# TECHNICAL MANUAL

# DESCRIPTION, SAFETY, SERVICE, AND HANDLING INSTRUCTIONS (INTERMEDIATE)

# AIRBORNE ROCKETS



This publication supersedes NAVAIR 11-85-5 dated 15 February 1969, OP2210 dated 15 September 1966, OP1793 dated 14 September 1954, OP2626 dated December 1960, that part of OP1415 on Aircraft Rockets dated May 1955, that part of OP2219 on Aircraft Rocket VT Fuzes dated 1961.

Published by direction of the Commander, Naval Air Systems Command

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# LIST OF EFFECTIVE PAGES

Insert latest changed pages; dispose of superseded pages in accordance with applicable regulations.

NOTE: On a changed page, the portion of the text affected by the latest change is indicated by a vertical line, or other change symbol, in the outer margin of the page. Changes to illustrations are indicated by miniature pointing hands. Changes to wiring diagrams are indicated by shaded areas.

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# SECTION I

# INTRODUCTION

## 1-1. PURPOSE.

1-2. This publication is intended to provide authorized ordnance personnel with general and specific information relative to the description and assembly of airborne rockets (figure 1-1).

## 1-3. SCOPE.

1-4. This manual is published by the authority of the Commander, Naval Material Command under the direction of the Commander, Naval Air Systems Command. The manual describes and illustrates airborne rocket fuzes,

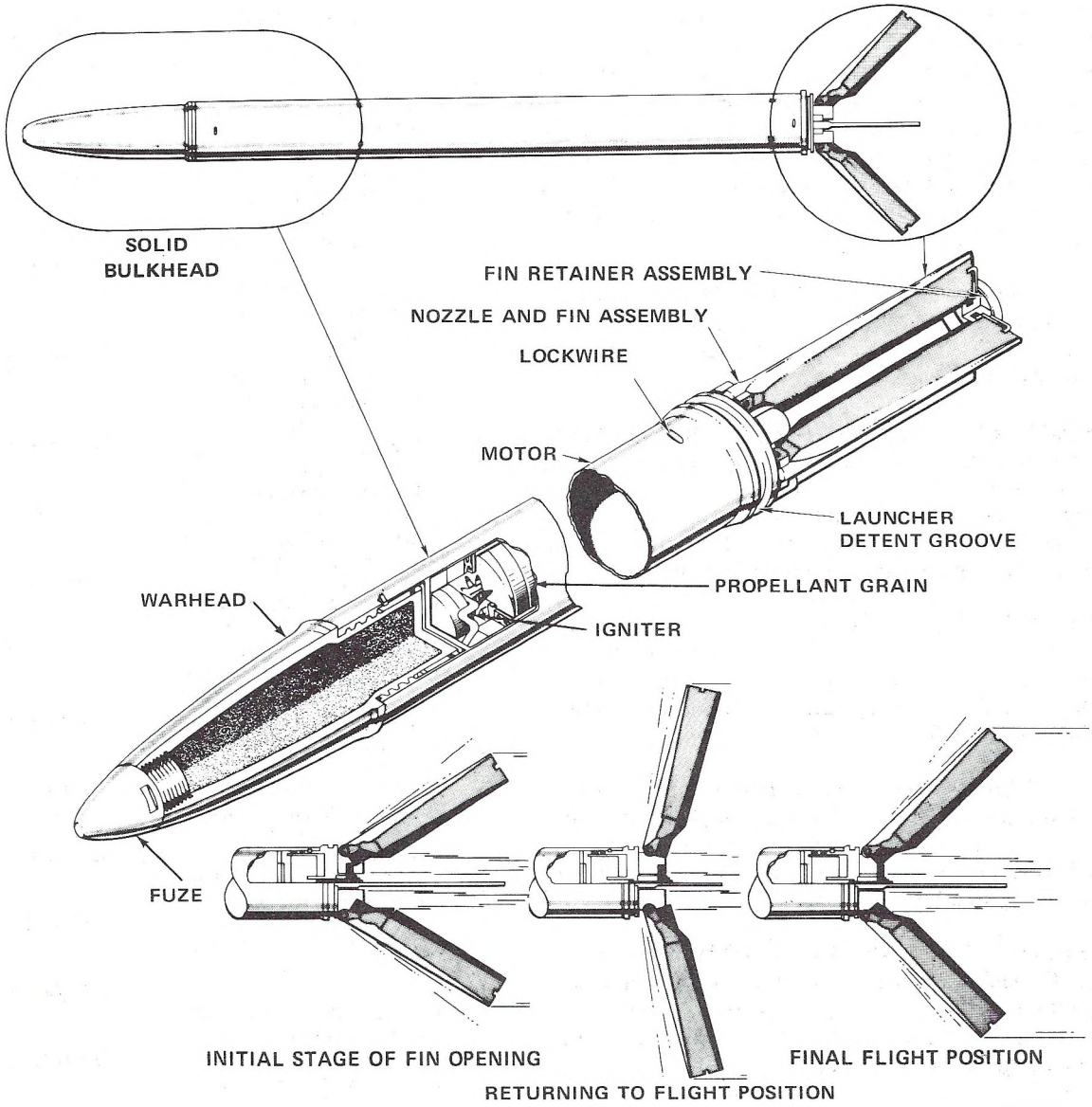



*Figure 1-1. Typical Airborne Rocket*

warheads and motors, authorized rocket assemblies and launchers, handling equipment, special tools and associated components. The text also includes information on component or equipment identification and function, model differences handling, assembly of components, and safety procedures.

NOTE

Specific information concerning detailed procedures for installing rocket assemblies into the launchers, rearming of the aircraft, and the aircraft release and control system checks are not included in this manual. Where applicable, the user is directed to the appropriate publication for detailed procedural data.

## 1-5. ARRANGEMENT.

1-6. This manual is divided into sections to provide detailed description, specifications and configuration, preparation for use and assembly, and required safety and handling procedures. Illustrations of airborne rocket assemblies and the major subassemblies thereof are also included. The family style grouping and the illustration of major subassemblies permits data to be presented with a minimum of cross-referencing. The manual is divided into the following sections.

**1-7. SECTION I – INTRODUCTION.** This section contains information relative to the purpose, scope, and arrangement of the manual, and includes tables of reference publications and technical directives.

**1-8. SECTION II – GENERAL SAFETY PRECAUTIONS.** This section contains the general safety precautions that authorized personnel shall observe in packing, unpacking, shipping, storing, handling, and performing assembly and inspection of rocket assemblies and rocket subassemblies. Additional safety publications are listed in table 1-1.

**1-9. SECTION III – ROCKET FUZES.** This section contains the characteristics and description, illustration and configuration, specific safety procedures, preparation for use and assembly, handling, and any specific emergency procedures required for rocket fuzes.

**1-10. SECTION IV – ROCKET WARHEADS.** This section contains the characteristics and description, illustration and configuration, specific safety procedures, preparation for use and assembly, handling, and any specific emergency procedures required for rocket warheads.

**1-11. SECTION V – ROCKET MOTORS.** This section contains the characteristics and description, illustration and configuration, specific safety procedures, preparation for use and assembly, handling, and any specific emergency procedures required for rocket motors.

**1-12. SECTION VI – AUTHORIZED AIRBORNE ROCKET ASSEMBLIES.** This section contains a tabular listing of various fuze, warhead, and motor configurations which may be assembled as complete airborne rockets. Illustrations show the external configurations and overall dimensions for various assemblies.

**1-13. SECTION VII – AIRBORNE ROCKET LAUNCHERS.** This section contains the characteristics and

*Table 1-1. Reference Publications*

| | |
|---|---|
| Airborne Weapons/Stores (Conventional/Nuclear) Checklist/SRC/Manual Publication Index | NAVAIR 01-700 |
| Radiation Hazards (C) | NAVAIR 16-1-529/ NAVORD OP3565 |
| Ammunition Afloat | NAVORD OP4 |
| Ammunition Ashore | NAVORD OP5 |
| Toxic Hazards Association with Pyrotechnic Items | NAVORD OP2793 |
| Navy Transportation Safety Handbook | NAVORD OP2165 |
| U.S. Navy Ordnance Safety Precautions | NAVORD OP3347 |
| Identification of Ammunition | NAVORD OP2238 |
| Naval Air Launched General Ordnance (C) | NAVAIR 00-120A-2 |
| LAU-3A/A Aircraft Rocket Launcher, Operation Instructions | NAVWEPS 11-75A-37 |
| Aero 7D Aircraft Rocket Launcher Package, Operation and Maintenance Instructions | NAVWEPS 11-5-597 |
| LAU-10/A Aircraft Rocket Launcher (ZUNI), Operation and Service Instructions | NAVWEPS 11-75A-20 |
| LAU-10A/A Aircraft Rocket Launcher (ZUNI), Operation and Service Instructions | NAVAIR 11-75A-20 |
| LAU-32A/A Aircraft Rocket Launcher, Operation Instructions | NAVWEPS 11-75A-36 |
| LAU-32B/A Airborne Rocket Launcher, Operation Instructions | NAVAIR 11-75A-41 |
| LAU-32/A Aircraft Rocket Launcher, Operation and Service Instructions | NAVWEPS 11-75AC-1 |
| LAU-33A/A Aircraft Rocket Launcher, Operations and Service Instructions | NAVAIR 11-75A-43 |
| LAU-35A/A Aircraft Rocket Launcher, Operation and Service Instructions | NAVAIR 11-75A-44 |
| LAU-56/A Airborne Rocket Launcher, Operation Instructions | NAVAIR 11-75A-42 |
| LAU-60/A Airborne Rocket Launcher, Operation Instructions | NAVAIR 11-75A-47 |
| LAU-61/A Airborne Rocket Launcher, Operation Instructions | NAVAIR 11-75A-50 |
| LAU-68/A Airborne Rocket Launcher, Operation Instructions | NAVAIR 11-75A-51 |
| LAU-69/A Airborne Rocket Launcher, Operation Instructions | NAVAIR 11-75A-52 |

description, illustration and configuration, specific safety procedures; and, by reference to basic launcher manuals, preparation for use and assembly; handling and specific emergency procedures required for various models of launchers.

## 1-14. REFERENCE PUBLICATIONS.

1-15. This manual provides the information necessary for authorized ordnance personnel to unpack, inspect, assemble, and perform post-assembly inspection of airborne rocket assemblies. The user shall refer to other publications for installation, inspection, maintenance, removal of airborne rockets from launchers, loading and unloading launchers on aircraft and aircraft rocket release and control system checks. Additional reference publications which are not listed in table 1-1 may be found in NAVSUP 2002, and NAVAIR 01-700.

## 1-16. REPORTING AIRBORNE ROCKET INCIDENTS, ACCIDENTS, OR MALFUNCTIONS.

1-17. Activities concerned with the operation, maintenance, inspection or repair of aircraft associated support equipment and airborne armament/weapon systems shall submit Unsatisfactory Material/Condition Reports (UR). The UR will be prepared and submitted in accordance with NAVAIRINST 4700.2, Chapter 15.

## 1-18. CHANGE RECOMMENDATIONS.

1-19. Recommended changes to this manual or reporting of conflicting information shall be submitted by an Unsatisfactory Material/Condition Report in accordance with NAVAIRINST 4700.2.

## 1-20. WARNINGS, CAUTIONS, AND NOTES.

1-21. The following definitions apply to Warnings, Cautions, and Notes found throughout this manual.

**WARNING**

An operating procedure, practice, etc., which if not correctly followed, could result in personal injury, or loss of life.

**CAUTION**

An operating procedure, practice, etc., which if not strictly observed, could result in damage to, or destruction of, equipment.

NOTE

An operating procedure, condition, etc., which it is essential to highlight.

## 1-22. PUBLICATION INFORMATION.

1-23. Management control of this manual is the responsibility of the Commander, Naval Air Systems Command. The manual was prepared by the Naval Missile Center, Point Mugu under general specification MIL-M-38784 and detailed specification MIL-M-81702, with the following activities furnishing source data: (1) Naval Weapons Center, China Lake; (2) Naval Ordnance Laboratory, White Oak; (3) Naval Ammunition Depot, Crane; (4) Naval Weapons Laboratory, Dahlgren; and (5) Naval Ammunition Depot, Earle. Source data cut-off date was June 1, 1970.

## 1-24. CHANGE SYMBOL.

1-25. Changed text is indicated by a black vertical line in either margin of the page, like the one printed next to this paragraph. The change symbol shows where there has been material added, revised, or information restated by a change.

## 1-26. HOW TO OBTAIN COPIES.

1-27. Additional copies of this publication may be obtained by submitting a DD form 1348 in accordance with the instructions contained in NAVSUP 2002, Section VIII, Part C and NAVSUP 437.

## 1-28. ROCKET ASSEMBLY IDENTIFICATION AND MARKING.

1-29. Airborne rocket fuze, warhead, motor, and rocket launcher nomenclature and type designations are assigned in accordance with Weapons Requirements WR-38 or MIL-STD-875 as applicable.

**1-30. ROCKET TYPES.** Rockets may be classed as either spin stabilized, fin/spin stabilized or fin stabilized. They may be further classed as to their purpose (service, practice, or dummy).

1. **Service Rockets.** Service rockets have live-loaded motors and warheads which carry a payload of high explosives, chemicals, or a special device.

2. **Practice Rockets.** Practice rockets have live-loaded motors with solid heads or heads loaded with an inert load (usually of plaster) and are used for target practice.

3. **Dummy Rockets.** Dummy rockets have an inert fuze, inert warhead, and an inert motor. They are used for instruction and display.

## 1-31. IDENTIFICATION.

**1-32. NAVY MARK (MK) AND MODIFICATION (MOD) NOMENCLATURE.** Nomenclature in the Navy Mk and Mod system consists of the item name followed by the caliber, Mk and Mod type designation. Example: Rocket Motor, 5.0-inch Mk 16 Mod 2.

**1-33. ARMY NOMENCLATURE.** Army components are designated by the letter M followed by an Arabic numeral. Modifications are indicated by addition of a letter and, if appropriate, an Arabic numeral. Example: Fuze M414A.

**1-34. AIR FORCE NOMENCLATURE.** Air Force components are designated by model numbers or the type designator nomenclature. Example: Fuze, Model 113A.

**1-35. TYPE DESIGNATION NOMENCLATURE.** The Type Designation Nomenclature system is defined as a combination of the item name and type designation. Typical example: Warhead, Practice, WTU-1/B. All airborne rockets and associated components under development by the Navy and Air Force will have Type Designation Nomenclature assigned in accordance with MIL-STD-875.

**1-36. Item Name.** Item name is defined as the name authorized and published in Federal Cataloging Handbook H6-1 or the name developed and subsequently approved for use by Defense Logistics Services Center.

**1-37. Type Designation.** Type designation is defined as the letter and number indicators combined in a specific sequence to provide a short significant method of identifying the equipment type.

**1-38. Drawing Numbers.** Components which are not assigned other nomenclature are designated by the drawing title and number.

**1-39. Color Coding.** Rocket warheads, motors, and accessories are painted different colors to distinguish explosive hazards (refer to MIL-STD-709 and NAVORD OP2238).

**1-40. Lot Numbers.** The ammunition lot system provides a means by which records may be maintained of components. The ammunition lot serves as a means of identification by which defective components may be restricted from issue or from service use. The lot number identification is also used for stowage and shipping records (refer to MIL-STD-1167, MIL-STD-1168, and NAVORD OP4 and 5).

**1-41. Data Cards.** Data cards are made for each ammunition lot of rockets and components, and contain information necessary to making out defective ammunition reports (MIL-STD-1168).

## 1-42. MARKING.

1-43. Fuzes, warheads, and motors are identified by legends which may be stenciled, rubber stamped, or indent stamped on their exterior. Refer to MIL-STD-130 and NAVORD OP2238 for information concerning marking and identification.

## 1-44. TECHNICAL DIRECTIVES.

1-45. Technical directives affecting airborne rockets and associated components incorporated in this manual are listed in table 1-2. Refer to NAVAIR 00-0500 and NAVSUP 2002 for complete list of technical directives.

**NOTE**

Technical directives incorporated in the contents of this manual are listed by type in numerical sequence and are retained in the summary as a permanent record of changes.

*Table 1-2. Record of Technical Directives*

| Number | Title | Issue Date | Category | Effectivity | Incorporated |
|---|---|---|---|---|---|
| AAB 311 | Air Launched Rockets – Safety requirements for circuit testing of | 9 Aug 1963 | URGENT | 2.75-Inch Folding Fin Aircraft Rockets (FFAR)<br>5.0-Inch Folding Fin Aircraft Rockets (FFAR) | BASIC |
| AAB 394 | 2.75 Rocket Launchers: Restrictions for | July 1966 | URGENT | AERO 6A<br>AERO 7D<br>LAU-3A/A<br>LAU-32A/A<br>LAU-56/A<br>LAU-60/A<br>Rocket Launchers | BASIC |
| AAC 519 | LAU-10/A ZUNI Rocket Launcher | 18 Nov 1968 | URGENT | LAU-10/A ZUNI Launcher | REV 1 |

# SECTION II

# GENERAL SAFETY PRECAUTIONS

## 2-1. INTRODUCTION.

2-2. The safety precautions in this section are necessarily general and as such must be supplemented by the special precautions listed for each specific piece of ordnance or equipment involved.

2-3. Such supplementary precautions are also mandatory as they enumerate detail problem areas and potential hazards.

2-4. The scope of this chapter is restricted to operations with ordnance material and equipment issued to naval forces and does not include manufacturing, processing, or laboratory testing. Reference should be made to appropriate publications of the Naval Air Systems Command and the Naval Ordnance Systems Command for information pertaining to these areas.

## 2-5. GENERAL.

2-6. Specific safety regulations, cautions, and warnings are found throughout this publication where applicable regarding the preparation and assembly of airborne rockets. When in doubt as to the exact meaning of safety precautions, an interpretation shall be requested from the Commander Naval Air Systems Command. Personnel shall consult the basic manuals and handbooks for all armament weapons material for additional safety warnings for operations involving airborne rockets not contained in this manual.

2-7. Any circumstances which conflict with the safety precautions, or which require changes or additions, shall be reported in accordance with Unsatisfactory Material/ Condition Report requirements NAVAIRINST 4700.2.

1. Only personnel who are authorized to handle airborne rockets should be in the vicinity of assembly operations. Personnel shall use only those special tools and holding fixtures specified when assembling airborne rockets.

2. During the handling of airborne rockets, rocket components, and launchers, all safety practices applying to airborne armament and weapons must be followed. Insofar as practicable, all work shall be performed from the side of the rocket.

3. The number of personnel and the quantity of explosives present in a given area should be kept to the minimum required.

4. Assembled rocket ammunition should be moved to the designated storage area as soon as practicable after completion of assembly operations.

5. Personnel assembling rocket ammunition shall wear appropriate protective clothing.

2-8. Handling and storage of rockets and components afloat and ashore shall be in accordance with NAVORD OP4, NAVORD OP5, and Radiation Hazards (RADHAZ) Manual NAVORD OD3565/NAVAIR 16-1-529 and NAVORD OP3347.

## 2-9. SAFETY PRECAUTIONS FOR ROCKETS.

2-10. Refer to applicable safety manual in table 1-1 and observe the following specific precautions when handling, shipping, or storing rockets:

**WARNING**

To prevent possible explosion, do not expose airborne rockets or launchers with airborne rockets installed to exhaust from jet engine starter pods or gas turbine compressors. A minimum distance as indicated on the unit must be maintained between the gas turbine exhaust path and any rocket assemblies upon which the exhaust impinges. In the absence of specific information on the unit, a minimum distance of 10 feet must be maintained.

1. Rockets which have been accidentally released from aircraft launchers on landing must be considered armed. Such rockets shall be disposed of in accordance with current directives.

2. Do not make changes or additions to rockets, launchers, or components thereof without explicit authority from Naval Air Systems Command.

3. An airborne weapon or explosive assembly shall not be used in any rocket launcher for which it is not designated.

4. Only inert weapons shall be used for drill or display.

5. Particular caution shall be exercised during handling of rocket motors to avoid propellant grain damage or fracture.

6. Personnel handling rockets shall be certified in accordance with OPNAVINST 3571.2.

## 2-11. SAFETY PRECAUTIONS FOR FUZES.

2-12. Refer to the applicable safety manual listed in table 1-1 and observe the following specific precautions when handling, shipping, or storing these fuzes:

1. Fuzes which are damaged are hazardous items and shall be disposed of in accordance with current directives.

2. Fuzes dropped 5 feet or more onto a hard surface, shall be disposed of in accordance with current directives.

3. Fuzes found corroded should be returned to an ammunition depot as issued.

4. Do not remove fuzes from warheads which do not contain fuze cavity liners.

## 2-13. SAFETY PRECAUTIONS FOR WARHEADS.

2-14. Refer to the applicable safety manuals listed in table 1-1 and observe the following specific precautions when handling, shipping, or storing warheads:

1. Warheads which are damaged are hazardous and shall be disposed of in accordance with current directives.

2. If a warhead is dropped and impacts on a hard surface after falling 5 feet or more, dispose of in accordance with current directives.

3. Fuzed rocket warheads shall be treated as fuzed projectiles. Refer to OP4 and OP5 for detailed precautions.

## 2-15. SAFETY PRECAUTIONS FOR MOTORS.

2-16. Refer to the applicable safety manual listed in table 1-1 and observe the following specific precautions when handling, shipping, or storing motors:

**WARNING**

The electrical continuity of a rocket motor igniter circuit shall not be checked.

1. If a rocket motor is dropped and any portion impacts on a hard surface after falling 2 feet or more, do not use. Cracks or breaks in the grain increase the carefully calculated burning area and cause excessive internal pressure buildup, which may result in motor blow up after ignition.

2. Rocket motors that are damaged are hazardous and shall be disposed of in accordance with current directives.

## 2-17. ASSEMBLY SAFETY PRECAUTIONS.

2-18. The assembly and fuzing of airborne rockets shall be conducted in a designated assembly area and as close to the time of aircraft re-arming as possible.

**WARNING**

Before attempting assembly or loading of airborne rockets, refer to NAVAIR 16-1-529/ NAVORD OD3565 for appropriate RADHAZ precautions and to the appropriate NAVAIR manual on the launcher to avoid injury to personnel and hazard to ships.

**NOTE**

Refer to NAVAIRINST 8020 for definition of designated assembly areas.

1. Do not assemble a high-explosive loaded rocket warhead to a motor without first making sure that the base fuze hole has a base fuze or NAVAIR approved steel base plug installed.

2. Disassembly or alteration of rocket components is not authorized except under specific instructions from Naval Air Systems Command.

## 2-19. SAFETY PRECAUTIONS FOR LAUNCHERS.

2-20. Refer to the applicable launcher handbook listed in table 1-1 and observe the following specific precautions when handling, shipping or storing loaded launchers:

**WARNING**

The electrical continuity of loaded rocket launchers shall not be checked.

