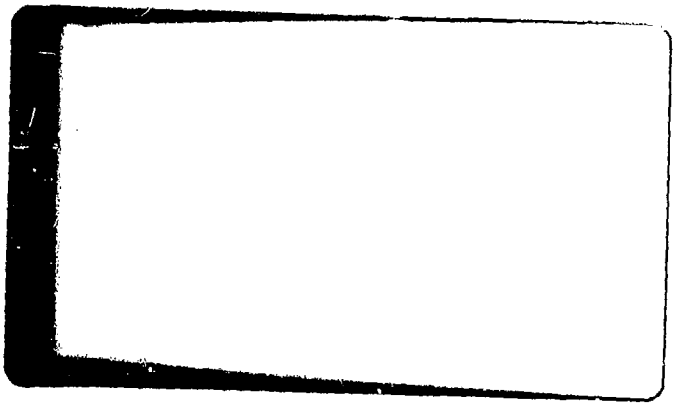
(2)



LOCKHEED ELECTRONICS COMPANY, INC.

A SUBSIDIARY OF LOCKHEED AIRCRAFT CORPORATION

LEC

(2)

(6) Redesign of Impact Fuze Seal.

Contract No
(15) DAAA21-75-C-0092
Task #15

Prepared for: ARRADCOM
Dover, New Jersey 07801

(14) LEC-
Report No. ER-0092-36

(11) Mar[redacted]78

(12) 17p.

Approved by: T. Affatigato
T. Affatigato

A. J. Lee
for J. Iervolino
J. Iervolino

D. Lee

210050

CONTENTS

ILLUSTRATIONS

1.0 INTRODUCTION

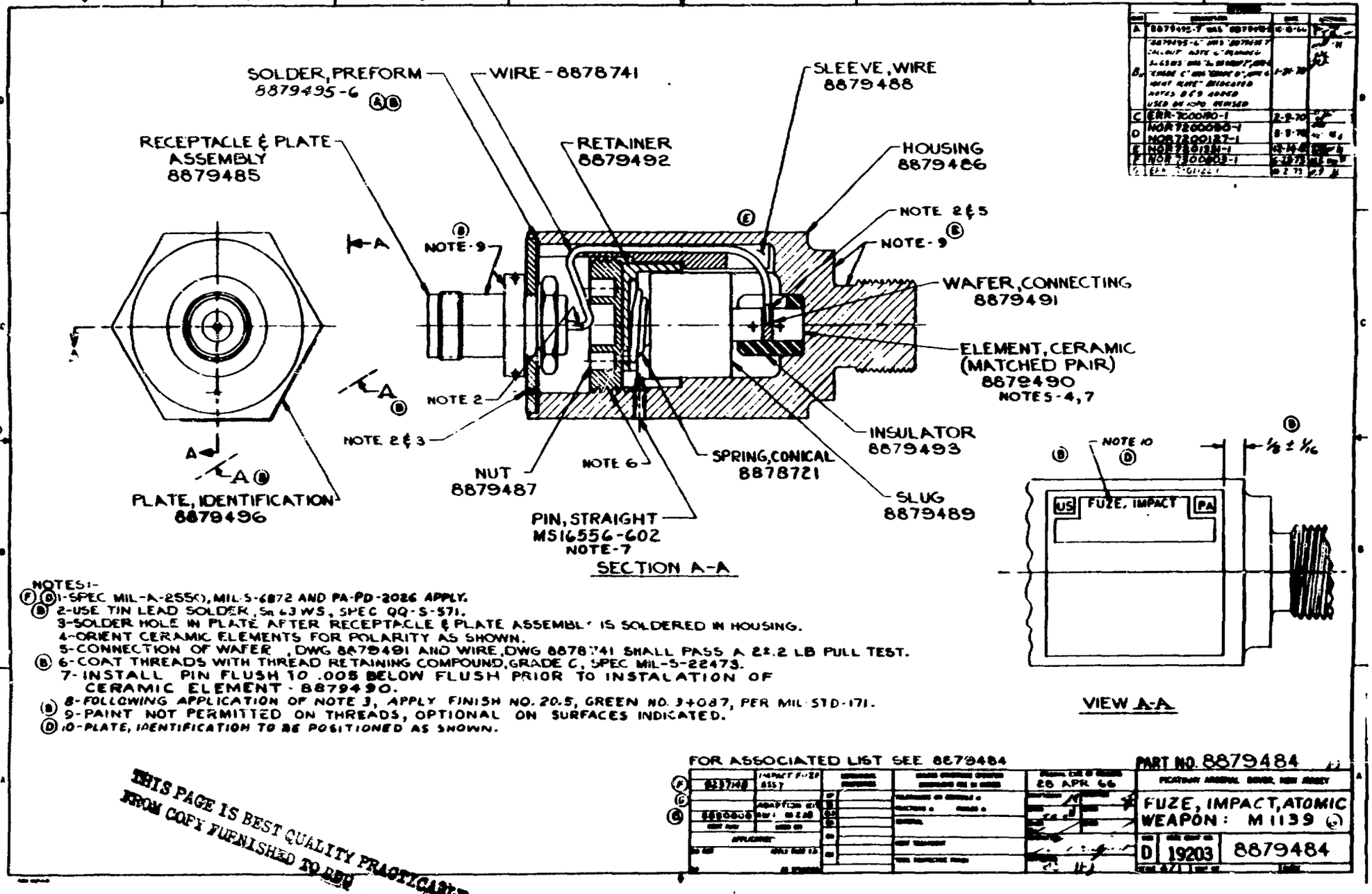
This report covers results of a study to design and develop an alternate configuration for the enclosure seal of the M1139 fuze. The study was conducted under contract DAAA21-75-C-0092 with Picatinny Arsenal, as defined by the work statement, task 15. The objective of the study was to improve the method of sealing the fuze by preventing possible deterioration of wire termination and/or possible degradation of the operational characteristics of the fuze which might result from the present method of sealing, e.g. induction soldering.

