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| 14. SUBJECT TERMS<br>M825                      White phosphorous                      M739A1 safe and arm<br>M825A1                      M739 safe and arm                      Fuze, PD, M739 series<br>M739 fuze                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                             |                                                            | 15. NUMBER OF PAGES<br>48                                                             |                                  |
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## INTRODUCTION

The Chemical Research Development and Engineering Center (CRDEC) has experienced two M825A1 white phosphorous (WP) projectile malfunctions during lot acceptance testing (LAT) at Dugway Proving Ground (DPG). An expeditious investigation of the hardware data revealed that the lot contained bursters and safing and arming (S&A) modules with an interfix number change. The burster interfix change was the result of contract administration, not hardware changes. The S&A interfix change was the result of S&A manufacturer change. This was the first lot of M825A1 using S&A manufactured by a new vendor. An examination of the recovered M825A1 hardware at DPG revealed that both S&A fully armed and functioned high order. The examination also revealed evidence that the bursters that expel the WP did not detonate.

The Armaments Research, Development and Engineering Center (ARDEC), Fuze Division was tasked to evaluate the S&A in order to see if it could contribute to the malfunctions. Evaluation of the recovered hardware, tolerance studies, spin tests, and functioning tests conducted indicated correct S&A functioning. Based on these results it was concluded that the S&A is highly unlikely to have caused the malfunctions.

## DISCUSSION

### M825A1 Failures

The two malfunctions experienced by CRDEC occurred at zone 8 during lot acceptance testing (LAT) conducted at Dugway Proving Ground (DPG), Utah on 20 December 1989 and 22 January 1990. The same projectile lot (PB-89J000E005) was retested on 13 March 1990 during which two additional canister malfunctions occurred at zone 8. One canister was seen as a streamer (WP smoke trail from ejection to ground). The second canister was a dud. Both canisters were recovered by Explosive Ordnance Disposal Personnel (EOD) at DPG.

Examination of the recovered canisters revealed evidence that the S&A module fully armed and functioned (fig. 1). The detonator and lead functioned, and the dimension of the output hole on the S&A bottom plate shown on figure 1 are:

Streamer - 0.4 in. x 0.3 in., measured 90 deg apart  
Dud - 0.42 in. x 0.48 in., measured 90 deg apart

Examination of the burster in the dud unit showed that the composition (Comp) A-5 explosive did not detonate (fig. 2); however, approximately 1 in. of the Comp A-5 was missing. The burster well and burster were mangled as shown on figure 3. Metal parts examination of the streamer showed evidence of Comp A-5 burning rather than detonating. Both rounds did not function high order as intended.

## **Hardware Data**

Examination of hardware manufacturing data related to the malfunction revealed changes in the burster interfix and the S&A manufacturer. The burster interfix change was related to a change in the administration of the contract to AMCCOM (Armament Munitions and Chemical Command, Rock Island Arsenal) from CRDEC. The S&A change was the result of a new manufacture for the item. These units were manufactured by Action Manufacturing Company. Rounds manufactured prior to this lot contained S&A supplied by Rexon Technology. Action S&A were also related to an M739A1 fuze lot (AKT88H001-010) which was initially rejected due to excessive delay mode duds. Piece part examination of M739A1 fuzes revealed that the fuze failures were due to the impact delay module (IDM) in the fuze. This component is not used in the M825/M825A1 smoke round. Fuzes functioning on subsequent impact (FSI) were labeled as duds. The FSI were caused by the IDM in the fuze, not by the S&A mechanism; all the S&A armed and functioned. Engineering changes were implemented as a result of the fuze lot failure investigation which modified the metal parts fuze specification (MIL-F-63518) and no longer classifies an FSI as a dud. The status of the fuze lot was therefore changed from rejected to accepted. The technical data package (TDP) does not specify a LAT for the S&A, however, the procurement of the S&A is incorporated into the fuze contract. An unspecified procurement policy requires the contractor to manufacture the S&A between two consecutive fuze lots which must pass metal parts LAT as outlined in the metal parts fuze specification. This requirement was met by Action Manufacturing; therefore, the S&A used in the failed M825A1 met the metal parts acceptance requirement.

## **S&A Tests**

ARDEC was requested by CRDEC to conduct tests as outlined in appendix A in order to determine possible S&A contribution to the problem. The effort included a tolerance study and functioning tests.

## **Tolerance Analysis**

The study focused on horizontal and vertical tolerances between the burster, S&A, and front plate assembly. The study of the horizontal tolerances revealed that the burster and the well may be off center by a maximum of 0.01975 in. It also revealed that the burster and the well may have a maximum side gap of 0.020 in. However, the PA-508 (S&A output lead) is always covering 100% of the Comp A-5 in the burster (fig. 4). Therefore, there was no need to examine this further. The vertical tolerances revealed that a maximum gap between the S&A output and the Comp A-5 is 0.015-in. minimum and 0.17-in. maximum. The maximum gap was determined by assuming that the felt disc is not assembled. An illustration is presented in figure 5. These data were provided to the ARDEC Energetics Division for their gap testing. Their test results showed that this gap variation has no effect on the S&A to burster output.

## **Spin and Functioning Tests**

Tests were conducted on 15 S&A in order to determine if the S&A provides sufficient output to function the burster. Ten S&A were manufactured by Action Manufacturing and five were manufactured by Rexon Technology. All 15 were spun at 2,000 rev/min and fully armed. This is well below the spin of 11,505 rev/min which is produced by the gun under the malfunction conditions. This test indicates that the S&A have experienced sufficient spin to fully arm. Furthermore, the DPG recovered units were also fully armed.

The 15 S&A were then manually resafed and transported for explosive testing in order to evaluate and compare the damage to the burster well and the S&A. Each S&A was manually rearmed prior to the test. The test data are located in appendix B for review. Eight of these were tested as specified by CRDEC using inert aluminum rods with varying cavities (0.070 in. to 0.090 in.). These rods were used in place of the burster in order to see if the S&A has sufficient output to deform the cavity. After functioning the eight S&A, it was observed that the aluminum rods had fused with the burster well. The S&A therefore have sufficient energy to deform the deepest cavity (0.090) inert aluminum rod.

## **Output Tests**

One S&A (manufactured by Action) was used for testing the output of the lead, PA-508. The boosted fuze specification (MIL-F-63519) requires that the lead output blow a minimum 0.210 in. through the hole in a 1/8-in. thick lead disc for a high order function. The S&A tested blew a 0.311 in. by 0.317 in. through the hole. Furthermore, LAT data on the leads used by Action and Rexon showed no failures (app C). This indicates that the S&A exceeded the minimum damage requirement.

One S&A was assembled into the empty well, i.e., no burster was used. This test was to evaluate the damage caused by the S&A alone and to establish a reference for S&A output comparison. The burster well absorbed no damage. The damage to the S&A (fig. 6) was similar to the DPG recovered units. The DPG units had a jagged output hole; whereas, this unit had a clean output hole. This is due to the fact that no obstruction or explosive material was in direct contact with the S&A. This would normally cause additional damage to the S&A.

### **Malassembly**

One S&A was placed upside down over the burster to simulate malassembly of the canister. An M1A1 electric squib was placed over the pyrotechnic delay element in order to simulate normal functioning of the delay element by a fuze. The M1A1 squib was initiated in order to function the lead (PA-508). The PA-508 sustained damage (fig. 7); however, it did not propagate to the stab detonator (M55) or the burster. This S&A was later destroyed by functioning the stab detonator which yielded identical S&A damage to the lead output tests. This clearly shows that the S&A in the recovered DPG unit could not have been installed upside down.

Five S&A, manufactured by Action, were functioned with bursters. One unit had a cocked S&A placed over the burster; two units were assembled with upside down bursters. These orientations were to simulate and evaluate the output of the S&A with various malassemblies. One unit was properly assembled so as to establish a comparison.

The unit used for the cocked S&A test yielded an output hole dimension of 0.525 in. by 0.496 in., measured 90 deg apart. An adapter was fabricated to ensure that the S&A remained in a tilted position. The gap between burster and the S&A lead was set at a maximum by placing a 0.017-in. shim. the felt disc was also removed from the burster in order to provide a vertical gap. This configuration is illustrated in figure 8. The S&A functioned the burster high order (fig. 9). The S&A output hole was measured to be 0.460 in. by 0.430 in., 90 deg apart. This damage was similar to the DPG recovered units. This penalty test clearly indicates that the S&A used in the M825A1 failures provided sufficient output to function the burster.

Two S&A were assembled with upside down bursters. The felt disc was removed and the burster was inserted with the green end down. These units functioned high order and the S&A had larger output hole dimensions when compared to the properly assembled test unit (fig. 10). The upside down bursters yielded an S&A output hole of 0.494 in. by 0.571 in. and 0.473 in. by 0.709 in. It also yielded larger front plate assembly hole dimensions when compared to the properly assembled unit.

## **CONCLUSION**

Based on the results of the tests, it is clear that the saving and arming used in the malfunctioned M825A1 projectiles have not contributed to the failures. Tests show that under worst case scenarios using gaps and malassembled units, sufficient energy to function the burster high order was obtained. It was also interesting to note that the upside down bursters yielded the best output. This may be related to the manufacture of the burster. The Comp A-5 in the burster is recessed by a minimum of 0.07 in. and a maximum of 0.09 in. at the top while flush at the bottom. This indicates that a more controlled pressing is required at the top of the burster.

## **RECOMMENDATIONS**

The U.S. Army Armament, Research and Development (ARDEC) Fuze Division recommends that the following areas be addressed by Chemical Research Development :

1. During the course of the investigation it was discovered that an unspecified procurement policy requires the contractor to manufacture the safe and armings (S&A) in between two consecutive fuze lots which must pass metal parts lot acceptance testing (LAT) as outlined in the metal parts fuze specification. This office recommends that CRDEC initiate action to require that this policy be documented by AMCCOM, Rock Island, on future S&A procurements. Even though the S&A involved in the malfunction adhered to this undocumented policy, this office feels that a potential for procuring S&A outside this policy exists.
2. The S&A is held in place by a retainer in the M825A1 assembly. No height checks or requirements are placed on this assembly to ensure proper alignment of the S&A. This office feels that this is a critical area and should be controlled. Measurements of the retainer heights under various conditions, while conducting the tests, have been recorded. These data may be used as guidance by CRDEC in implementing height requirements and checks.
3. The current design of the S&A retainer for the M825A1 has right hand threads. It is felt that this poses a possibility of unscrewing the retainer during firing thereby loosening the S&A which may result in duds. Even though the Dugway Proving Ground recovered units did not experience this, this office strongly recommends left hand threads be implemented. The spin environment of the projectile along with the left hand threads will ensure that the S&A will remain in the position intended, and avoids the possibility of loose assemblies due to firings.