1. Safety/Arming device must be in safe position.

2. Required RADHAZ Barriers must be installed.

3. No electrical power source or test equipment shall be connected to the launcher with rocket motors installed.

4. Shock pans shall be installed on launchers stored in magazines.

## 2-21. HANDLING SAFETY PRECAUTIONS.

2-22. Refer to the applicable safety manual listed in table 1-1 and observe the following specific precautions when handling rockets and components:

1. Handle all components as little as possible.

2. Authorized personnel who will be involved in handling shall be instructed as to the nature of the material

and only those men essential for handling shall be in the area.

3. Personnel working with smoke warheads shall be equipped with and required to use proper and adequate protective devices and clothing in accordance with NAVORD OP2793. When entering smoke clouds produced by smoke rockets, personnel shall use gas masks.

4. If a loaded launcher is dropped do not use until the launcher tubes, latching mechanisms and rockets are inspected for damage.

## 2-23. STORAGE SAFETY PRECAUTIONS.

2-24. Refer to the applicable manuals listed in table 1-1 and observe the following specific precautions when storing rocket motors and warheads:

1. Rocket warheads, which have fuzes issued separately, shall not be stored with these fuzes installed.

2. Rocket motors and electric or electronic fuzes shall not be stored in the same compartment with, or be within five feet of, any unshielded transmitting apparatus or unshielded antenna leads. Refer to NAVAIR 16-1-529/ NAVORD OD3565.

3. Matches, naked lights, flame producing devices, or any open flames are forbidden in the magazine areas.

4. Warheads containing pyrotechnic material shall be stored in regular pyrotechnic storage spaces.

5. Nothing shall be stored in rocket ammunition magazines except rocket ammunition, containers, and authorized magazine equipment. Material susceptible to spontaneous combustion shall not be stored in these places.

6. Ready-service storage of assembled rockets is authorized for the 2.75-inch and 5.0-inch folding fin aircraft rockets in accordance with OP4 and OP5.

7. Rockets should be protected from direct sunlight.

8. Warheads containing white phosphorus (WP) or plasticized white phosphorus (PWP) shall not be stored with other warheads.

# SECTION III

# ROCKET FUZES

## 3-1. INTRODUCTION.

3-2. Rocket fuzes are primarily classified according to their location in the warhead; that is, nose fuze or base fuze. They may be further classified by mode of operation such as, impact firing, mechanical time, acceleration and deceleration, or proximity. All fuzes contain safety/arming devices to prevent detonation during normal transporting, handling and launch of the complete rocket. Inert fuzes are available for drill and display. Refer to tables 6-1, 6-2, and 6-3 for authorized fuze-rocket combinations.

**WARNING**

Disassembly of airborne rocket fuzes is not authorized except under specific instructions from Naval Air Systems Command to forestall possible injury to personnel.

**WARNING**

Fuzes which are damaged to any extent are hazardous items and should be disposed of in accordance with current directives. Corroded fuzes should be returned to an ammunition depot. Failure to comply could result in serious injury to personnel.

**CAUTION**

Sensitive explosive materials, such as those in fuzes, lose their effectiveness if they absorb moisture. For shipping, fuzes are packaged in sealed containers. Special care should be taken to prevent damage from moisture.

**3-3. IMPACT FIRING FUZES.** Impact firing fuzes (figure 3-1) are fuzes that function when the rocket strikes a target which offers sufficient resistance to cause crushing or other disarrangement of actuating parts.

3-4. All current impact firing rocket fuzes have the same type of safety/arming mechanism. This mechanism consists of an unbalanced rotor which, under setback forces, drives a gear-train timing system (figure 3-2). A given minimum acceleration over a given length of time is required to complete the arming cycle. If acceleration of the rocket is too low or extends over too short a period of time, the arming mechanism will return to the unarmed condition. The timing mechanism provides a safe separation distance from the launcher before arming.

3-5. If the fuze is dropped it may become inoperable or the arming may be started. However, the arming cycle will not be complete because the inertial force caused by impacting is of insufficient time duration. Although the fuze is not armed, it may be unserviceable.

3-6. These fuzes may be located in the nose of the warhead, in which case they are called point detonating fuzes, or located in the base of the warhead and are called base detonating fuzes. Nose and base fuzes are designed to function either instantaneously, or after a short delay that gives the warhead time to penetrate the target before functioning.

**3-7. MECHANICAL TIME FUZES.** Mechanical time fuzes are fuzes that function by the action of a mechanical timer.

3-8. These fuzes contain a safety/arming device and a clock mechanism. The arming mechanism is similar to those in impact detonating fuzes and requires a minimum acceleration over a given time to complete the arming cycle. Upon arming, the mechanical timer is started, and after a set elapsed time, the fuze initiates the firing train.

**3-9. ACCELERATION-DECELERATION FUZES.** Acceleration-deceleration fuzes are similar to impact and time fuzes in that they require acceleration for a given time to complete the arming cycle. After the arming cycle is complete and when the rocket velocity begins to drop, this deceleration causes the fuze to function.

**3-10. PROXIMITY FUZES.** Proximity fuzes, sometimes referred to as VT fuzes, are those fuzes wherein initiation occurs by sensing, usually by electronic means, the presence and distance of a target. The proximity fuzes in this manual are primarily used in air-to-ground operations where air bursts above the target are desired. These fuzes are not suitable for use against targets which require penetration and detonation within the target for effective destruction.

3-11. In general, proximity fuzes consist of an electronics package in the forward end, a thermal battery, a safety/arming device and an explosive booster in the base. The arming mechanism is similar to those in impact detonating

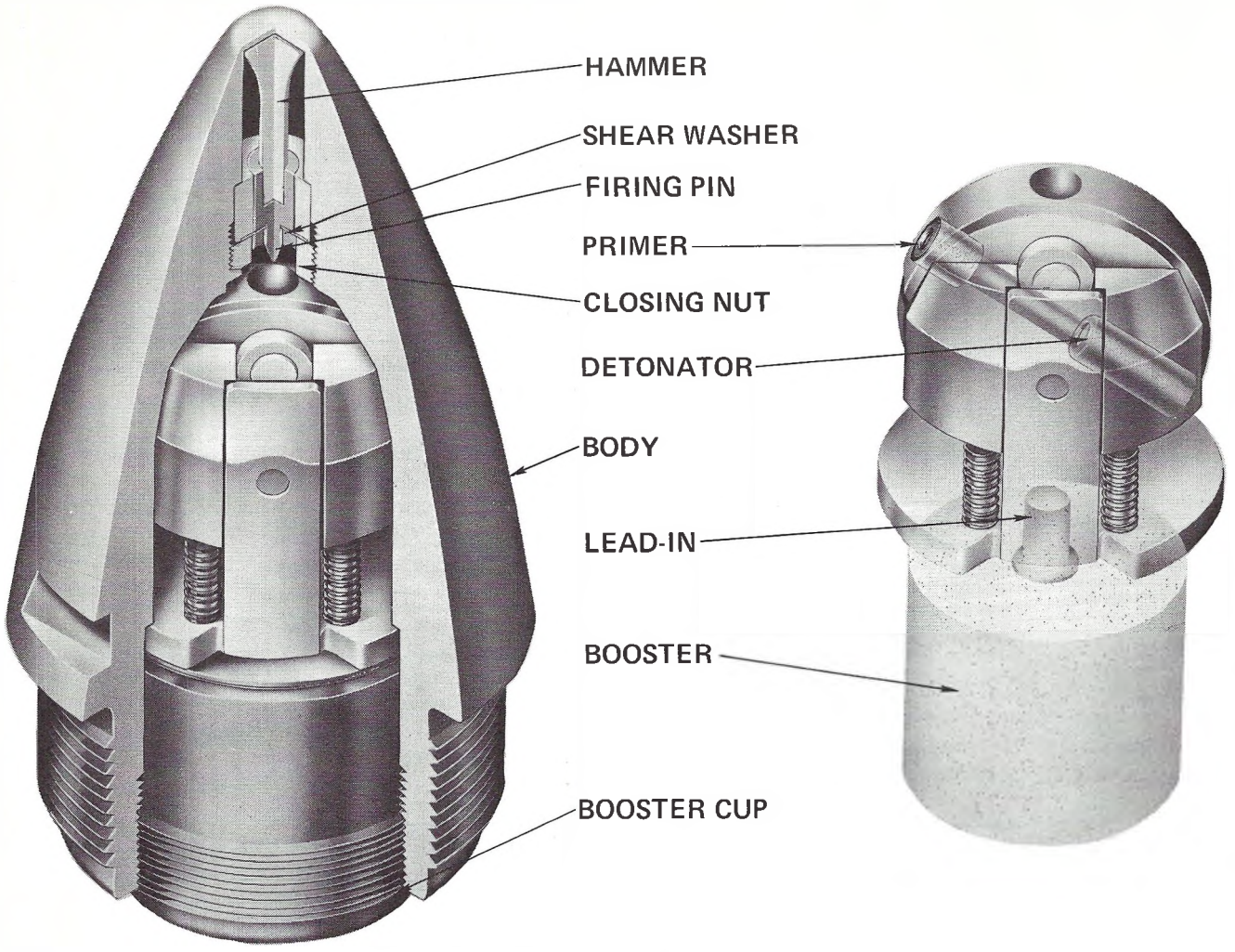



*Figure 3-1. Typical Impact Firing Fuze Assembly*

fuzes and requires a minimum acceleration over a given time to complete the arming cycle.

3-12. Unpackaged proximity fuzes are likely to deteriorate if exposed to warm, humid conditions longer than one or two days. Fuzes should be unpacked only when they are required for use. Fuzes which are returned to storage must be stored in a cool dry place or otherwise protected from dampness and high temperatures. They should be repackaged in individual containers and the containers sealed with tape. Additional moistureproof packing or moisture-absorbing material may be added either internally or externally as further protection. Repackaged fuzes should always be used before using fuzes in originally sealed containers.

## 3-13. MK 176 MOD 1 IMPACT FIRING FUZE (POINT DETONATING).

**3-14. INTRODUCTION.** The Mk 176 Mod 1 fuze (figure 3-3) is similar to the typical acceleration-arming, point detonating fuze described in paragraph 3-3. This fuze is designed for use with the 2.75-inch FFAR.

**3-15. CHARACTERISTICS AND DESCRIPTION.** Characteristics for the Mk 176 Mod 1 fuze are listed in table 3-1. This fuze is designed for delayed action. A delay element in the rotor is located between the primer and the detonator.

**3-16. CONFIGURATION.** Configuration of the Mk 176 Mod 1 fuze is shown in figure 3-4.

**3-17. SAFETY.** No specific safety precautions, other than those described in section II and those normally observed in the handling of explosive materials, are required for the Mk 176 Mod 1 fuze.

**3-18. PREPARATION FOR USE AND ASSEMBLY.** No specific preparation for use or assembly is required for the Mk 176 Mod 1 fuze.

**3-19. HANDLING.** No specific handling procedures other than those described in section II are required for the Mk 176 Mod 1 fuze.

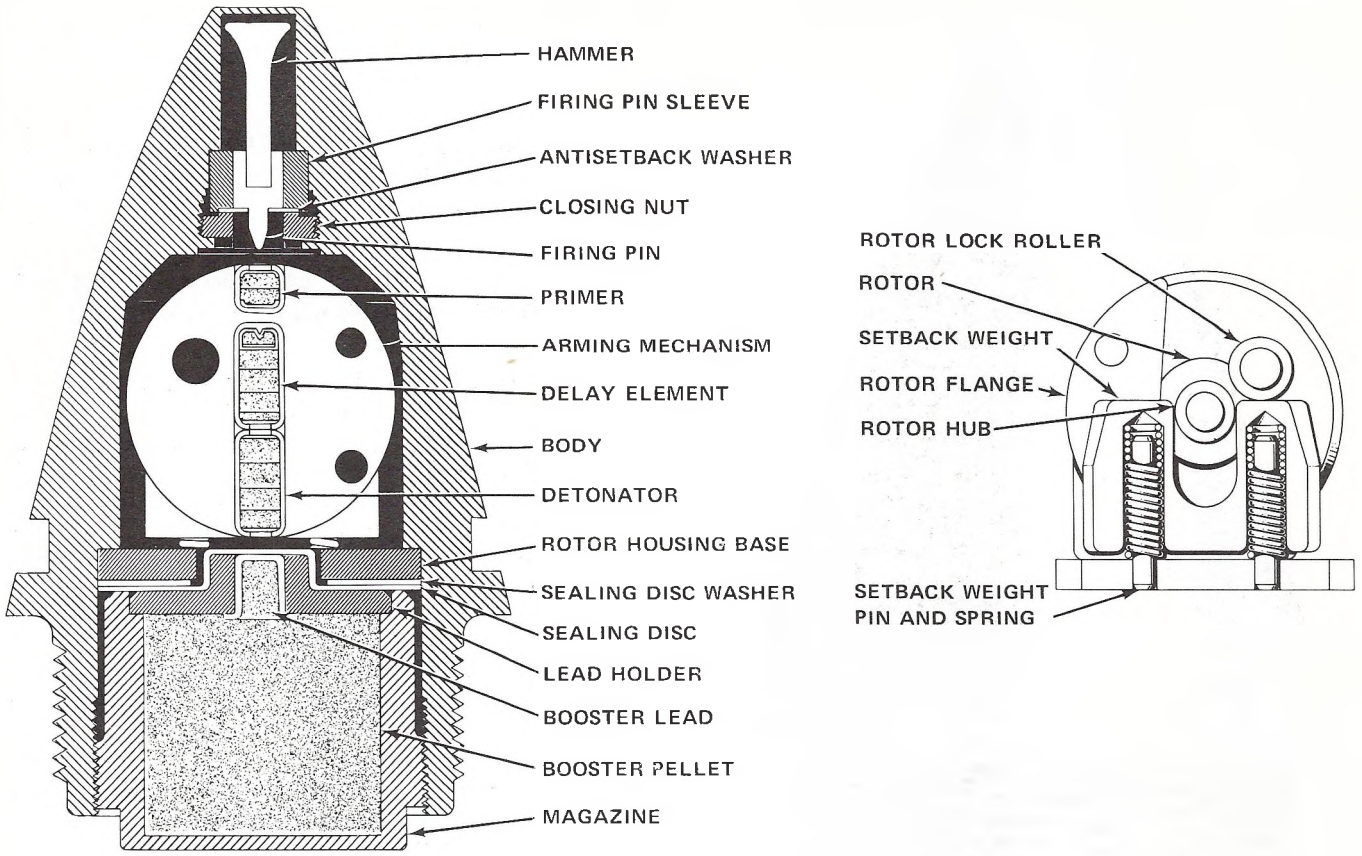



*Figure 3-2. Armed Fuze Assembly*

*Table 3-1. Mk 176 Mod 1 Fuze Characteristics*

| | |
|---|---|
| Type | Point detonating |
| Nominal Weight (lb) | 0.75 |
| Overall Length (in.) | 3.01 |
| Arming Distance (ft) | 400–1200 |
| Delay Time (sec) | 0.0004 |
| Sensitive to Firing on Water Impact | Not reliable |
| Explosive Components: | |
| Primer (Mk 125 Mod 0): | |
| Type | Stab |
| Contents | Lead azide primer mix and lead azide |
| Delay Element (Mk 10 Mod 0): | |
| Type | Pyrotechnic |
| Contents | Lead peroxide, nickel and zirconium |
| Detonator (Mk 59 Mod 0): | |
| Type | Flash |
| Contents | Tetryl and lead azide |
| Booster and Lead-In | Tetryl |

**3-20. EMERGENCY PROCEDURES.** No specific procedures other than those described in section II are required for the Mk 176 Mod 1 fuzes.

## 3-21. MK 178 MOD 1 AND MOD 2 IMPACT FIRING FUZE (POINT DETONATING).

**3-22. INTRODUCTION.** The Mk 178 Mod 1 and Mod 2 fuzes (figure 3-5) are similar to the typical acceleration-arming, point detonating fuze described in paragraph 3-3. These fuzes are designed for use with the 2.75-inch FFAR.

**3-23. CHARACTERISTICS AND DESCRIPTION.** Characteristics for the Mk 178 Mod 1 and Mod 2 fuze are listed in table 3-2. These fuzes are designed for instantaneous action. There is no delay element in the rotor between the primer and the detonator.

**3-24. CONFIGURATION.** Configuration of Mk 178 Mod 1 and Mod 2 fuzes are shown in figure 3-6. They differ only in minor design changes.

**3-25. SAFETY.** No specific safety precautions, other than those described in section II and those normally observed in the handling of explosive materials are required for the Mk 178 Mod 1 and Mod 2 fuzes.

**3-26. PREPARATION FOR USE AND ASSEMBLY.** No specific preparation for use or assembly is required for the Mk 178 Mod 1 and Mod 2 fuzes.

*Figure 3-3. Mk 176 Mod 1 Point Detonating Fuze*

**3-27. HANDLING.** No specific handling procedures other than those described in section II are required for the Mk 178 Mod 1 and Mod 2 fuzes.

**3-28. EMERGENCY PROCEDURES.** No specific procedures other than those described in section II are required for the Mk 178 Mod 1 and Mod 2 fuzes.

## 3-29. MK 181 MOD 0 AND MOD 1 IMPACT FIRING FUZE (POINT DETONATING).

**3-30. INTRODUCTION.** The Mk 181 Mod 0 and Mod 1 fuzes (figure 3-7) are similar to the typical acceleration-arming, point detonating fuze described in paragraph 3-3. These fuzes are designed for use with the 2.75-inch FFAR. The major innovations in these fuzes are the impact-sensitive primer, the absence of a firing pin and the shaped-charge booster. The primer is protected from accidental ignition by an air gap between the windshield and that part of the fuze body which houses the primer.

**3-31. CHARACTERISTICS AND DESCRIPTION.** Characteristics for the Mk 181 Mod 0 and Mod 1 fuze are listed in table 3-3. At normal impact velocities these fuzes will function against such targets as earth or mild steel plate of a minimum thickness of 0.125 inch. On armored targets, they will function at angles-of-impact between 0 and 60 degrees from the perpendicular to the armor.

**3-32. CONFIGURATION.** Configuration of the Mk 181 Mod 0 and Mod 1 fuzes are shown in figure 3-8. The Mod 1 fuze is the same as the Mod 0 fuze, except for minor design changes.

**3-33. SAFETY.** No specific safety precautions, other than those described in section II and those normally observed in the handling of explosive materials are required for the Mk 181 Mod 0 and Mod 1 fuzes.

*Table 3-2. Mk 178 Mod 1 and Mod 2 Fuze Characteristics*

| | | |
|---|---|---|
| Type | Point detonating | Point detonating |
| Mod | 1 | 2 |
| Nominal Weight (lb) | 0.75 | 0.75 |
| Overall Length (in.) | 3.01 | 3.01 |
| Arming Distance (ft) | 400–1200 | 400–1200 |
| Delay Time (sec) | None | None |
| Sensitive to Firing on Water Impact | Not reliable | Not reliable |
| Explosive Components: | | |
| Primer (Mk 125 Mod 0): | | |
| Type | Stab | Stab |
| Contents | Lead azide primer mix and lead azide | Lead azide primer mix and lead azide |
| Detonator (Mk 59 Mod 0): | | |
| Type | Flash | Flash |
| Contents | Tetryl and lead azide | Tetryl and lead azide |
| Booster and Lead-In | Tetryl | Tetryl |

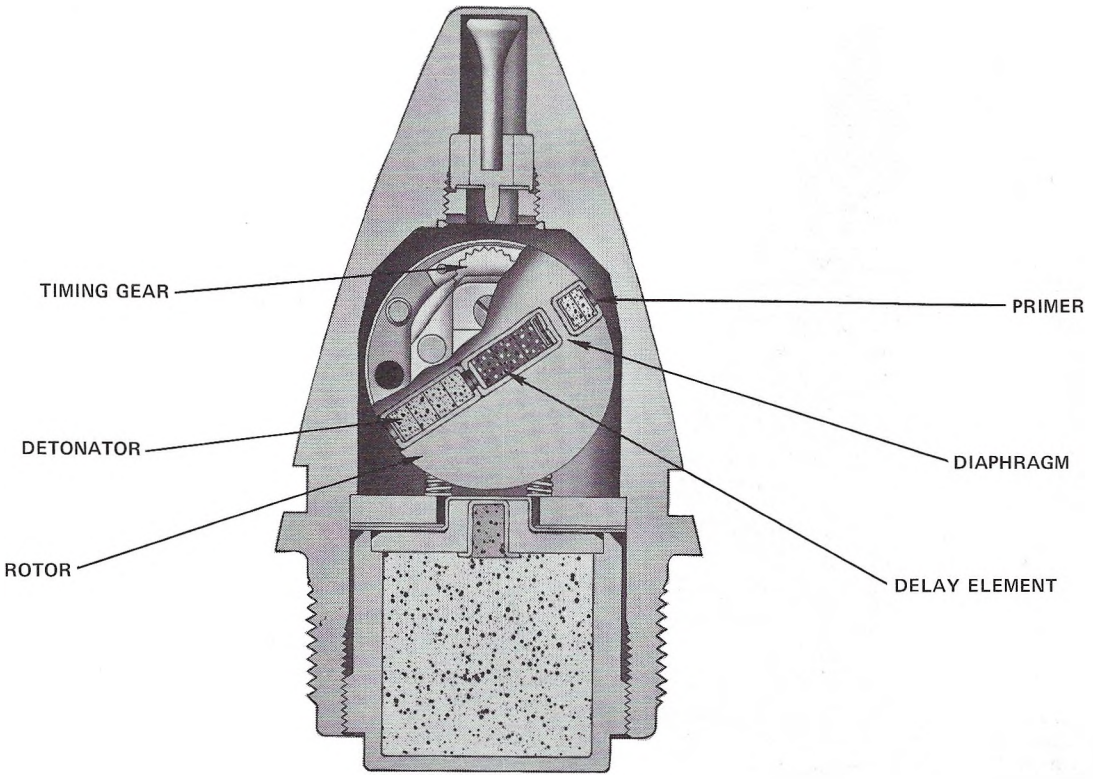



*Figure 3-4. Mk 176 Mod 1 Point Detonating Fuze Configuration (Unarmed)*

**3-34. PREPARATION FOR USE AND ASSEMBLY.** No specific preparation for use or assembly is required for the Mk 181 Mod 0 and Mod 1 fuzes.

**3-35. HANDLING.** No specific handling procedures other than those described in section II are required for the Mk 181 Mod 0 and Mod 1 fuzes.