Prime consideration was given to maintaining the exact mechanical and electrical operating element configuration of the existing fuze. Thus, proven performance characteristics, supported by test data accumulated over several years production, will not be changed by the cover and seal modification.

The design described in this report eliminates the application of heat sealing the receptacle and receptacle and plate assembly to the fuze body. The design makes provision for mechanical fastening of the receptacle and plate assembly in conjunction with a silicone rubber O-ring seal.

2.0 DESIGN DESCRIPTION

Comparisons between existing and proposed designs are illustrated in Figures 1, 2 and 3. The existing design 8879484, Ref 1, see Fig 1 accomplishes the receptacle and receptacle and plate assembly attachments and seals by solder bonding. The assembly



NOTES:-

(F)(G) 1-SPEC MIL-A-2550, MIL-S-6872 AND PA-PD-2026 APPLY.

(B) 2-USE TIN LEAD SOLDER, Sn 63 WS, SPEC QQ-S-571.

3-SOLDER HOLE IN PLATE AFTER RECEPTACLE & PLATE ASSEMBLY IS SOLDERED IN HOUSING.

4-ORIENT CERAMIC ELEMENTS FOR POLARITY AS SHOWN.

5-CONNECTION OF WAFER , DWG 8879491 AND WIRE, DWG 8878741 SHALL PASS A 22.2 LB PULL TEST.

(B) 6-COAT THREADS WITH THREAD RETAINING COMPOUND, GRADE C, SPEC MIL-S-22473.

7-INSTALL PIN FLUSH TO .005 BELOW FLUSH PRIOR TO INSTALATION OF CERAMIC ELEMENT - 8879490.

(B) 8-FOLLOWING APPLICATION OF NOTE 3, APPLY FINISH NO. 20.5, GREEN NO. 34087, PER MIL-STD-171.

(B) 9-PAINT NOT PERMITTED ON THREADS, OPTIONAL ON SURFACES INDICATED.

(D) 10-PLATE, IDENTIFICATION TO BE POSITIONED AS SHOWN.