4. The results of the upside down burster should not be ignored and should be further analyzed by CRDEC. This office feels that the upside down burster results gave an indication that the design and manufacturing of the burster is the main source of the problem.



DUD

STREAMER

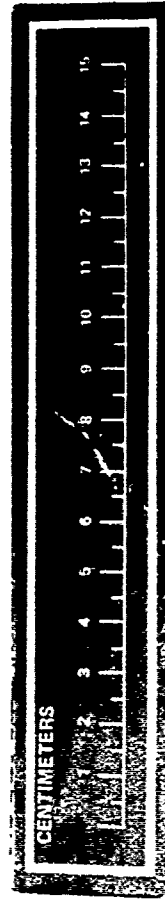


Figure 1. M739/M739A1 recovered safe and arm, M825A1 assembly

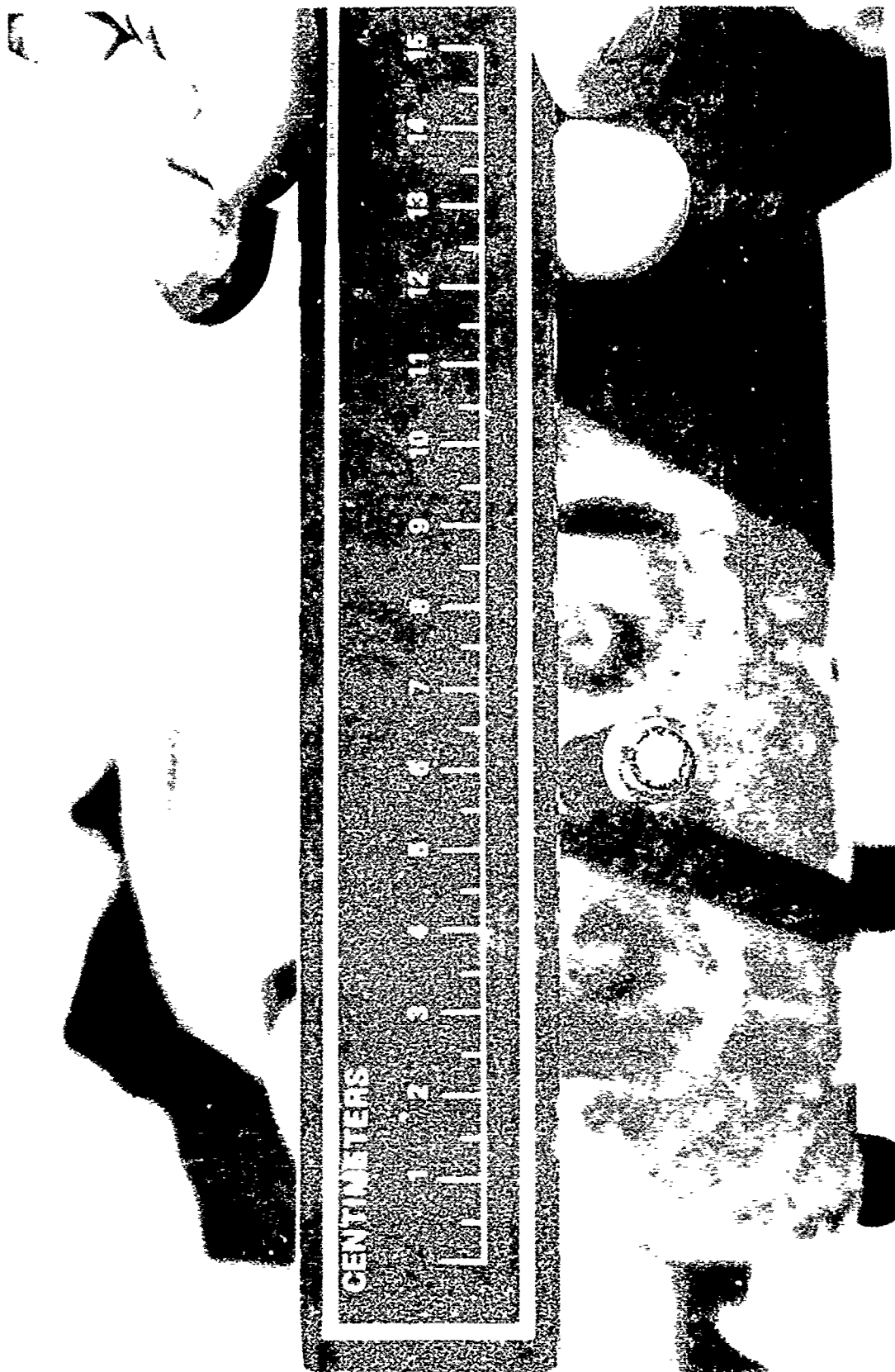


Figure 2. M825A1 recovered burster, lot PB-89J000E005

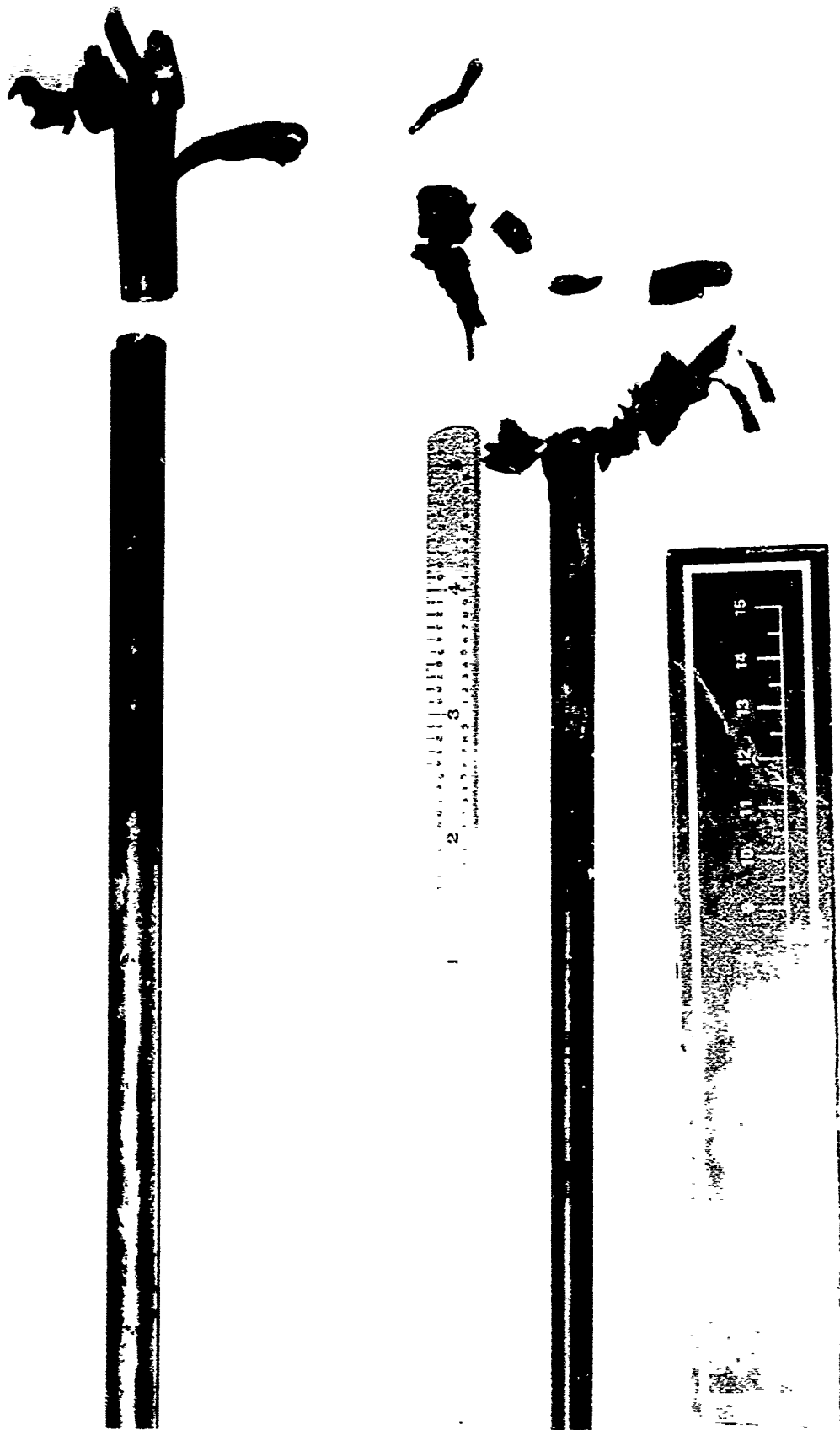


Figure 3. Damage on recovered dud, M825A1, lot PB-89J000E005