*Table 3-3. Mk 181 Mod 0 and Mod 1 Fuze Characteristics*

| | | |
|---|---|---|
| Type | Point detonating | Point detonating |
| Mod | 0 | 1 |
| Nominal Weight (lb) | 0.82 | 0.82 |
| Overall Length (in.) | 3.37 | 3.37 |
| Arming Distance (ft) | 400–1200 | 400–1200 |
| Delay Time (sec) | None | None |
| Sensitive to Firing on Water Impact | Not reliable | Not reliable |
| Explosive Components: | | |
| Primer (Model M56): | | |
| Type | Crush | Crush |
| Contents | Potassium chlorate, antimony sulfide, lead thiocyanate, and lead azide | Potassium chlorate, antimony sulfide, lead thiocyanate, and lead azide |
| Detonator (Model M29): | | |
| Type | Flash | Flash |
| Contents | Potassium chlorate, antimony sulfide, lead azide, tetryl, and carborundum | Potassium chlorate, antimony sulfide, lead azide, tetryl, and carborundum |
| Booster (Model M122): | | |
| Type | RDX mix, shaped charge | RDX mix, shaped charge |
| Lead-In (2) | RDX mix | RDX mix |

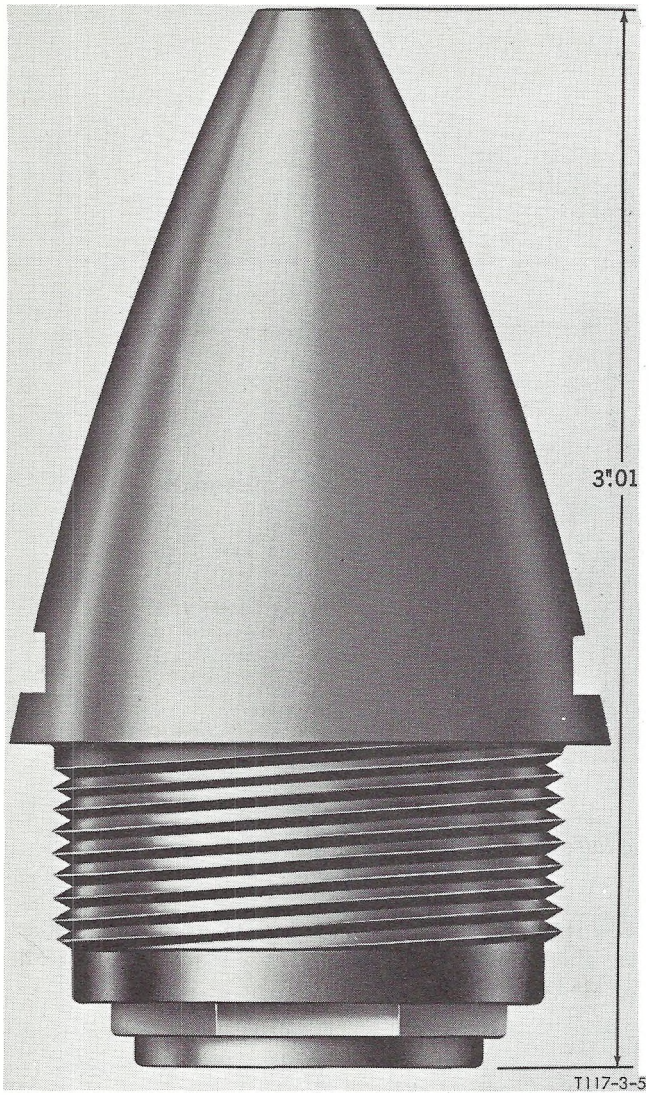



*Figure 3-5. Mk 178 Mod 1 and Mod 2 Point Detonating Fuzes*

**3-36. EMERGENCY PROCEDURES.** No specific procedures other than those described in section II are required for the Mk 181 Mod 0 and Mod 1 fuzes.

## 3-37. MK 188 MOD 0 IMPACT FIRING FUZE (POINT DETONATING).

**3-38. INTRODUCTION.** The Mk 188 Mod 0 fuze (figure 3-9) is similar to the typical acceleration-arming, point detonating fuze described in paragraph 3-3. This fuze is designed for use with the Mk 24 Mod 0, Mk 32 Mod 0 and Mk 34 Mod 0 warheads used in conjunction with the 5.0-inch FFAR.

**3-39. CHARACTERISTICS AND DESCRIPTION.** Characteristics for the Mk 188 Mod 0 fuze are listed in table 3-4. Because of the design of the nose and striker assembly, this fuze is capable of functioning at low angles of impact.

**3-40. CONFIGURATION.** Configuration of the Mk 188 Mod 0 fuze is shown in figure 3-10.

*Table 3-4. Mk 188 Mod 0 Fuze Characteristics*

| | |
|---|---|
| Type | Point Detonating |
| Nominal Weight (lb) | 0.75 |
| Overall Length (in.) | 5.11 |
| Arming Distances (ft) | 400–1200 |
| Delay Time (sec) | None |
| Sensitive to Firing on Water Impact | Yes |
| Explosive Components: | |
| Primer (Mk 125 Mod 0): | |
| Type | Stab |
| Contents | Lead azide primer mix and lead azide |
| Detonator (Mk 59 Mod 0): | |
| Type | Flash |
| Contents | Tetryl and lead azide |
| Booster and Lead-In | Tetryl |

**3-41. SAFETY.** No specific safety precautions, other than those described in section II and those normally observed in the handling of explosive materials are required for the Mk 188 Mod 0 fuze.

**3-42. PREPARATION FOR USE AND ASSEMBLY.** No specific preparation for use or assembly is required for the Mk 188 Mod 0 fuze.

**3-43. HANDLING.** No specific handling procedures other than those described in section II are required for the Mk 188 Mod 0 fuze.

**3-44. EMERGENCY PROCEDURES.** No specific procedures other than those described in section II are required for the Mk 188 Mod 0 fuze.

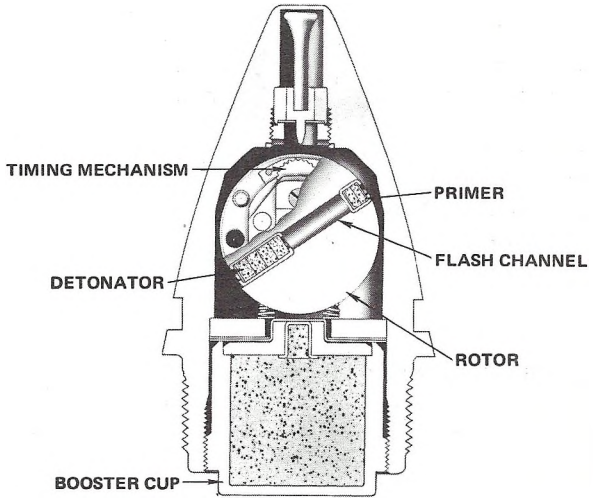



*Figure 3-6. Mk 178 Mod 1 and Mod 2 Point Detonating Fuze Configuration (Unarmed)*


*Figure 3-7. Mk 181 Mod 0 and Mod 1 Point Detonating Fuze*

## 3-45. MK 352 MOD 2 IMPACT FIRING FUZE (POINT DETONATING).

**3-46. INTRODUCTION.** The Mk 352 fuze (figure 3-11) is similar to the typical acceleration-arming point detonating fuze described in paragraph 3-3 and is designed for use with the 2.75-inch rocket. An adapter booster BBU 15/B is available to permit use of the Mk 352 in 5.0-inch rocket applications.

**3-47. CHARACTERISTICS AND DESCRIPTION.** Characteristics of the Mk 352 fuze are listed in table 3-5. This fuze provides for functioning at low angles of impact and reliable functioning against soft targets. The fuze functions properly when fired against 0.016-inch thick aluminum sheet at impact angles of 5 degrees. It also functions on water impact.

**3-48. CONFIGURATION.** The Mk 352 fuze is a redesigned Mk 188 ZUNI fuze and is scaled down to fit the 2.75-inch rocket warheads. Configuration of the BBU 15/B adapter booster is shown in figure 3-12.

*Table 3-5. Mk 352 Mod 2 Fuze Characteristics*

| | |
|---|---|
| Type | Point Detonating |
| Mk | 352 |
| Mod | 2 |
| Nominal Weight (lb) | 0.5 |
| Overall Length (in.) | 3.0 |
| Arming Distance (ft) | 400–1200 |
| Delay Time (sec) | None |
| Sensitive to Functioning on Water Impact | Yes |
| Explosive Components: | |
| Primer (Mk 125 Mod 1): | |
| Type | Stab |
| Contents | NOL No. 130 Primer and lead azide |
| Detonator (Mk 59 Mod 0): | |
| Type | Flash |
| Contents | Tetryl and lead azide |
| Booster and Lead-In | Tetryl |

**3-49. SAFETY.** No specific safety precautions other than those described in section II, or normally observed in the handling of explosive materials are required for the Mk 352 fuze.

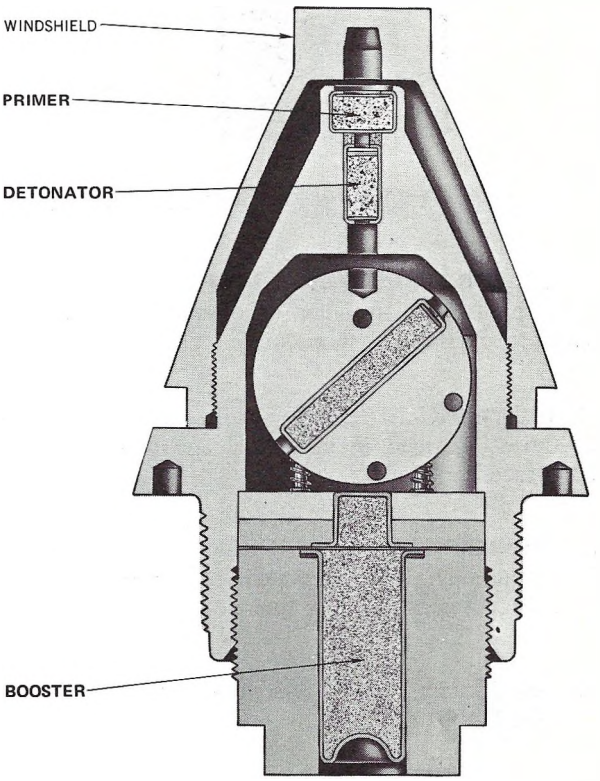



*Figure 3-8. Mk 181 Mod 0 and Mod 1 Point Detonating Fuze Configuration*

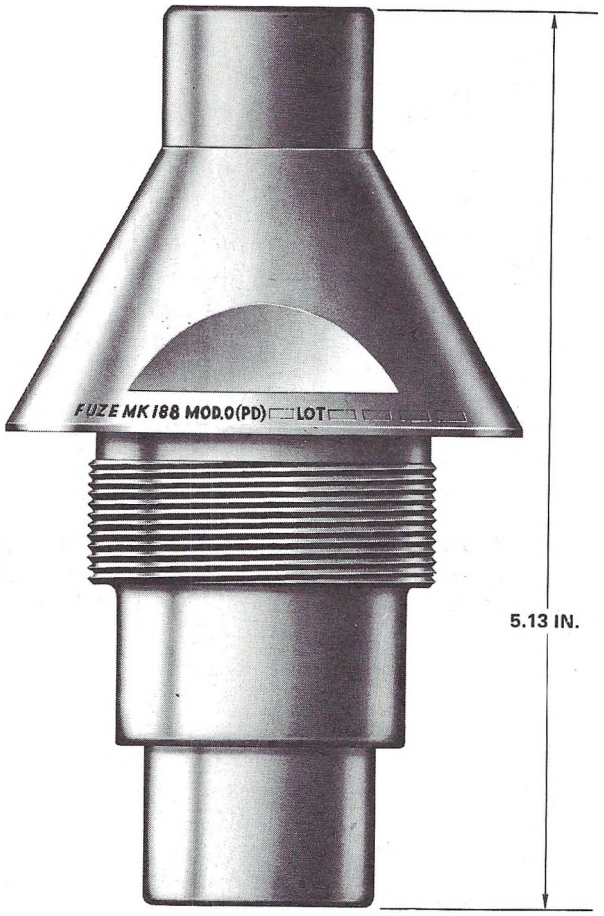



*Figure 3-9. Mk 188 Mod 0 Point Detonating Fuze*

**3-50. PREPARATION FOR USE AND ASSEMBLY.** No specific preparation for use or assembly procedures is required for the Mk 352 fuze.

**3-51. HANDLING.** No specific handling procedures, other than those described in section II are required for the Mk 352 fuze.

**3-52. EMERGENCY PROCEDURES.** No specific procedures other than those described in section II are required for the Mk 352 fuze.

## 3-53. M423 IMPACT FIRING FUZE (POINT DETONATING).

**3-54. INTRODUCTION.** The M423 fuze (figure 3-13) is similar to the typical acceleration-arming, point detonating fuze described in paragraph 3-3. This fuze is designed for use with the 2.75-inch LSFFAR.

**WARNING**

The M423 fuze was designed to be used on rockets fired from helicopters and low speed aircraft. Because of the shorter arming time, it must not be used on rockets which are to be fired from high speed aircraft.

**3-55. CHARACTERISTICS AND DESCRIPTION.** Characteristics of the M423 fuze are listed in table 3-6. This fuze is a redesigned Mk 178 fuze with modifications providing lower angles of impact, shorter arming range and greater reliability against soft targets. This fuze is reliable for impact angles as low as five degrees against soft targets.

*Table 3-6. M423 Fuze Characteristics*

| | |
|---|---|
| Type | Point Detonating |
| Army Nomenclature | M423 |
| Nominal Weight (lb) | 0.62 |
| Overall Length (in.) | 4.035 |
| Arming Distance (ft) | 140–300 |
| Delay Time (sec) | None |
| Sensitive to Firing on Water Impact | Yes |
| Explosive Components: | |
| Primer (Model M104): | |
| Type | Stab |
| Contents | Lead styphnate |
| Detonator (Mk 59 Mod 0): | |
| Type | Flash |
| Contents | Tetryl and lead azide |
| Booster and Lead-In | Tetryl |

**3-56. CONFIGURATION.** Configuration of the M423 fuze is shown in figure 3-13.

**3-57. SAFETY.** No specific safety precautions, other than those described in section II and those normally observed in the handling of explosive materials are required for the M423 fuze.

**3-58. PREPARATION FOR USE AND ASSEMBLY.** No specific preparation for use or assembly is required for the M423 fuze.

**3-59. HANDLING.** No specific handling procedures other than those described in section II are required for the M423 fuze.

**3-60. EMERGENCY PROCEDURES.** No specific procedures other than those described in section II are required for the M423 fuze.

## 3-61. M427 IMPACT FIRING FUZE (POINT DETONATING).

**3-62. INTRODUCTION.** The M427 fuze (figure 3-14) is similar to the M423 and the typical acceleration-arming,

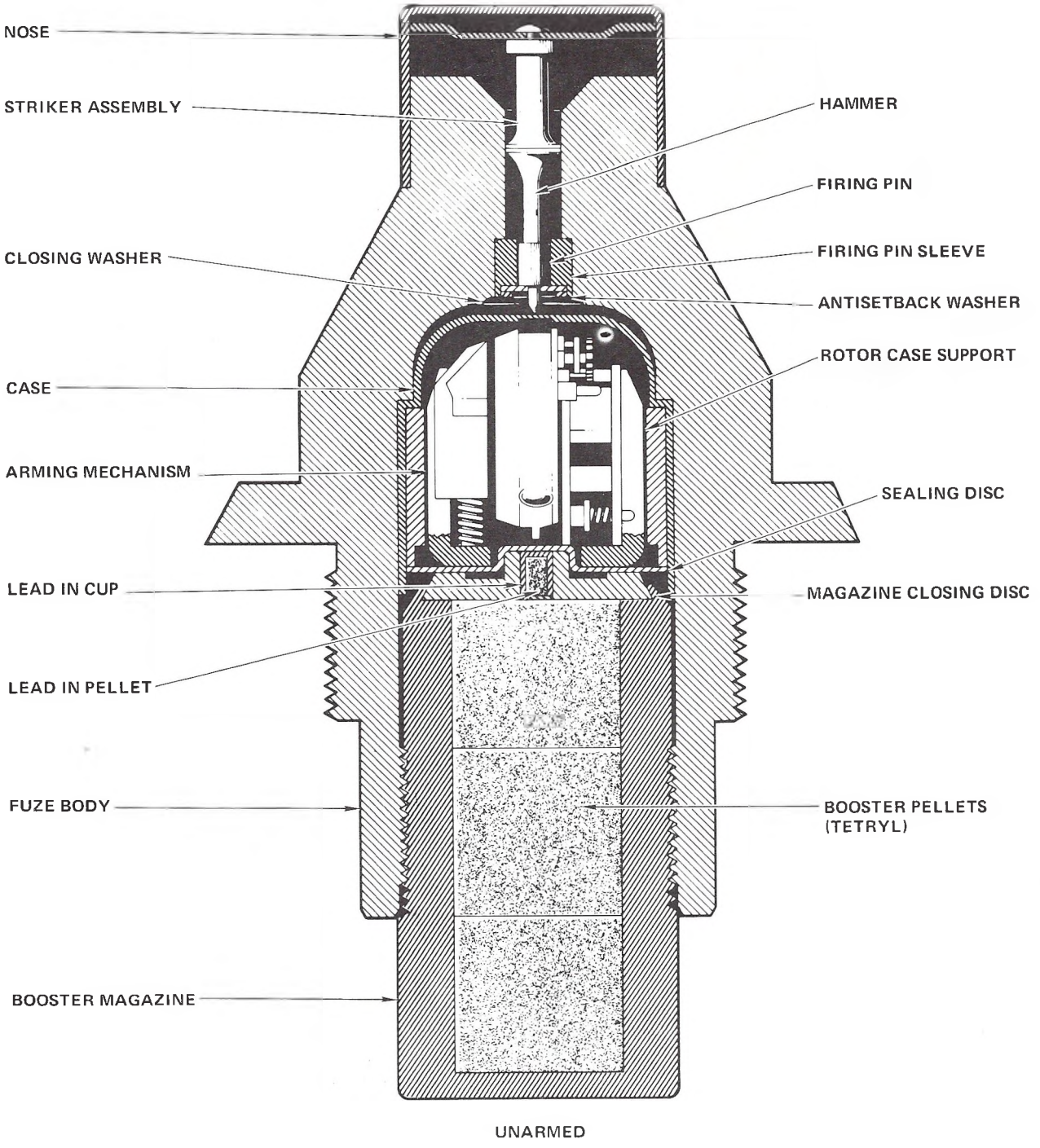



*Figure 3-10. Mk 188 Mod 0 Point Detonating Fuze Configuration*


*Figure 3-11. Mk 352 Mod 2 Point Detonating Fuze and BBU 15/B Adapter Booster*

point detonating fuze described in paragraph 3-3. This fuze is designed for use with the 2.75-inch FFAR.

**3-63. CHARACTERISTICS AND DESCRIPTION.** Characteristics of the M427 fuze are listed in table 3-7. This fuze is a redesigned Mk 178 fuze having modifications similar to the M423 fuze with the exception of retaining the long arming range characteristics of the Mk 178 fuze. Since the arming range is too great, maximum effectiveness from rotary wing aircraft is greatly diminished. This fuze is reliable for impact angles as low as five degrees against soft targets.

**3-64. CONFIGURATION.** Configuration of the M427 fuze is shown in figure 3-14.

**3-65. SAFETY.** No specific safety precautions, other than those described in section II and those normally observed in the handling of explosive materials are required for the M427 fuze.

**3-66. PREPARATION FOR USE AND ASSEMBLY.** No specific preparation for use or assembly is required for the M427 fuze.

*Table 3-7. M427 Fuze Characteristics*

| | |
|---|---|
| Type | Point Detonating |
| Army Nomenclature | M427 |
| Nominal Weight (lb) | 0.62 |
| Overall Length (in.) | 4.035 |
| Arming Distance (ft) | 550–1400 |
| Delay Time (sec) | None |
| Sensitive to Firing on Water Impact | Yes |
| Explosive Components: | |
| Primer (Model M104): | |
| Type | Stab |
| Contents | Lead styphnate |
| Detonator (Mk 59 Mod 0): | |
| Type | Flash |
| Contents | Tetryl and lead azide |
| Booster and Lead-In | Tetryl |

**3-67. HANDLING.** No specific handling procedures other than those described in section II are required for the M427 fuze.

**3-68. EMERGENCY PROCEDURES.** No specific procedures other than those described in section II are required for the M427 fuze.

## 3-69. MK 191 MOD 1 IMPACT FIRING FUZE (BASE DETONATING).

**3-70. INTRODUCTION.** The Mk 191 Mod 1 fuze (figure 3-15) is similar to the typical acceleration-arming base detonating fuze described in paragraph 3-3. This fuze is permanently installed in the Mk 24 Mod 0 warhead used with the 5.0-inch FFAR.

**3-71. CHARACTERISTICS AND DESCRIPTION.** Characteristics for the Mk 191 Mod 1 fuze are listed in table 3-8. This fuze provides delayed detonation after impact when used with the nose ogive on the Mk 24 Mod 0 warhead.

