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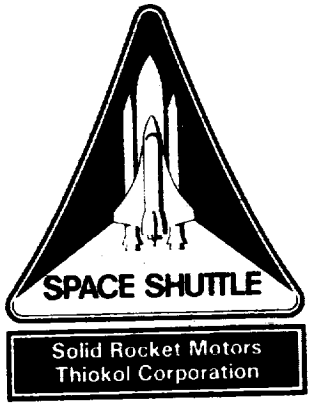

Shelf Life Extension for the Lot AAE Nozzle Severance LSCs Final Test Report

April 90

Contract No. NAS8-30490
DR No. 5-3
WBS No. 4B102 10 05
ECS No. SS3569

Thiokol CORPORATION

SPACE OPERATIONS

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Publications No. 90523

Shelf Life Extension for the Lot AAE Nozzle Severance LSCs
Final Test Report

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ABSTRACT

Shelf life extension tests for the remaining lot AAE linear shaped charges for redesigned solid rocket motor nozzle aft exit cone severance were completed on 19 February 1990 at Thiokol Corporation's small motor conditioning and firing bay, T-11. Five linear shaped charge test articles were thermally conditioned and detonated, demonstrating proper end-to-end charge propagation. Penetration depth requirements were exceeded. Results indicate that there was no degradation in performance due to aging or the linear shaped charge curving process.

It is recommended that the shelf life of the lot AAE nozzle severance linear shaped charges be extended through January 1992.

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1
INTRODUCTION

This report documents the procedures, performance, and results from the testing performed to extend the shelf life of the remaining lot AAE nozzle severance linear shaped charges (LSC), on which the shelf life has expired. In addition to the shelf life extension tests, test results were compared to previous acceptance test data to determine if there has been any aging-related performance degradation. The testing was completed on 19 February 1990 at the Thiokol small motor conditioning and firing bay, T-11. Vibration testing was performed at the T-53 vibration building, and thermal shock testing was performed at the T-51 conditioning chamber. Testing was performed in accordance with CTP-0163, Linear Shaped Charge Lot Shelf Life Extension Acceptance Test Plan.

The purpose of nozzle severance LSCs is to sever the redesigned solid rocket motor (RSRM) nozzle aft exit cone after RSRM separation from the space shuttle system. Nozzle severance LSCs consist of RDX explosive encased in a copper sheath, formed to provide the desired cutting characteristics for nozzle severance. Four 90-deg LSC segments are installed around each aft exit cone, with one segment containing provisions for a NASA standard detonator (NSD).

The test consisted of fabricating and testing five shelf life extension test articles made from lot AAE flight hardware. Straight segments were not available, so curved LSC sections were tested. Shelf life extension tests demonstrate that LSCs are capable of end-to-end charge propagation and sufficient charge penetration. The shelf life extension tests were similar to lot acceptance tests (LAT) and in-processes penetration tests. Differences between the lot AAE shelf life extension test and previous LATs are listed in Table 1.

Table 1. Differences Between Lot AAE Shelf Life Extension Test and Previous LATs

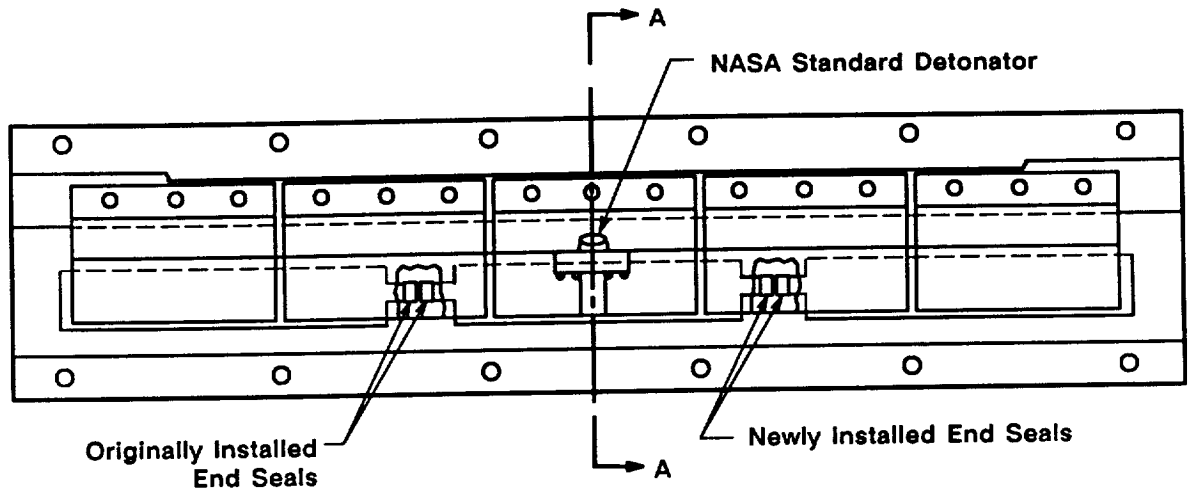
Shelf Life Extension Test	Previous LATs
Use of flight configuration (curved) LSC segments	Straight LSC segments
Test segments were reworked from flight configuration LSCs	Test segments were manufactured specifically for LAT testing
Use of thicker/heavier curved witness plate (4-in. thick at center)	1-in.-thick flat witness plate
Added penetration requirements to configuration (0.385 in. minimum average penetration with a 0.32 in. absolute minimum penetration)	Penetration requirements verified on straight LSC segments

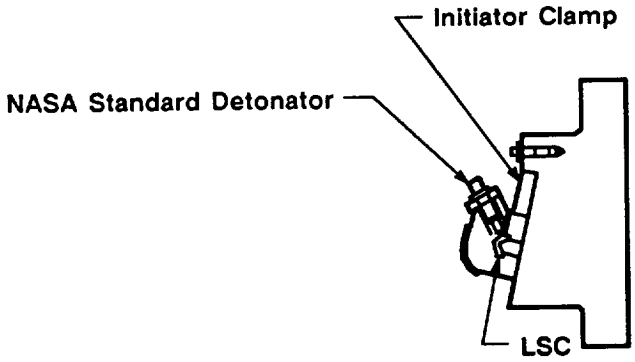
Lot AAE LSCs were originally procured and accepted under the age life requirements of STW3-3230 Rev A, Ring Segment, Nozzle Severance. Fabrication of the lot AAE LSCs began during January 1985, and the LSCs were originally certified on 9 October 1985. Under STW3-3230 Rev A, the shelf life of lot AAE LSCs expired on September 1990. Since there is enough lot AAE LSC sections to meet flight needs through at least Flight 18, it was decided to perform tests to determine if these LSCs could continue to be used.

Testing under CTP-0163 was performed to ensure that lot AAE LSCs comply with the pyrotechnic age life requirements of NASA's NSTS 08060 Rev F, Space Shuttle System Pyrotechnic Specification. This document specifies that the date of manufacture begins when the first charge is loaded. NSTS 08060 specifies that the shelf life lasts 10 years from the date of manufacture, provided that useful life demonstrations are performed at 4 and 7 years after the date of manufacture. Under NSTS 08060, the shelf life of the lot AAE LSCs expired in January 89, because the 4-year tests were not performed.

1.1 TEST ARTICLE DESCRIPTION

Five shelf life extension test articles were constructed with LSC segments from the lot AAE curved LSCs. Each test article consisted of three 10-in. LSC segments cut from one flight ring segment with end seals and retainers. Two of the three test segments of each test article had one original end seal and one newly installed end seal. The third test segment of each test article had two newly installed end seals. Each test article was configured with the two original end seals adjacent to each other. Each set of segments and retainers were attached to a curved witness plate using flight hardware (Figures 1 through 4). An NSD was mounted to the middle of each initiator (center) segment. The nonflight NSDs used were certified for test use by Johnson Space Center.