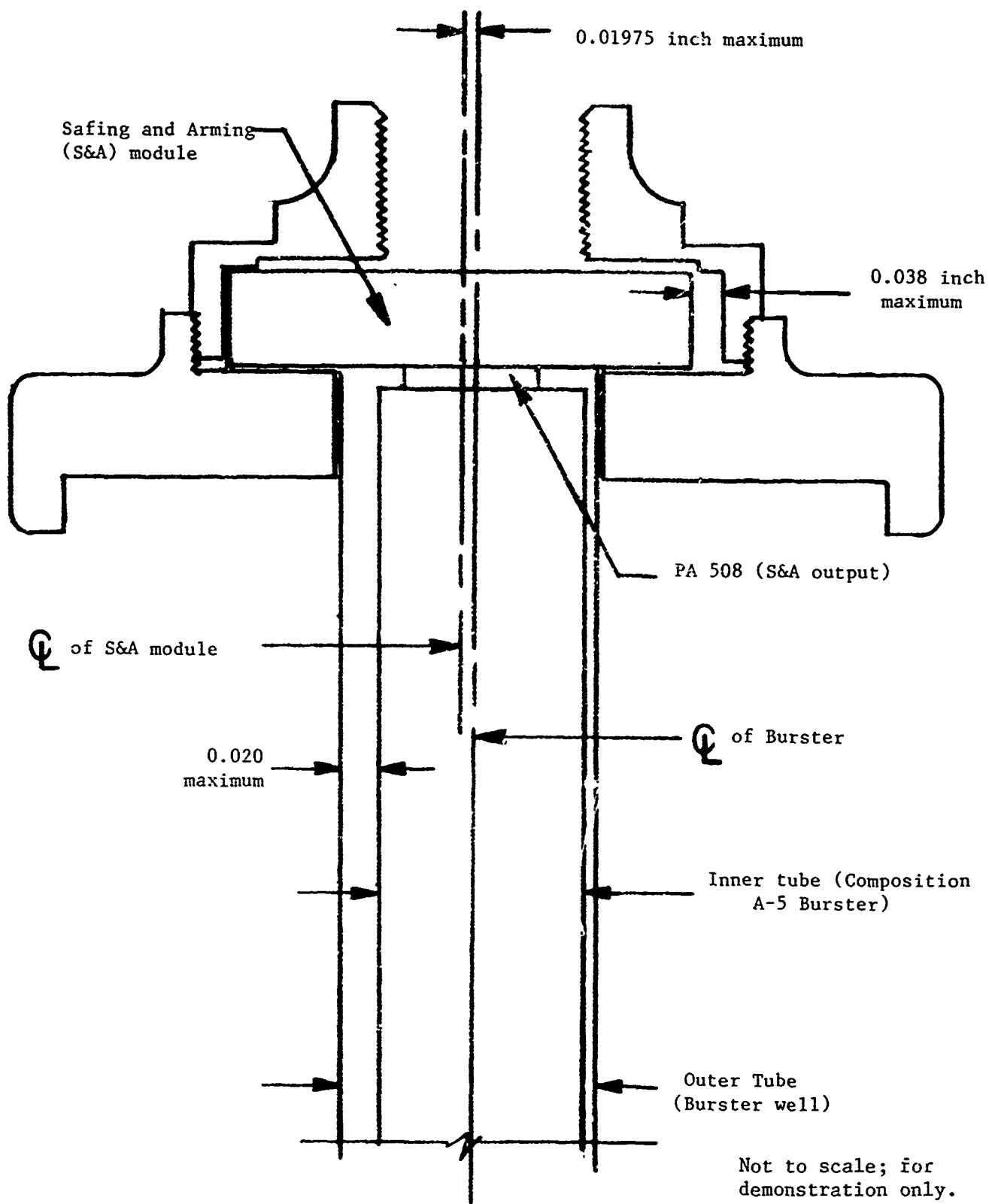


Figure 4. Horizontal tolerance M825/M825AI assembly

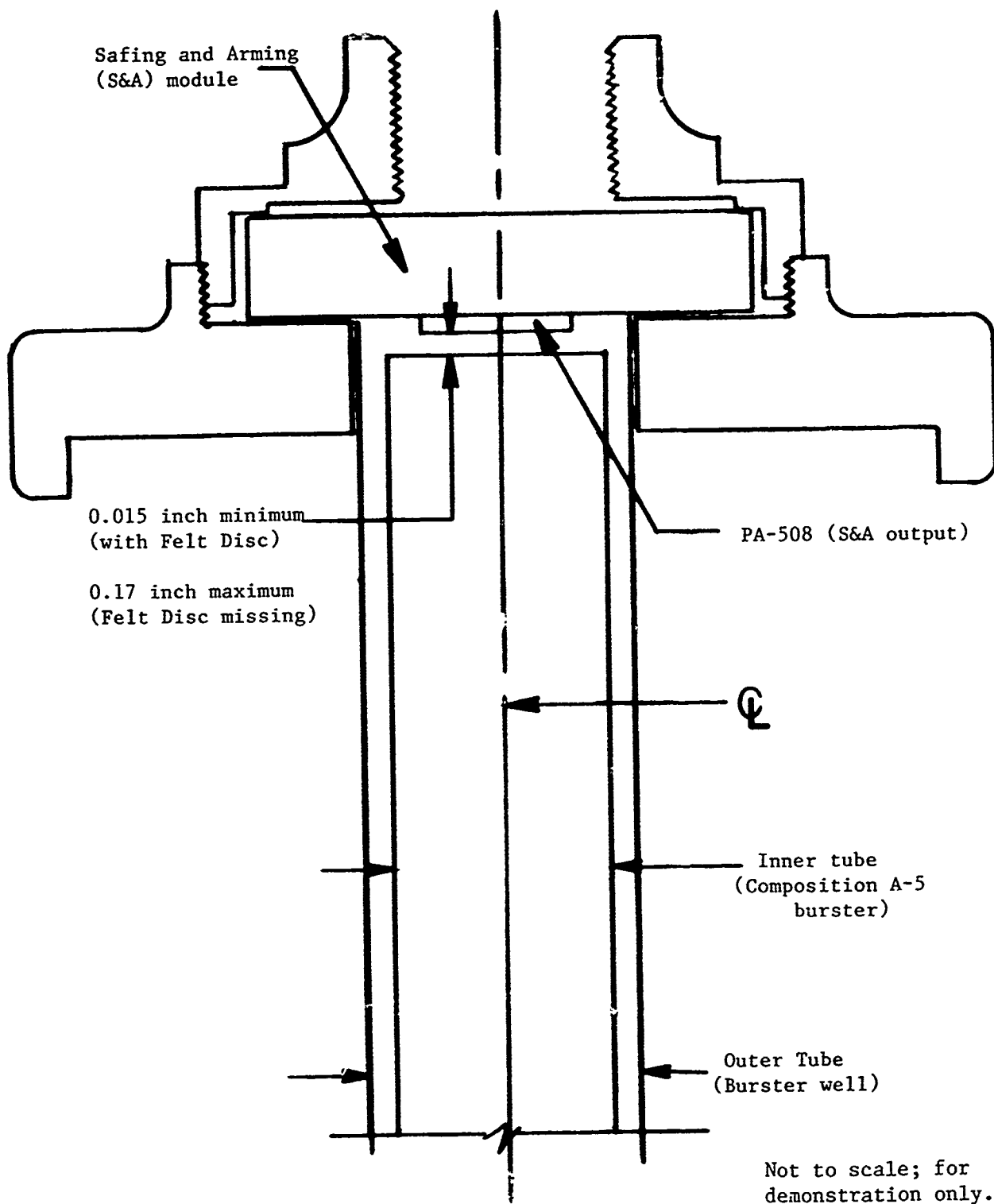


Figure 5. Vertical tolerance M825/M825A1 assembly

TEST #10  
SEA in  
EMPTY  
WELL



Figure 6. M739/M739A1 safe and arm in empty well M825A1 assembly



Figure 7. M739/M739A1 safe and arm upside down M825A1 assembly, after test, sideview

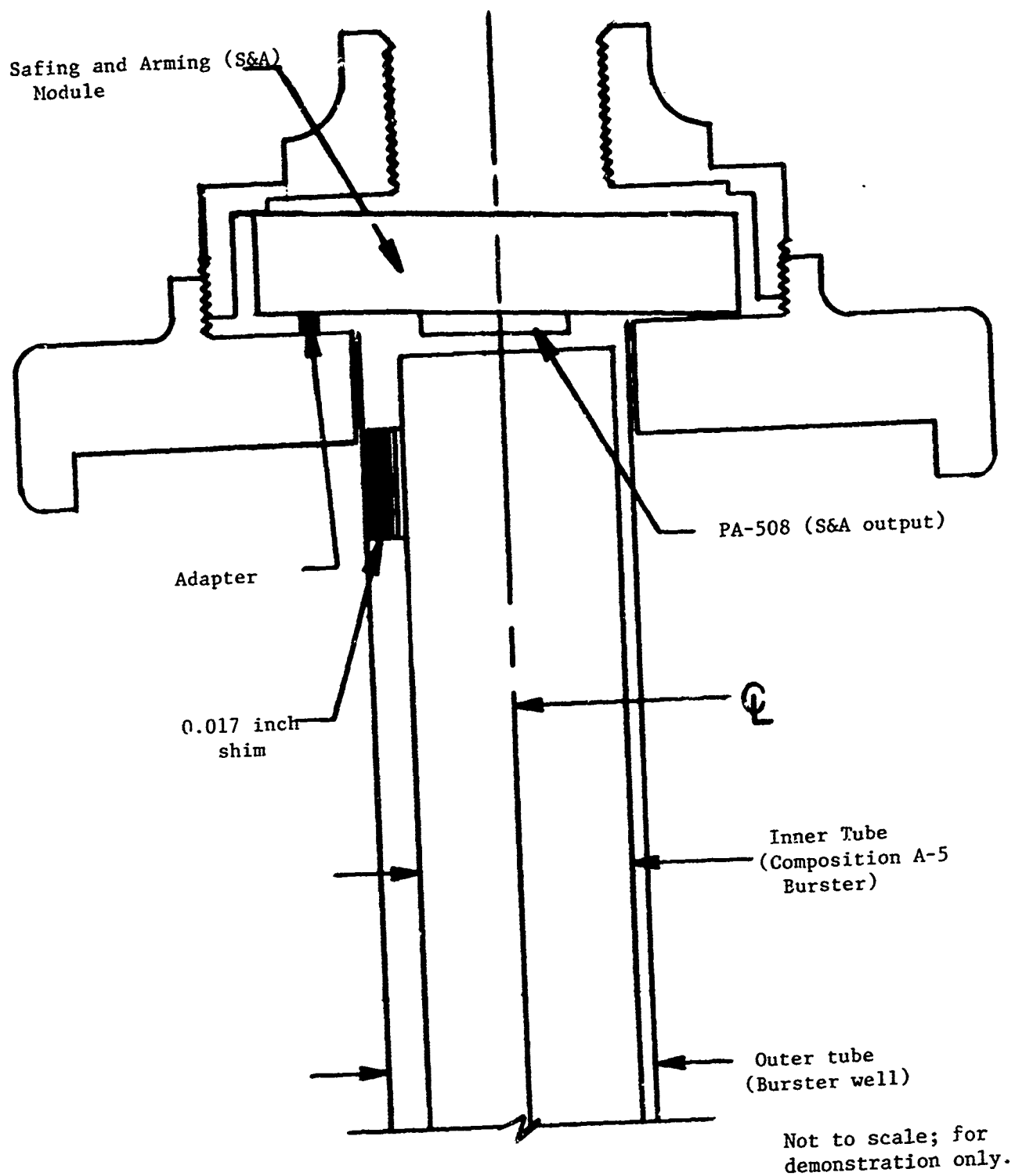


Figure 8. Cocked safing and arming M825/M825A1 assembly

M825 TEST #12  
S&A COCKED  
Bursting Shined .017" ID  
one side & felt Disc  
removed.

