 1.069 | 1.054 | 1.07 | 1.064 | 1.037 | 0.447 | 0.912 | 0.881 | 0.85 | 0.81 | 0.75 | 0.808 | 0.784 | 0.205 | 7.37 | 5.31 | 4.88 | 4.31 | 3.34 | 4.15 | 4.09 | 1.84 |
| | 180 DEGREES | 1.06 | 1.075 | 1.036 | 1.036 | 1.075 | 1.064 | 0.998 | 0.432 | 0.918 | 0.868 | 0.77 | 0.778 | 0.76 | 0.86 | 0.678 | 0.19 | 7.46 | 5.19 | 3.89 | 4.01 | 3.41 | 5.21 | 3.11 | 1.78 |
| FLIGHT 1A | 0 DEGREES | 0.999 | 1.06 | 1.046 | 1.024 | 1.048 | 1.107 | 1.046 | N/A | 0.915 | 0.813 | 0.88 | 0.79 | 0.81 | 0.808 | 0.785 | INCOR 0.436 | 11.8 | 4.29 | 6.30 | 4.37 | 4.40 | 3.70 | 4.00 | N/A |
| | 180 DEGREES | 0.936 | 1.04 | 1.024 | 1.024 | 1.012 | 1.071 | 1.041 | N/A | 0.85 | 0.818 | 0.778 | 0.795 | 0.765 | 0.68 | 0.65 | 0.415 | 10.8 | 4.68 | 4.16 | 4.47 | 4.09 | 2.73 | 2.66 | N/A |
| FLIGHT 1B | 0 DEGREES | 0.982 | 1.025 | 1.028 | 1.029 | 1.027 | 1.126 | 1.035 | 0.423 | 0.835 | 0.822 | 0.815 | 0.817 | 0.778 | 0.882 | 0.6 | 0.295 | 6.68 | 5.04 | 4.82 | 4.85 | 4.12 | 4.61 | 2.37 | 3.30 |
| | 180 DEGREES | 0.993 | 1.033 | 1.024 | 1.024 | 1.024 | 1.092 | 1.041 | 0.423 | 0.79 | 0.772 | 0.756 | 0.768 | 0.778 | 0.782 | 0.612 | 0.275 | 4.89 | 3.95 | 3.82 | 4 | 4.16 | 3.52 | 2.42 | 2.85 |

N/A = NOT AVAILABLE

INCOR = MEASUREMENT TAKEN AT WRONG LOCATION OR CHAR WAS NOT REMOVED

Igniter Insulation History

TABLE A1

# APPENDIX B

Table A-II

Safe & Arm - Evaluation Checkoff Worksheet

| Inspector(s): Pat McCluskey | | |
|---|---|---|
| Motor No.: 26 R | Side: ☒ Left(A) ☐ Right(B) | Date: 10/9/85 |

| | | | |
|---|---|---|---|
| I. | Heat Affect (Blisters or Discoloration)? | ____ yes | X no |
| II | Physical Damage (Nicks, Scratches, Gouges)? | ____ yes | X no |
| III. | Corrosion? | ____ yes | X no |

If yes, note:

| Condition (I, II, or III) | Degree Location (Deg.) | Circumferential Width (In.) | Degree Arc |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

Notes / Comments

No unacceptable conditions

**Table A-IV**
**Igniter Instrumentation (Removed) - Evaluation Checkoff Worksheet**

Inspector(s): Pat McCluskey

Motor No.: 26 R | Side: [X] Left(A) [ ] Right(B) | Date: 10/9/86

I. Evidence of Combustion Product Leakage (i.e. Soot)?

| | | |
|---|---|---|
| A. Transducers | ___ yes | X no |
| B. Transducer Bolt Assemblies | ___ yes | X no |
| C. Plugs | ___ yes | X no |

If Yes:

| Affected Part (A, B or C) | Degree Location (Deg) |
|---|---|
| | |
| | |
| | |
| | |

II. Physical Damage (Nicks, Scratches, Gouges)?

| | | |
|---|---|---|
| A. Transducers | ___ yes | X no |
| B. Transducer Bolt Assemblies | ___ yes | X no |
| C. Plugs | ___ yes | X no |