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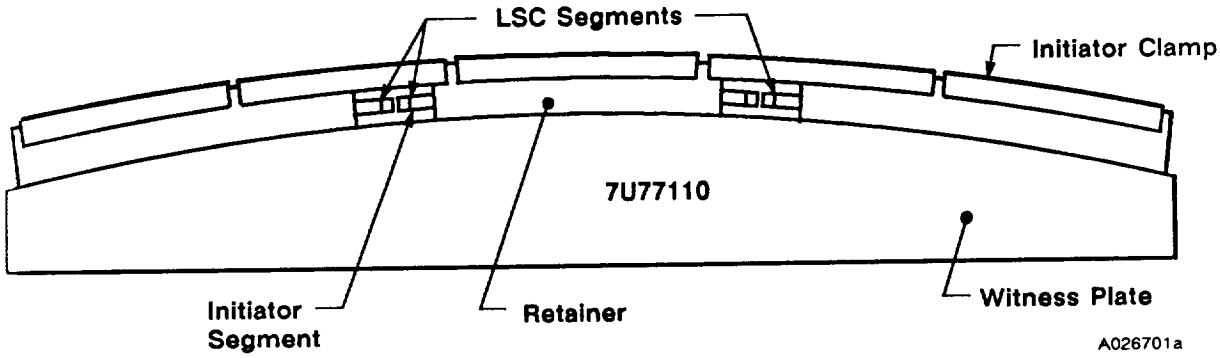

Figure 1. Nozzle Severance LSC Shelf Life Extension Test— Test Article Configuration

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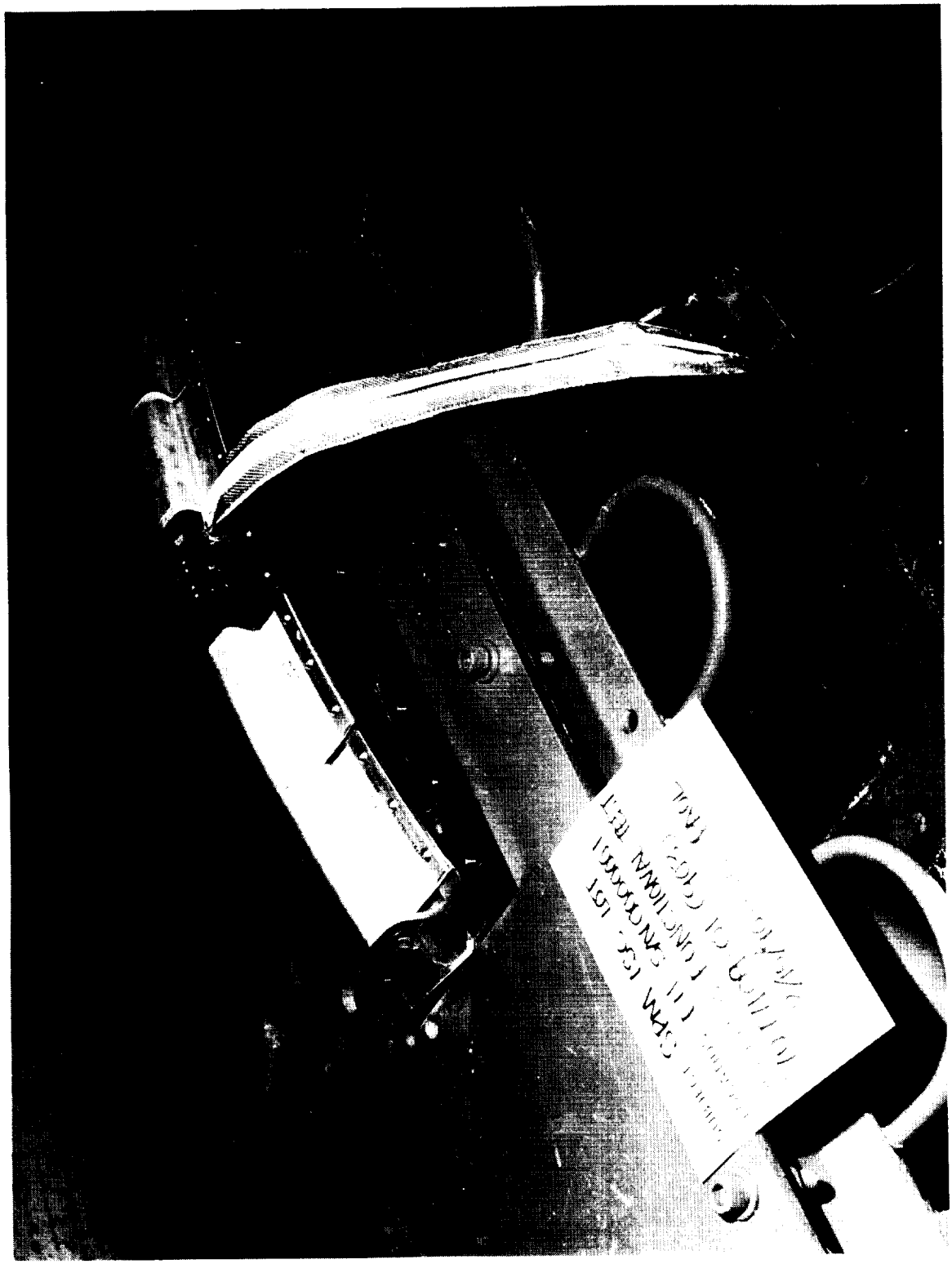

Figure 2. Nozzle Severance LSC Shelf Life Extension Test — Typical Test Article Setup

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Figure 3. Nozzle Severance LSC Shelf Life Extension Test—Typical Front View of Test Article Setup

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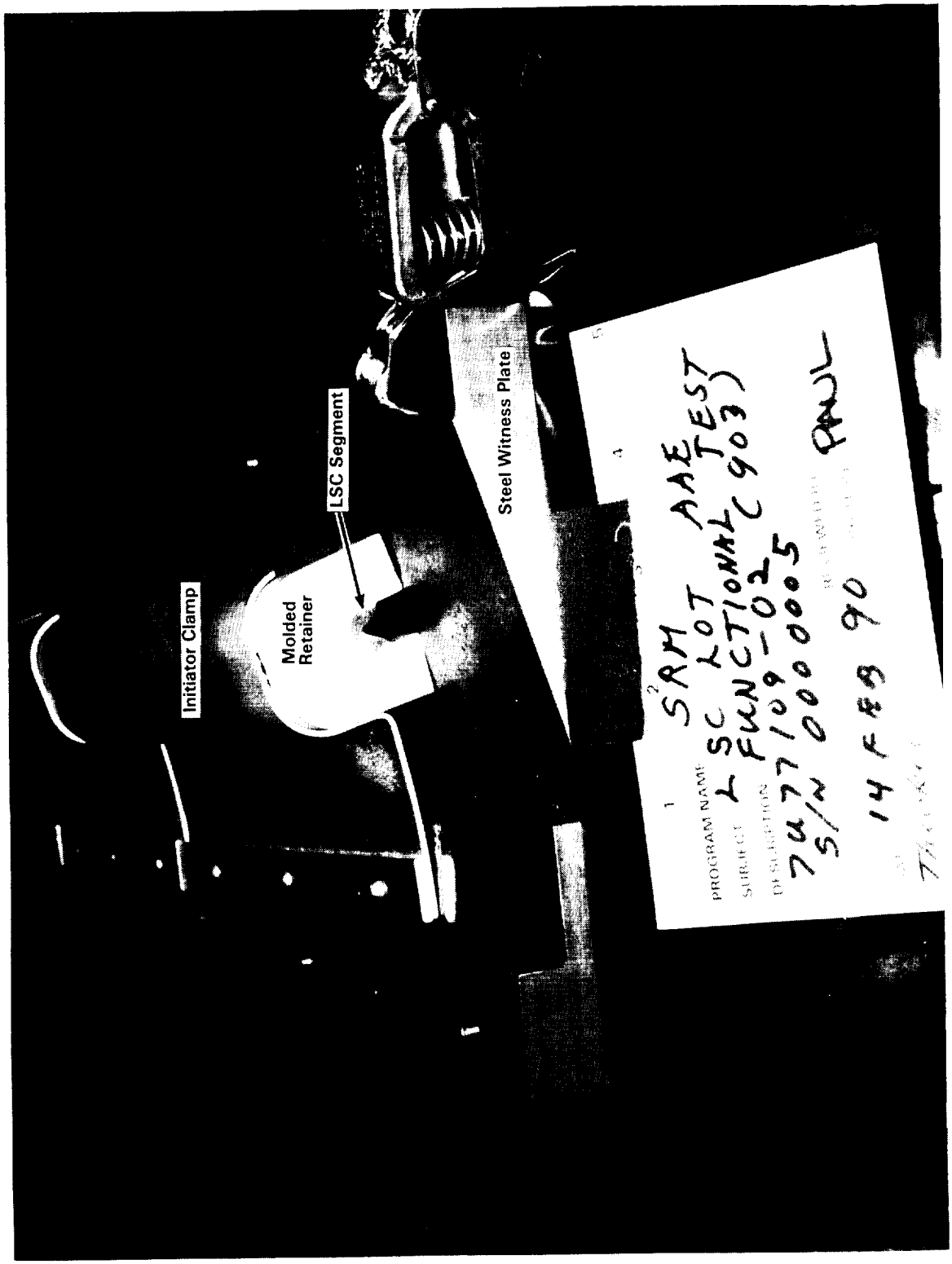

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Figure 4. **Nozzle Severance** LSC Shelf Life Extension Test—Typical Side View of Test Article Setup

2
OBJECTIVES

The objectives of test plan CTP-0163 were:

A. Retest and extend the shelf life (NSTS 08060, paragraph 3.7.1) of the remainder of Lot AAE LSCs.

B. Evaluate and compare test results with previous acceptance test data to determine if there is any performance degradation.

3
EXECUTIVE SUMMARY

3.1 SUMMARY

This section contains an executive summary of the key results from the LSC functional test and post-test inspection. Additional information can be found in Section 6, Results and Discussion.