FOR ASSOCIATED LIST SEE 8879484

PART NO. 8879484

FUZE, IMPACT, ATOMIC WEAPON: M1139 (C)

D | 19203 | 8879484

Figure 1

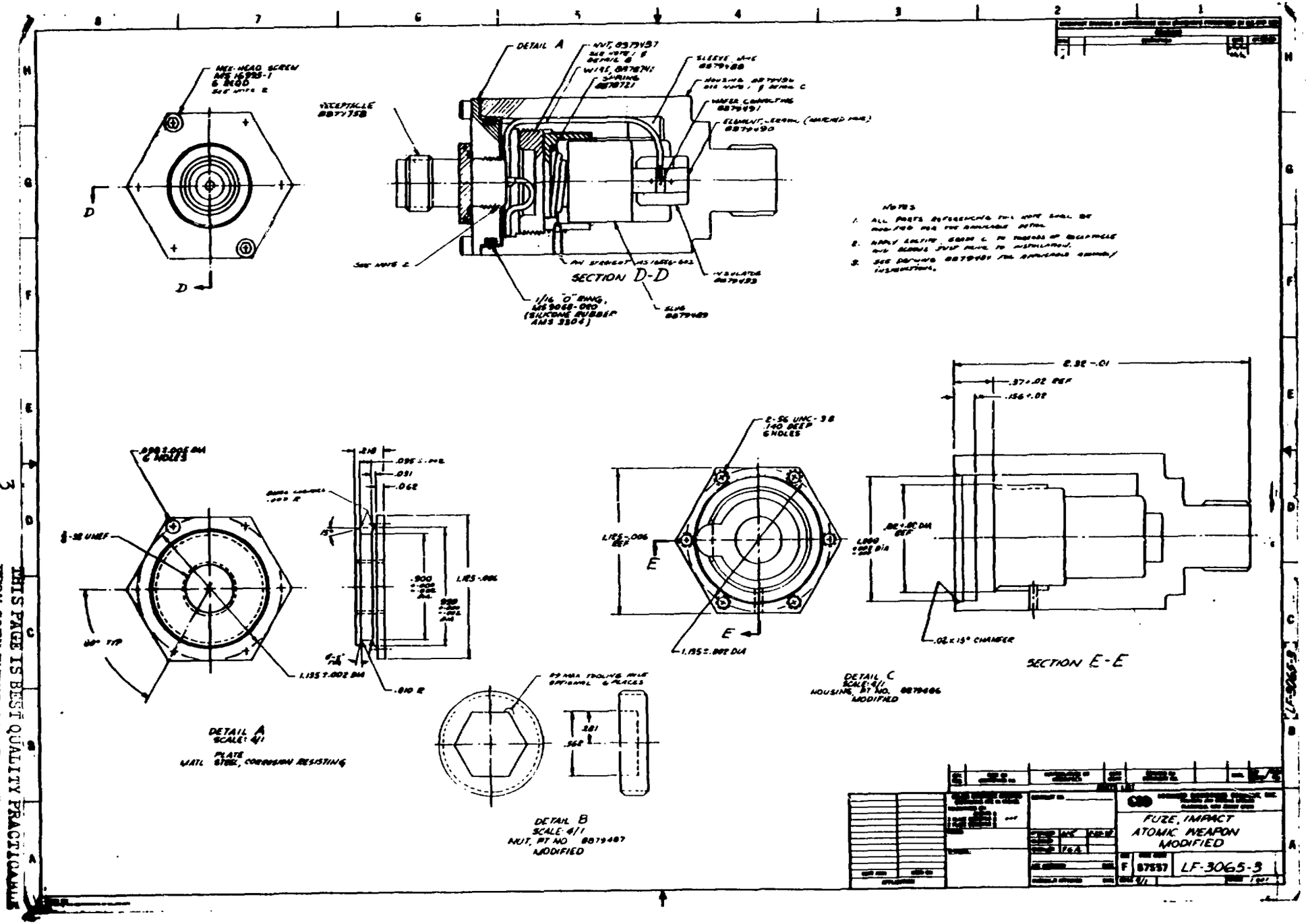
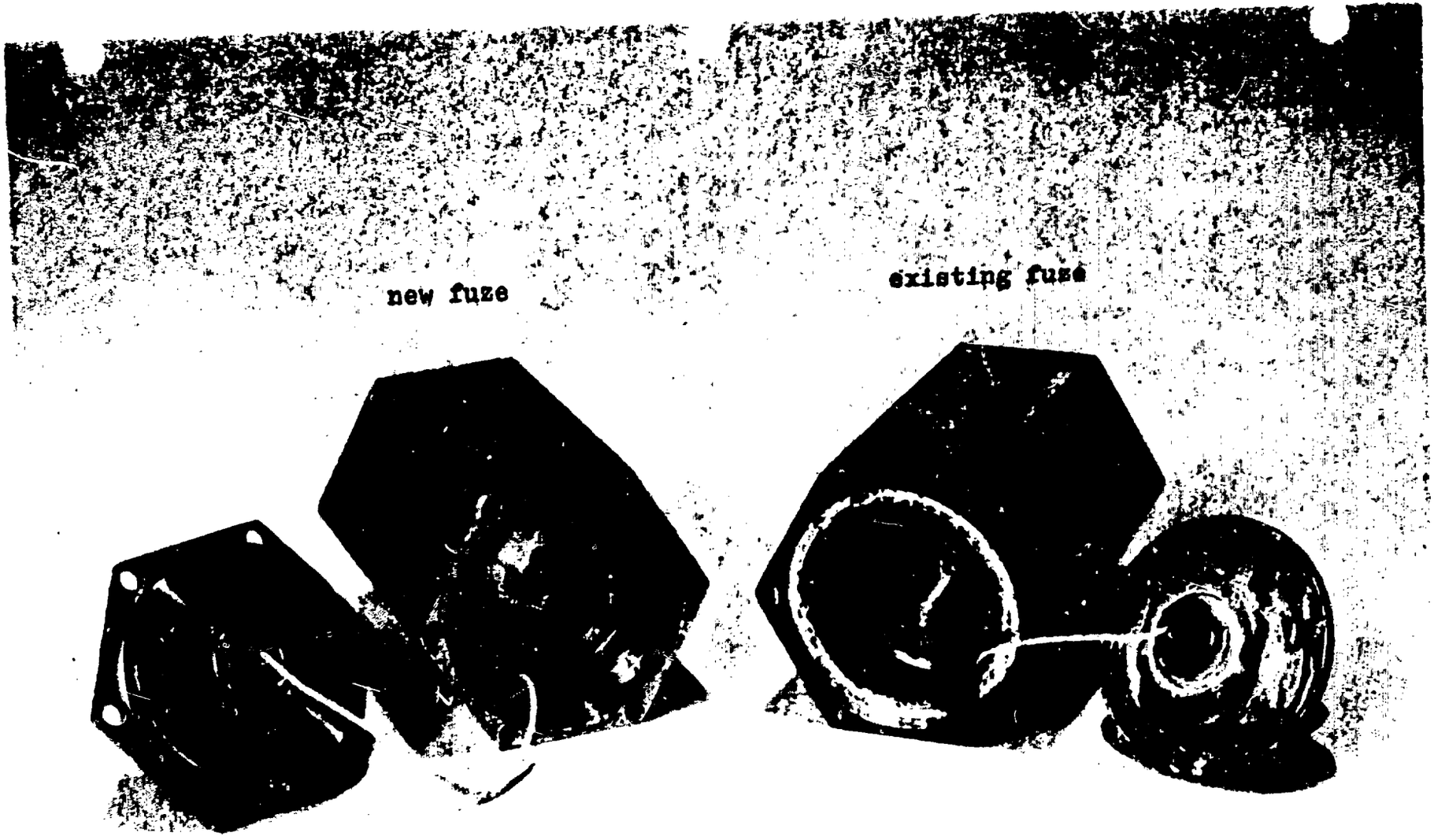