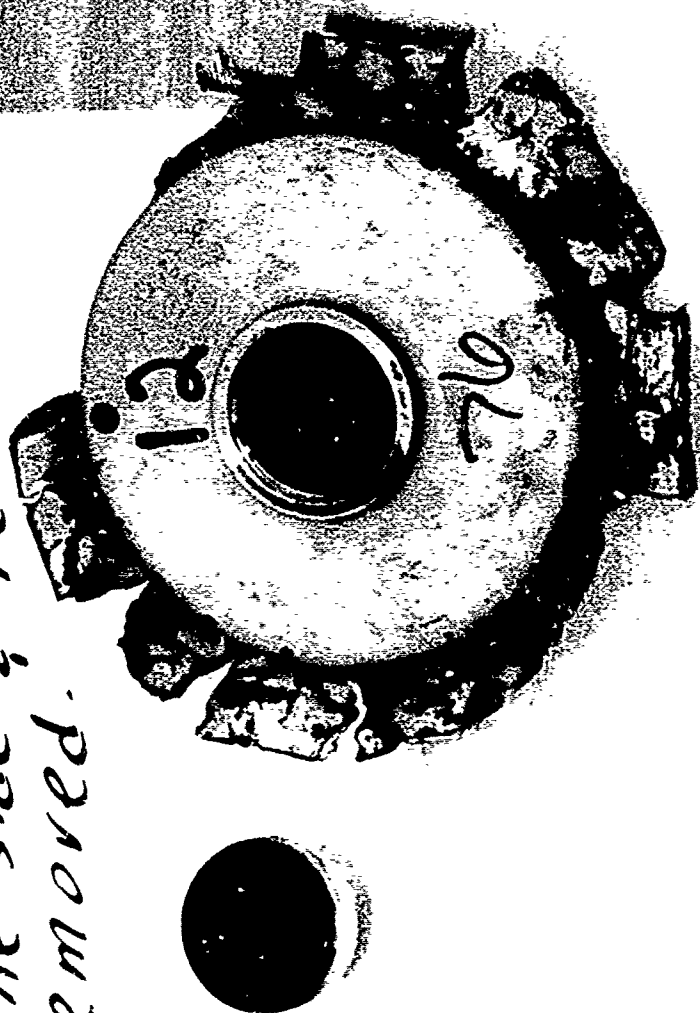
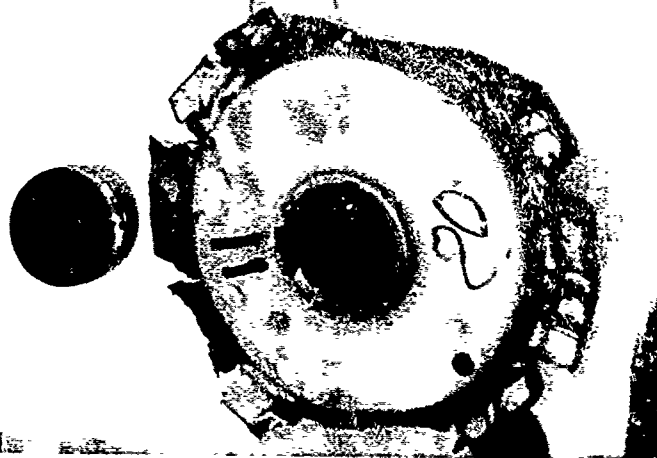
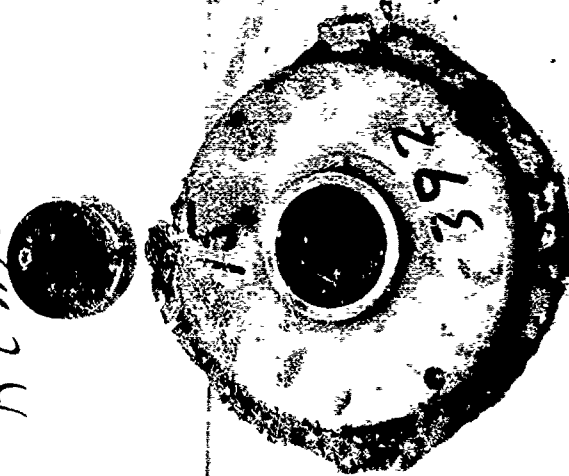


Figure 9. Cocked M739/M739A1 safe and arm, M825A1 assembly

TEST #11  
NORMAL  
ASSEMBLY



TEST #15  
UPSIDEDOWN  
BURSTER  
FELT DISC  
REMOVED



TEST #13  
UPSIDEDOWN  
BURSTER  
FELT DISC  
REMOVED

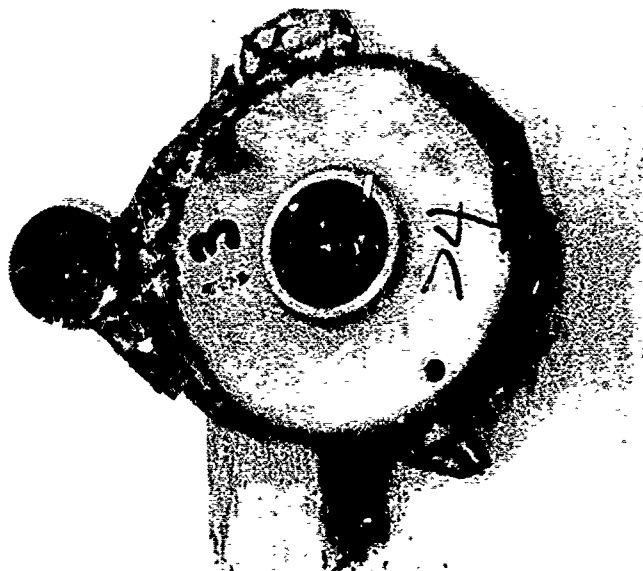


Figure 10. Damage comparison M825A1 assembly upside down burster versus normal assembly

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**APPENDIX A**  
**CRDEC SPECIFIED TESTS**



DEPARTMENT OF THE ARMY  
U.S. ARMY CHEMICAL RESEARCH, DEVELOPMENT AND ENGINEERING CENTER  
ABERDEEN PROVING GROUND, MARYLAND 21010-5423



REPLY TO  
ATTENTION OF

SMCCR-MUS-T

26 APR 1990

MEMORANDUM FOR: Commander, U.S. Army Research Development and Engineering Center, ATTN: SMCAR-AEF-F (S. Koury), SMCAR-AEE-WE (F. Correll), Picatinny Arsenal, NJ 07806-5000

SUBJECT: Static Test of M825 S&A/Front Plate Assembly

1. Examination of recovered "dud" canisters at Dugway Proving Ground, reveal considerable metal damage to the top end of both the burster and burster well for approximately 1.5 - 2.0 inches column length. It is not certain whether or not the missing composition A5 explosive in the short length (1.5 - 2.0 inches) detonated or was blown away, the remaining 16.5 - 17.0 inches of burster contained undetonated A5 material.

2. This confirms our request for ARDEC to add to their Scope of Work (SOW) for M825/M825A1 explosive component testing. The following static test is to help us better assess the explosive train components and hardware from recovered "dud" canisters:

| Test No. | Front Plate Assembly | Simulated Burster       | Safe & Arms Module |
|----------|----------------------|-------------------------|--------------------|
| 1        | From Reject Lot      | Alum. Rod w/.070 cavity | From Reject Lot    |
| 2        | From Reject Lot      | Alum. Rod w/.080 "      | From Reject Lot    |
| 3        | From Reject Lot      | Alum. Rod w/.090 "      | From Reject Lot    |
| 4        | From Accepted Lot    | Alum. Rod w/.070 "      | From Accepted Lot  |
| 5        | From Accepted Lot    | Alum. Rod w/.080 "      | From Accepted Lot  |
| 6        | From Accepted Lot    | Alum. Rod w/.090 "      | From Accepted Lot  |
| 7        | From Accepted Lot    | Alum. Rod w/.090 "      | From Reject Lot    |
| 8        | From Reject Lot      | Alum. Rod w/.070 "      | From Accepted Lot  |

NOTE:

- Priority of effort is to conduct test numbers 3, 6, 7 and 8 first.
- S&A should be retained in Front Plate Assembly with the M825 retainer (any lot)
- Initiate the S&A (M55 stab detonator) with whatever means is appropriate and will work and have on hand to ensure successful test results.
- Simulated bursters (aluminum rods machined to burster configuration) were hand carried to ARDEC by CRDEC on 26 April 1990 and are in the possession of Mr. S. Koury.

3. My POC for this testing is Mr. Donny W. Bromley, AV 584-2882.

FOR THE COMMANDER:

JOHN M. PERBITER  
Acting Director, Munitions

25 APR 1990

SMCCR-MUS-T

SUBJECT: Static Test of M825 S&A/Front Plate Assembly

MEMO FOR RECORD

We had originally planned to conduct these tests at CRDEC. Shipping delivery problems encountered at ARDEC resulted in our decision to leave our sample of reject and accepted explosive components at ARDEC as backup to their explosive work. ARDEC can conduct these tests for us.