Each of the five lot AAE nozzle severance LSC test articles was thermally conditioned and fired within 5 minutes after removal from the conditioning chamber. Each LSC segment detonated, demonstrating proper end-to-end charge propagation. For each test article, the minimum average penetration depth requirement of 0.385 in. was exceeded. Each single penetration measurement exceeded the absolute minimum requirement of 0.320 inch.

Penetration depth differences between the shelf life and acceptance test results were attributed to density and dimensional variations along the length of the LSCs. Comparison of the penetration results indicates that there was no degradation in performance due to aging or the LSC curving process.

3.2 CONCLUSIONS

The following listing is the conclusions as they relate directly to the objectives. Additional information to support each conclusion can be found in Section 6.

Objective	Conclusions
A. Retest and extend the shelf life (NSTS 08060, paragraph 3.7.1) of the remainder of lot AAE LSCs. (The requirements of NSTS 08060, paragraph 3.7.1, are summarized in Section 1 of this report.)	The five test articles were subjected to the pretest simulated environmental conditions specified in CTP-0163. The test articles were then detonated with NSDs. Each LSC segment detonated, demonstrating proper end-to-end charge propagation. Witness plate penetration measurements exceeded requirements. The lot AAE LSCs are acceptable for continued use on RSRMs.
B. Evaluate and compare test results with previous acceptance test data to determine if there is any performance degradation.	Shelf life extension test penetration measurements were compared to the original acceptance test penetration data. Of the five test articles, average penetration increased on two LSCs, decreased on two LSCs, and remained the same on one LSC. Penetration differences were attributable to variations in RDX density and the hardware dimensional characteristics. Results indicate that LSC performance did not degrade due to aging. Results also indicate that performance did not degrade as a result of the LSC curving process.

3.3 RECOMMEDATIONS

Based on the successful completion of all tests defined in CTP-0163, the shelf life of the lot AAE nozzle severance LSCs should be extended through January 1992. At that time, testing should be performed for remaining lot AAE LSCs per the 7-year real-time test requirements of NSTS-08060.

Since this test demonstrated that LSC penetration depths do not change for curved segments (as compared to straight segments), the feasibility of performing all future LAT tests in the curved (flight) configuration should be evaluated.

4
INSTRUMENTATION

Accelerometers were installed under STW3-3230. Test instrumentation met the system requirements of MIL-STD-45662.

5
PHOTOGRAPHY

Still color photographs of the LSC shelf life extension test sets were taken. Copies of the photographs (Series 115140, 115788, 116088, 116141, 116142, and 116429) are available from the Thiokol Photographic Services department.

6
RESULTS AND DISCUSSION

6.1 TEST ARTICLE ASSEMBLY

Construction of each shelf life test article began with the removal of portions of the rubber retainer from a lot AAE LSC curved segment. Three 10-in. sections were cut from each LSC curved segment; two of the sections were cut from each end, the remaining section was cut from the middle. One new end seal was bonded on each of the freshly cut ends of the two end segments, with the originally installed end seals remaining on the opposite ends. New end seals were also installed on both of the freshly cut ends of the third segment. End seals were bonded in place using the same procedures used on flight hardware that included: leak checks to verify that the segments were hermetically sealed, and X-ray inspections to verify end seal installation tolerances.

Individual LSC test segments were bonded into new molded retainers. The segments and retainers were fastened, using flight hardware, onto curved witness plates. Each initiator (center) segment had one originally installed end seal positioned against the other originally installed end seal on a non-initiator segment to demonstrate flight hardware end-to-end charge propagation. Three test articles had a 0.100- to 0.110-in. gap between the original end seals and a 0.035- to 0.045-in. gap between the new end seals. The other two test articles had a 0.035- to 0.045-in. gap between the original end seals and a 0.100- to 0.110-in. gap between the new end seals. An NSD was mounted to the middle of each center segment. Typical configuration of the test articles is shown in Figures 2 through 4.

6.2 TEST AND RESULTS

6.2.1 Pretest

Prior to the functional test, each test article was subjected to simulated flight random vibration (Figures 5 and 6), re-entry random vibration, and thermal shock per the requirements of STW3-3230 as applied to drawing 1U52702. End seal offset and gap measurements were performed upon completion of the thermal shocks. The measured offset and gap dimensions remained within the specified tolerances of drawing 7U77109, ensuring that the test articles could withstand a simulated worst-case flight environment. Test conditions and dimensions are included in Appendices A and B.

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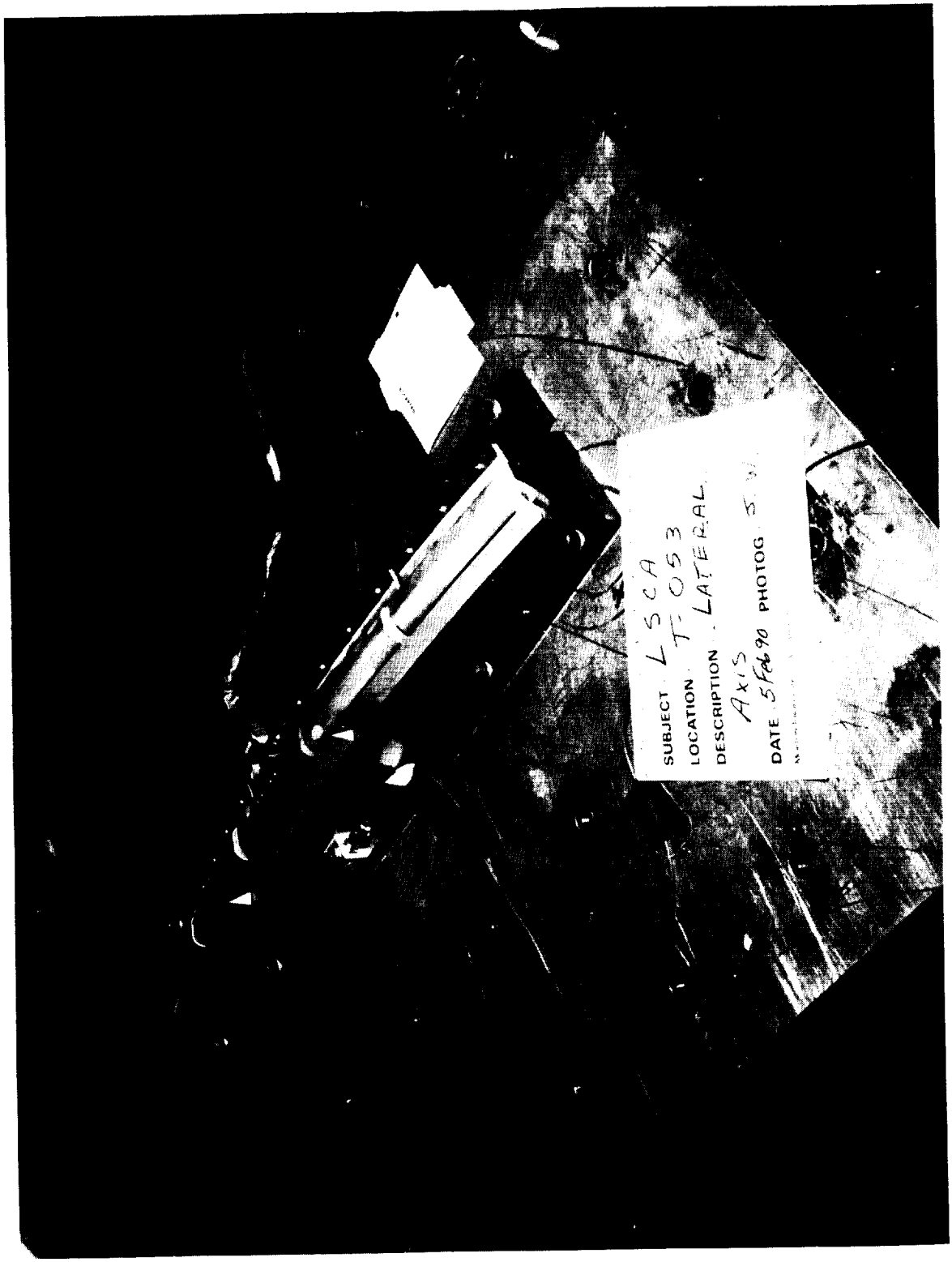

Figure 5. Nozzle Severance LSC Shelf Life Extension Test—Vibration Shaker Table and Test Article Configuration, Lateral Axis