*Table 3-8. Mk 191 Mod 1 Fuze Characteristics*

| | |
|---|---|
| Type | Base Detonating |
| Nominal Weight (lb) | 3.75 |
| Overall Length (in.) | 5.25 |
| Arming Distance (ft) | 400–1000 |
| Delay Time (sec) | 0.005 |
| Sensitive to Firing on Water Impact | Not reliable |
| Explosive Components: | |
| Primer (Mk 134 Mod 0): | |
| Type | Electric delay |
| Contents | Lead azide, lead styphnate and tetracene |
| Detonator (Mk 59 Mod 0): | |
| Type | Flash |
| Contents | Lead azide and tetryl |
| Booster and Lead-In | Tetryl |

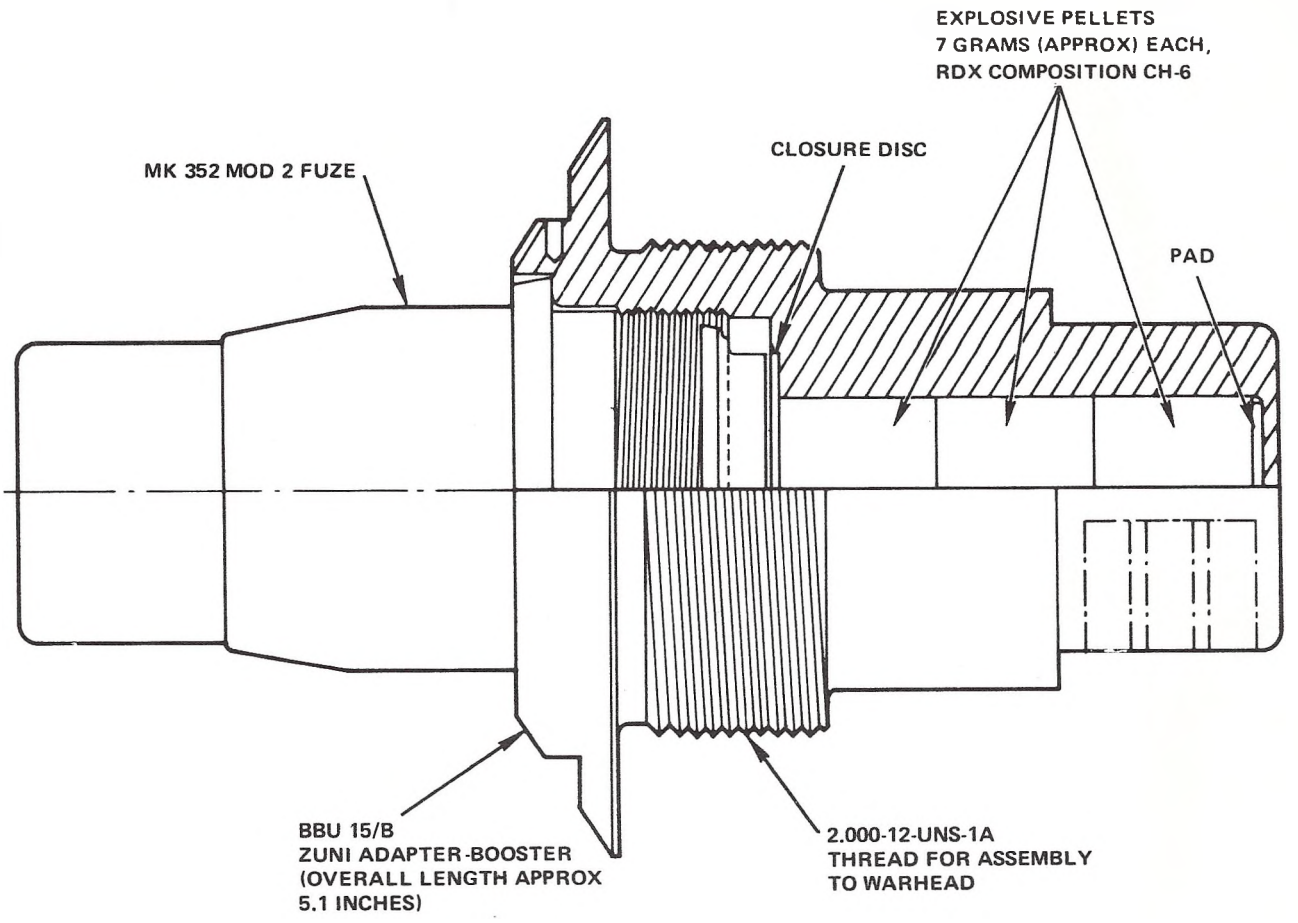



*Figure 3-12. ZUNI Adapter BBU 15/B Booster with Mk 352 Mod 2 Fuze Installed*

**3-72. CONFIGURATION.** Configuration of the Mk 191 Mod 1 fuze is shown in figure 3-16.

**3-73. SAFETY.** No specific safety precautions other than those described in section II and those normally observed in the handling of explosive materials are required for the M427 fuze.

**3-74. PREPARATION FOR USE AND ASSEMBLY.** The Mk 191 fuze is permanently installed in the Mk 24 Mod 0 warhead and no specific preparation for use is required.

**3-75. HANDLING.** No specific handling procedures other than those described in section II are required for the Mk 191 Mod 1 fuze.

**3-76. EMERGENCY PROCEDURES.** No specific procedures other than those described in section II are required for the Mk 191 Mod 1 fuze.

## 3-77. MK 193 MOD 0 MECHANICAL TIME FUZE.

**3-78. INTRODUCTION.** The Mk 193 Mod 0 fuze (figure 3-17) is similar to the typical mechanical time fuze described in paragraph 3-7. This fuze is a permanently installed, nose mounted, non-settable fuze designed for use with the Mk 33 Mod 1 flare warhead (section IV, figure 4-23).

**3-79. CHARACTERISTICS AND DESCRIPTION.** Characteristics for the Mk 193 Mod 0 fuze are listed in table 3-9. This fuze performs the typical safety/arming function, and after a 15-second delay, initiates the explosive train for candle ignition and candle and parachute expulsion from the head.

**3-80. CONFIGURATION.** The main component is a modified version of the safety/arming mechanism used in the Mk 93 fuze. The fuze also contains a timing device and incorporates a fail-safe feature in case of arming gear train failure.

**3-81. SAFETY.** No specific safety precautions, other than those described in section II, and those normally observed in the handling of explosive materials are required for the Mk 193 Mod 0 fuze.

**3-82. PREPARATION FOR USE AND ASSEMBLY.** The Mk 193 Mod 0 fuze is permanently installed in the Mk 33 Mod 1 flare head and no specific preparation for use is required.

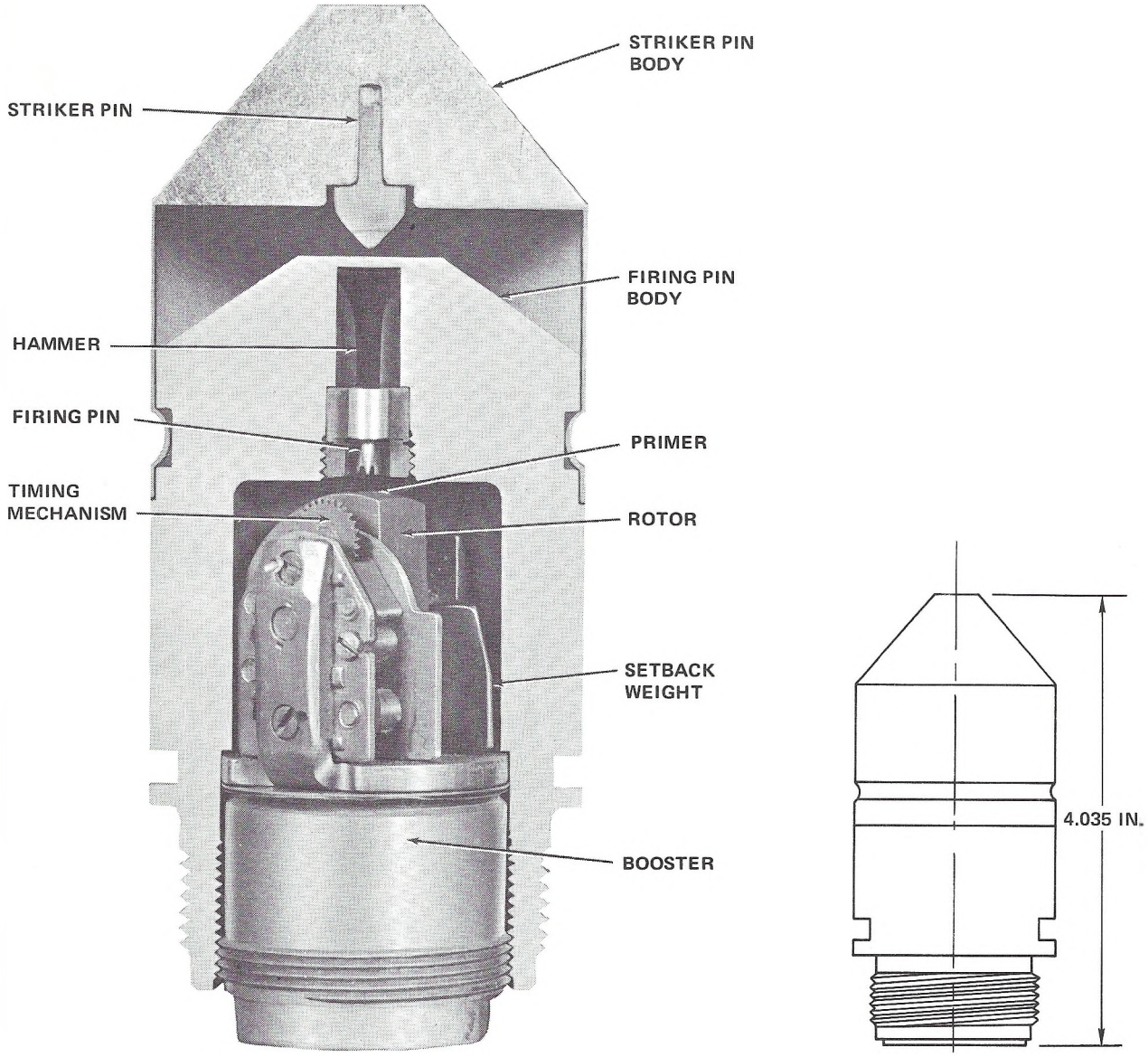



*Figure 3-13. M423 Point Detonating Fuze Configuration*

*Table 3-9. Mk 193 Mod 0 Fuze Characteristics*

| | |
|---|---|
| Type | Mechanical Time |
| Nominal Weight (lb) | 2 |
| Overall Length (in.) | 3 |
| Arming Distance (ft) | 500–1000 |
| Delay Time (sec) | 15 |
| Sensitive to Firing on Water Impact | No |
| Explosive Components: | |
| Primer (Mk 125 Mod 1): | |
| Type | Stab |
| Contents | NOL Type 130 primer mix and lead azide |
| Detonator (Mk 66 Mod 0): | |
| Type | Flash |
| Contents | Lead azide and tetryl |
| Booster and Lead-In: | |
| Black Powder | 10 grams |
| Tetryl Lead-In | 0.082 grams |

3-83. **HANDLING.** No specific handling procedures other than those described in section II are required for the Mk 193 Mod 0 fuze.

3-84. **EMERGENCY PROCEDURES.** No specific procedures other than those described in section II are required for the Mk 193 Mod 0 fuze.

## 3-85. MODEL 113A ACCELERATION-DECELERATION DETONATING FUZE.

3-86. **INTRODUCTION.** The Model 113A fuze has a safety/arming device similar to those used in impact detonating fuzes described in paragraph 3-9. This fuze is permanently installed in the WDU-4/A and WDU-4A/A warheads used with the 2.75-inch LSFFAR and FFAR.

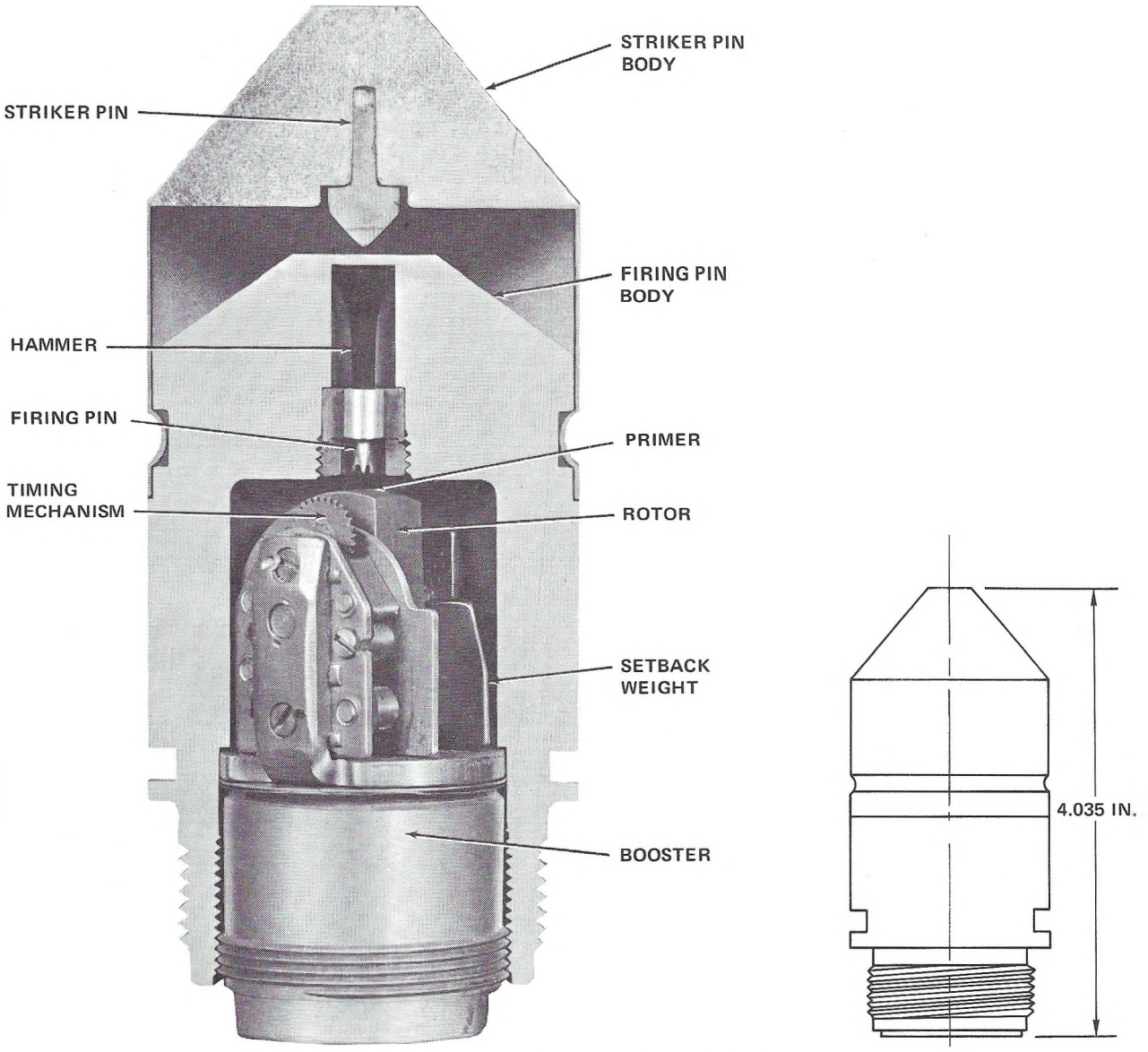



*Figure 3-14. M427 Point Detonating Fuze Configuration*

**3-87. CHARACTERISTICS AND DESCRIPTION.** Characteristics of the Model 113A fuze are listed in table 3-10. This fuze arms with sustained acceleration and fires on deceleration (motor burnout).

*Table 3-10. Model 113A Fuze Characteristics*

| | |
|---|---|
| Type | Acceleration-Deceleration |
| Air Force Nomenclature | Model 113A |
| Nominal Weight (lb) | 0.657 |
| Length (in.) | 3.30 |
| Arming Distance (ft) | 550–1400 |

**3-88. CONFIGURATION.** The Model 113A fuze contains an acceleration arming, deceleration firing safe-arm mechanism and is located in the aft end of the WDU-4 *flechette warhead (figure 4-17).*

**3-89. SAFETY.** No specific safety precautions other than those described in section II and those normally observed in the handling of explosive materials are required for the Model 113A fuze.

**3-90. PREPARATION FOR USE AND ASSEMBLY.** The Model 113A fuze is permanently installed in the WDU-4/A and WDU-4A/A warheads and no specific preparation for use is required.

**3-91. HANDLING.** No specific handling procedures other than those described in section II are required for the Model 113A fuze.

**3-92. EMERGENCY PROCEDURES.** No specific procedures other than those described in section II are required *for the Model 113A fuze.*

## 3-93. MK 93 MOD 0 AND M414A1 PROXIMITY FUZE.

**3-94. INTRODUCTION.** The Mk 93 Mod 0 fuze (figure 3-18) is identical to the Army M414A1 fuze, and is similar to the typical proximity fuze described in paragraph 3-10. This fuze is designed for use with the Mk 24, Mk 32 and Mk 63 warheads used with the 5.0-inch FFAR.

**3-95. CHARACTERISTICS AND DESCRIPTION.** Characteristics for the Mk 93 Mod 0 fuze are listed in table 3-11. Detonation of this fuze occurs from 10 to 50 feet above ground making the Mk 93 Mod 0 highly effective for flak suppression and anti-personnel missions.

**3-96. CONFIGURATION.** The Mk 93 Mod 0 fuze contains an acceleration operated safety/arming device as well as the electronic circuit which provides an airburst capability.

**3-97. SAFETY.** No specific precautions other than those described in section II, and those normally observed in the handling of explosive materials are required for the Mk 93 Mod 0 fuze.

**3-98. PREPARATION FOR USE AND ASSEMBLY.** No specific preparation for use or assembly is required for the Mk 93 Mod 0 fuze.

**CAUTION**

If the seal of any individual fuze packing box is found to be broken when received, the fuze shall be disposed of in accordance with current directives.

**3-99. HANDLING.** Proximity fuzes packed in shipping containers may be subjected to the same handling as any other fuze. Rough handling of unpacked fuzes will increase the malfunction rate of the fuzes and shall be avoided.

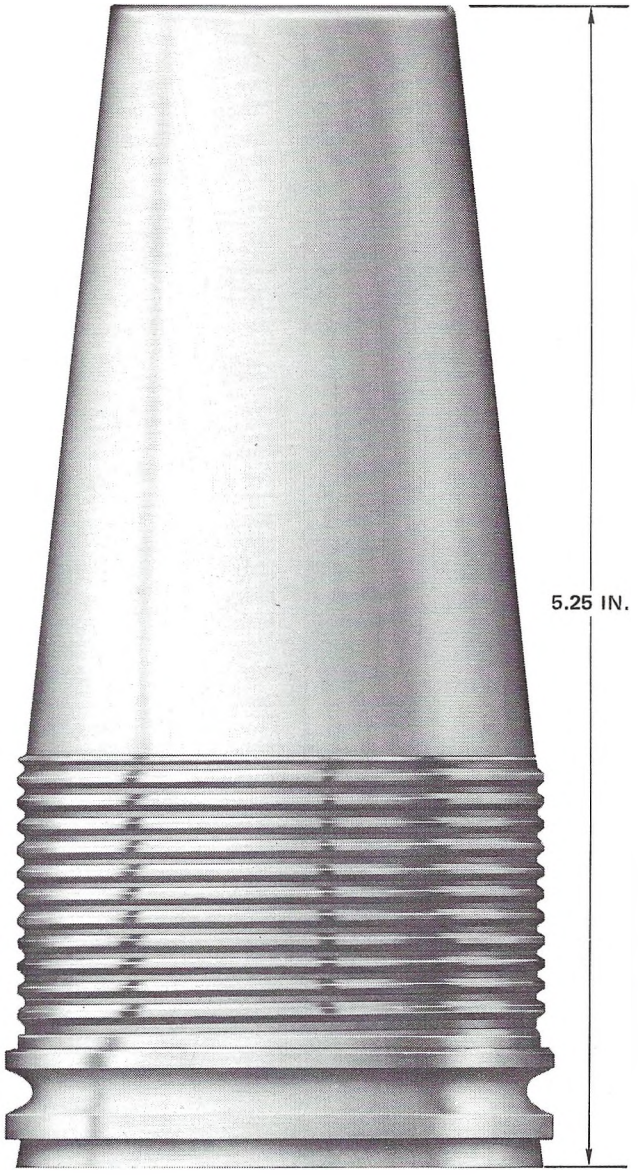



*Figure 3-15. Mk 191 Mod 1 Base Detonating Fuze*

*Table 3-11. Mk 93 Mod 0 and M414A1 Fuze Characteristics*

| | | |
|---|---|---|
| Type | Proximity | Proximity |
| Army Nomenclature | | M414A1 |
| Nominal Weight (lb) | 2.6 | 2.6 |
| Overall Length (in.) | 9.184 | 9.184 |
| Arming Distance (ft) | 400–1000 | 400–1000 |
| Delay Time (sec) | None | None |
| Sensitivity to Firing on Water Impact | Not reliable | Not reliable |
| Optimized Approach Angle (deg) | 20–40 | 20–40 |
| Explosive Components: | | |
| Primer (Mk 102 Mod 1): | | |
| Type | Stab | Stab |
| Contents | Lead azide, lead styphnate and PETN | Lead azide, lead styphnate and PETN |
| Detonator (M62): | | |
| Type | Electric | Electric |
| Booster and Lead-In | Tetryl | Tetryl |

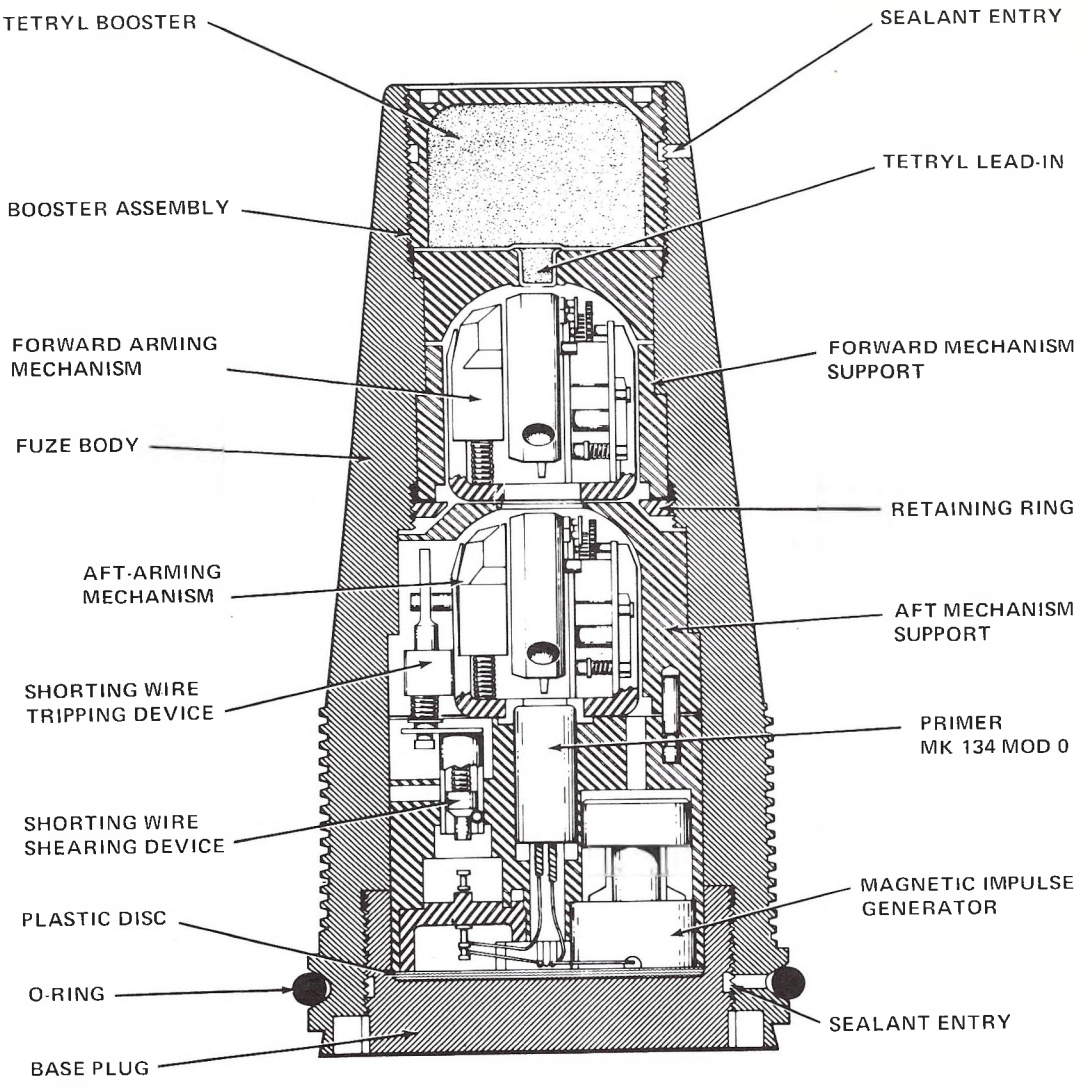



*Figure 3-16. Mk 191 Mod 1 Base Detonating Fuze Configuration*

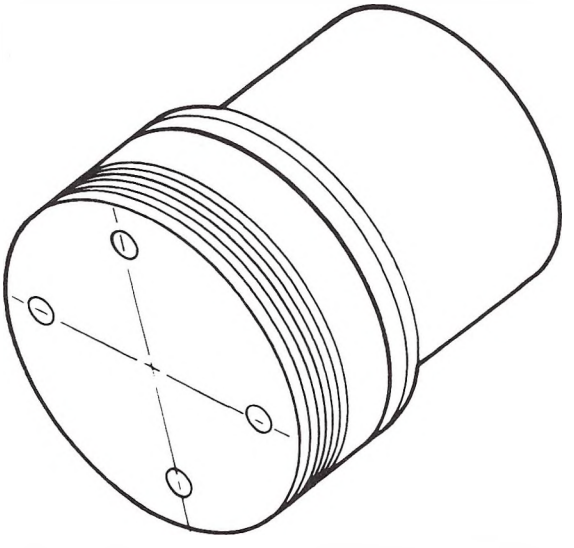


*Figure 3-17. Mk 193 Mod 0 Mechanical Time Fuze Configuration*

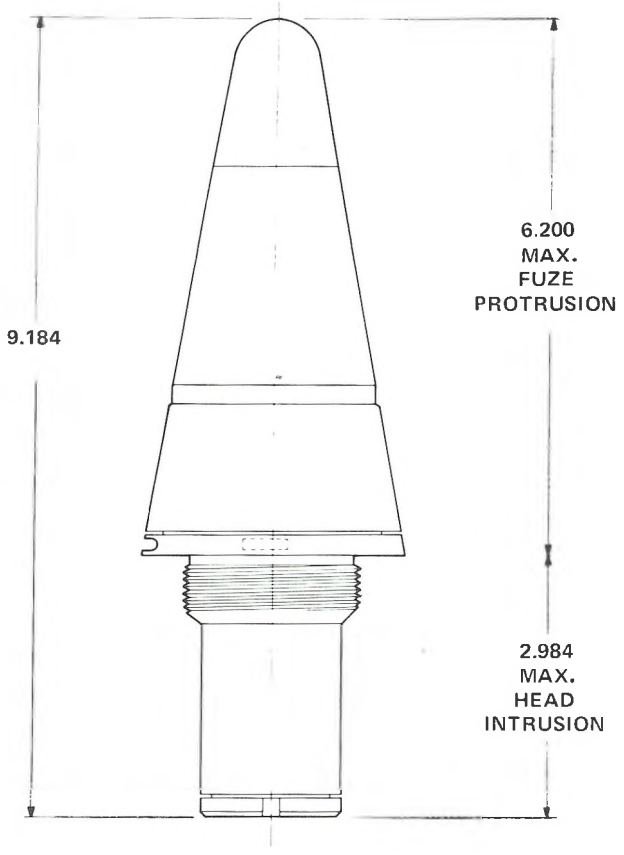



*Figure 3-18. Mk 93 Mod 0/M414A1 Proximity Fuze*

**3-100. EMERGENCY PROCEDURES.** No specific procedures other than those described in section II are required for the Mk 93 Mod 0 fuze.