If Yes:

| Affected Part (A, B or C) | Degree Location (Deg) |
|---|---|
| | |
| | |
| | |
| | |

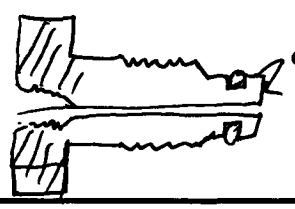
III. Plugged Ports? ___ yes X no

If Yes:

| Degree Location (Deg) |
|---|
| |
| |
| |
| |

Notes / Comments

Corrosion was located at the bottom of the 4 special Bolts. (below the o-ring)




* Note special bolts are stainless steel! the corrosion came from the igniter chamber OPT ports.

Table A-V

Igniter Putty Condition – Evaluation Checkoff Worksheet

Inspector(s): Pat McCluskey

Motor No.: 26R | Side: [X] Left(A) [ ] Right(B) | Date:

Joint: [X] ~~Adapter to Case~~ Igniter to Fwd. Dome

A. Putty Condition

1. Color? X Variable ____ Constant

2. Tack? X Good ____ Nominal ____ Poor

B. Putty Gas Paths? X Yes ____ No

C. Putty Adhesive/~~Cohesive~~ Failure? X Yes P.M. No

Clarify below or on a OCF, if necessary

If any of the above conditions exist, record indicated data below:

| Condition Indicate with: B or C | Degree Location (For B & C) | Degree Arc (For B & C) | Circumferential Width (For B & C) |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

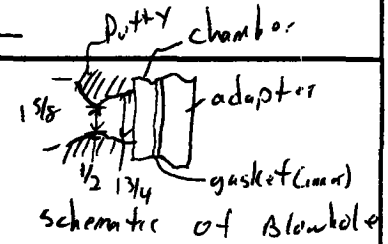
Notes / Comments

Putty gas path: Located at 285°

Putty application was light from ~~340°~~ 210°-340°.

Blow hole occured at the thinnest area of putty.

* No blowhole or gas path was observed in the igniter adapter to igniter chamber joint. No gas or combustion products reach the seals.



schematic of Blowhole

Table A-II

Safe & Arm - Evaluation Checkoff Worksheet

| | | |
|---|---|---|
| Inspector(s): Pat McCluskey | | |
| Motor No.: 26 R | Side: ☐ Left(A) ☒ Right(B) | Date: 10-8-88 |

| | | | |
|---|---|---|---|
| I. | Heat Affect (Blisters or Discoloration)? | ____ yes | X no |
| II | Physical Damage (Nicks, Scratches, Gouges)? | ____ yes | X no |
| III. | Corrosion? | ____ yes | X no |

If yes, note:

| Condition (I, II, or III) | Degree Location (Deg.) | Circumferential Width (In.) | Degree Arc |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

Notes / Comments

No unacceptable conditions

Table A-IV
Igniter Instrumentation (Removed) - Evaluation Checkoff Worksheet

Inspector(s): Pat McCluskey

Motor No.: 26R | Side: ☐ Left(A) ☒ Right(B) | Date: 10-9-85

I. Evidence of Combustion Product Leakage (i.e. Soot)?

| | | |
|---|---|---|
| A. Transducers | ____ yes | X no |
| B. Transducer Bolt Assemblies | ____ yes | X no |
| C. Plugs | ____ yes | X no |

If Yes:

| Affected Part (A, B or C) | Degree Location (Deg) |
|---|---|
| | |
| | |
| | |
| | |

II. Physical Damage (Nicks, Scratches, Gouges)?

| | | |
|---|---|---|
| A. Transducers | ____ yes | X no |
| B. Transducer Bolt Assemblies | ____ yes | X no |
| C. Plugs | ____ yes | X no |

If Yes:

| Affected Part (A, B or C) | Degree Location (Deg) |
|---|---|
| | |
| | |
| | |
| | |

III. Plugged Ports? ____ yes X no

If Yes:

| Degree Location (Deg) |
|---|
| |
| |
| |
| |

Notes / Comments
Corrosion from the igniter chamber was deposited on the bottom end of all 4 special bolts.