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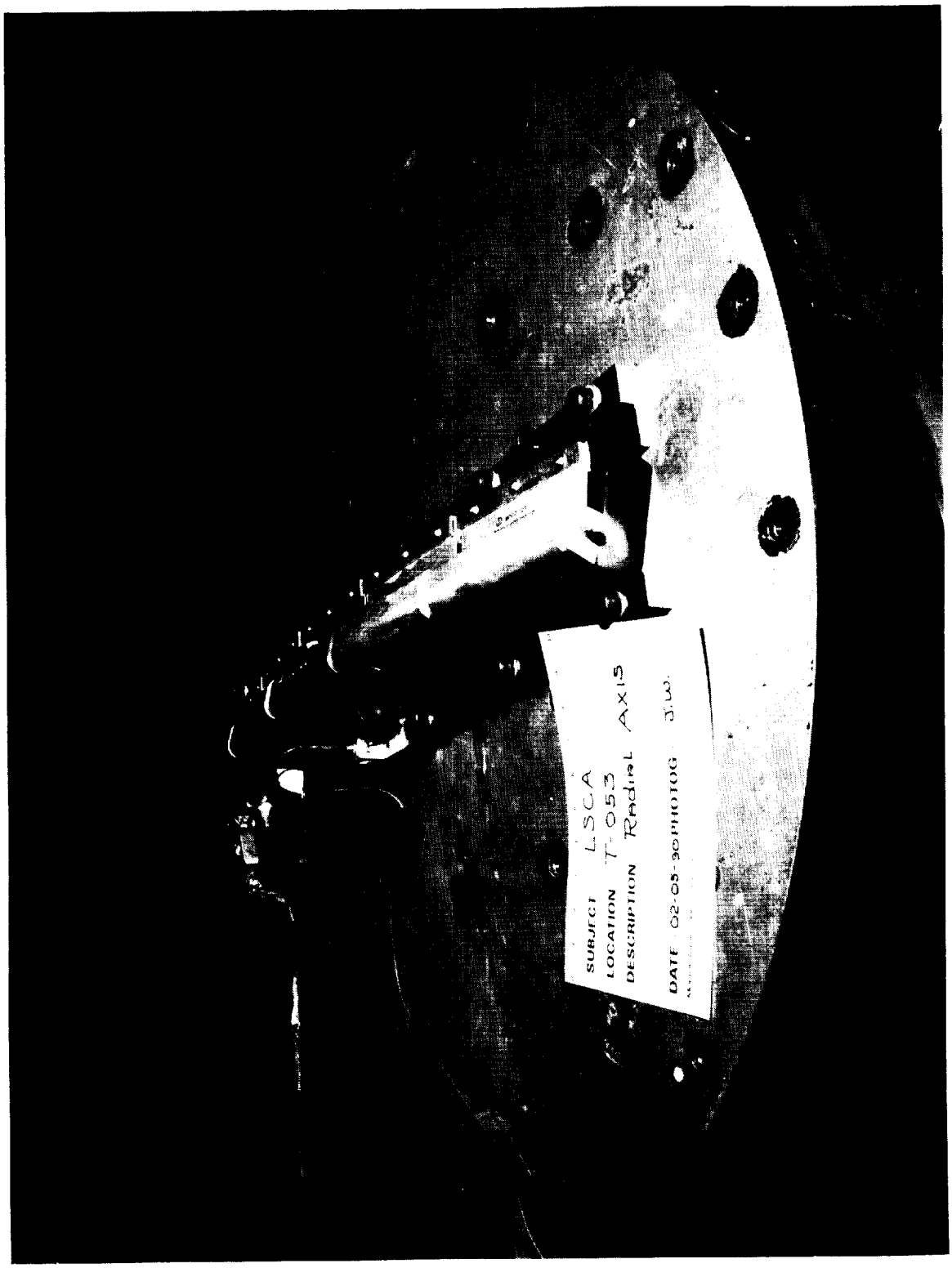

Figure 6. Nozzle Severance LSC Shelf Life Extension Test — Vibration Shaker Table and Test Article Configuration, Radial Axis

6.2.2 Functional Test

Each test article was thermally conditioned to 75 ±5°F just prior to functional testing. The test articles were fired within 5 minutes after removal from the conditioning chamber. Each LSC segment detonated, demonstrating proper end-to-end charge propagation. Specific test conditions and dimensions are included in Appendix B.

6.2.3 Post-test Disassembly and Inspection

Typical post-test condition of the test articles is shown in Figures 7 and 8. After test article detonation, all remaining LSC mounting hardware was disassembled from the five witness plates. The witness plates were then dissected through their centers and every 2 in. from the centers out to the end of the LSC cuts (Figures 9 and 10). Dissection cuts were made normal to the witness plate test surfaces. After dissection, the copper LSC sheaths were removed at the penetration measurement locations. Penetration depth measurements were made using a dial indicator with a special bracket to measure from the witness plate test surfaces to the bottom of the LSC cuts (Figure 11).

Penetration results for each test article are shown in Table 2. Sixteen measurements were used for each average value. In each case, the minimum average penetration depth requirement (averaged over one test article) of 0.385-in. was exceeded. Each single penetration measurement exceeded the absolute minimum penetration depth requirement of 0.320-inch. Typical post-test condition of the test articles is shown in Figures 5 and 6.

Penetration results for each individual curved LSC test section were compared to the original, straight configuration lot AAE acceptance test penetration results. The original penetration results and a comparison between the original and tested average penetration results are listed in Table 2. Penetration depth differences were attributed to density and dimensional variations along the length of the LSCs. Comparison of the penetration results indicate that there was no degradation in performance due to aging or the LSC curving process.

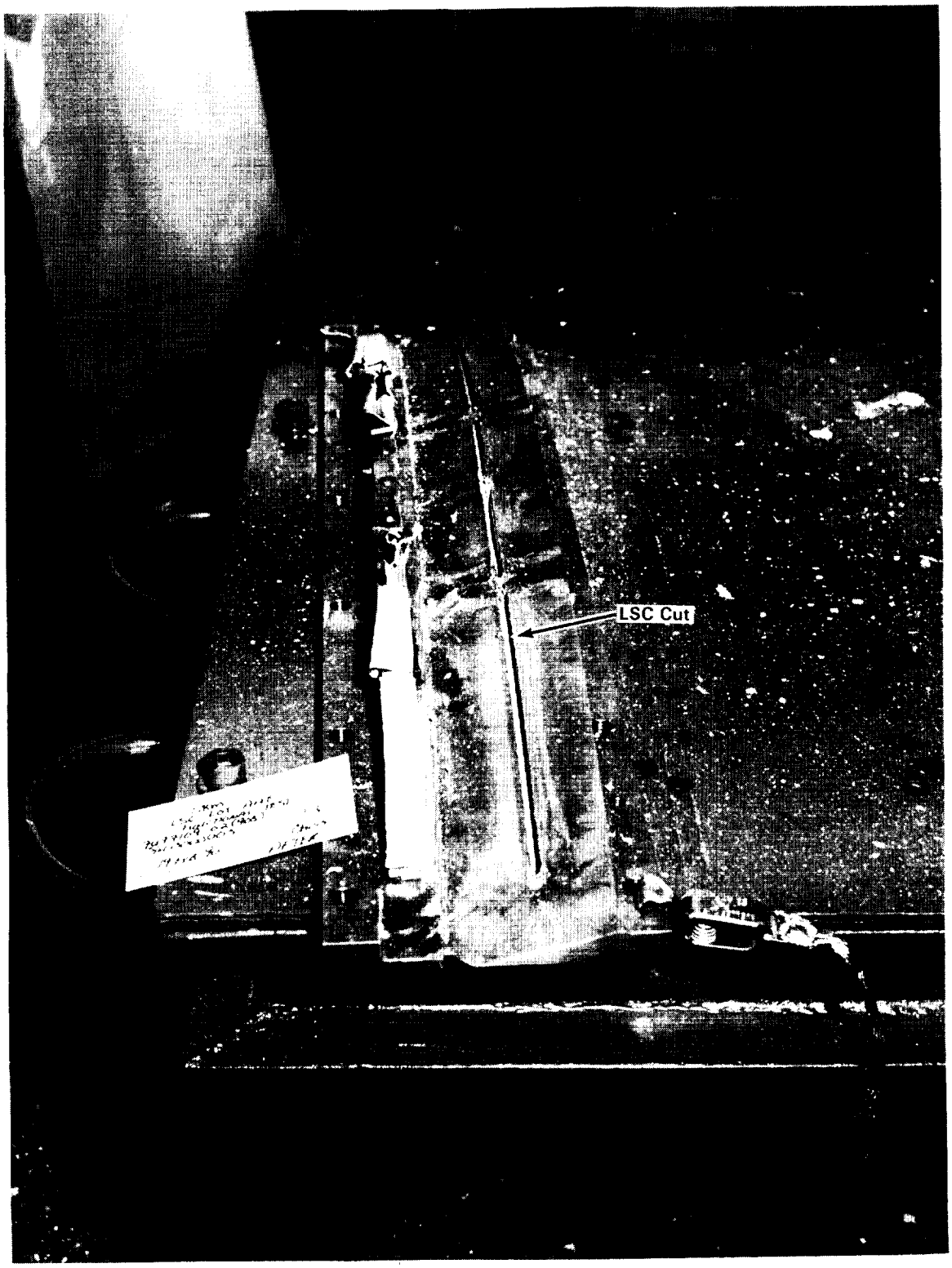

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Figure 7. Nozzle Severance LSC Shelf Life Extension Test—Typical Post-test Condition of Steel Witness Plate