## 3-101. M429 PROXIMITY FUZE.

**3-102. INTRODUCTION.** The M429 fuze (figure 3-19) is similar to the typical proximity fuze described in paragraph 3-10 and is designed for use with the 2.75-inch LSFFAR.

**3-103. CHARACTERISTICS AND DESCRIPTION.** Characteristics for the M429 fuze are listed in table 3-12.

*Table 3-12. M429 Fuze Characteristics*

| | |
|---|---|
| Type | Proximity |
| Army Nomenclature | M429 |
| Nominal Weight (lb) | 0.85 |
| Length to Shoulder (in.) | 5.0 |
| Delay Time | None |
| Arming Distance (ft) | 500–1080 |
| Sensitive to Water Impact | Not reliable |
| Total Explosive Weight (g) | 9 |
| Optimized Approach Angle (deg) | 5–15 |

**3-104. CONFIGURATION.** The M429 contains an acceleration operated arming mechanism as well as the electronic circuit which provides the airburst capability.

**3-105. SAFETY.** No specific safety precautions other than those described in section II and those normally observed in the handling of explosive materials are required for the M429 fuze.

**3-106. PREPARATION FOR USE AND ASSEMBLY.** No specific preparation for use or assembly procedures is required for the M429 fuze.

**3-107. HANDLING.** Proximity fuzes packed in shipping containers may be subjected to the same handling as any other fuze. Rough handling of unpacked fuzes will increase the malfunction rate of the fuzes and shall be avoided.

**3-108. EMERGENCY PROCEDURES.** No specific procedures other than those described in section II are required for the M429 fuze.

## 3-109. FUZE SHIPPING CONTAINERS.

3-110. Current packaging for rocket fuzes includes wood and metal boxes, and metal cans. Detailed packaging information is contained in WR54. Typical Shipping Containers for fuzes are shown in figure 3-20.

3-111. Mechanical time fuzes are received permanently installed in warheads.

3-112. Special precautions are taken to assure that proximity fuzes are received in good operating condition. Each fuze is held in a shock-resistant mounting. A typical individual container is shown in figure 3-21.

3-113. Each box of fuzes is marked with the complete fuze nomenclature, the number of fuzes included, the lot number, date loaded, weight, volume, and shipping data. Fuzes produced or repacked since 1958 will have a Federal Stock Number in place of the Ammunition Identification Code (AIC).

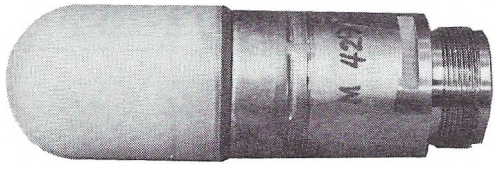



*Figure 3-19. M429 Proximity Fuze*


*Figure 3-20. Typical Fuze Shipping Containers*

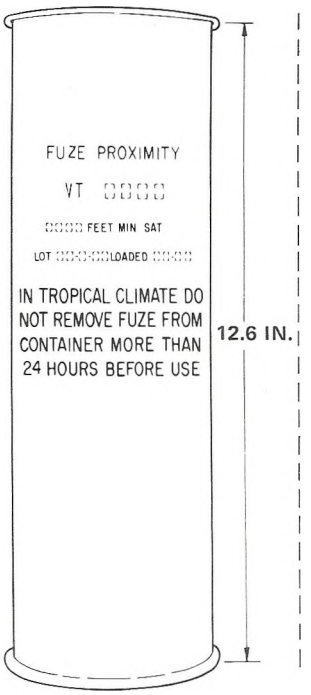



*Figure 3-21. Proximity Fuze Container*

# SECTION IV

# ROCKET WARHEADS

## 4-1. INTRODUCTION.

4-2. Different tactical requirements demand specific types of rocket warheads to be used with airborne rockets. The warheads are broadly classified as high-explosive, flechette, smoke, flare, and practice. Warheads for the 2.75-inch rockets are normally received with the fuze installed. See table of characteristics listed under each warhead for individual fuzing.

4-3. The following paragraphs describe the intended purpose and functions of warheads which are currently in use by the fleet.

**4-4. HIGH-EXPLOSIVE FRAGMENTATION WARHEADS (HE-FRAG).** These warheads are designed to be effective against personnel and lightly armored targets. The warhead explosive is detonated by a point detonating or proximity fuze. Upon detonation, a large quantity of metal fragments is accelerated to a high velocity. Target damage is caused by impact of these fragments.

**4-5. HIGH-EXPLOSIVE ANTI–TANK (HEAT).** These warheads are designed to be effective against armored targets such as tanks, bunkers, armored vehicles, etc. The warheads contain a shaped charge which when detonated produces a high-energy jet that penetrates the armored targets. This warhead uses a point detonating fuze.

**4-6. HIGH-EXPLOSIVE ANTI-TANK/ANTI-PERSONNEL (AT/APERS).** This type of warhead combines the effectiveness of the fragmentation warhead with the HEAT warhead (refer to paragraphs 4-4 and 4-5).

**4-7. HIGH-EXPLOSIVE GENERAL PURPOSE (GP) WARHEAD.** The GP warhead produces fragments and may be fuzed for contact, proximity, or delayed detonation.

**4-8. FLECHETTE WARHEADS.** Flechette warheads are designed to be effective against personnel and lightly armored targets. These warheads contain a large number of small arrow shaped projectiles. A small explosive charge in the warhead dispenses the flechettes after rocket motor burnout. Target damage is caused by impact of the high velocity flechettes.

**4-9. SMOKE WARHEADS.** Smoke warheads are designed to produce a volume of heavy smoke for target marking. The warhead contains a burster tube of explosive, usually Composition B, which bursts the walls of the warhead, dispersing the smoke. These warheads are designated SMOKE, followed by the abbreviation for the smoke producing agent it contains; for example, WP for white phosphorus, or PWP for plasticized white phosphorus.

**4-10. FLARE WARHEADS.** Flare warheads are designed to provide illumination for tactical operations. These warheads consist, basically, of a delay action fuze, illuminating candle, and parachute assembly.

**WARNING**

In some cases, the same Mk and Mod numbers have been assigned to both loaded and practice warheads. Personnel should observe MIL-STD-709, NAVORD OP2238 and warhead markings to ensure that these warheads are not interchanged.

**4-11. PRACTICE WARHEADS.** Practice warheads are either dummy configurations or inert-loaded service warheads in which the weight and placement of an inert filler gives the practice warhead and the same ballistic characteristics as those of the explosive-loaded service warhead.

## 4-12. M151 HE-FRAG WARHEAD.

**4-13. INTRODUCTION.** The Army M151 warhead (figure 4-1) is designed to be used with the 2.75-inch rocket.

**4-14. CHARACTERISTICS AND DESCRIPTION.** Characteristics for the M151 warhead are listed in table 4-1. This

*Figure 4-1. M151 Fragmentation Warhead with Fuze Installed*

warhead comes with either an M423, M427, or M429 fuze. The M423 and M429 fuzes are used for helicopter and low speed aircraft only. Refer to paragraph 4-4 for a general description of the warhead.

*Table 4-1. M151 Warhead Characteristics*

| | |
|---|---|
| Type | Fragmentation |
| Army Nomenclature | M151 |
| Overall Shipping Length (in.) | 12.9 w/o fuze |
| Nominal Weight (lb) | 9.4 w/fuze |
| Filler: | |
| Type | Comp B |
| Weight (lb) | 2.3 |
| Fuze | M423 (LSFFAR only), M429 (LSFFAR only, not shipped assembled), or M427 |

**4-15. CONFIGURATION.** Configuration of the M151 warhead is shown in figure 4-2.

**WARNING**

Fuzes must not be removed and loose fuzes must not be tightened on M151 warheads that do not contain a fuze cavity liner. Detonation can occur.

**4-16. SAFETY.** Early production M151 warheads were not equipped with fuze cavity liners. Removal or tightening of loose fuzes on these warheads may cause detonation. The later model M151 warheads are equipped with fuze cavity liners and are marked WITH LINER.

**4-17. PREPARATION FOR USE AND ASSEMBLY.** No specific preparation for use or assembly is required for the M151 warhead.

**4-18. HANDLING.** No specific handling procedures other than those described in section II are required for the M151 warhead.

**4-19. EMERGENCY PROCEDURES.** No specific procedures other than those described in section II are required for the M151 warhead.

## 4-20. MK 1 MOD 1, 3, 4, 5, AND 7 HE-FRAG WARHEAD.

**4-21. INTRODUCTION.** The Mk 1 Mod 1, 3, 4, 5, and 7 (figures 4-3 and 4-4) are fragmentation warheads designed to be used with the 2.75-inch rocket.

**4-22. CHARACTERISTICS AND DESCRIPTION.** Characteristics for the Mk 1 Mod 1, 3, 4, 5, and 7 warheads are listed in table 4-2. Refer to paragraph 4-4 for a general description of the warhead.

**4-23. CONFIGURATION.** The differences in the mods of the Mk 1 warheads are in case design, see figures 4-5 and 4-6.

*Table 4-2. Mk 1 Mod 1, 3, 4, 5, and 7 Warhead Characteristics*

| | | | | | |
|---|---|---|---|---|---|
| Type | Fragmentation | Fragmentation | Fragmentation | Fragmentation | Fragmentation |
| Mk | 1 | 1 | 1 | 1 | 1 |
| Mod | 1 | 3 | 4 | 5 | 7 |
| Overall Length (in.) | 10.99 | 10.99 | 10.99 | 10.99 | 10.99 |
| Nominal Weight (lb) | 6.47 | 6.47 | 6.47 | 6.47 | 6.47 |
| Filler: | | | | | |
| Type | HBX-1 | HBX-1 | HBX-1 | HBX-1 | Comp B |
| Weight (lb) | 1.40 | 1.40 | 1.40 | 1.40 | 1.40 |
| Fuze | Mk 178, Mk 176, M423 or M427 | Mk 178, Mk 176, M423 or M427 | Mk 178, Mk 176, M423 or M427 | Mk 178, Mk 176, M423 or M427 | Mk 178, Mk 176, M423 or M427 |

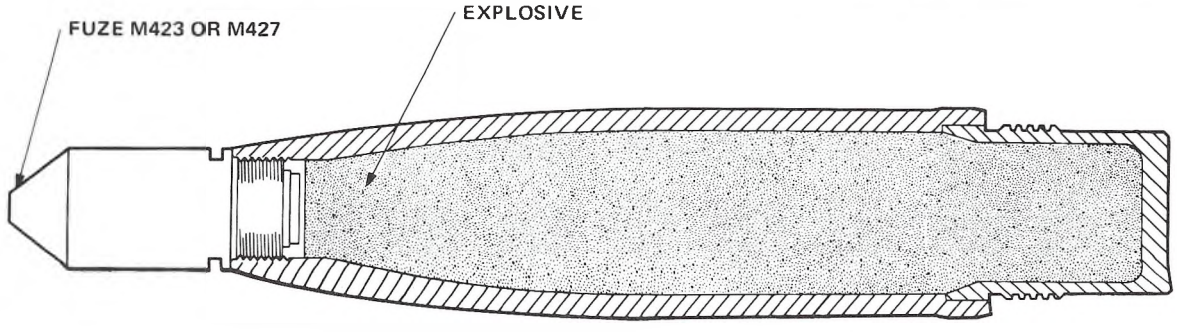



*Figure 4-2. M151 Fragmentation Warhead Configuration*

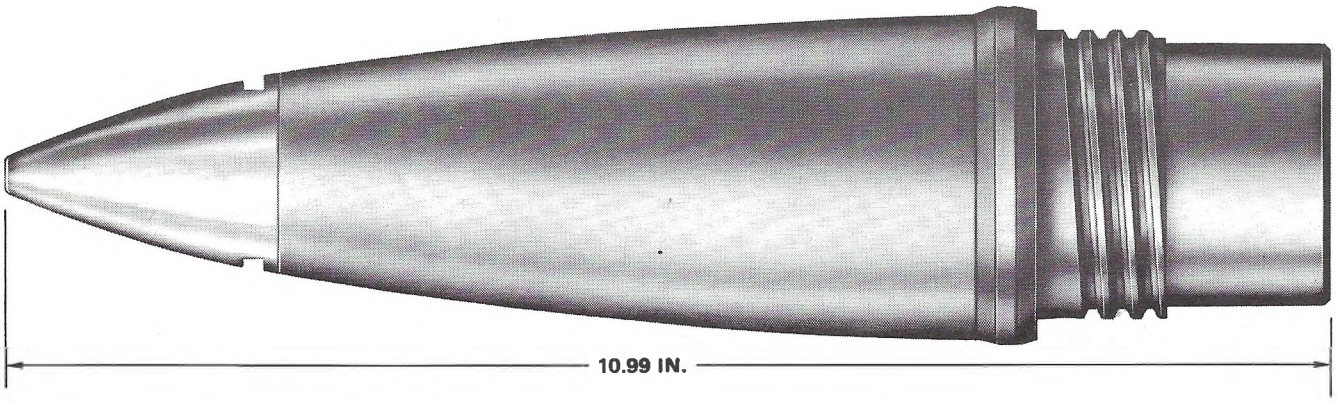



*Figure 4-3. Mk 1 Mod 5 Fragmentation Warhead with Fuze Installed*

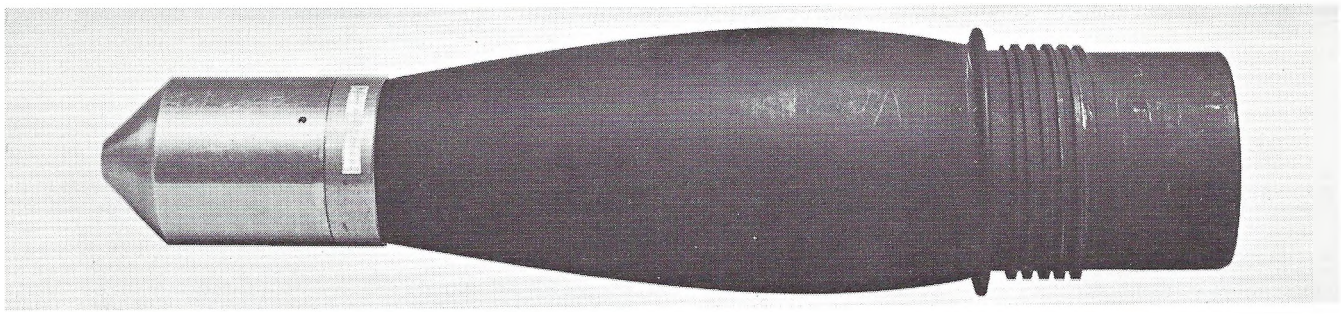


*Figure 4-4. Mk 1 Mod 7 Fragmentation Warhead with Fuze Installed*

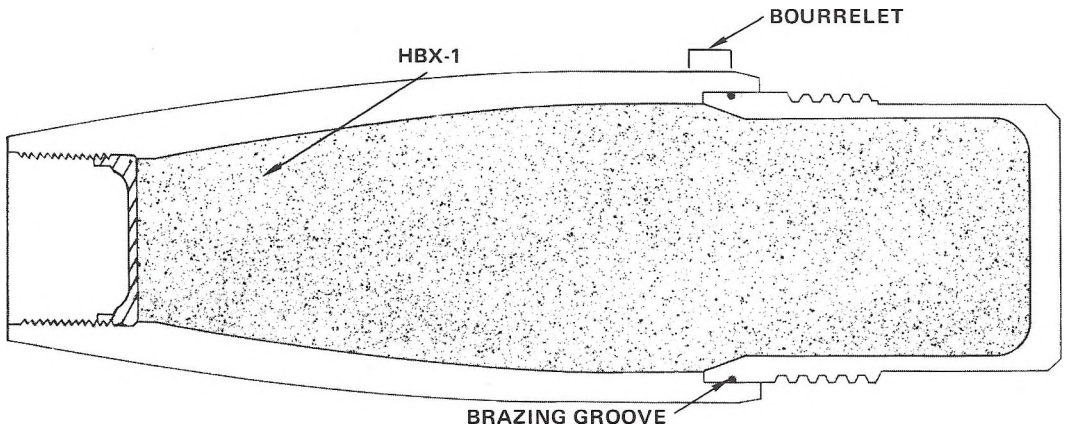



*Figure 4-5. Mk 1 Mod 5 Fragmentation Warhead Configuration*

**NOTE**

Mk 1 Mod 2 used only for inert loading, is made of two pieces brazed together (near bourrelet) without a fuze cavity liner.

**4-24. SAFETY.** No specific safety precautions other than those described in section II, and those normally observed in the handling of explosive materials, are required for the Mk 1 Mod 1, 3, 4, 5, and 7 warheads.

**4-25. PREPARATION FOR USE AND ASSEMBLY.** No specific preparation for use or assembly is required for the Mk 1 Mod 1, 3, 4, 5, and 7 warheads.

**4-26. HANDLING.** No specific handling procedures other than those described in section II are required for the Mk 1 Mod 1, 3, 4, 5, and 7 warheads.

**4-27. EMERGENCY PROCEDURES.** No specific procedures other than those described in section II are required for the Mk 1 Mod 1, 3, 4, 5, and 7 warheads.

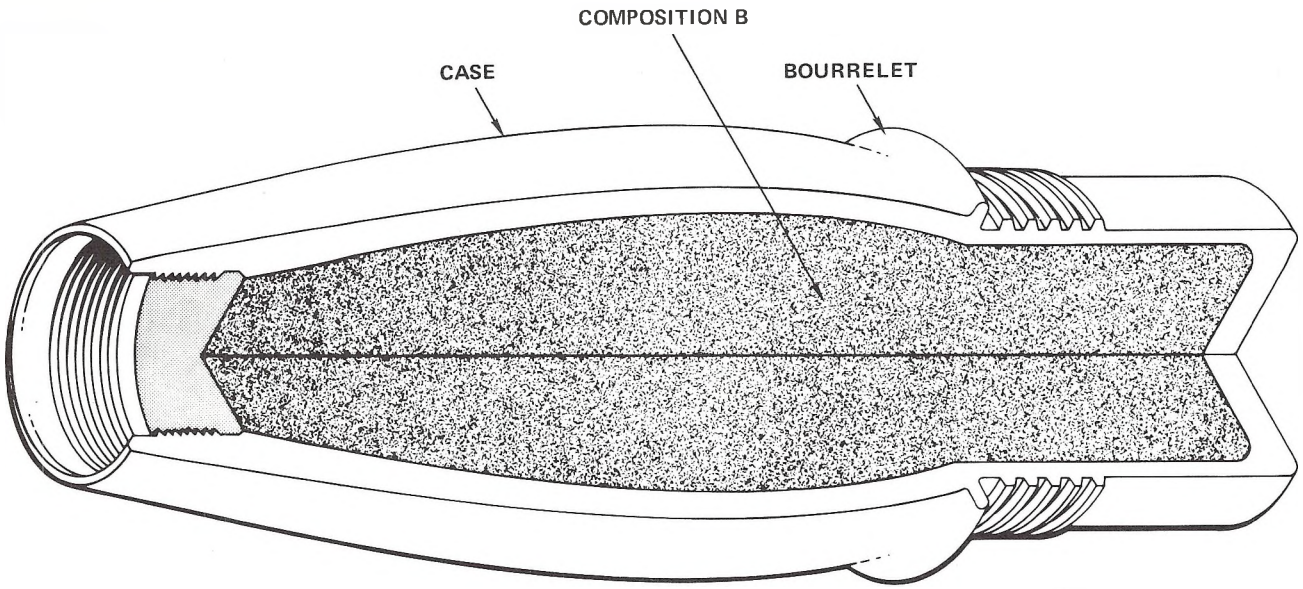



*Figure 4-6. Mk 1 Mod 7 Fragmentation Warhead Configuration*

## 4-28. MK 63 MOD 0 HE-FRAG WARHEAD.

**4-29. INTRODUCTION.** The Mk 63 Mod 0 (figure 4-7) is a fragmentation warhead designed to be used on the 5.0-inch FFAR.