Figure 2


new fuze
existing fuse

sequence, necessitated by the existing design, requires, 1) soldering of receptacle (8877758, Ref 2) to the receptacle plate (8879494, Ref 3), 2) soldering of the output wire (8878741, Ref 4), to the receptacle (Ref 2), and 3) soldering the receptacle and plate assembly (8879485, Ref 5) to the fuze body. While this arrangement provides for a relatively permanent and effective seal, extreme care and control are required to prevent adverse effects from excess heat on: the receptacle elements, on the receptacle and plate assembly to fuze body solder joint, and on the integrity of the "blind" receptacle wire solder termination. Fuze elements are also subjected to the possibly deleterious effects of soldering flux fumes and flux residue since venting and cleaning are not possible after the final soldering operation.

The elastomer seal configuration eliminates the necessity for using solder, flux or heat to attach the receptacle and receptacle and plate assembly to the fuze. The design utilizes an elastomer "O-ring" installed in a gland or groove located on the periphery of the fuze cover (see Fig. 2). Radial compression between the bottom of the seal groove and the fuze body wall provides the proper sealing action. The male-female "O-ring" seal design was chosen over the face type since its application permits retention of the existing fuze body with only minor modifications.

To maintain the overall fuze dimensions, provide for cover mounting hardware, and to minimize cost, the cover design makes use of the same hexagonal stock material from which the fuze housing is currently manufactured.

The choice of material for the O-ring is silicone and it was chosen for its low permeability rate, compression set resistance over a wide temperature range and its ability to maintain its properties in a radiation environment. The "O"-ring selected MS9068-20 (see Fig 4) is a standard size and readily available. Military Handbook 695 (Ref 6), which sorts synthetic elastomers into three groups according to age resistance, lists silicone in the up to 20 years life group. These lists were compiled from the results of controlled laboratory studies of many years duration.

Dimensions for the O-ring and corresponding groove diameter, plug diameter, and groove width, were determined from the Parker Seal Company O-ring handbook (Ref 7), using the modified fuze housing bore as the baseline.

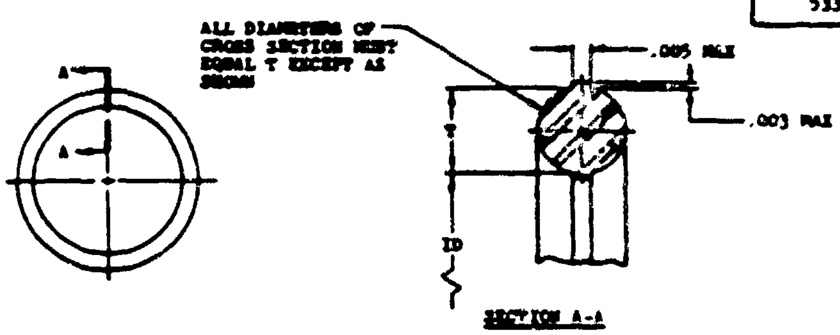
3.0 EVALUATION PROGRAM

3.1 Test Samples

Four prototype fuzes were fabricated and assembled per Figure 2 using the new seal. All parts contained in these fuzes are identical to the existing M1139 fuze with the exception of the following:

MS9068 (ASG)