N116141-2

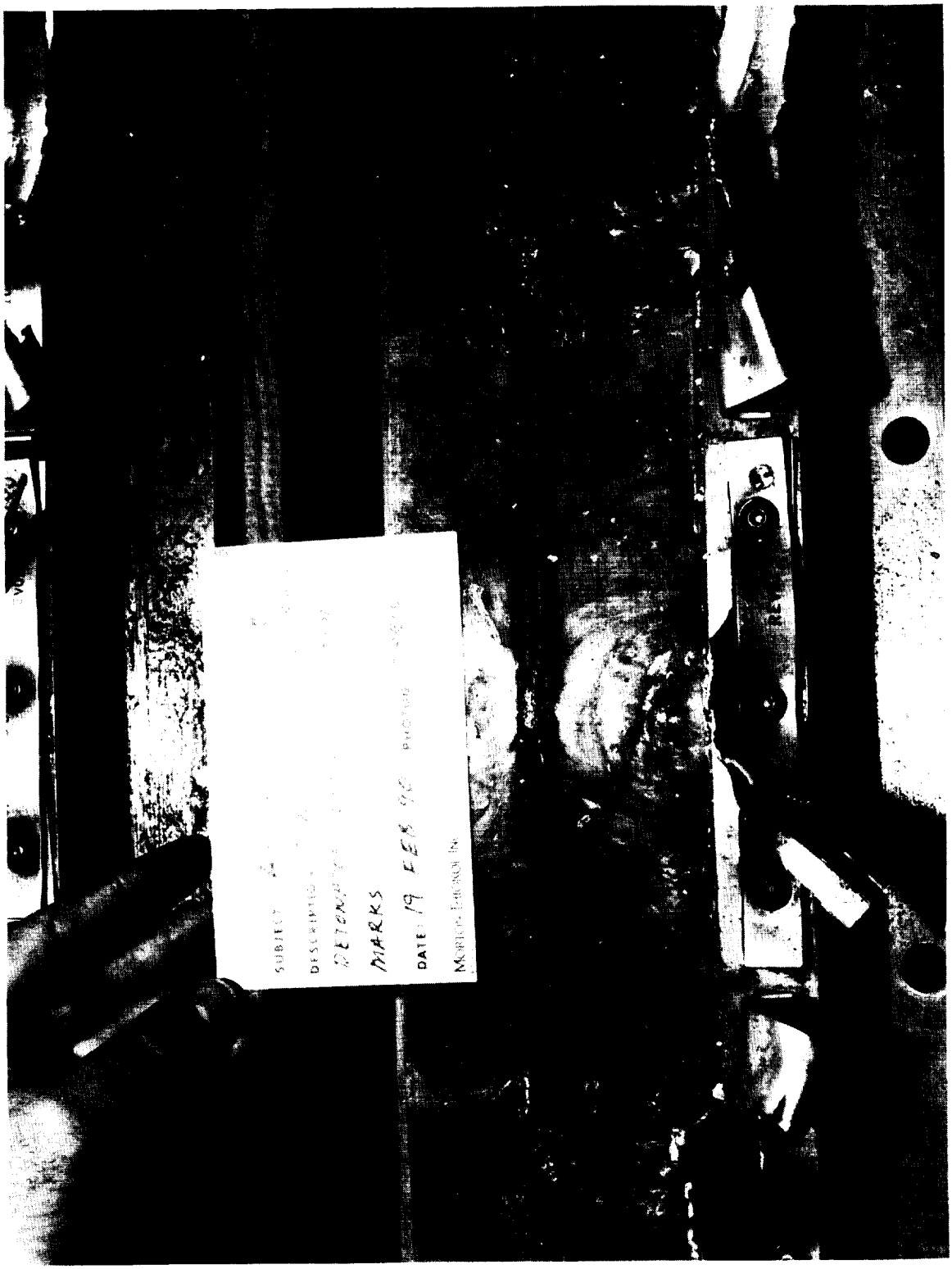

Figure 8. Nozzle Severance LSC Shelf Life Extension Test — Typical Post-test Condition of Steel Witness Plate, Detonator and Initiator Segment End Seal Area

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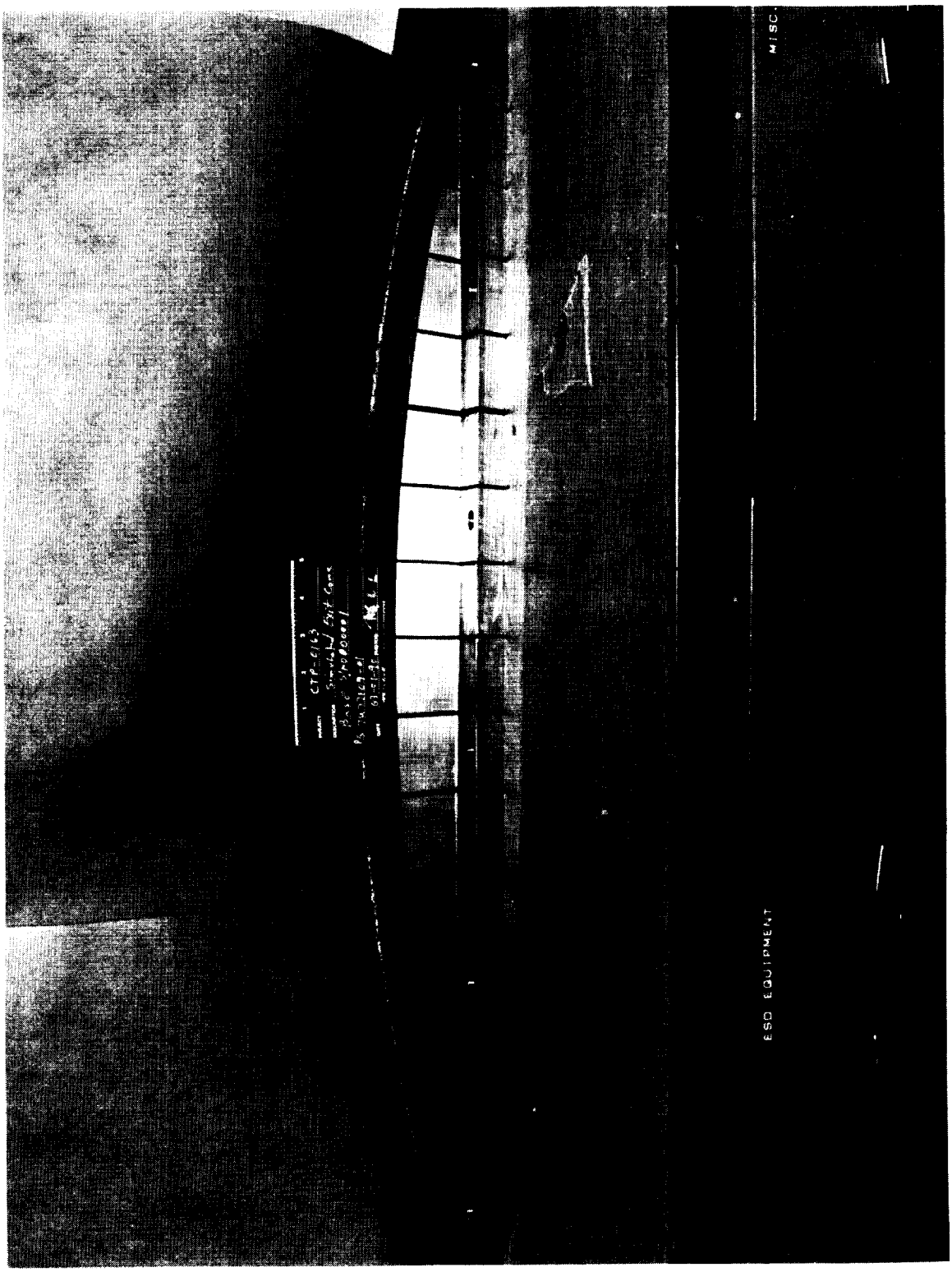

Figure 9. Nozzle Severance LSC Shelf Life Extension Test — Typical Witness Plate Dissection

N116429-1

Figure 10. Nozzle Severance LSC Shelf Life Extension Test—Typical Witness Plate Cross-Section

N116429-11

Figure 11. Nozzle Severance LSC Shelf Life Extension Test—Typical Penetration Depth Measurement

Table 2. Lot AAE Nozzle Severance LSC Acceptance Test and Shelf Life Extension Test–Penetration Depth Comparison