**4-30. CHARACTERISTICS AND DESCRIPTION.** Characteristics for the Mk 63 Mod 0 warhead are listed in table 4-3. This warhead is proximity fuzed to take advantage of the more uniform fragment distribution produced by the design. When compared with the fragmentation characteristics of the Mk 32 warhead under identical air burst condition, the Mk 63 Mod 0 warhead provides a considerably higher lethal area coverage. The casing of this warhead is made from thin walled aluminum alloy rather than steel, as are most warheads. Refer to paragraph 4-4 for a general description of the warhead.

*Table 4-3. Mk 63 Mod 0 Warhead Characteristics*

| | |
|---|---|
| Type | HE-FRAG |
| Overall Shipping Length (in.) | 39.00 |
| Length without Details (in.) | 28.70 |
| Nominal Shipping Weight (lb) | 65.00 |
| Nominal Weight without Nose Fuze (lb) | 55.00 |
| Filler: | |
| Type | Comp B |
| Weight (lb) | 15.0 |
| Booster: | |
| Type | CH-6 |
| Weight (gm) | 21 |
| Fuze | Mk 93 Mod 0 or M414A1 |

**4-31. CONFIGURATION.** The Mk 63 Mod 0 warhead is specially designed to produce a large quantity of fragments with improved distribution compared to other HE-FRAG warheads.

**4-32. SAFETY.** No specific safety precautions other than those described in section II, and those normally observed in the handling of explosive materials, are required for the Mk 63 Mod 0 warhead.

**4-33. PREPARATION FOR USE AND ASSEMBLY.** No specific preparation for use or assembly is required for the Mk 63 Mod 0 warhead.

**CAUTION**

Apply wrench only in designated area to prevent damage of casing (see decal on warhead, figure 4-7).

**4-34. HANDLING.** No specific handling procedures other than those described in section II are required for the Mk 63 Mod 0 warhead.

**4-35. EMERGENCY PROCEDURES.** No specific procedures other than those described in section II are required for the Mk 63 Mod 0 warhead.

## 4-36. MK 64 MOD 0 HE-FRAG WARHEAD.

**4-37. INTRODUCTION.** The Mk 64 Mod 0 (figure 4-8) is a fragmentation warhead used with the 2.75-inch rocket.

**4-38. CHARACTERISTICS AND DESCRIPTION.** Characteristics for the Mk 64 Mod 0 warhead are listed in table 4-4. The Mk 64 Mod 0 warhead is identical to the


*Figure 4-7. Mk 63 Mod 0 HE-FRAG Warhead with Fuze Installed*

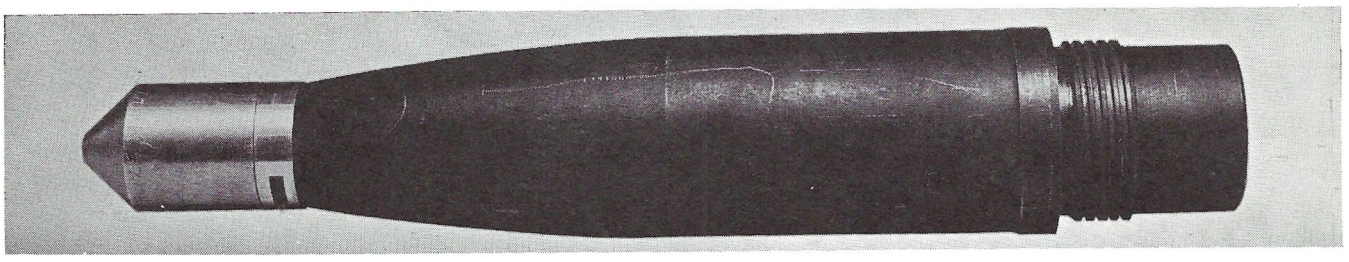


*Figure 4-8. Mk 64 Mod 0 Fragmentation Warhead with Fuze Installed*

M151 HE-FRAG warhead except for markings. Refer to paragraph 4-4 for a general description of the warhead.

*Table 4-4. Mk 64 Mod 0 Warhead Characteristics*

| | |
|---|---|
| Type | HE-FRAG |
| Overall Shipping Length (in.) | 13.00 |
| Nominal Weight (lb) | 9.20 |
| Filler: | |
| Type | Comp B |
| Weight (lb) | 2.3 |
| Fuze | Mk 176, Mk 178, M423 (LSFFAR use only) or M427 |

**4-39. CONFIGURATION.** Configuration of the Mk 64 Mod 0 warhead is shown in figure 4-9.

**4-40. SAFETY.** No specific safety precautions other than those described in section II, and those normally observed in the handling of explosive materials, are required for the Mk 64 Mod 0 warhead.

**4-41. PREPARATION FOR USE AND ASSEMBLY.** No specific preparation for use or assembly is required for the Mk 64 Mod 0 warhead.

**4-42. HANDLING.** No specific handling procedures other than those described in section II are required for the *Mk 64 Mod 0 warhead.*

**4-43. EMERGENCY PROCEDURES.** No specific procedures other than those described in section II are required for the Mk 64 Mod 0 warhead.

## 4-44. MK 5 MOD 0 HEAT WARHEAD.

**4-45. INTRODUCTION.** The Mk 5 Mod 0 (figure 4-10) is a HEAT warhead designed to be used with the 2.75-inch rocket.

**4-46. CHARACTERISTICS AND DESCRIPTION.** Characteristics of Mk 5 Mod 0 warhead are listed in table 4-5. Refer to paragraph 4-5 for a general description of the warhead.

*Table 4-5. Mk 5 Mod 0 Warhead Characteristics*

| | |
|---|---|
| Type | HEAT |
| Overall Shipping Length (in.) | 11.08 |
| Nominal Weight (lb) | 6.60 |
| Filler: | |
| Type | Comp B |
| Weight (lb) | 0.89 |
| Booster: | |
| Type | Tetryl |
| Weight (g) | 13.8 |
| Fuze (Mk/Mod) | 181/0 |

**4-47. CONFIGURATION.** Configuration of the Mk 5 *Mod 0 warhead is shown in figure 4-11.*

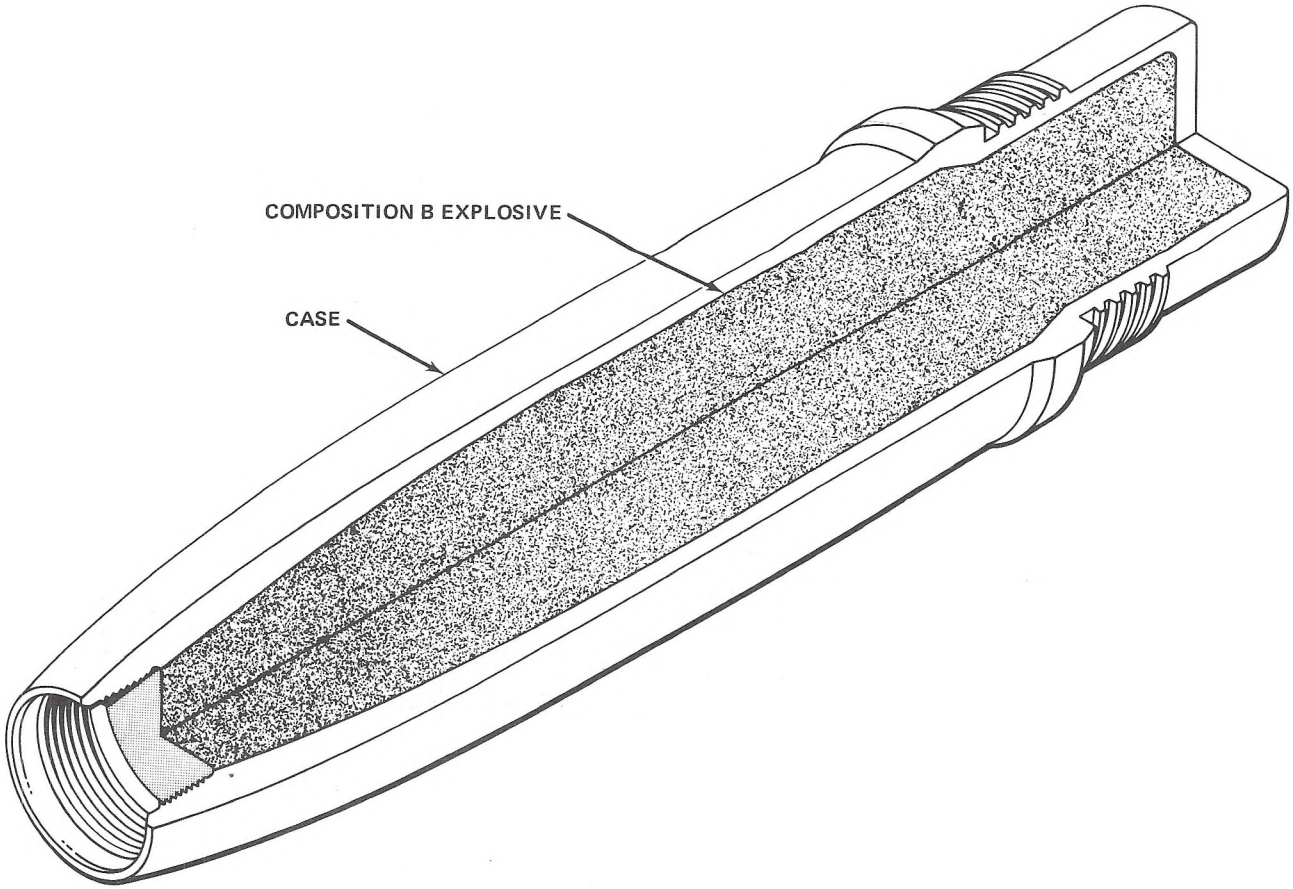



*Figure 4-9. Mk 64 Mod 0 Fragmentation Warhead Configuration*

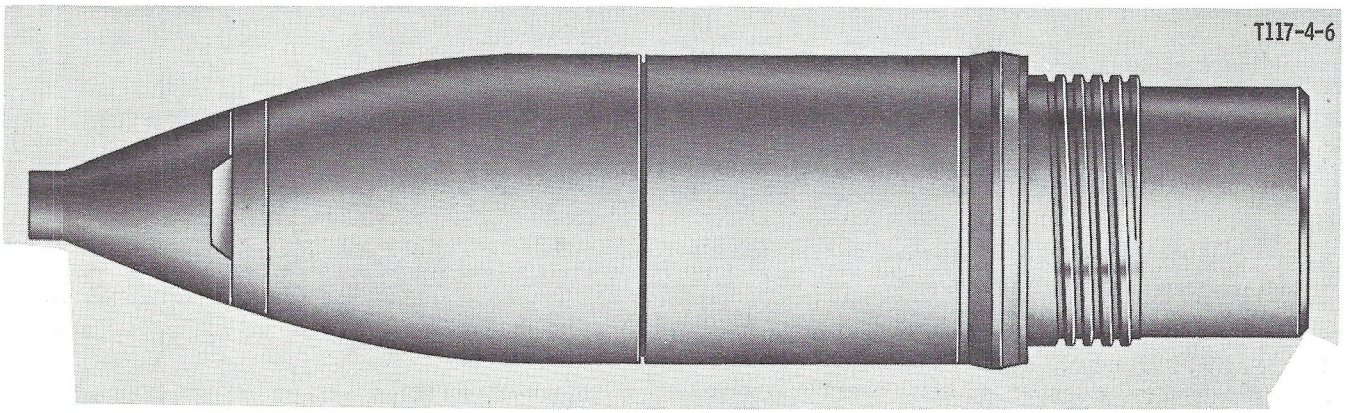



*Figure 4-10. Mk 5 Mod 0 HEAT Warhead with Fuze Installed*

**4-48. SAFETY.** No specific safety precautions other than those described in section II and those normally observed in the handling of explosive materials, are required for the Mk 5 Mod 0 warhead.

**4-49. PREPARATION FOR USE AND ASSEMBLY.** No specific preparation for use or assembly is required for the Mk 5 Mod 0 warhead.

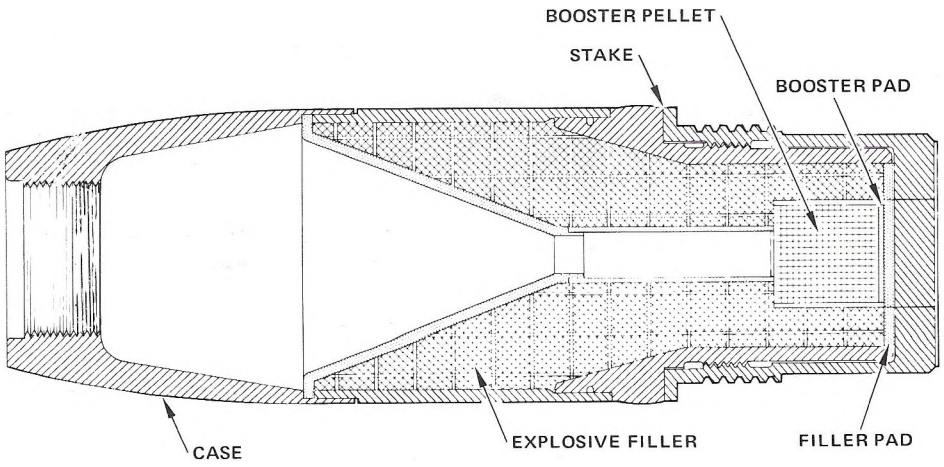



*Figure 4-11. Mk 5 Mod 0 HEAT Warhead Configuration*

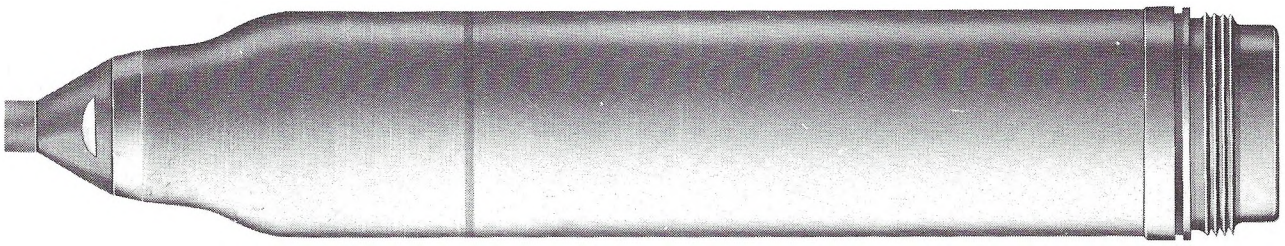


*Figure 4-12. Mk 32 Mod 0 AT/APERS Warhead*

**4-50. HANDLING.** No specific handling procedures other than those described in section II are required for the Mk 5 Mod 0 warhead.

**4-51. EMERGENCY PROCEDURES.** No specific procedures other than those described in section II are required for the Mk 5 Mod 0 warhead.

## 4-52. MK 32 MOD 0 AT/APERS WARHEAD.

**4-53. INTRODUCTION.** The Mk 32 Mod 0 (figure 4-12) is a AT/APERS warhead designed to be used with the 5.0-inch FFAR. It is effective against heavy or light armored targets.

**4-54. CHARACTERISTICS AND DESCRIPTION.** Characteristics for the Mk 32 Mod 0 warhead are listed in table 4-6. For shaped charge action against heavily armored targets, the warhead is fitted with a Mk 188 Mod 0 point detonating fuze. For light targets the Mk 93 Mod 0 proximity fuze is used. Refer to paragraph 4-6 for a general description of the warhead.

**4-55. CONFIGURATION.** Configuration of the Mk 32 Mod 0 warhead is shown in figure 4-13.

**4-56. SAFETY.** No specific safety precautions other than those described in section II and those normally observed in the handling of explosive materials, are required for the Mk 32 Mod 0 warhead.

*Table 4-6. Mk 32 Mod 0 Warhead Characteristics*

| | |
|---|---|
| Type | AT/APERS |
| Overall Shipping Length (in.) | 30.299 |
| Length without Details (in.) | 29.112 |
| Nominal Shipping Weight (lb) | 46.16 |
| Nominal Weight (lb) | 45.76 |
| Filler: | |
| Type | Comp B |
| Weight (lb) | 15.00 |
| Booster: | |
| Type | Tetryl |
| Weight (g) | 0.30 |
| VT Fuze (Mk/Mod) | 93/0 or M414A1 |
| Point Detonating Fuze (Mk/Mod) | 188/0 |

**4-57. PREPARATION FOR USE AND ASSEMBLY.** No specific preparation for use or assembly is required for the Mk 32 Mod 0 warhead.

**4-58. HANDLING.** No specific handling procedures other than those described in section II are required for the Mk 32 Mod 0 warhead.

**4-59. EMERGENCY PROCEDURES.** No specific procedures other than those described in section II are required for the Mk 32 Mod 0 warhead.

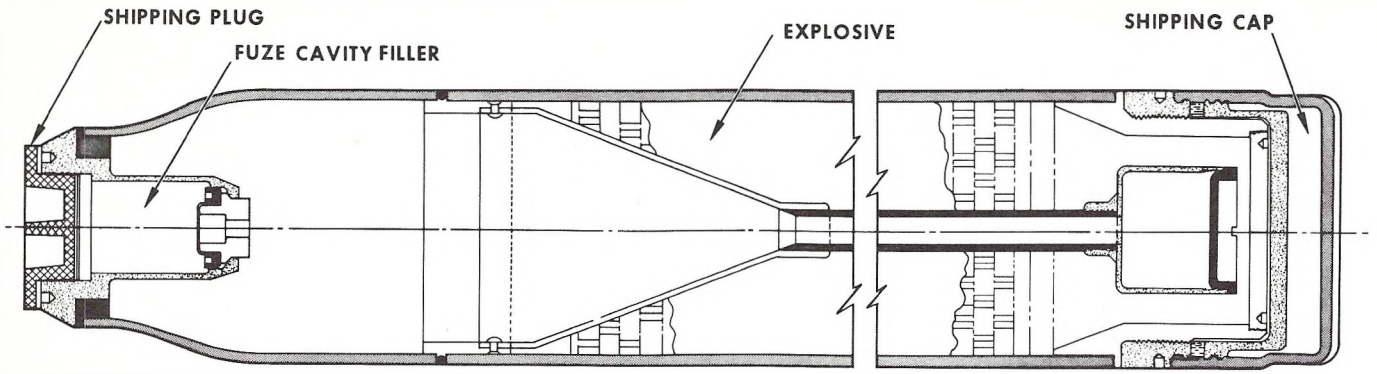



*Figure 4-13. Mk 32 Mod 0 AT/APERS Warhead Configuration*

## 4-60. MK 24 MOD 0 GP WARHEAD.

**4-61. INTRODUCTION.** The Mk 24 Mod 0 (figure 4-14) is a GP warhead designed to be used with the 5.0-inch FFAR.

**4-62. CHARACTERISTICS AND DESCRIPTION.** Characteristics for the Mk 24 Mod 0 warhead are listed in table 4-7. Permanently installed in the warhead is the M191 Mod 1 base fuze that is used in conjunction with a steel ogival nose plug. The heat treated (hardened) steel nose plug enables the warhead to penetrate heavy targets, such as concrete buildings or surface vessels, and to detonate inside. This warhead may also be fuzed with a point detonating or proximity fuze for varying tactical requirements. Refer to paragraph 4-7 for a general description of the warhead.

*Table 4-7. Mk 24 Mod 0 Warhead Characteristics*

| | |
|---|---|
| Type | HE GP |
| Overall Shipping Length (in.) | 19.107 |
| Length without Details (in.) | 17.850 |
| Nominal Weight (lb) | 47.6 |
| Filler: | |
| Type | Comp B |
| Weight (lb) | 9.10 |
| VT Fuze (Mk/Mod) | 93/0 or M414A1 |
| Nose Fuze (Mk/Mod) | 188/0 |
| Base Fuze (Mk/Mod) | 191/1 |
| Ogival Nose Plug | Dwg No. 458162 |

**4-63. CONFIGURATION.** Configuration of the Mk 24 Mod 0 warhead is shown in figure 4-15.

**4-64. SAFETY.** Refer to section II for general safety procedures and precautions related to the Mk 24 Mod 0 warhead.

**WARNING**

The base fuze cavity in the Mk 24 Mod 0 warhead does not contain a cavity liner. Attempts to remove or tighten the base fuze can cause detonation. If base fuze or an approved steel base plug (reference paragraph 2-18) is not in place in the Mk 24 Mod 0 rocket warhead, the warhead shall not be used.

**WARNING**

At the time of removal of warheads from shipping container, the base fuze shall be inspected for protrusion. Warheads with base fuzes protruding more than 1/16 inch are unserviceable and shall be disposed of in accordance with current directives. Do not attempt to tighten base fuze as detonation may occur.

*Figure 4-14. Mk 24 Mod 0 GP Warhead*

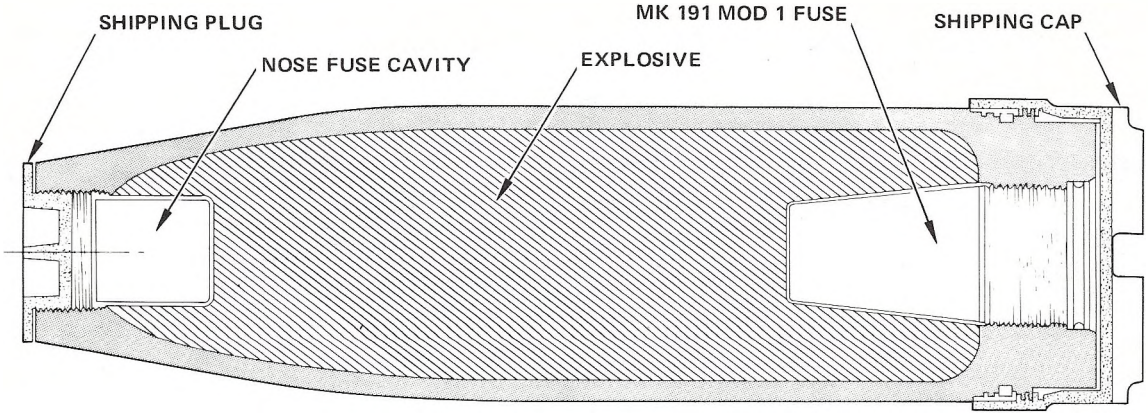



*Figure 4-15. Mk 24 Mod 0 GP Warhead Configuration*

**4-65. PREPARATION FOR USE AND ASSEMBLY.** When penetration of a hard target is desired, the nose fuze of the Mk 24 warhead is replaced with a hardened steel ogival nose plug (Drawing No. 458162) and the Mk 191 Mod 1 fuze supplies delayed detonation after the head has penetrated the target.