DONNY W. BROMLEY

DONALD W. PALUGHI  
Acting Dep Dir, Munitions

**APPENDIX B**  
**M825A1 FUZE DIVISION TEST DATA, ARDEC**

M825A1 FUZE DIVISION TEST DATA

SHEET 1 OF 3

| T<br>E<br>S<br>T | FRONT PLATE<br>ASSEMBLY |               | BURSTER  |                      | SAFE & ARM |          | RETAINER<br>HEIGHT<br>(See figure B1) |               |          |                 |      |      |      |
|------------------|-------------------------|---------------|----------|----------------------|------------|----------|---------------------------------------|---------------|----------|-----------------|------|------|------|
| #                | #                       | M825 LOT #    | #        | LOT #                | DEPTH      | #        | LOT #                                 | M825 LOT #    | #        | A               | B    | C    | D    |
| 1                | NOT USED                |               | NOT USED |                      |            | NOT USED |                                       |               | NOT USED |                 |      |      |      |
| 2                | 77                      | PB-89J000E005 | A1       | rod w/.090 cav       | .459       | 191      | AKT-88H001-001                        | PB-89J000E005 | 55       | .412            | .411 | .407 | .413 |
| 3                | 393                     | PB-87K008-002 | A1       | rod w/.090 cav       | .471       | 261      | REX-85E001-007                        | PB-88A008-007 | 57       | .389            | .389 | .387 | .386 |
| 4                | 394                     | PB-87K008-002 | A1       | rod w/.090 cav       | .455       | 192      | AKT-88H001-001                        | PB-89J000E005 | 60       | .387            | .390 | .386 | .381 |
| 5                | 78                      | PB-89J000E005 | A1       | rod w/.070 cav       | .458       | 262      | REX-85E001-007                        | PB-88A008-007 | 61       | .382            | .382 | .380 | .388 |
| 6                | 71                      | PB-89J000E005 | A1       | rod w/.070 cav       | .453       | 193      | AKT-88H001-001                        | PB-89J000E005 | 62       | .380            | .384 | .381 | .384 |
| 7                | 72                      | PB-89J000E005 | A1       | rod w/.080 cav       | .459       | 194      | AKT-88H001-001                        | PB-89J000E005 | 73       | .362            | .366 | .353 | .361 |
| 8                | 395                     | PB-87K008-002 | A1       | rod w/.070 cav       | .460       | 263      | REX-85E001-007                        | PB-88A008-007 | 63       | .358            | .362 | .358 | .367 |
| 9                | 400                     | PB-87K008-002 | A1       | rod w/.080 cav       | .456       | 264      | REX-85E001-007                        | PB-88A008-007 | 64       | .356            | .358 | .354 | .363 |
| 10               | 73                      | PB-89J000E005 | NOT USED |                      |            | 265      | REX-85E001-007                        | PB-88A008-007 | 65       | .366            | .361 | .364 | .370 |
| 11               | 80                      | PB-89J000E005 | 10       | AMN-86H002-002 AB FL |            | 195      | AKT-88H001-001                        | PB-89J000E005 | 67       | .363            | .366 | .361 | .365 |
| 12               | 76                      | PB-89J000E005 | 6        | AMN-86H002-002 .436  |            | 196      | AKT-88H001-001                        | PB-89J000E005 | 58       | .492            | .493 | .490 | .495 |
| 13               | 74                      | PB-89J000E005 | 17       | AMN-86H002-002 .447  |            | 197      | AKT-88H001-001                        | PB-89J000E005 | 59       | .379            | .373 | .379 | .372 |
| 14               | 75                      | PB-89J000E005 | 18       | AMN-86H002-002 AB FL |            | 198      | AKT-88H001-001                        | PB-89J000E005 | 70       | .416            | .422 | .442 | .427 |
| 15               | 392                     | PB-87K008-002 | 7        | AMN-86H002-002 .450  |            | 199      | AKT-88H001-001                        | PB-89J000E005 | 69       | .363            | .367 | .363 | .358 |
| 16               | 79                      | PB-89J000E005 | NOT USED |                      |            | 200      | AKT-88H001-001                        | PB-89J000E005 | 77       | .594            | .589 | .582 | .588 |
| 17               | NOT USED                |               | NOT USED |                      |            | 198      | AKT-88H001-001                        | PB-89J000E005 | 68       | Not Applicable. |      |      |      |
|                  |                         | 365           |          |                      |            |          |                                       |               |          |                 |      |      |      |

Notes:

- \* All Bursters used were from M825 Lot # PB89J000E005
- \*\* All Retainers were from M825 Lot # PB-89J000E005
- \*\*\* All Delays used were from M825 Lot # PB88A008-007
- AB FL ABOVE FLUSH

M825A1 FUZE DIVISION TEST DATA

SHEET 2 OF 3

| T<br>E<br>S<br>T<br># | D<br>E<br>L<br>A<br>Y<br># | COMMENTS                                                        | SAFE & ARM<br>OUTPUT<br>HOLE<br>AFTER TEST<br>(See fig B2)<br>A B | FRONT PLATE<br>ASSEMBLY<br>HOLE<br>AFTER TEST<br>(See fig B3)<br>A B |
|-----------------------|----------------------------|-----------------------------------------------------------------|-------------------------------------------------------------------|----------------------------------------------------------------------|
| 1                     | 284                        | To see if a M1A1 Squib will initiate the Delay                  | .269 .326                                                         | .207 .247                                                            |
| 2                     | 283                        |                                                                 | .322 .306                                                         | .272 .226                                                            |
| 3                     | 282                        |                                                                 | .338 .362                                                         | .256 .239                                                            |
| 4                     | 281                        |                                                                 | .356 .312                                                         | .266 .276                                                            |
| 5                     | 280                        |                                                                 | .407 .319                                                         | .265 .250                                                            |
| 6                     | 279                        |                                                                 | .326 .240                                                         | .273 .260                                                            |
| 7                     | 278                        |                                                                 | .348 .328                                                         | .268 .281                                                            |
| 8                     | 277                        |                                                                 | .359 .352                                                         | .379 .252                                                            |
| 9                     | 276                        |                                                                 | .318 .336                                                         | .323 .333                                                            |
| 10                    | 275                        |                                                                 | .525 .496                                                         | .437 .390                                                            |
| 11                    | 274                        | Normal assembly                                                 | .460 .430                                                         | .393 .387                                                            |
| 12                    | 273                        | Felt removed, .017" shim to side, S&A cocked (PA-508 to shim)   | .494 .571                                                         | .512 .463                                                            |
| 13                    | 272                        | Felt removed, Burstster upsidedown                              | No hole                                                           | .336 .335                                                            |
| 14                    | 271                        | S&A upsidedown                                                  | .473 .709                                                         | .454 .447                                                            |
| 15                    | 270                        | Felt removed, Burstster upsidedown                              | .448 .407                                                         | .331 .331                                                            |
| 16                    | 269                        | PA-508 output, 1/8" thick Lead disc (.210 Dia hole/spec)        | .353 .404                                                         | Not used                                                             |
| 17                    | 268                        | To destroy S&A used in test #14.<br>Unused Front Plate Assembly |                                                                   | .334 .334                                                            |

Notes:

- \* All Burststers used were from M825 Lot # PB89J000E005
- \*\* All Retainers were from M825 Lot # PB-89J000E005
- \*\*\* All Delays used were from M825 Lot # PB88A008-007
- AB FL ABOVE FLUSH

M825A1 FUZE DIVISION TEST DATA

SHEET 3 OF 3

| T<br>E<br>S<br>T<br># | REMARKS                                                                            |
|-----------------------|------------------------------------------------------------------------------------|
| 1                     |                                                                                    |
| 2                     | Alum. rod fused in well.                                                           |
| 3                     | Alum. rod fused in well.                                                           |
| 4                     | Alum. rod fused in well.                                                           |
| 5                     | Alum. rod fused in well.                                                           |
| 6                     | Alum. rod fused in well.                                                           |
| 7                     | Alum. rod fused in well.                                                           |
| 8                     | Alum. rod fused in well.                                                           |
| 9                     | Alum. rod fused in well.                                                           |
| 10                    | No Damage                                                                          |
| 11                    | Function High Order, S&A damage identical to DPG recovered.                        |
| 12                    | Function High Order                                                                |
| 13                    | Function High Order, sounded louder than other tests.                              |
| 14                    | PA-508 did not propagate.                                                          |
| 15                    | Function High Order, sounded louder than other tests.                              |
| 16                    | Lead disc hole is .31ix.317 (90 Deg apart), spec .210 dia hole, no damage to well. |
| 17                    |                                                                                    |

Notes:

- \* All Bursters used were from M825 Lot # PB89J000E005
- \*\* All Retainers were from M825 Lot # PB-89J000E005
- \*\*\* All Delays used were from M825 Lot # PB88A008-007
- AB FL ABOVE FLUSH