LSC No. (original designation)	Original Penetration Depth (in.) (straight configuration)		CTP-0163 Penetration Depth (in.) (curved configuration)		Difference Between Average Values
		Average		Average	
AAE0025	0.428 0.444 0.406	0.426	0.410 0.372 0.349 0.390 0.401 0.396 0.385 0.425 0.361 0.384 0.411 0.414 0.377 0.355 0.400 0.387	0.389	-0.031
AAE0026	0.460 0.434 0.430	0.441	0.439 0.427 0.423 0.412 0.420 0.427 0.396 0.378 0.349 0.381 0.433 0.420 0.417 0.443 0.438 0.431	0.415	-0.026
AAE0027	0.401 0.440 0.447	0.429	0.442 0.448 0.442 0.417 0.463 0.462 0.402 0.424 0.423 0.425 0.456 0.458 0.470 0.469 0.463 0.466	0.446	0.017

Table 2. Lot AAE Nozzle Severance LSC Acceptance Test and Shelf Life Extension Test - Penetration Depth Comparison (cont)

LSC No. (original designation)	Original Penetration Depth (in.) (straight configuration)		CTP-0163 Penetration Depth (in.) (curved configuration)		Difference Between Average Values
		Average		Average	
AAE0028	0.408 0.395 0.398	0.400	0.387 0.392 0.380 0.395 0.392 0.391 0.422 0.405 0.405 0.401 0.393 0.410 0.405 0.399 0.398 0.394	0.398	-0.002
AAE0094	0.421 0.429 0.408	0.419	0.417 0.429 0.431 0.445 0.430 0.428 0.432 0.438 0.449 0.442 0.417 0.430 0.451 0.441 0.450 0.457	0.437	0.018

7

APPLICABLE DOCUMENTS

Document No.	Title
CTP-0163	Linear Shaped Charge Lot Shelf Life Extension Acceptance Test Plan
STW3-3230	Ring Segment, Nozzle Severance
Military Std.	
MIL-STD-45662	Calibration Systems Requirements
NSTS 08060	National Space Transportation System Space Shuttle System Pyrotechnic Specification
Drawing No.	
1U52702	LAT Assembly
7U77109	Shelf Life Extension Test Assembly
7U77110	Base, Simulated Exit Cone

Appendix A

Lot AAE Nozzle Severance LSC Pretest Results

TEST REPORT

TITLE: Linear Shape Charge Vibration and Temp. Cycle Tests

PROJECT: 4B501-05-20 **DATE:** 10 April 1990

TEST DATE: 5 - 10 February 1990 **REPORT NO.** TE-13164

PREPARED BY: Deloss Everton

Deloss Everton
Test Engineer

APPROVED BY: Bruce O. Tams

Bruce O. Tams, Manager
Test Engineering

DISTRIBUTION:

Brian Baugh M/S L62A

THIOKOL CORPORATION
SPACE OPERATIONS

1.0	SUMMARY
2.0	TEST IMPLEMENTATION
3.0	VIBRATION TESTING
4.0	TEMPERATURE CYCLE
5.0	DATA

THIOKOL CORPORATION
SPACE OPERATIONS

1.0 SUMMARY

1.1 Flight Random and Reentry Random vibration tests were run on five Linear Shape Charge assemblies, Part No. 7U77109-01 and -02, on 5 through 8 February 1990. Temperature Cycling tests were conducted on these assemblies on 9 and 10 Feb 1990. Testing was done to meet the requirements of CTP-0163.

1.2 All units tested sustained no damage except for some minor rust on the test fixtures during the temp cycling.

2.0 TEST IMPLEMENTATION

2.1 Assemblies tested:

7U77109-01 S/N 0000001
S/N 0000002
S/N 0000003

7U77109-02 S/N 0000004
S/N 0000005

2.2 Test Documents (CPI's):

RB86N	Vibration, mechanical 7U77109-01
RB86P	Vibration, instrumentation
RB86W	Temperature cycling
RB866	Vibration, mechanical7U77109-02
RB867	Vibration, instrumentation
RB868	Temperature cycling

2.3 Hazards Analysis

Since the LSC vibration and temp cycling tests are considered low risk and similar units were vibrated several years ago with no incidents, a full hazards analysis was not required. A hazards analysis was completed on the test procedures and approval to perform these tests was received from Plant Safety.

2.4 Test Directors Review

A Test Directors Review was held on 5 February 1990 to review all phases of planning and preparation for the test. No constraining items were found.

3.0 VIBRATION TEST

3.1 Vibration testing started on 5 February 1990. Ambient temperature of the T-53 test bay was maintained at 68 to 70 degrees F during the vibration of all units. Per test plan, one accelerometer, mounted on the test article, was used as the control accelerometer. Data was stored in the vibration controller computer memory and a plot of the vibration spectrum was produced on paper for each vibration run. No data was recorded on magnetic tape. Each test assembly was vibrated in all three axes in flight random and in reentry random vibration. The correct level of vibration was applied in each axis as required by the test plan. Vibration testing was completed on 8 February 1990.

3.2 Vibration Tooling

2U16748	30000 LB Mass
2U61266	Support Stands
4U114262	Head Expander
4U114264	Slip Plate
4U114263	Head Plate
6021ST	Drive Bar
6021XK	Drive Bar (alternate)

4.0 TEMPERATURE CYCLING TEST

All five units were tested at the same time in two different chambers held at -12,+/- 5 degrees F and +118, +/- 5 degrees F. The units were put into the cold chamber at 0815 hours on 9 February 1990. The last temperature cycle was completed at 0841 on 10 February 1990. The units were then put into a chamber and held at 75, +/-5 degrees until they were ready to be static tested.

A Process Departure was written on the units, PD 401448, dated 10 February 1990, because a failure in the temperature controller caused a -15 degree out of tolerance on one of the cold cycles for a maximum of 45 minutes. The disposition of the PD was to use as is because the cold would not affect performance.

Appendix B

LSC Lot Shelf Extension Functional Test for Lot AAE P/N 7U77109-01 and 02

TEST REPORT

TITLE: LSC Lot Shelf Extension Functional Test for LOT AAE P/N 7U77109-01 and 02

PROJECT: 4B501-05-20 **DATE:** 20 February 1990

TEST DATE: 14-19 February 1990 **REPORT NO.** TE-13130

PREPARED BY: George B Doney

G. B. Doney
Test Engineer

APPROVED BY: Bruce O Tams

Bruce O. Tams, Manager
Test Engineering

DISTRIBUTION:

Jerry Walters M/S E65

THIOKOL CORPORATION
SPACE OPERATIONS

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2.0	TEST REQUIREMENTS
3.0	TEST PROCEDURES
4.0	TEST DATA
5.0	TEST RESULTS

THIOKOL CORPORATION
SPACE OPERATIONS

1.0 SUMMARY

The Linear Shaped Charge LOT Shelf Extension Functional Test of LOT AAE was conducted on 15 February 1990 for P/N 7U77109-01 and for P/N 7U77109-02 on 19 February 1990 in test bay T-11. Preliminary inspection results for all LSC Test assemblies revealed that all LSC segments functioned properly. Final assessment of proper performance will be made by I-10 personnel after they perform penetration depth measurements. The results of there inspection will be reported by I-10 Engineering.

2.0 TEST REQUIREMENTS

2.1 Test Objectives:

The Test Plan CTP-0163, Rev. A for Linear Shaped Charge Lot Shelf Life Extension defines the test objectives.

2.2 Instrumentation:

The LSC test assemblies did not require any instrumentation according to CTP-0163, Rev. A for the functional test.

2.3 Conditioning

2.3.1 LSC test assemblies were conditioned in building T-11, Box 4. Conditioning temperature for LSC test assemblies was 75 +/- 5 degrees F. Minimum required conditioning time prior to functional test was four hours.

2.3.1.1 Conditioning for 7U77109-01, S/N 0000001

Conditioning Start Time: 11:10, 14 February 1990
Conditioning Stop Time: 15:00, 15 February 1990
Total Conditioning Time: 27 hours, 50 minutes
Time out of Conditioning Prior to Test: 3 minutes

2.3.1.2 Conditioning for 7U77109-01, S/N 0000002

Conditioning Start Time: 15:00, 14 February 1990
Conditioning Stop Time: 16:23, 15 February 1990
Total Conditioning Time: 25 hours, 23 minutes
Time out of Conditioning Prior to Test: 3 minutes

2.3.1.3 Conditioning for 7U77109-01, S/N 0000003

Conditioning Start Time: 14:45, 14 February 1990
Conditioning Stop Time: 16:35 15 February 1990
Total Conditioning Time: 25 hours, 50 minutes
Time out of Conditioning Prior to Test: 3 minutes

2.3.1.4 Conditioning for 7U77109-02, S/N 0000004

Conditioning Start Time: 10:00, 14 February 1990
Conditioning Stop Time: 09:40, 19 February 1990
Total Conditioning Time: 119 hours, 40 minutes
Time out of Conditioning Prior to Test: 3 minutes

2.3.1.5 Conditioning for 7U77109-02, S/N 000005

Conditioning Start Time: 10:10. 14 February 1990
Conditioning Stop Time: 09:58, 19 February 1990
Total Conditioning Time: 119 hours, 48 minutes
Time out of Conditioning Prior to Test: 3 minutes