FED. SUP CLASS 5330



* Preferred Sizes
(a) FOR REFERENCE PURPOSES ONLY

PART NO.	ID MIN	ID MAX	T MIN	T MAX	(a) BASIC VOLUME CU IN.	APPROX WEIGHT LBS/100
*MS9068-004	.065	.075	.067	.073	.0017	.008
*MS9068-005	.096	.106	.067	.073	.0021	.010
*MS9068-006	.109	.119	.067	.073	.0022	.010
*MS9068-007	.140	.150	.067	.073	.0026	.012
*MS9068-008	.171	.181	.067	.073	.0030	.014
*MS9068-009	.203	.213	.067	.073	.0034	.016
*MS9068-010	.234	.244	.067	.073	.0037	.017
*MS9068-011	.296	.306	.067	.073	.0045	.021
*MS9068-012	.359	.369	.067	.073	.0052	.024
*MS9068-013	.421	.431	.067	.073	.0060	.028
*MS9068-014	.484	.494	.067	.073	.0068	.031
*MS9068-015	.546	.556	.067	.073	.0075	.034
*MS9068-016	.609	.619	.067	.073	.0083	.038
*MS9068-017	.671	.681	.067	.073	.0090	.041
*MS9068-018	.734	.744	.067	.073	.0098	.045
MS9068-019	.795	.807	.067	.073	.0105	.048
*MS9068-020	.858	.870	.067	.073	.0113	.052
MS9068-021	.920	.932	.067	.073	.0120	.055
*MS9068-022	.983	.995	.067	.073	.0128	.059
MS9068-023	1.045	1.057	.067	.073	.0136	.062
*MS9068-024	1.108	1.120	.067	.073	.0143	.066
MS9068-025	1.170	1.182	.067	.073	.0151	.069
*MS9068-026	1.233	1.245	.067	.073	.0158	.072
MS9068-027	1.295	1.307	.067	.073	.0166	.076
*MS9068-028	1.358	1.370	.067	.073	.0173	.080
*MS9068-029	1.479	1.499	.067	.073	.0188	.086
MS9068-030	1.604	1.624	.067	.073	.0204	.094
*MS9068-031	1.729	1.749	.067	.073	.0219	.101
MS9068-032	1.854	1.874	.067	.073	.0234	.108
*MS9068-033	1.979	1.999	.067	.073	.0249	.114
MS9068-034	2.104	2.124	.067	.073	.0264	.121
*MS9068-035	2.229	2.249	.067	.073	.0279	.128
MS9068-036	2.354	2.374	.067	.073	.0294	.135
*MS9068-037	2.479	2.499	.067	.073	.0309	.142
MS9068-038	2.604	2.624	.067	.073	.0324	.149
*MS9068-039	2.724	2.754	.067	.073	.0340	.156
MS9068-040	2.849	2.879	.067	.073	.0355	.163
*MS9068-041	2.974	3.004	.067	.073	.0370	.170
MS9068-042	3.224	3.254	.067	.073	.0400	.184
*MS9068-043	3.474	3.504	.067	.073	.0430	.198
MS9068-044	3.724	3.754	.067	.073	.0460	.212
*MS9068-045	3.974	4.004	.067	.073	.0491	.226
*MS9068-110	.357	.367	.100	.106	.0122	.056
*MS9068-111	.419	.429	.100	.106	.0138	.063
*MS9068-112	.482	.492	.100	.106	.0154	.071
*MS9068-113	[illegible]	.554	.100	.106	.0171	.079
*MS9068-114	.607	.617	.100	.106	.0187	.086
*MS9068-115	.669	.679	.100	.106	.0203	.093
*MS9068-116	.732	.742	.100	.106	.0220	.101
MS9068-117	.793	.805	.100	.106	.0235	.108
*MS9068-118	.856	.866	.100	.106	.0253	.116
MS9068-119	.918	.930	.100	.106	.0269	.124
*MS9068-120	.981	.993	.100	.106	.0285	.131
MS9068-121	1.043	1.055	.100	.106	.0302	.139
*MS9068-122	1.106	1.118	.100	.106	.0318	.146
MS9068-123	1.168	1.180	.100	.106	.0334	.154
*MS9068-124	1.231	1.243	.100	.106	.0351	.161
MS9068-125	1.293	1.305	.100	.106	.0367	.169
*MS9068-126	1.356	1.368	.100	.106	.0383	.176
MS9068-127	1.418	1.430	.100	.106	.0400	.184
*MS9068-128	1.431	1.493	.100	.106	.0416	.191
MS9068-129	1.539	1.559	.100	.106	.0432	.199
MS9068-130	1.602	1.622	.100	.106	.0449	.207
MS9068-131	1.664	1.684	.100	.106	.0465	.214
*MS9068-132	1.727	1.747	.100	.106	.0482	.222
MS9068-133	1.789	1.809	.100	.106	.0498	.230
MS9068-134	1.852	1.872	.100	.106	.0514	.236
MS9068-135	1.915	1.935	.100	.106	.0531	.244
*MS9068-136	1.977	1.997	.100	.106	.0547	.252
MS9068-137	2.040	2.060	.100	.106	.0564	.259
MS9068-138	2.102	2.122	.100	.106	.0580	.267
MS9068-139	2.165	2.185	.100	.106	.0596	.274
*MS9068-140	2.227	2.247	.100	.106	.0612	.282
MS9068-141	2.290	2.310	.100	.106	.0627	.289
MS9068-142	2.352	2.372	.100	.106	.0645	.297
MS9068-143	2.415	2.435	.100	.106	.0662	.304
*MS9068-144	2.477	2.497	.100	.106	.0679	.312
MS9068-145	2.540	2.560	.100	.106	.0694	.319
MS9068-146	2.602	2.622	.100	.106	.0711	.327
MS9068-147	2.660	2.690	.100	.106	.0727	.334
*MS9068-148	2.722	2.752	.100	.106	.0743	.342
MS9068-149	2.785	2.815	.100	.106	.0760	.350
MS9068-150	2.847	2.877	.100	.106	.0776	.357
*MS9068-151	2.972	3.002	.100	.106	.0809	.372
MS9068-152	3.222	3.252	.100	.106	.0874	.402
*MS9068-153	3.472	3.502	.100	.106	.0940	.432
MS9068-154	3.722	3.752	.100	.106	.1005	.462
*MS9068-155	3.972	4.002	.100	.106	.1071	.493
MS9068-156	4.222	4.252	.100	.106	.1136	.523
*MS9068-157	4.472	4.502	.100	.106	.1202	.553
MS9068-158	4.722	4.752	.100	.106	.1267	.583
*MS9068-159	4.973	5.002	.100	.106	.1332	.613
MS9068-160	5.214	5.260	.100	.106	.1399	.643