**4-66. HANDLING.** No specific handling procedures other than those described in section II are required for the Mk 24 Mod 0 warhead.

**4-67. EMERGENCY PROCEDURES.** No specific procedures other than those described in section II are required for the Mk 24 Mod 0 warhead.

## 4-68. WDU-4/A AND WDU-4A/A FLECHETTE WARHEAD.

**4-69. INTRODUCTION.** The WDU-4/A and WDU-4A/A (figure 4-16) are similar to the typical flechette warhead described in paragraph 4-8. These warheads are designed for use with the 2.75-inch FFAR. The WDU-4A/A differs from the WDU-4/A only in the size and number of flechettes contained in the warhead.

**4-70. CHARACTERISTICS AND DESCRIPTION.** Characteristics for the WDU-4/A and WDU-4A/A are listed in table 4-8. These warheads have a self-contained fuzing mechanism (Model 113A) which expels the flechette payload at the end of motor burning. The WDU-4/A and WDU-4A/A warheads are restricted to the LAU-61, LAU-68, and LAU-69 launchers.

*Table 4-8. WDU-4/A and 4A/A Characteristics*

| | Flechette | |
|---|---|---|
| Designation | WDU-4/A and WDU-4A/A | |
| Overall Shipping Length | 18 inches | |
| Nominal Weight (lb) | 9.3 | |
| Expulsion Charge: | | |
| Type | M-9 propellant | |
| Weight | 6 grains | |
| Flechettes: | | |
| Head | WDU-4/A | WDU-4A/A |
| Number | 6000 | 2200 |
| Weight | 6 grains | 20 grains |
| Fuze | Model 113A | |

**4-71. CONFIGURATION.** Configuration of the WDU-4/A and WDU-4A/A is shown in figure 4-17.

**4-72. SAFETY.** No specific safety precautions other than those described in section II, or normally observed in the handling of explosive materials are required for the WDU-4/A and WDU-4A/A warheads.

**CAUTION**

Apply strap wrench to last 3/4 inch of base of warhead only. Any force exerted forward of this area may collapse the case and render it unserviceable.

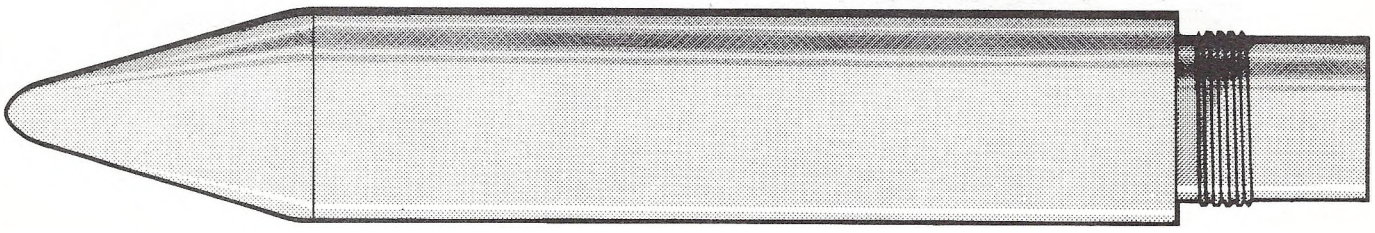


*Figure 4-16. WDU-4/A Flechette Warhead*

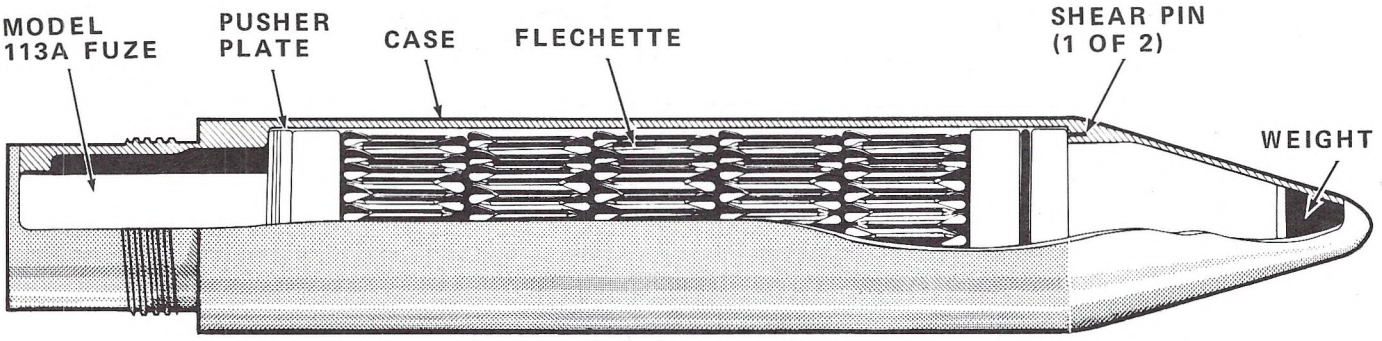



*Figure 4-17. WDU-4/A Flechette Warhead Configuration*

**4-73. PREPARATION FOR USE AND ASSEMBLY.** When assembling WDU-4/A and WDU-4A/A warhead to rocket motor apply wrench to last 3/4 inch portion of base end of warhead.

**4-74. HANDLING.** No specific handling procedures other than those described in section II are required for the WDU-4/A and WDU-4A/A warheads.

**4-75. EMERGENCY PROCEDURES.** No specific procedures other than those described in section II are required for the WDU-4/A and WDU-4A/A flechette warheads.

## 4-76. M156 SMOKE WARHEAD.

**4-77. INTRODUCTION.** The M156 smoke warhead (figure 4-18) is designed to be used with the 2.75-inch rocket. This warhead was formerly designated E-13.

**4-78. CHARACTERISTICS AND DESCRIPTION.** Characteristics for the M156 warhead are listed in table 4-9. The smoke producing element is white phosphorus. This warhead is used primarily to provide smoke for target marking. Refer to paragraph 4-9 for a general description of this warhead. The body casing is similar to the M151 in configuration and material. This warhead is furnished with M423 or M427 fuze. The M423 is used for helicopter and low speed aircraft only.

**4-79. CONFIGURATION.** Configuration of the M156 warhead is shown in figure 4-19.

*Table 4-9. M156 Warhead Characteristics*

| | |
|---|---|
| Type | Smoke |
| Overall Shipping Length (in.) | 12.9 |
| Nominal Weight with Fuze (lb) | 9.70 |
| Nominal Weight without Fuze (lb) | 8.95 |
| Filler: | |
| Type | White Phosphorus |
| Weight (lb) | 2.0 |
| Burster: | |
| Type | Comp B-4 |
| Weight (g) | 48 |
| Point Detonating Fuze | M423 (LSFFAR use only) or M427 |

**4-80. SAFETY.** No specific safety precautions other than those described in section II and those normally observed in the handling of explosive materials are required for the M156 warhead.

**4-81. PREPARATION FOR USE AND ASSEMBLY.** No specific preparation for use or assembly is required for the M156 warhead.

**4-82. HANDLING.** No specific handling procedures other than those described in section II are required for the M156 warhead.

**4-83. EMERGENCY PROCEDURES.** No specific procedures other than those described in section II are required for the M156 warhead.

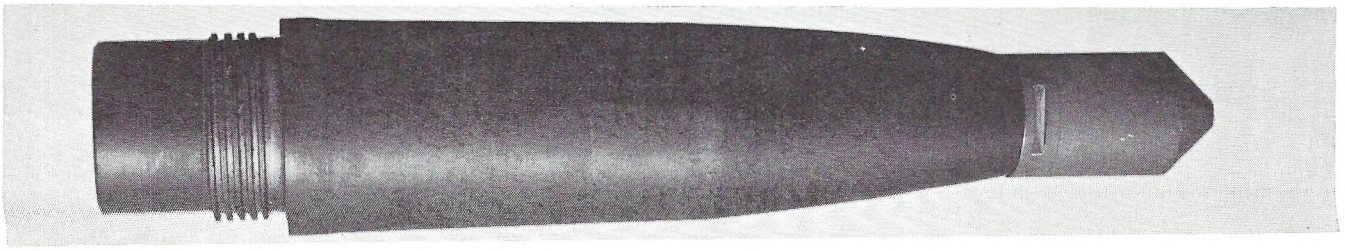


*Figure 4-18. M156 Smoke Warhead*

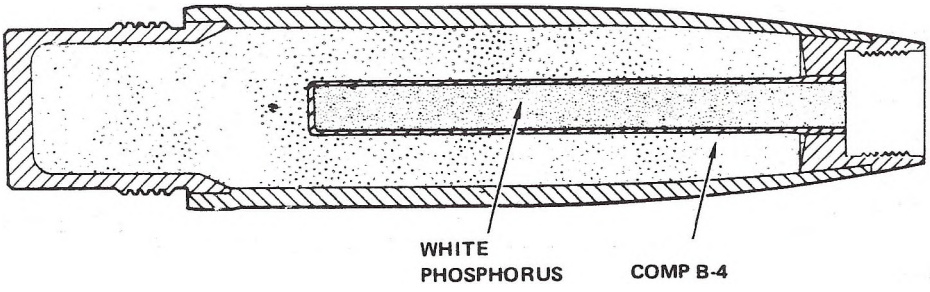



*Figure 4-19. M156 Smoke Warhead Configuration*

## 4-84. MK 67 MOD 0 SMOKE WARHEAD.

**4-85. INTRODUCTION.** The Mk 67 Mod 0 smoke warhead (figure 4-20) is designed to be used with the 2.75-inch rocket.

**4-86. CHARACTERISTICS AND DESCRIPTION.** Characteristics for the Mk 67 Mod 0 warhead are listed in table 4-10. The smoke producing element is white phosphorus. The primary purposes of this warhead is to provide smoke for target marking. This warhead is made from thin wall aluminum alloy rather than steel as are most warheads. Refer to paragraph 4-9 for a general description of this warhead.

*Table 4-10. Mk 67 Mod 0 Warhead Characteristics*

| | |
|---|---|
| Type | Smoke |
| Overall Shipping Length (in.) | 12.9 |
| Nominal Weight with Fuze (lb) | 5.2 |
| Nominal Weight without Fuze (lb) | 4.5 |
| Filler: | |
| Type | White Phosphorus |
| Weight (lb) | 2.6 |
| Burster: | |
| Type | Comp B |
| Point Detonating Fuze | M423 (LSFFAR use only) or M427 |

**4-87. CONFIGURATION.** Configuration of the Mk 67 Mod 0 warhead is shown in figure 4-21.

**4-88. SAFETY.** No specific safety precautions other than those normally observed in the handling of explosive materials are required for the Mk 67 Mod 0 warhead.

**4-89. PREPARATION FOR USE AND ASSEMBLY.** When assembling Mk 67 Mod 0 warheads to rocket motors apply wrench adjacent to base of warhead to prevent damage to the thin casing.

**4-90. HANDLING.** No specific handling procedures other than those described in section II are required for the Mk 67 Mod 0 warhead.

**4-91. EMERGENCY PROCEDURES.** No specific emergency procedures other than those described in section II are required for the Mk 67 Mod 0 warhead.

## 4-92. MK 34 MOD 0 SMOKE WARHEAD.

**4-93. INTRODUCTION.** The Mk 34 Mod 0 smoke warhead (figure 4-22) is designed to be used with the 5.0-inch FFAR. Refer to paragraph 4-9 for general description of this warhead.

**4-94. CHARACTERISTICS AND DESCRIPTION.** Characteristics for the Mk 34 Mod 0 warhead are listed in table 4-11. This warhead, originally the Mk 4, has been adapted for 5.0-inch FFAR application with the addition of a base adapter and a nose fuze adapter. The smoke producing element is plasticized white phosphorus (PWP).

*Table 4-11. Mk 34 Mod 0 Warhead Characteristics*

| | |
|---|---|
| Type | Smoke |
| Overall shipping Length (in.) | 40.457 |
| Nominal Weight (lb) | 51.94 |
| Filler: | |
| Type | PWP |
| Weight (lb) | 19.30 |
| Fuze (Mk/Mod) | 188/0 |

*Figure 4-20. Mk 67 Mod 0 Smoke Warhead*

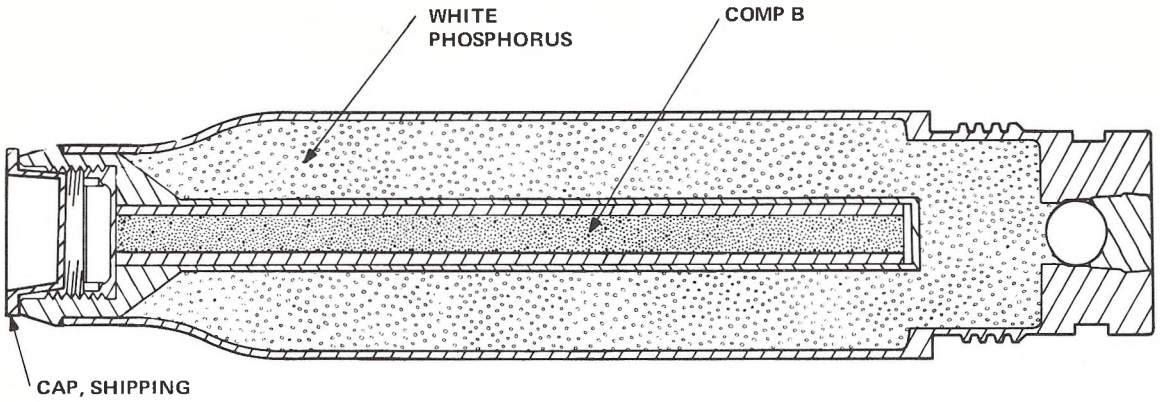



*Figure 4-21. Mk 67 Mod 0 Smoke Warhead Configuration*

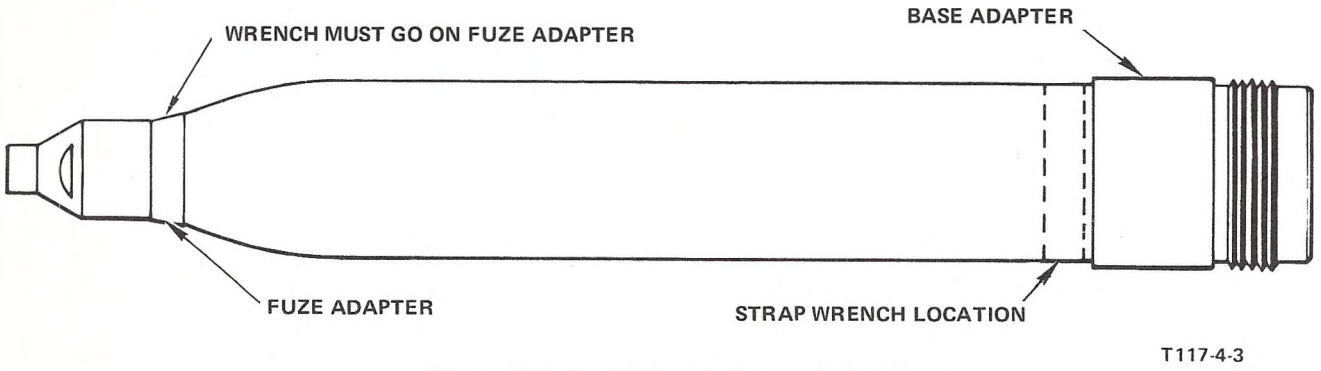



*Figure 4-22. Mk 34 Mod 0 Smoke Warhead*

**4-95. CONFIGURATION.** Configuration of the Mk 34 Mod 0 warhead is similar to other smoke warheads.

**4-96. SAFETY.** No specific safety precautions other than those described in section II and those normally observed in the handling of explosive materials are required for the Mk 34 Mod 0 warhead.

**4-97. PREPARATION FOR USE AND ASSEMBLY.** The Mk 34 Mod 0 warhead may be received either as disassembled component parts or in the assembled configuration. Assembly instructions for the component parts (Mk 4 warhead, base adapter Dwg No. 1517465, and fuze adapter Dwg No. 155626) are as follows:

1. Remove components from shipping container.

2. Thread the base adapter onto the warhead.

3. Using a strap wrench as far aft as possible on the head, and a chain wrench on the base adapter, secure adapter and head together.

4. Thread the fuze adapter into the warhead.

5. Using a strap or chain wrench on the base adapter, securely seat the fuze adapter on the head using a strap wrench.

6. Verify that the adapter seats on the warhead for a full 360 degrees.

**4-98. HANDLING.** No specific handling procedures other than those described in section II are required for the Mk 34 Mod 0 warhead.

**4-99. EMERGENCY PROCEDURES.** No specific procedures other than those described in section II are required for the Mk 34 Mod 0 warhead.

## 4-100. MK 33 MOD 1 FLARE WARHEAD.

**4-101. INTRODUCTION.** The Mk 33 Mod 1 flare warhead (figure 4-23) is designed to be used with the 5.0-inch FFAR. This warhead is used for illuminating surface areas at a distance ahead of high-performance aircraft so that the launching aircraft may avail itself of the parachute-suspended illumination in attacking the target. Refer to paragraph 4-10 for a general description of this warhead.

**4-102. CHARACTERISTICS AND DESCRIPTION.** Characteristics for the Mk 33 Mod 1 warhead are listed in table 4-12. This warhead consists of the permanently installed Mk 193 Mod 0 mechanical time fuze, an illuminating candle, and a parachute assembly. Approximately 15 seconds after the rocket is fired from the launching aircraft, the fuze simultaneously ignites the expelling charge and the

ignition composition. The expelling charge generates gas pressure sufficient to separate the outer case from the aluminum base and to shoot it forward, allowing the parachute to open and suspend the burning candle.

*Table 4-12. Mk 33 Mod 1 Warhead Characteristics*

| | |
|---|---|
| Type | Flare |
| Overall Shipping Length (in.) | 34.9 |
| Nominal Weight (lb) | 45.9 |
| Filler: | |
| Type | Illuminating Composition (Flare Material) |
| Candle Power | Variable |
| Burn Time | 90 sec |
| Weight (lb) | Variable |
| Fuze (Mk/Mod) | 193/0 |

**4-103. CONFIGURATION.** Configuration of the Mk 33 Mod 1 warhead is shown in figure 4-24.

**4-104. SAFETY.** No specific safety precautions other than those described in section II or those normally observed in the handling of explosive materials are required for the Mk 33 Mod 1 warhead.

**CAUTION**

Any force exerted forward of designated area may cause damage to case or the shear pins.

**4-105. PREPARATION FOR USE AND ASSEMBLY.** Apply chain or strap wrench on last 1.0 inch of base on warhead only. Any force exerted forward of this area may cause damage to case of the shear pins.

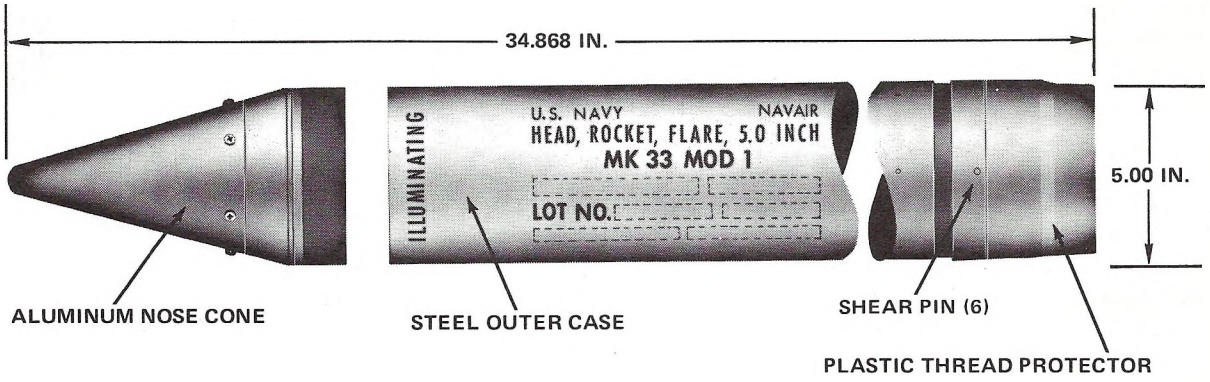



*Figure 4-23. Mk 33 Mod 1 Flare Warhead*

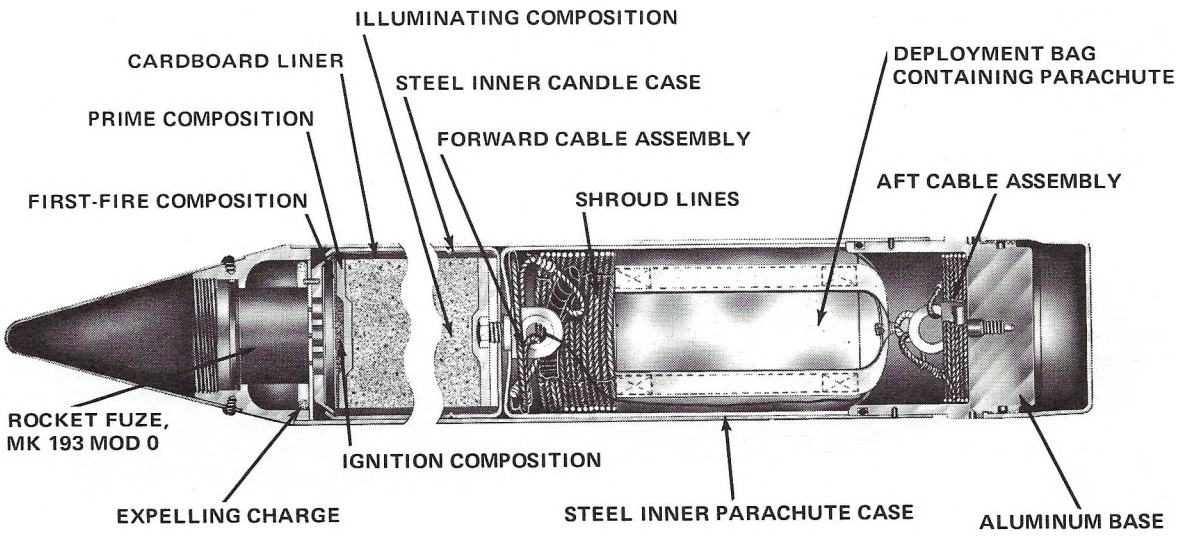



*Figure 4-24. Mk 33 Mod 1 Flare Warhead Configuration*

**4-106. HANDLING.** Refer to section II for general handling procedures related to the Mk 33 Mod 1 warhead.

**CAUTION**

During attachment of this warhead to the rocket motor and in all handling of the complete rocket, extreme caution must be exercised to avoid dropping or exerting and bending forces that might weaken or break any of the six shear pins that secure the flare outer case to its base. This warhead shall be stored in pyrotechnic lockers or magazines.

**4-107. EMERGENCY PROCEDURES.** No specific procedures other than those described in section II are required for the Mk 33 Mod 1 warhead.