2.4 PRE-TEST MEASUREMENTS*

2.4.1 Pre-Test Measurements for 7U77109-01, S/N 0000001

Gap Measurements for Side "A" in Inches

(A) 0.361 (B) 0.356 (C) 0.358 (D) 0.324 (E) 1.445
(F) 1.442 (G) 0.107
Horizontal Misalignment: 0.023
Vertical Misalignment: 0.027

Gap Measurements for Side "B" in Inches

(A) 0.324 (B) 0.314 (C) 0.360 (D) 0.353 (E) 1.427
(F) 1.451 (G) 0.035
Horizontal Misalignment: 0.024
Vertical Misalignment: 0.037

Detonator Measurements

LSC Angle: 10 Degrees 30 Minutes
Gap Between Detonator and LSC: 0.065 inches
Surface "X": 0.013 inches Inside

2.4.2 Pre-Test Measurements for 7U77109-01, S/N 000002

Gap Measurements for Side "A" in Inches

(A) 0.349 (B) 0.344 (C) 0.329 (D) 0.313 (E) 1.450
(F) 1.436 (G) 0.108
Horizontal Misalignment: 0.014
Vertical Misalignment: 0.026

Gap Measurements for Side "B" in Inches

(A) 0.313 (B) 0.321 (C) 0.357 (D) 0.351 (D) 1.422
(F) 1.433 (G) 0.036
Horizontal Misalignment: 0.011
Vertical Misalignment: 0.032

2.4.2 Pre-Test Measurements for 7U77109-01, S/N 0000002 (Cont.)

Detonator Measurements

LSC Angle: 10 Degrees 30 Minutes
Gap Between Detonator and LSC: 0.074 inches
Surface "X": 0.006 inches inside

2.4.3 Pre-Test Measurements for 7U77109-01, S/N 0000003

Gap Measurements for Side "A" in Inches

(A) 0.356 (B) 0.351 (C) 0.320 (D) 0.318 (E) 1.416
(F) 1.411 (G) 0.105
Horizontal Misalignment: 0.005
Vertical Misalignment: 0.035

Gap Measurements for Side "B" in Inches

(A) 0.322 (B) 0.319 (C) 0.358 (D) 0.347 (E) 1.432
(F) 1.424 (G) 0.045
Horizontal Misalignment: 0.008
Vertical Misalignment: 0.035

Detonator Measurements

LSC Angle: 10 Degree 45 Minutes
Gap Between Detonator and LSC: 0.080 inches
Surface "X": 0.025 inches inside

2.4.4 Pre-Test Measurements for 7U77109-02, S/N 0000004

Gap Measurements for Side "A" in Inches

(A) 0.342 (B) 0.343 (C) 0.336 (D) 0.331 (E) 1.447
(F) 1.443 (G) 0.039
Horizontal Misalignment: 0.004
Vertical Misalignment: 0.009

Gap Measurements for Side "B" in Inches

(A) 0.318 (B) 0.317 (C) 0.343 (D) 0.346 (E) 1.443
(F) 1.436 (G) 0.105
Horizontal Misalignment: 0.003
Vertical Misalignment: 0.027

Detonator Measurements

LSC Angle: 12 Degrees 00 Minutes
Gap Between Detonator and LSC: 0.064 inches
Surface "X": 0.006 inches inside

2.4.5 Pre-Test Measurements for 7U77109-02, S/N 0000005

Gap Measurements for Side "A" in Inches

(A) 0.348 (B) 0.340 (C) 0.318 (D) 0.309 (E) 1.468
(F) 1.440 (G) 0.043
Horizontal Misalignment: 0.028
Vertical Misalignment: 0.031

Gap Measurements for Side "B" in Inches

(A) 0.317 (B) 0.319 (C) 0.342 (D) 0.341 (E) 1.430
(F) 1.429 (G) 0.101
Horizontal Misalignment: 0.001
Vertical Misalignment: 0.024

Detonator Measurements

LSC Angle: 9 Degrees 00 Minutes
Gap Between Detonator and LSC: 0.060 inches
Surface "X": 0.026 inches inside

* Reference figure 1,2 and 3 for pre-test measurement locations.

3.0 TEST PROCEDURES

3.1 Test Documents

CTP-0163 Rev. A	Linear Shaped Charge LOT Shelf Life Extension Acceptance Test Plan
RB86X	Mechanical Operations Test Shop Traveler for LSC 7U77109-01
RB869	Mechanical Operations Test Shop Traveler for LSC 7U77109-02
RB86Y	Instrumentation Operation Test Shop Traveler for LSC 7U77109-01
RB87A	Instrumentation Operation Test Shop Traveler for LSC 7U77109-02

3.2 Test Configuration

7U77109-01	LSC Test Assembly
7U77109-02	LSC Test Assembly
SEB26100094-201	Detonator

4.0 TEST DATA

LSC P/N 7U77109-01

	S/N 0000001	S/N 0000002	S/N 0000003
Test Date	15 Feb. 90	15 Feb. 90	15 Feb. 90
Test Time	15:03	16:26	16:38
Bay Temp.	50 F	24 F	24 F
Bay Humidity	15%	20%	22%
Bar. Pressure	25.20	25.20	25.20

LSC P/N 7U77109-02

	S/N 0000004	S/N 0000005
Test Date	19 Feb. 90	19 Feb. 90
Test Time	09:43	10:01
Bay Temp.	42 F	42 F
Bay Humidity	16%	16%
Bar. Pressure	25.48	25.48

5.0 TEST RESULTS

Post Test Inspection:

Post test inspection revealed that all LSC test assemblies functioned properly with all LSC segments detonating. Final assessment of proper performance will be made by I-10 personnel after completion of penetration depth measurements.