Table A-V

Igniter Putty Condition – Evaluation Checkoff Worksheet

| | | |
|---|---|---|
| Inspector(s): Pat McCluskey | | |
| Motor No.: 26 R | Side: ☐ Left(A) ☒ Right(B) | Date: 10-9-85 |
| Joint: ☒ Adapter to ~~Case~~ chamber X igniter to Fwd Dome | | |

A. Putty Condition

1. Color? ____ Variable X Constant
2. Tack? X Good ____ Nominal ____ Poor

B. Putty Gas Paths? X Yes ____ No

C. Putty Adhesive/~~Cohesive~~ Failure? X Yes ____ No

Clarify below or on a OCF, if necessary

If any of the above conditions exist, record indicated data below:

| Condition Indicate with: B or C | Degree Location (For B & C) | Degree Arc (For B & C) | Circumferential Width (For B & C) |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Notes / Comments

Putty gas path located at 320°. Putty application was uniform and consistant.

(Schematic)

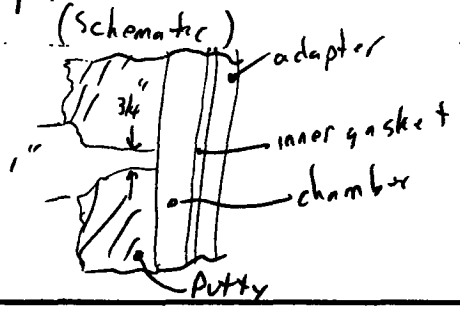


Table B-I
Igniter Insulation – Evaluation Checkoff Worksheet

Inspector(s): Pat McCluskey

Motor No.: 26A | Date: 10-9-88

Side: ☐ Left(A) ☑ Right(B)

Part: ☐ A. Igniter Chamber ~~Exterior~~ / adapter

I. Severe or Abnormal Insulation Erosion? ___ yes X no

II. Blistering? ___ yes X no

If yes, record:

| Condition (I or II) | Axial Location (In.) | Degree Location (Deg.) | Axial Length (In.) | Circumferential Width (In.) | Degree Arc |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Notes / Comments

Sea water had washed of most of the char. Erosion pattern and depth is acceptable and within acceptable limits (adapter internal, chamber internal/external, initiator external)

Table B-I
Igniter Insulation – Evaluation Checkoff Worksheet

Inspector(s): Pat McCluskey

Motor No.: 26 R | Date: 10/9/85

Side: [X] Left(A) [ ] Right(B)

Part: [X] A. Igniter Chamber ~~Exterior~~ / adapter

I. Severe or Abnormal Insulation Erosion? ___ yes X no

II. Blistering? ___ yes X no

If yes, record:

| Condition (I or II) | Axial Location (In.) | Degree Location (Deg.) | Axial Length (In.) | Circumferential Width (In.) | Degree Arc |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Notes / Comments

Most of the char was washed of in the ocean. Insulation erosion patterns were normal and as expected. No hot spots or un uniform erosion patterns.

(adapter internal, chamber internal/external/ initiator external

Table A-VI

Igniter Nozzle Insert – Evaluation Checkoff Worksheet

Inspector(s): Pat McCluskey

Motor No.: 26 P | Side: ☐ Left(A) ☒ Right(B) | Date: 10-9-85

I. Cracked Nozzle Insert? ____ yes X no

II. Chipped Nozzle Insert? ____ yes X no

If Yes:

| Condition (I or II) | Degree Location (Deg.) | Axial Length (In.) | Circumferential Width (In.) | Degree Arc |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |

Notes / Comments

Nozzle insert looked normal. No unacceptable conditions

Table A-VI

Igniter Nozzle Insert - Evaluation Checkoff Worksheet

Inspector(s): Pat McCluskey

Motor No.: 26R | Side: ☒ Left(A) ☐ Right(B) | Date: 10/9/85

I. Cracked Nozzle Insert? ____ yes X no

II. Chipped Nozzle Insert? ____ yes X no

If Yes:

| Condition (I or II) | Degree Location (Deg.) | Axial Length (In.) | Circumferential Width (In.) | Degree Arc |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |

Notes / Comments

Nozzle insert functioned normally. No unacceptable conditions

Table A-I
External Ignition System – Evaluation Checkoff Worksheet

Inspector(s): Pat McCluskey

Motor No.: 26A | Side: ☐ Left(A) ☒ Right(B) | Date: 10-9-85

I. Hotspots (Blisters or Discoloration) on Igniter Adapter? ____ yes X no

If yes:

| Condition | Degree Location (Deg.) | Radial Location (In.) | Radial Distance (In.) | Circumferential Width (In.) | Degree Arc |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

II. Physical Damage (Nicks, Scratches, Gouges)?

| | | |
|---|---|---|
| A. Adapter | ____ yes | X no |
| B. Adapter Bolts (Outer Circle) | ____ yes | X no |
| C. Adapter Bolts (Inner Circle) | ____ yes | X no |
| D. S&A Bolts | ____ yes | X no |

If yes, note the affected part (A, B, C or D) and the indicated data:

| Affected Part | Condition | Degree Location (Deg.) | Radial Location (In.) | Radial Distance (In.) | Circumferential Width (In.) | Degree Arc |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

III. Corrosion?

| | | |
|---|---|---|
| A. Adapter | X yes | ____ no |
| B. Adapter Bolts (Outer Circle) | ____ yes | X no |
| C. Adapter Bolts (Inner Circle) | ____ yes | X no |
| D. S&A Bolts | ____ yes | X no |

If yes, note the affected part (A, B, C or D) and the indicated data:

| Affected Part | Degree Location (Deg.) | Radial Location (In.) | Radial Distance (In.) | Circumferential Width (In.) | Degree Arc |
|---|---|---|---|---|---|
| A | 160 | | 10.75" | 1" | 5° |
| B | 250 | | " | 1 | 5° |
| A | 0-360 | | 10.75 | | 360° |
| | | | | | |

Notes / Comments
light rust was on the adapter outer gasket sealing surface intermittantly around the entire circumference. Corrosion was not past the primary outer gasket seal.

Table A-I
External Ignition System – Evaluation Checkoff Worksheet

Inspector(s): Pat McCluskey

Motor No.: 26R | Side: ☒ Left(A) ☐ Right(B) | Date: 10/8/85

I. Hotspots (Blisters or Discoloration) on Igniter Adapter? ____ yes X no

If yes:

| Condition | Degree Location (Deg.) | Radial Location (In.) | Radial Distance (In.) | Circumferential Width (In.) | Degree Arc |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

II. Physical Damage (Nicks, Scratches, Gouges)?

A. Adapter ____ yes X no
B. Adapter Bolts (Outer Circle) ____ yes X no
C. Adapter Bolts (Inner Circle) ____ yes X no
D. S&A Bolts ____ yes X no

If yes, note the affected part (A, B, C or D) and the indicated data:

| Affected Part | Condition | Degree Location (Deg.) | Radial Location (In.) | Radial Distance (In.) | Circumferential Width (In.) | Degree Arc |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

III. Corrosion?

A. Adapter X yes ____ no
B. Adapter Bolts (Outer Circle) ____ yes X no
C. Adapter Bolts (Inner Circle) ____ yes X no
D. S&A Bolts ____ yes X no

If yes, note the affected part (A, B, C or D) and the indicated data:

| Affected Part | Degree Location (Deg.) | Radial Location (In.) | Radial Distance (In.) | Circumferential Width (In.) | Degree Arc |
|---|---|---|---|---|---|
| A | | 10.5 R | 10.5 R | 360° | 360° |
| | | | | | |
| | | | | | |
| | | | | | |

Notes / Comments
~~Rust~~ Corrosion was located on the igniter adaptor sealing surface (outer gasket) 360° intermittently around entire circumference up to the primary seal in the outer gasket

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