REVISED

APPROVED 23 Sep 6[illegible]

P.A. ASG Other Cust Navy - Wep USAF	TITLE SILICONE RUBBER PACKING, PREFORMED - AMS 3304, "O" RING	MILITARY STANDARD MS9068 (ASG)
PROCUREMENT SPECIFICATION NONE	SUPERSEDES:	SHEET 1 OF 3

This standard has been approved by the Bureau of [illegible] (Department of the Navy) and the Department of the USAF, and is mandatory for use by [illegible] activity. All other military activities are required to employ this standard where suitable.

DD FORM 1 SEP 57 672-1 (Limited coordination)

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE.

a. Fuze housing, (8879486 Ref 8) modified to accept new receptacle and plate assembly and O-ring seal.(See Figure 2).

b. Nut, (8879487 Ref 9) modified to provide additional clearance for the fuze output wire (See Figure 2).

c. New receptacle and plate assembly containing the existing receptacle with "O" ring mounted to the new cover plate and sealed using loctite. (See Figure 2).

d. New O-ring (MS9068-20) and mounting screws (MK 16995-1).

The fuzes were assembled and inspected using existing Lance AK procedures and Military Specification MIL-F-48306 (Ref 10) as applicable.

3.2 Evaluation Testing

Electrical and environmental testing was conducted as follows:

3.2.1 Electrical Tests: Electrical Tests per MIL-F-48306 were performed prior to and after each environmental test. Tests were per the referenced paragraph of MIL-F-48306 as follows:

A. Insulation resistance para. 3.5

B. Capacitance para. 3.6

C. Output voltage para. 3.7

All electrical requirements were met both before and after each environmental test. A sample data sheet is included as Appendix A.

3.2.2 Gross Leak Tests: The effectivness of the O-ring seal was evaluated by performing gross leak tests and observing for bubbles in accordance with MIL-STD-202E, method 112B, test condition B. Leak tests were performed prior to and after subjecting the fuses to temperature and humidity, and impact shock tests per MIL-F-48306. The fuses were leak tested by submerging them in silicone oil at 25°C (77°F) to a depth of 1 inch below the surface. A vacuum was then drawn over the bath to a pressure of 1.5 in of mercury for 1 minute. The requirements of MIL-STD-202 were met during each test. The electrical tests (see para 3.2.1) were successfully repeated after each leak test.

3.2.3 Temperature and Humidity Tests

The four impact fuses were placed in a test chamber and subjected to temperature and humidity tests per MIL-F-48306 para 3.8.5 for 14 days over a temperature range of -65°F to +165°F. Gross leak (see para 3.2.2) and electrical tests (see para 3.2.1) were performed after the completion of temperature humidity testing.

3.2.4 Impact Shock Tests

The four impact fuses were subjected to impact shock in accordance with par. 3.8.6 of MIL-F-48306. The fuses

were mounted and tested simultaneously with the Lance AK impact fuze production samples using a common fixture and procedure. The fuzes were subjected to a shock of 50 gravity units (g's) ±5 g's, three times in each duration along the longitudenal and transverse axis (2 planes) for 11 millimeters. Gross leak tests and electrical tests were successfully performed after the impact shock tests.

4.0 CONCLUSIONS

As a result of the electrical and environmental testing of four prototype modified impact fuzes, it can be concluded that the modified fuze design (see Fig 2) is capable of meeting the electrical and environmental requirements of MIL-F-48306.

5.0 RECOMMENDATIONS

The present M1139 fuze has over the years proven itself to be a safe and reliable component of the Lance Missile and it is not the intention of this report to imply that it needs to be replaced, however, this investigation has shown that the modified fuze design meets all the requirements of MIL-F-48306 plus offers the advantage of not using induction soldering to achieve its environmental seal. The ability to maintain environmental integrity without resorting to the high heat, required by induction soldering, makes the new design more reliable. Therefore, it is recommended that consideration be given to use of the new design concept for any possible future Lance production contracts or for any other new missile programs. It

is also recommended that the present M1139 fuze continue to be used in any fielded Lance units and for the current Lance Production Program.