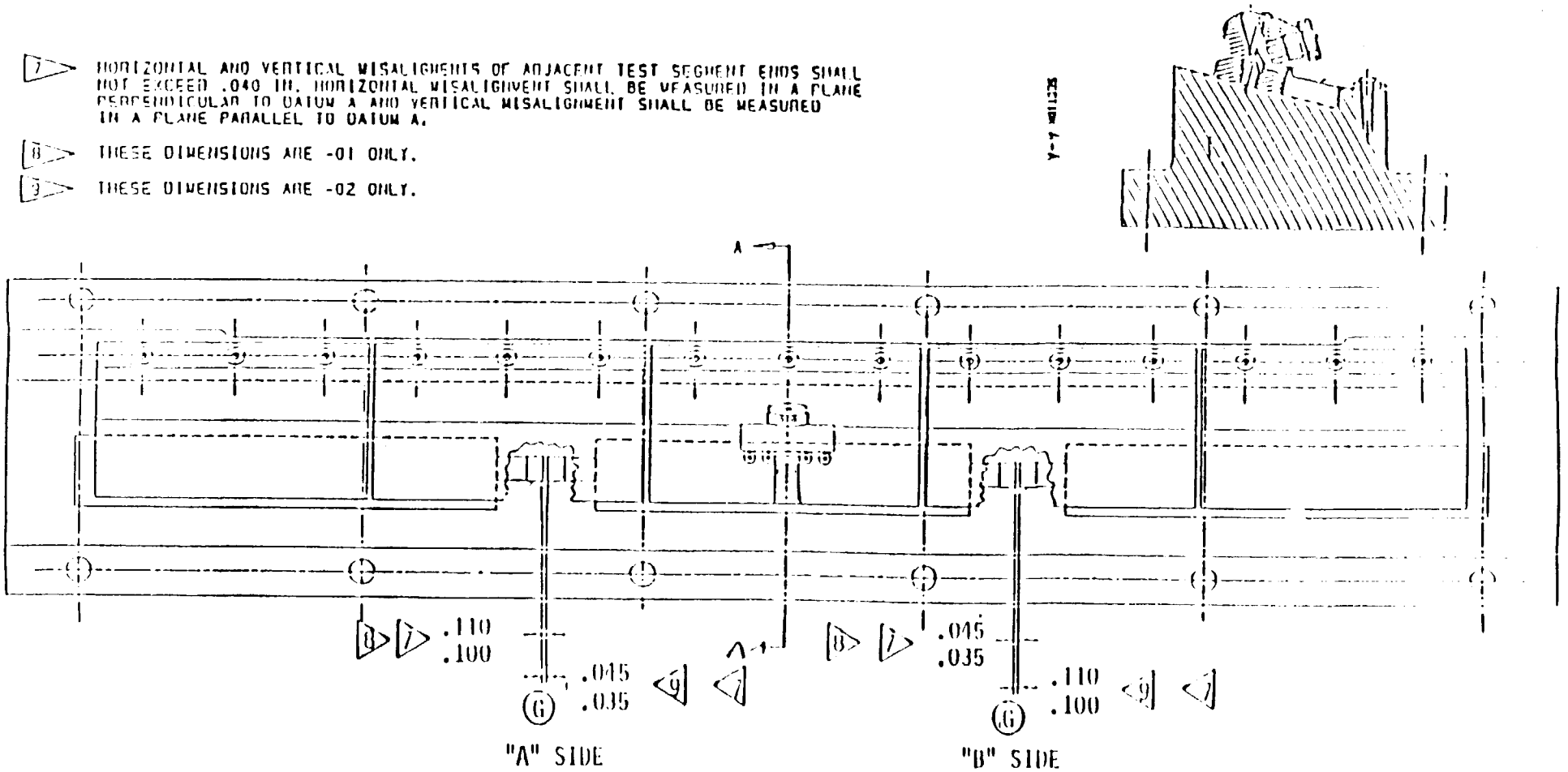

Figure 1. LSC Shelf Life Extension Test Arrangement

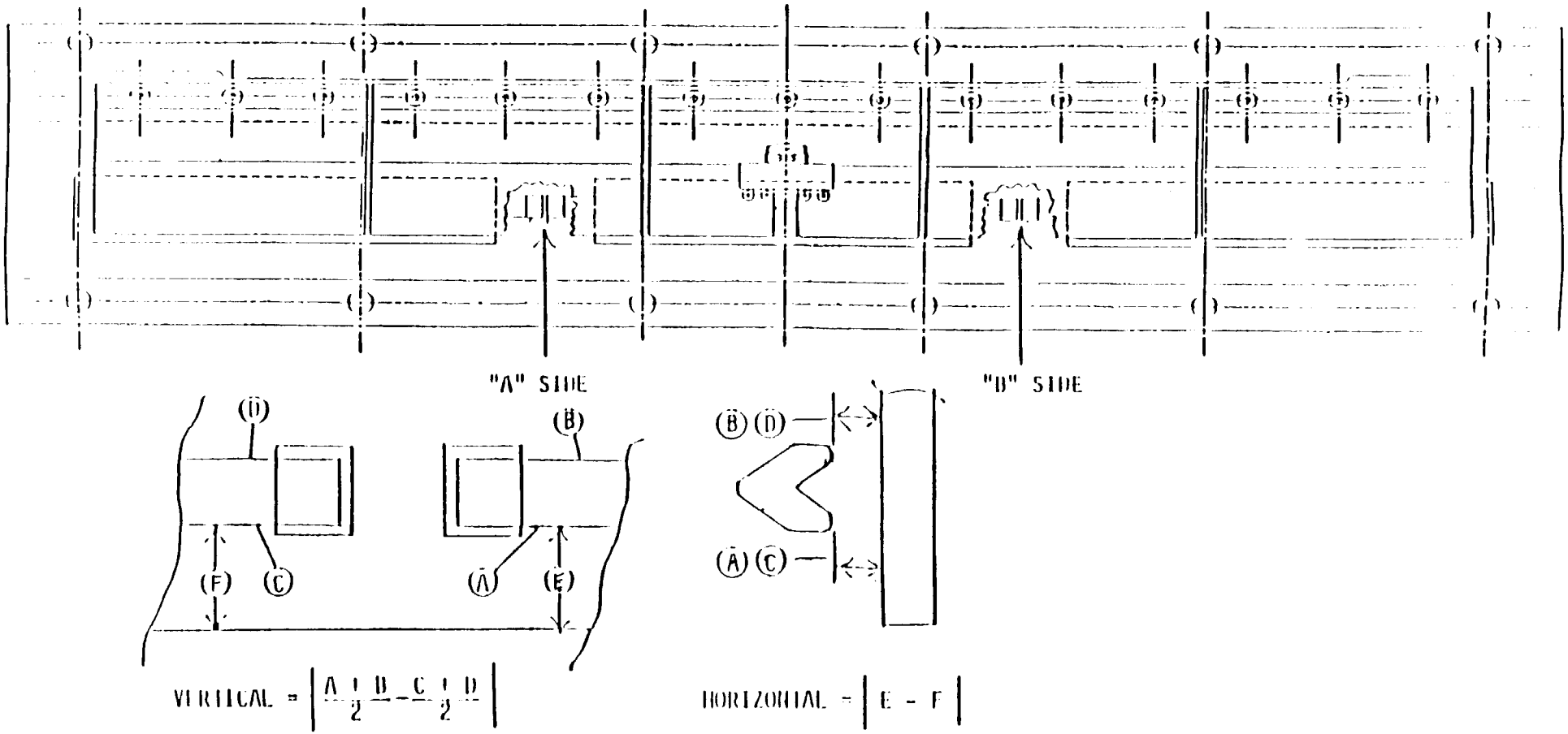

Figure 2. LSC Shelf Life Extension Test Arrangement

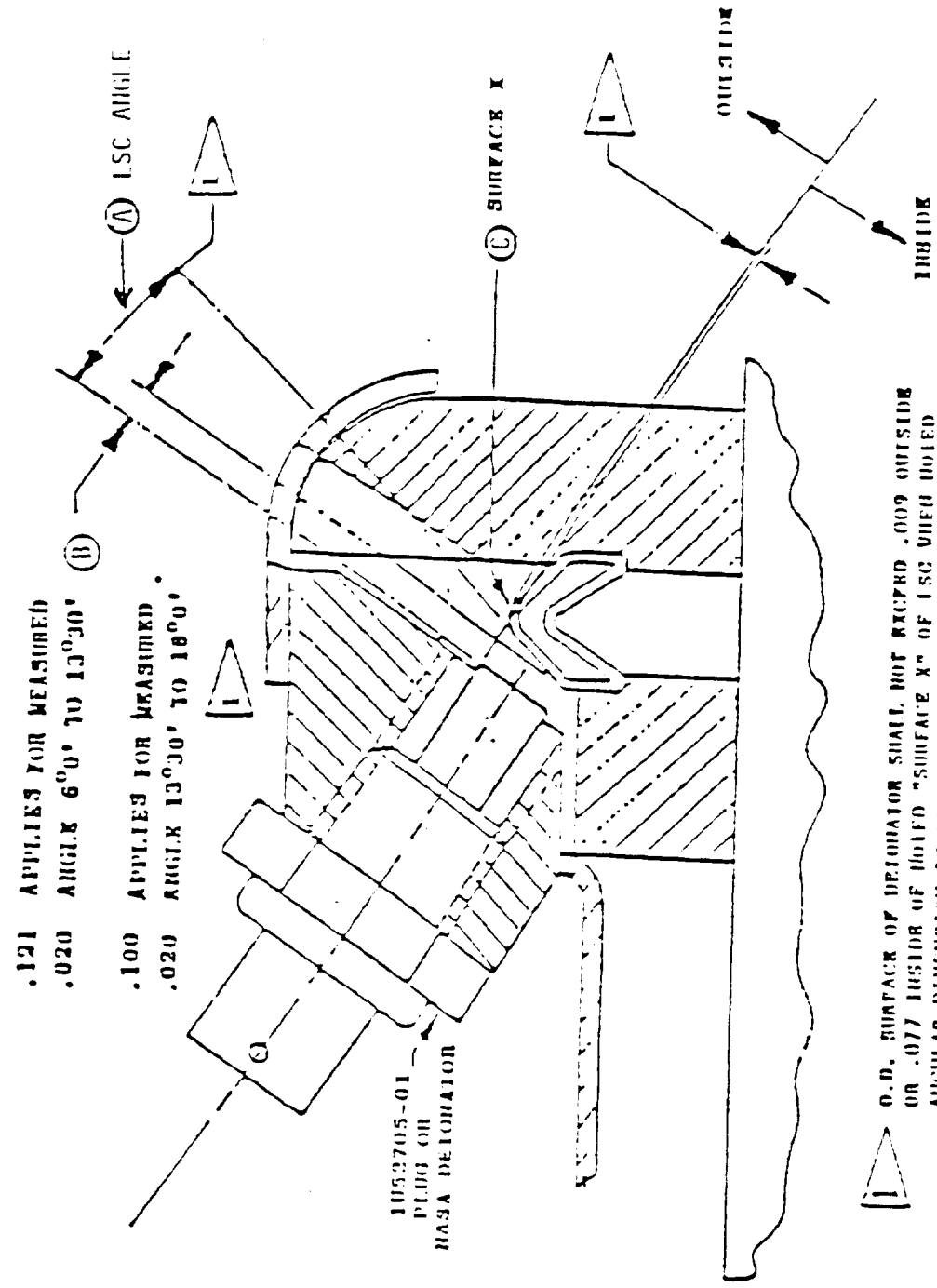

Figure 3. LSC Shelf Life Extension Test Arrangement

Distribution List

Name	Number of Copies	M/S
M. Cook	1	L71
N. Black	1	L71
H. Huppi	1	L72
J. Walters	1	E65
B. Whidden	1	L62
B. Baugh	1	L62
K. Sanofsky	1	851
F. Duersch	1	851
L. Hislop	1	851
R. Mikesell	1	851
D. Day	1	565
C. Wright	1	811
L. Bailey	1	L80
J. Sutton	1	L72
M. Kahn	1	800A
M. Pickart	1	Z10
D. Burton	1	K68
R. Papasian	45	E05
Print Crib	5	K23B1
Data Management	5	L74B