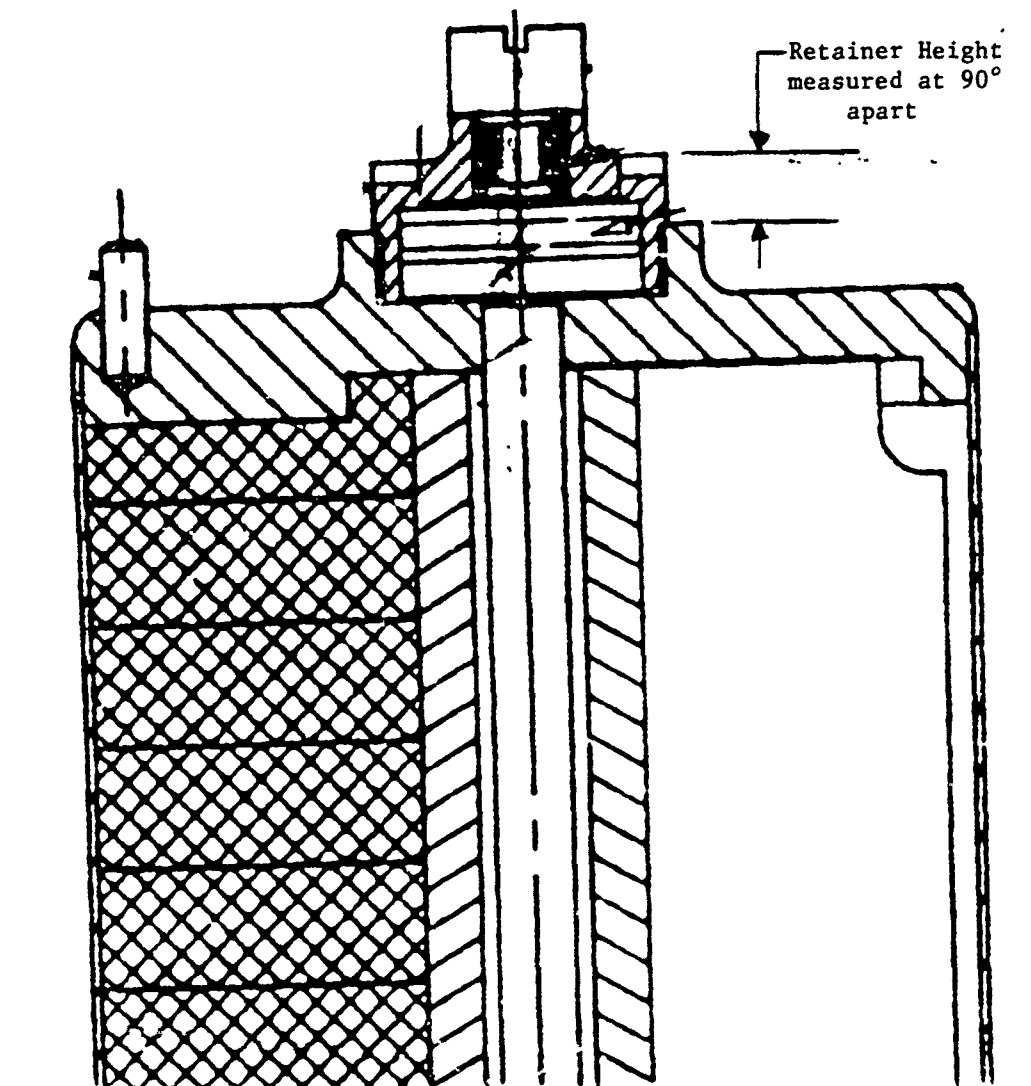


FIGURE B1

Retainer Height  
Measurement  
M825/M825A1 Assembly

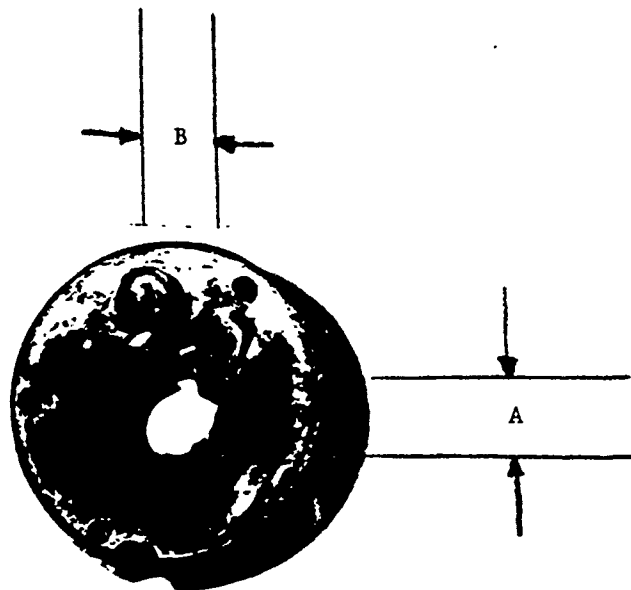


FIGURE B2  
M739/M739A1  
S&A Output Hole  
Dimension Measurement

For demonstration only

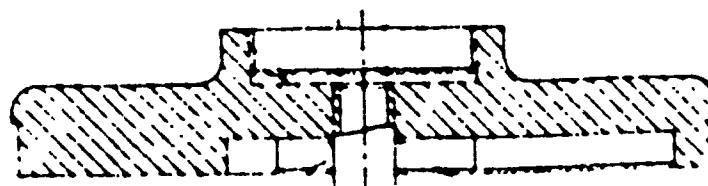
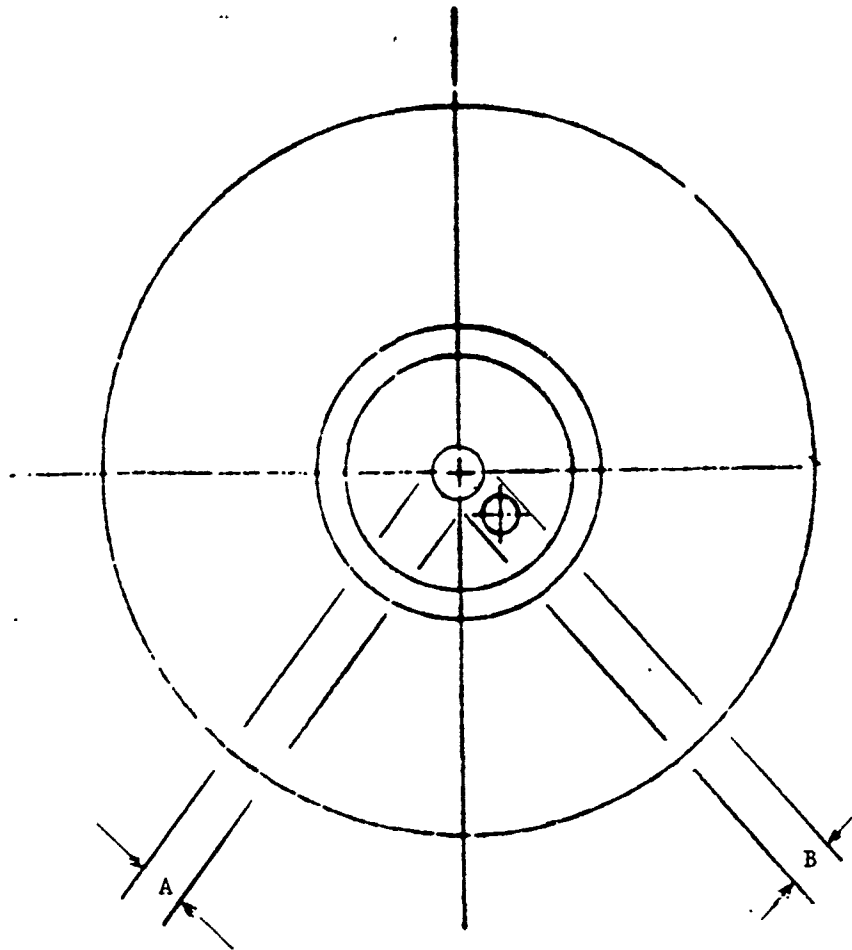


FIGURE B3

M825/M825A1 FRONT PLATE ASSEMBLY  
DIMENSION MEASUREMENTS

**APPENDIX C**  
**LOT ACCEPTANCE TEST DATA**  
**(PA-508 LEAD)**

M825 Smoke Projectile  
Ballistic Lot

S&A Lot

Burster Lot

PB-87K008-002

REX-85E001-007

AMN-85D001-010

Pine Bluff mfg  
18 Nov 87 accept

Rexon Mfg  
3 May 85

Action  
1 Apr 85

HE  
mfg  
lot  
lot  
lot

M55  
LS-85C351-063  
  
PA508  
MA-84J003-059  
Holston Comp A-5  
HOL83D640-109

Comp A-5 C-2  
Expro Chemical  
PCE-2922  
PCE-2927  
PCE-2928

PB-88A008-007

REX-85E001-007

AMN-86D001-021

Pine Bluff  
unk

Rexon Mfg  
3 May 85

Action Mfg Co  
1 Apr 85

Comp A-5 C-2  
Expro Chemical  
86-035 to 043

PB-89J000-E005

AKT-88H001-001

AMN-86H002-002

Pine Bluff  
unk

Action Mfg Co  
20 Jan 89

Action Mfg Co  
1 Oct 86

M55  
KA-87K356-006  
  
PA508  
MA-87H006-006  
Holston Comp A-5  
HOL85L640-277  
HOL85L640-279

Comp A-5 C-2  
Expro Chemical  
86-044, 045, 073  
86-074, 076, 077  
86-079, 082, 084  
86-086

COAST TEST AREA RES-  
HEAD EXPLOSIVE, PASOB

COMPLETED ON  
Y ( 104500)

DOT NO. (2) MA-87H005-006 ) 41A  
BODY LOTS ( ) (

TEST DESCRIPTIONS:

FUNCTIONING

DATE TEST COMPLETED

=1 (150) (0-FAILURES  
(000) (00/00/07

1000) (

11 (000) (

三 (000) (

1

(

1

1

37) APPROVED BY TWA

IN FINISHED ROUND LOT

(1) (150) (OK)

(2) ( ) (ALL)

$$\{ \quad \} \quad ( \quad ) \quad ( \quad )$$

( ) ( ) ( )  
( ) ( ) ( )

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( ) ( ) ( )

$$\{ \quad \} \quad ( \quad ) \quad ( \quad )$$

( ) ( ) ( )

( ) ( ) ( )

( ) ( ) ( )  
( ) ( ) ( )

$$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \quad \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \quad \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$$

( ) ( ) ( )

( ) ( ) ( )

( ) ( ) ( )

TESTED DATE: 10/1/80  
USED DATE: ( ) IN FINISHED ROUND LOT ( )

# P/A 508 Lead Assembly

| TYPE OF TEST |         | DISPOSITION |         | DATE       |         | LOT NO.         |         |
|--------------|---------|-------------|---------|------------|---------|-----------------|---------|
| Output Test  |         | acceptable  |         | 9-22-87    |         | MHA-87 H006-006 |         |
| SAMPLE NO.   | RESULTS | SAMPLE NO.  | RESULTS | SAMPLE NO. | RESULTS | SAMPLE NO.      | RESULTS |
| 1            | OK      | 26          |         | 91         |         | 101             |         |
| 2            | ↑       | 27          |         | 92         |         | 102             |         |
| 3            |         | 28          |         | 93         |         | 103             |         |
| 4            |         | 29          |         | 94         |         | 104             |         |
| 5            |         | 30          |         | 95         |         | 105             |         |
| 6            |         | 31          |         | 96         |         | 106             |         |
| 7            |         | 32          |         | 97         |         | 107             |         |
| 8            |         | 33          |         | 98         |         | 108             |         |
| 9            |         | 34          |         | 99         |         | 109             |         |
| 10           |         | 35          |         | 100        |         | 110             |         |
| 11           |         | 36          |         |            |         | 111             |         |
| 12           |         | 37          |         |            |         | 112             |         |
| 13           |         | 38          |         |            |         | 113             |         |
| 14           |         | 39          |         |            |         | 114             |         |
| 15           |         | 40          |         |            |         | 115             |         |
| 16           |         | 41          |         |            |         | 116             |         |
| 17           |         | 42          |         |            |         | 117             |         |
| 18           |         | 43          |         |            |         | 118             |         |
| 19           |         | 44          |         |            |         | 119             |         |
| 20           |         | 45          |         |            |         | 120             |         |
| 21           |         | 46          |         |            |         | 121             |         |
| 22           |         | 47          |         |            |         | 122             |         |
| 23           |         | 48          |         |            |         | 123             |         |
| 24           |         | 49          |         |            |         | 124             |         |
| 25           |         | 50          |         |            |         | 125             |         |