REFERENCES

1. Picatinny Arsenal Dwg. 8879484, Fuze Impact Atomic Weapon: M1139
2. " " " 8877758, Receptacle, Electrical
3. " " " 8879494, Plate, Receptacle
4. " " " 8878741, Wire
5. " " " 8879485, Receptacle & Plate Assembly
6. Military Handbook 695
7. Parker Seal Co. O-Ring Handbook
8. Picatinny Arsenal Dwg. 8879486, Housing
9. " " " 8679487, Nut
10. " " " Military Specification: Fuze Impact, Atomic Weapon: M1139

APPENDIX A

Acceptance Test Procedure Data Sheet

for Modified Impact Fuzes M1139
Serial Nos "X", "O", "A" & "B"

LOCKHEED ELECTRONICS COMPANY, INC.

ACCEPTANCE TEST PROCEDURE (ATP) DATA SHEET

FOR MODIFIED IMPACT FUZES M113? S/N "X", "O", "A" & "B"

OPERATOR	DEPT	DATE
K. GARCIA	275-13	8-1-76
LEC INSPECTOR	DEPT	DATE

SERIAL NO SEE BELOW

O.D. PT-23031-044 REV A

O.D. SHEET 13 OF 14

DATA SHEET 1 OF 2

ACCEPTED LEC [ ] CUST. [ ]

REJECTED [ ] [ ]

PART NAME IMPACT FUZE XM1139

PART NO. 8879484

PROGRAM LANCE

PARAGRAPH NUMBER	REQUIREMENT MIN	REQUIREMENT MAX.	UNITS	RECORD*	REJECT (✓)	ACCEPT (✓)
SERIAL X 2.12(F1)	20 MEG	-	MEG OHMS	>20M		✓
O 2.12(F2)		-		↓		✓
A 2.12(F3)		-		↓		✓
B 2.12(F4)		-		>20M		✓
2.12(F5)		-				
2.12(F6)		-				
2.12(F7)		-				
2.12(F8)		-				
2.12(F9)		-				
2.12(F10)		-				
X 3.7(F1)	95 Pf	125 Pf	CAPACITY	111.4		✓
O 3.7(F2)				108.3		✓
A 3.7(F3)				109.7		✓
B 3.7(F4)				112.6		✓
3.7(F5)						
3.7(F6)						
3.7(F7)						
3.7(F8)						
3.7(F9)						
3.7(F10)						

* RECORD WHEN APPLICABLE. N.A. DENOTES NOT APPLICABLE.

FORM LEC 109-2

ACCEPTANCE TEST PROCEDURE (ATP) DATA SHEET

OPERATOR	DEPT	DATE
LEC INSPECTOR	DEPT	DATE
SERIAL NO. RECORD ON BACK OF PICTURE		

O.D. PT-23031-044 REV B

O.D. SHEET 14 OF 14

DATA SHEET 2 OF 2

ACCEPTED LEC ☐ CUST. ☐

REJECTED LEC ☐ CUST. ☐

PART NAME: IMPACT FUZE XM1139

PART NO.: 887948

PROGRAM: LANCE

PARAGRAPH NUMBER	REQUIREMENT MIN.	REQUIREMENT MAX.	UNITS	RECORD*	REJECT (✓)	ACCEPT (✓)
4.10.1			F3	NA	-	-
4.10.2			20uSEC/CM	NA	-	-
4.10.3		UPPER BEAM	1V/CM	NA	-	-
		LOWER BEAM	20V/CM	NA	-	-
4.10.6 UPPER BEAM	2.125V	2.375V	VOLTS	RECORD ON BACK		
4.10.7 LOWER BEAM*	250VP	-	VOLTS PEAK	OF PICTURE		
X	-	160μSEC	TIME (μSEC)			✓
O		"				✓
A		"				✓
B		"				✓

*READING IS OBTAINED BY MULTIPLYING (VOLTS PER CM MULTIPLIER X SCREEN DISPLAYING CM X PROBE MULTIPLIER).

* RECORD WHEN APPLICABLE. N.A. DENOTES NOT APPLICABLE.

FORM LEC 182-2

A-2