PP-288 (REV 9-72)

INSPECTOR

OK

# SHOP TEST WORK SHEET

Lead Explosive PA508

TYPE OF TEST Functioning Output DISPOSITION Accepted DATE 10-2-83 LOT NO. MM-843003-059

| SAMPLE NO. | RESULTS | SAMPLE NO. | RESULTS | SAMPLE NO. | RESULTS | SAMPLE NO. | RESULTS | SAMPLE NO. | RESULTS | SAMPLE NO. | RESULTS |
|------------|---------|------------|---------|------------|---------|------------|---------|------------|---------|------------|---------|
| 1          | OK      | 26         | OK      | 51         | OK      | 76         | OK      | 101        | OK      | 126        | OK      |
| 2          | ↑       | 27         | ↑       | 52         | ↑       | 77         | ↑       | 102        | ↑       | 127        | ↑       |
| 3          |         | 28         |         | 53         |         | 78         |         | 103        |         | 128        |         |
| 4          |         | 29         |         | 54         |         | 79         |         | 104        |         | 129        |         |
| 5          |         | 30         |         | 55         |         | 80         |         | 105        |         | 130        |         |
| 6          |         | 31         |         | 56         |         | 81         |         | 106        |         | 131        |         |
| 7          |         | 32         |         | 57         |         | 82         |         | 107        |         | 132        |         |
| 8          |         | 33         |         | 58         |         | 83         |         | 108        |         | 133        |         |
| 9          |         | 34         |         | 59         |         | 84         |         | 109        |         | 134        |         |
| 10         |         | 35         |         | 60         |         | 85         |         | 110        |         | 135        |         |
| 11         |         | 36         |         | 61         |         | 86         |         | 111        |         | 136        |         |
| 12         |         | 37         |         | 62         |         | 87         |         | 112        |         | 137        |         |
| 13         |         | 38         |         | 63         |         | 88         |         | 113        |         | 138        |         |
| 14         |         | 39         |         | 64         |         | 89         |         | 114        |         | 139        |         |
| 15         |         | 40         |         | 65         |         | 90         |         | 115        |         | 140        |         |
| 16         |         | 41         |         | 66         |         | 91         |         | 116        |         | 141        |         |
| 17         |         | 42         |         | 67         |         | 92         |         | 117        |         | 142        |         |
| 18         |         | 43         |         | 68         |         | 93         |         | 118        |         | 143        |         |
| 19         |         | 44         |         | 69         |         | 94         |         | 119        |         | 144        |         |
| 20         |         | 45         |         | 70         |         | 95         |         | 120        |         | 145        |         |
| 21         |         | 46         |         | 71         |         | 96         |         | 121        |         | 146        |         |
| 22         |         | 47         |         | 72         |         | 97         |         | 122        |         | 147        |         |
| 23         |         | 48         |         | 73         |         | 98         |         | 123        |         | 148        |         |
| 24         | ↓       | 49         | ↓       | 74         | ↓       | 99         | ↓       | 124        | ↓       | 149        | ↓       |
| 25         | OK      | 50         | OK      | 75         | OK      | 100        | OK      | 125        | OK      | 150        | OK      |

MM-298 (rev. 0-72)

INSPECTOR

**APPENDIX D**

**DESCRIPTION OF THE M825/M825A1 WEAPON SYSTEM**

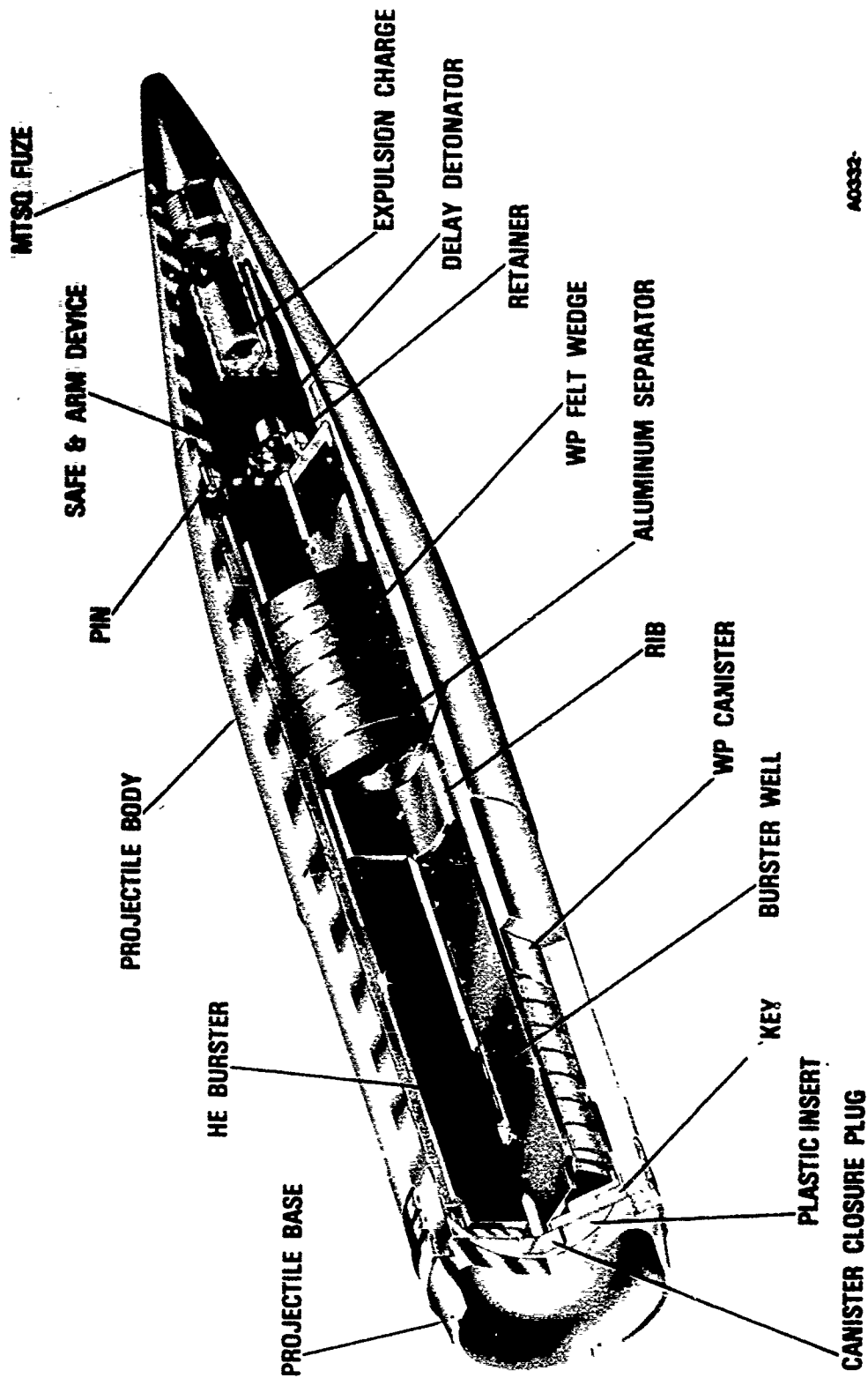
### DESCRIPTION OF THE M825/M825A1 WEAPON SYSTEM

The M825/M825A1 is an artillery delivered 155mm projectile which produces a ground screening smoke for five to ten minutes, figure D1. The smoke screen is produced by burning multiple wedge-shaped pieces of felt which have been saturated in WP. The system consists principally of the projectile carrier and the payload (felt wedge WP). The projectile carrier consists of a modified M483A1 steel body and an expulsion charge. The felt wedges are contained in a hermetically sealed canister, in the projectile body.

The canister is made of a cylinder of thin rolled steel. Four aluminum angles are arranged in a shape of an asymmetric "X" rib configuration within the canister. This configuration runs the entire length of the canister and divides it into quadrants. A total of one hundred sixteen (116) 3/4 inch thick felt wedges are shaped to conform to the quadrants and are stacked twenty-nine (29) per quadrant.

A burster charge, 1/4 inch diameter (0.1 pounds of Comp A-5), runs the entire length of the canister. The burster is initiated by the M739/M739A1 S&A which is located in the forward end of the main charge below the heat sensitive pyrotechnic delay element.

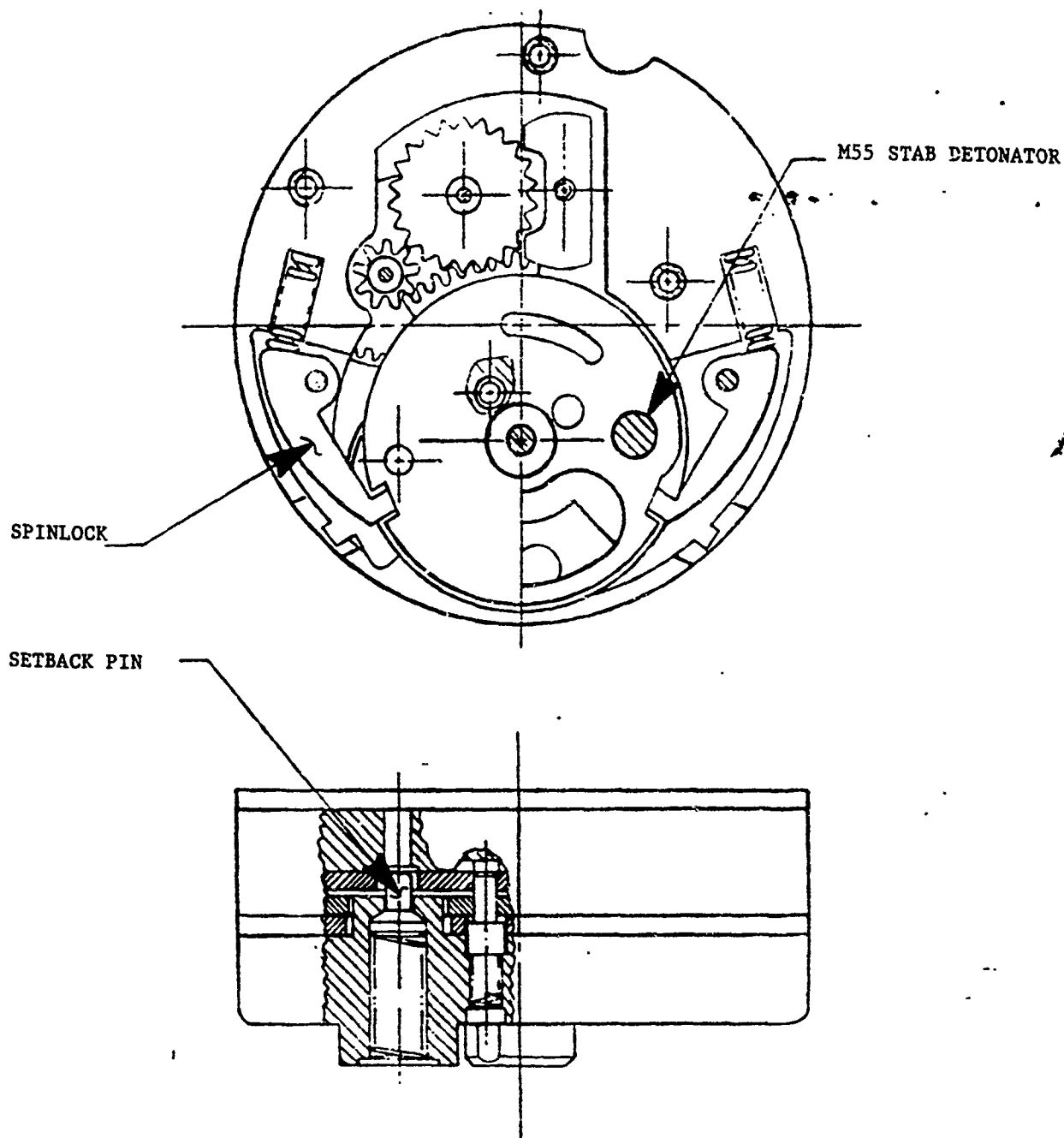
Upon launch the S&A module arms due to setback and spin. The setback retracts the setback pin while the spin moves the spinlocks outward. Since the safeties have been overcome by setback and spin, the rotor, driven by spin, now turns the M55 stab detonator to inline with the lead (PA-508). The S&A is now armed. A rotor lock pin ensures that the S&A remains armed. Figures D2 to D4 show the arming process of the M739/M739A1 S&A. Even though the M55 is a stab detonator it may also be initiated pyrotechnically. The M55 is initiated by a one hundred (100) milisecond delay that is activated by the burning ogive expulsion charge.



A0332-

PROJECTILE, 155 MM SMOKE, WP, M825A1

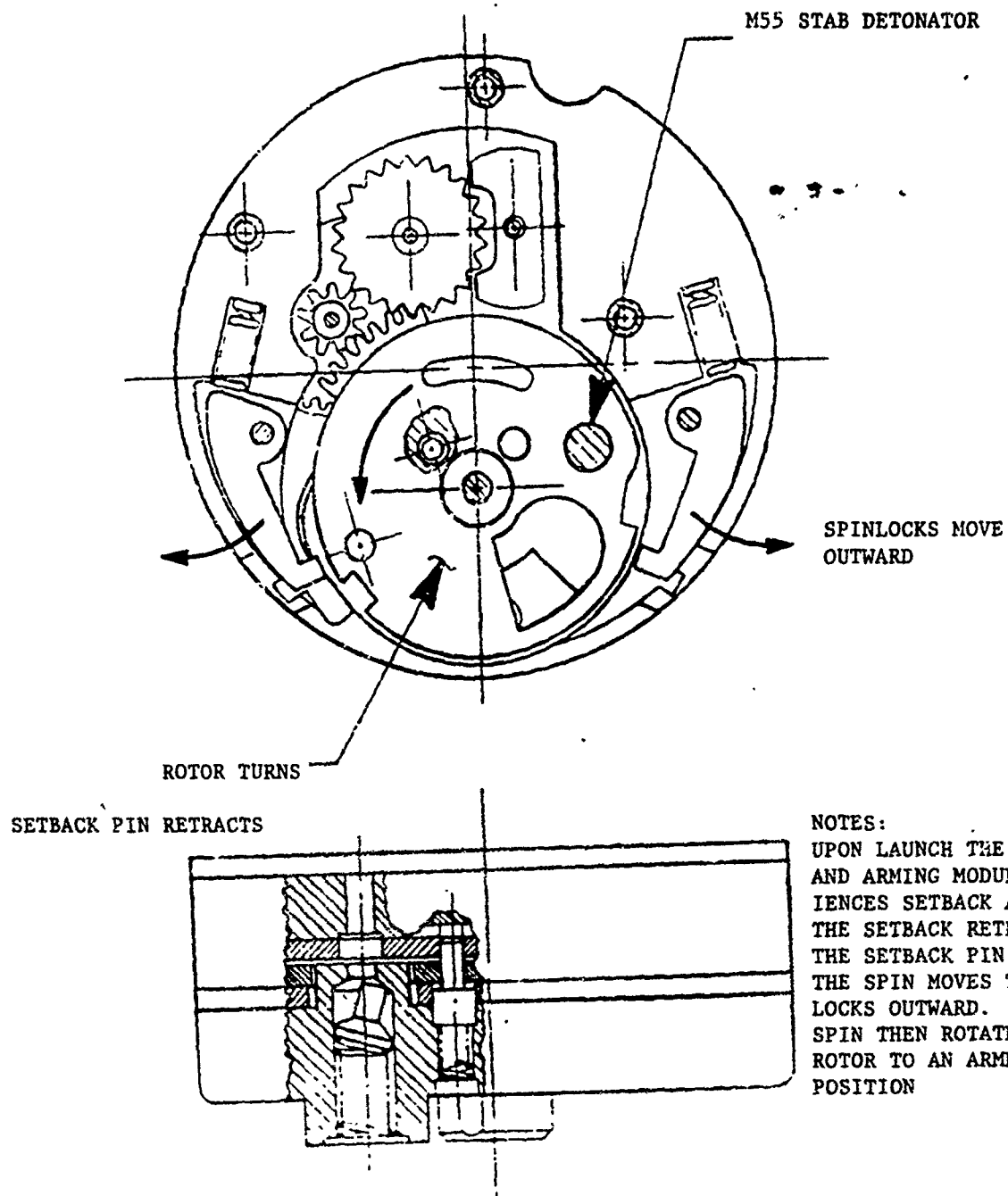
Figure D1



M739/M739A1 SAFING AND ARMING MODULE

FULLY SAFE

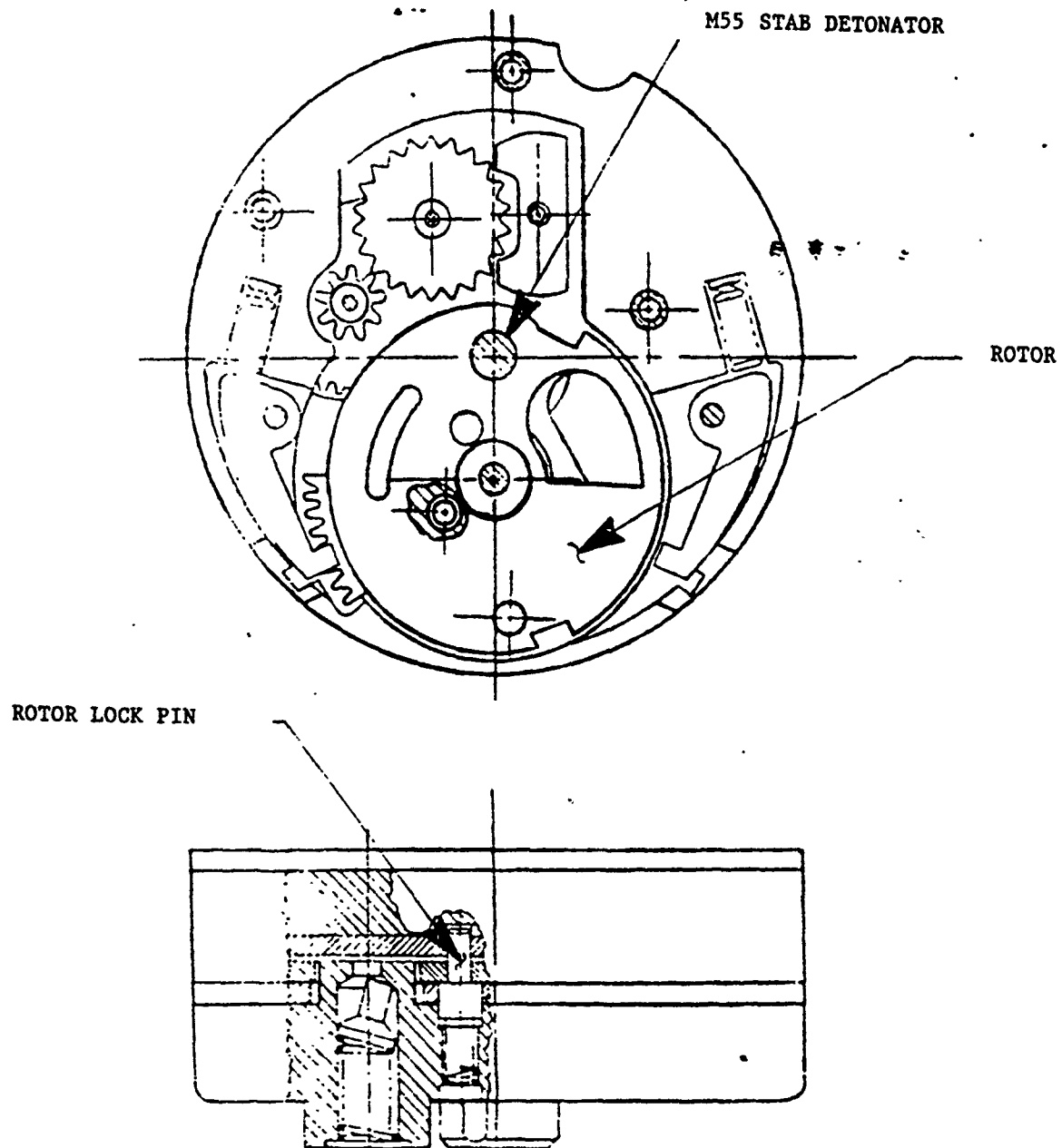
FIGURE D2



M739/M739A1 SAFING AND ARMING MODULE IN FLIGHT

ARMING, IN FLIGHT

FIGURE D3



M739/M739A1 SAFING AND ARMING MODULE  
FULLY ARMED IN FLIGHT

FIGURE D4

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