## 4-108. MK 1 MOD 1, 2, 3, 4, AND 5 PRACTICE WARHEAD.

**WARNING**

In some cases, the same Mk and Mod numbers have been assigned to both loaded and practice warheads. Personnel should observe MIL-STD-709, NAVORD OP2238 and warhead markings to ensure that these warheads are not interchanged.

**4-109. INTRODUCTION.** The Mk 1 Mod 1, 2, 3, 4, and 5 practice warheads (figure 4-25) are identical to the Mk 1 service warheads, except that they are loaded with an inert filler.

**4-110. CHARACTERISTICS AND DESCRIPTION.** Characteristics for the Mk 1 Mod 1, 2, 3, 4, and 5 practice warheads are listed in table 4-13. Refer to paragraph 4-11 for a general description of the warhead.

**4-111. CONFIGURATION.** Configurations of the Mk 1 Mod 1, 2, 3, 4, and 5 practice warheads are identical to the Mk 1 warheads described in paragraph 4-20 except that they are inert loaded.

*Table 4-13. Mk 1 Mod 1, 2, 3, 4, and 5 Warhead Characteristics*

| | |
|---|---|
| Type | Inert Loaded |
| Mk | 1 |
| Mod | 1, 2, 3, 4, and 5 |
| Overall Length (in.) | 10.99 |
| Nominal Weight (lb) | 6.47 |
| Filler: | |
| Type | Inert |
| Weight (lb) | 1.40 |

**4-112. SAFETY.** No specific safety precautions are required for the Mk 1 Mod 1, 2, 3, 4, and 5 practice warheads.

**4-113. PREPARATION FOR USE AND ASSEMBLY.** No specific preparation for use or assembly procedures is required for the Mk 1 Mod 1, 2, 3, 4, and 5 practice warheads.

**4-114. HANDLING.** No specific handling procedures are required for the Mk 1 Mod 1, 2, 3, 4, and 5 practice warheads.

**4-115. EMERGENCY PROCEDURES.** No specific procedures are required for the Mk 1 Mod 1, 2, 3, 4, and 5 practice warheads.

## 4-116. WTU 1/B PRACTICE WARHEAD.

**4-117. INTRODUCTION.** The WTU 1/B practice warhead is a dummy version of the M151 warhead configured with a M423 or M427 fuze for the 2.75-inch rocket.

**4-118. CHARACTERISTICS AND DESCRIPTION.** Characteristics of the WTU 1/B are listed in table 4-14. Refer to paragraph 4-11 for a general description.

*Table 4-14. WTU 1/B Practice Warhead Characteristics*

| | |
|---|---|
| Type | Dummy |
| Overall Shipping Length (in.) | 16.01 |
| Nominal Weight (lb) | 9.4 |

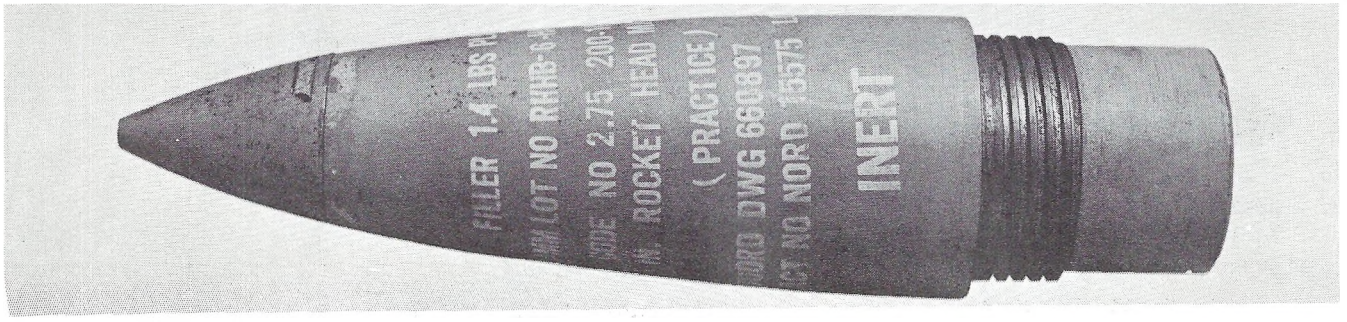



*Figure 4-25. Mk 1 Mod 1, 2, 3, 4, and 5 Practice Warhead*

**4-119. CONFIGURATION.** The WTU 1/B practice warhead is a one piece metal head assigned to match the weight and external configuration of the fuzed M151 warhead.

**4-120. SAFETY.** No specific safety precautions are required for the WTU 1/B practice warheads.

**4-121. PREPARATION FOR USE AND ASSEMBLY.** No specific preparation for use or assembly procedures is required for the WTU 1/B practice warheads.

**4-122. HANDLING.** No specific handling procedures are required for the WTU 1/B practice warheads.

**4-123. EMERGENCY PROCEDURES.** No specific procedures are required for the WTU 1/B practice warheads.

## 4-124. M230 PRACTICE WARHEAD.

**4-125. INTRODUCTION.** The M230 practice warhead (figure 4-26) is an inert loaded version of the M151 warhead and intended for use with the M435 dummy fuze (an inert version of the M423/M427).

**4-126. CHARACTERISTICS AND DESCRIPTION.** Characteristics of the M230 practice warhead are listed in table 4-15. Refer to paragraph 4-11 for a general description.

*Table 4-15. M230 Practice Warhead Characteristics*

| | |
|---|---|
| Type | Inert Loaded |
| Overall Length (in.) | 12.9 |
| Nominal Weight (lb) | 8.7 |

**4-127. CONFIGURATION.** The M230 practice head is identical to the M151 warhead except that it is inert loaded.

**4-128. SAFETY.** No specific safety precautions are required for the M230 practice warheads.

**4-129. PREPARATION FOR USE AND ASSEMBLY.** No specific preparation for use or assembly procedures is required for the M230 practice warheads.

**4-130. HANDLING.** No specific handling procedures are required for the M230 practice warheads.

**4-131. EMERGENCY PROCEDURES.** No specific procedures are required for the M230 practice warheads.

## 4-132. MK 61 MOD 0 PRACTICE WARHEAD.

**4-133. INTRODUCTION.** The Mk 61 Mod 0 practice warhead is a dummy version of the Mk 1 fragmentation warhead configured with a Mk 176 or Mk 178 fuze for the 2.75-inch rockets.

**4-134. CHARACTERISTICS AND DESCRIPTION.** Characteristics for the Mk 61 Mod 0 dummy warhead are listed in table 4-16. Refer to paragraph 4-11 for a general description.

*Table 4-16. Mk 61 Mod 0 Practice Warhead Characteristics*

| | |
|---|---|
| Type | Dummy |
| Overall Shipping Length (in.) | 10.98 |
| Nominal Weight (lb) | 6.47 |

**4-135. CONFIGURATION.** The Mk 61 Mod 0 practice warhead is a one piece metal head designed to match the weight and external configuration of the fuzed Mk 1 Mod 1 through 5 HE-FRAG warheads.

**4-136. SAFETY.** No specific safety precautions are required for the Mk 61 Mod 0 practice warhead.

**4-137. PREPARATION FOR USE AND ASSEMBLY.** No specific preparation for use or assembly procedures is required for the Mk 61 Mod 0 practice warheads.

**4-138. HANDLING.** No specific handling procedures are required for the Mk 61 Mod 0 practice warhead.

**4-139. EMERGENCY PROCEDURES.** No specific procedures are required for the Mk 61 Mod 0 practice warhead.

## 4-140. MK 6 MOD 1 PRACTICE WARHEAD.

**4-141. INTRODUCTION.** The Mk 6 Mod 1 practice warhead (figure 4-27) is designed for use with the 5.0-inch FFAR.

**4-142. CHARACTERISTICS AND DESCRIPTION.** Characteristics for the Mk 6 Mod 1 inert loaded practice warhead are listed in table 4-17. This practice warhead is made up of Mk 6 warhead body with inert filler, a base adapter to convert to the 5.0-inch FFAR rocket motor, and either the flat nose plug or the steel ogival nose plug may be used. Refer to paragraph 4-11 for a general description.

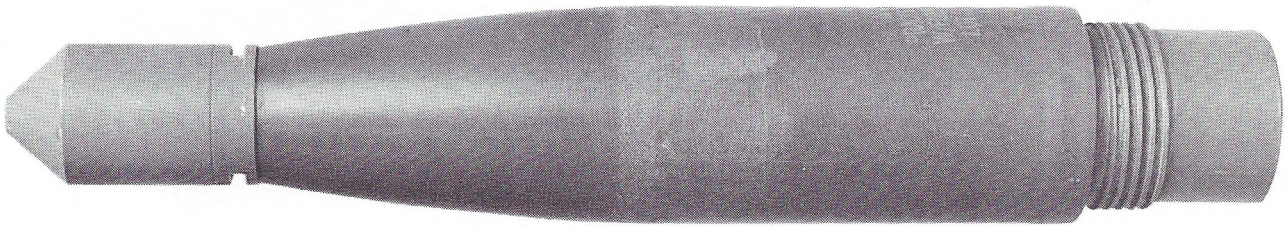


*Figure 4-26. M230 Practice Warhead*

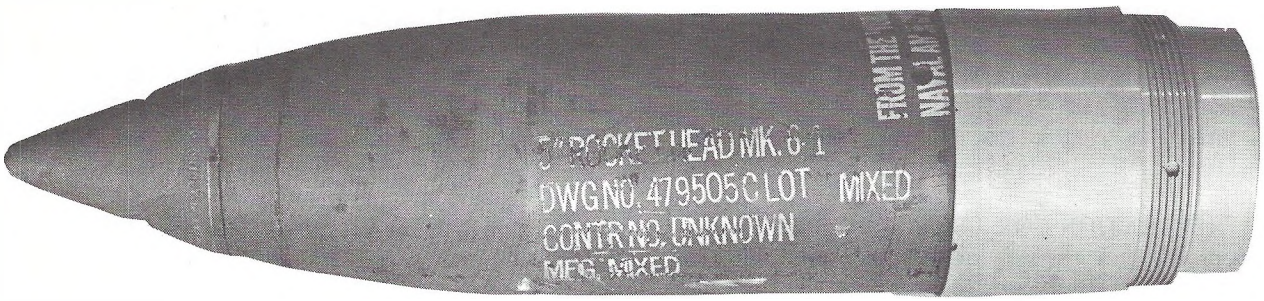



*Figure 4-27. Mk 6 Mod 1 Practice Warhead*

*Table 4-17. Mk 6 Mod 1 Warhead Characteristics*

| | |
|---|---|
| Type | Inert Loaded |
| Overall Shipping Length (in.) | 20.435 |
| Nominal Weight (lb) | 48 |

**4-143. CONFIGURATION.** The Mk 6 Mod 1 practice warhead is an inert loaded warhead used to simulate the Mk 24 service warhead.

**4-144. SAFETY.** No special safety precautions are required for the Mk 6 Mod 1 practice warhead.

**4-145. PREPARATION FOR USE AND ASSEMBLY.** No specific preparation for use or assembly procedures is required for the Mk 6 Mod 1 practice warhead.

**4-146. HANDLING.** No specific handling procedures are required for the Mk 6 Mod 1 practice warhead.

**4-147. EMERGENCY PROCEDURES.** No specific procedures are required for the Mk 6 Mod 1 practice warhead.

## 4-148. MK 24 MOD 0 PRACTICE WARHEAD.

**4-149. INTRODUCTION.** The Mk 24 Mod 0 practice warhead is designed to be used with the 5.0-inch FFAR (figure 4-28).

**4-150. CHARACTERISTICS AND DESCRIPTION.** Characteristics for the Mk 24 Mod 0 practice warhead are listed in table 4-18. This practice warhead is made of Mk 24 Mod 0 warhead body loaded with inert filler. Either the ogival nose plug or the flat nose plug may be used. Refer to paragraph 4-11 for a general description.

*Table 4-18. Mk 24 Mod 0 Practice Warhead Characteristics*

| | |
|---|---|
| Type | Inert Loaded |
| Overall Shipping Length (in.) | 19.1 |
| Nominal Weight (lb) | 46.4 |
| Length without Details (in.) | 17.8 |

**4-151. CONFIGURATION.** The configuration of the Mk 24 Mod 0 practice warhead is the same as the Mk 24 Mod 0 service warhead except that it has a base plug rather than a base fuze.

**4-152. SAFETY.** No specific safety precautions are required for the Mk 24 Mod 0 practice warhead.

**4-153. PREPARATION FOR USE AND ASSEMBLY.** No specific preparation for use or assembly procedures is required for the Mk 24 Mod 0 practice warhead.

**4-154. HANDLING.** No specific handling procedures are required for the Mk 24 Mod 0 practice warhead.

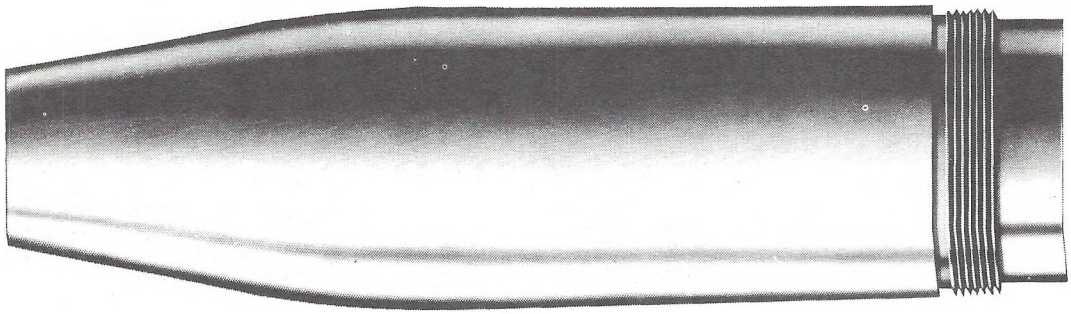


*Figure 4-28. Mk 24 Mod 0 Practice Warhead*

**4-155. EMERGENCY PROCEDURES.** No specific procedures are required for the Mk 24 Mod 0 practice warhead.

## 4-156. MK 32 MOD 1 PRACTICE WARHEAD.

**4-157. INTRODUCTION.** The Mk 32 Mod 1 practice warhead is designed to be used with the 5.0-inch FFAR (figure 4-29).

**4-158. CHARACTERISTICS AND DESCRIPTION.** Characteristics for the Mk 32 Mod 1 practice warhead are listed in table 4-19. Refer to paragraph 4-11 for a general description.

*Table 4-19. Mk 32 Mod 1 Practice Warhead Characteristics*

| | |
|---|---|
| Type | Inert Loaded |
| Overall Shipping Length (in.) | 30.229 |
| Nominal Weight (lb) | 46.16 |

**4-159. CONFIGURATION.** Configuration of the Mk 32 Mod 1 practice warhead is made up of Mk 25 warhead body loaded with inert filler, and a base adapter to convert to the 5.0-inch FFAR. Either the ogival nose plug or the flat nose plug may be used.

**4-160. SAFETY.** No specific safety precautions are required for the Mk 32 Mod 1 practice warhead.

**4-161. PREPARATION FOR USE AND ASSEMBLY.** No specific preparation for use or assembly procedures is required for the Mk 32 Mod 1 practice warhead.

**4-162. HANDLING.** No specific handling procedures are required for the Mk 32 Mod 1 practice warhead.

**4-163. EMERGENCY PROCEDURES.** No special procedures are required for the Mk 32 Mod 1 practice warhead.

## 4-164. MK 62 MOD 0 PRACTICE WARHEAD.

**4-165. INTRODUCTION.** The Mk 62 Mod 0 practice warhead (figure 4-30) is a dummy version of the Mk 24 Mod 0 GP warhead for the 5.0-inch FFAR.

**4-166. CHARACTERISTICS AND DESCRIPTION.** Characteristics for the Mk 62 Mod 0 practice warhead are listed in table 4-20. Refer to paragraph 4-11 for a general description.

*Table 4-20. Mk 62 Mod 0 Practice Warhead Characteristics*

| | |
|---|---|
| Type | Dummy |
| Overall Shipping Length (in.) | 21.37 |
| Nominal Weight (lb) | 46.4 |

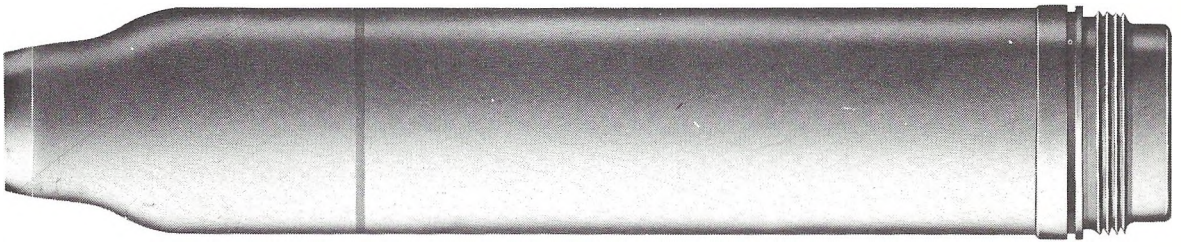


*Figure 4-29. Mk 32 Mod 1 Practice Warhead*

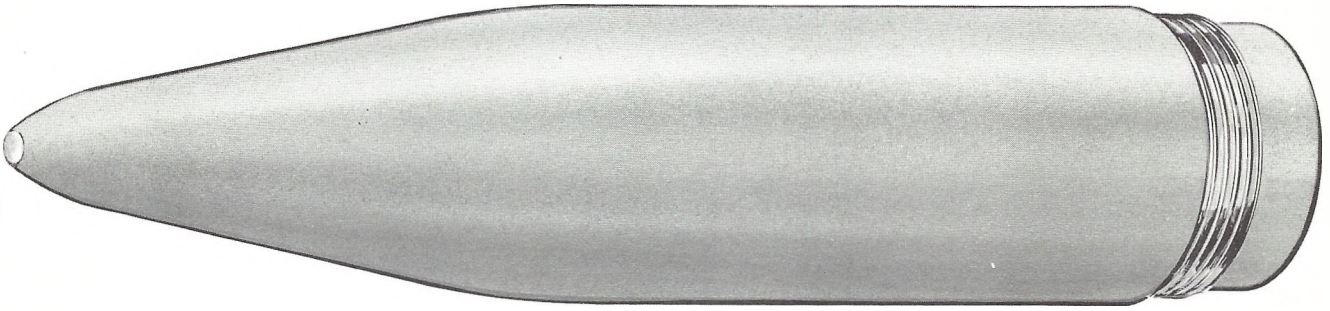


*Figure 4-30. Mk 62 Mod 0 Practice Warhead*

**4-167. CONFIGURATION.** The Mk 62 Mod 0 practice warhead is a one piece metal head designed to match the weight and exterior configuration of a fuzed Mk 24 Mod 0 warhead.

**4-168. SAFETY.** No specific safety precautions are required for the Mk 62 Mod 0 practice warhead.

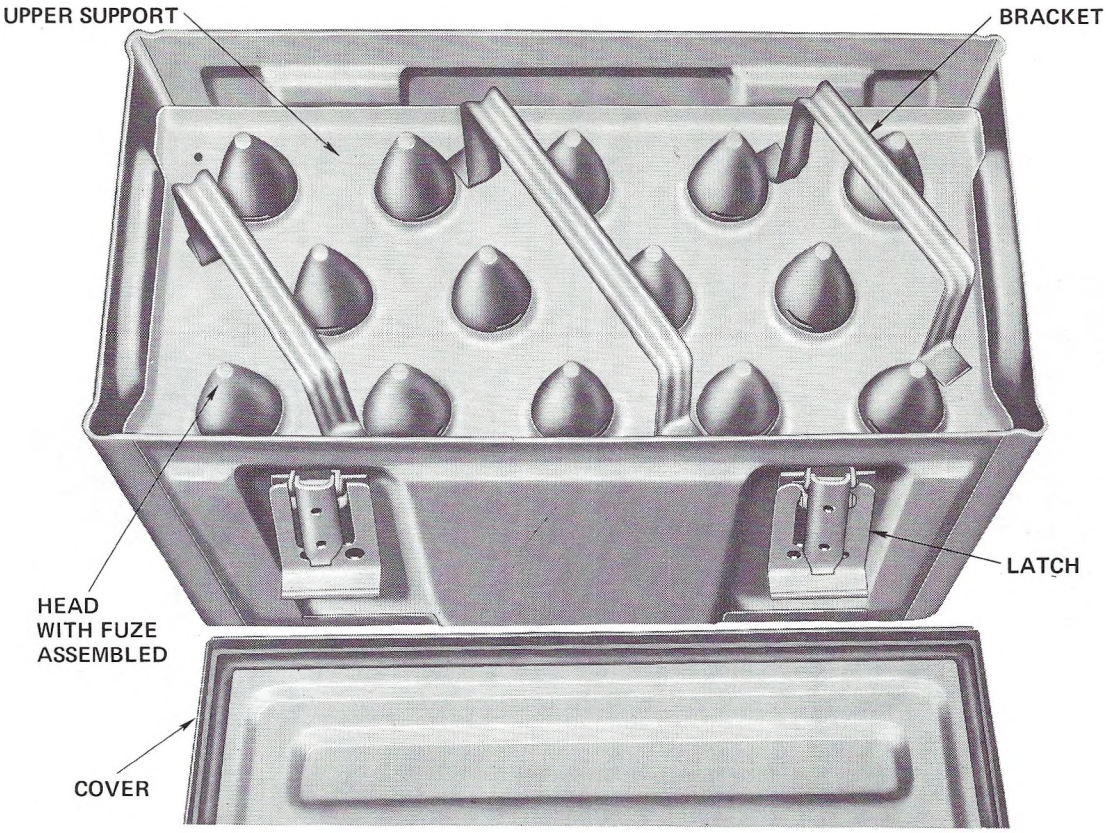
**4-169. PREPARATION FOR USE AND ASSEMBLY.** No specific preparation for use or assembly procedures is required for the Mk 62 Mod 0 practice warhead.

**4-170. HANDLING.** No specific special handling procedures are required for the Mk 62 Mod 0 practice warhead.

**4-171. EMERGENCY PROCEDURES.** No specific procedures are required for the Mk 62 Mod 0 practice warhead.

## 4-172. WARHEAD SHIPPING CONTAINERS.

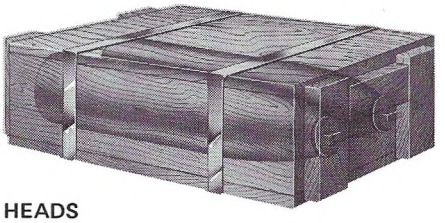
4-173. Current packaging for warheads include wood and metal boxes, and metal cans (figure 4-31). Larger size warheads such as those for the 5.0-inch FFAR may be palletized (figure 4-32). Detailed packaging information is contained in WR-54.




METAL SHIPPING CONTAINER

HEAD

METAL SHIPPING CONTAINER



HEADS

WOOD SHIPPING CONTAINER

*Figure 4-31. Typical Warhead Shipping Containers*

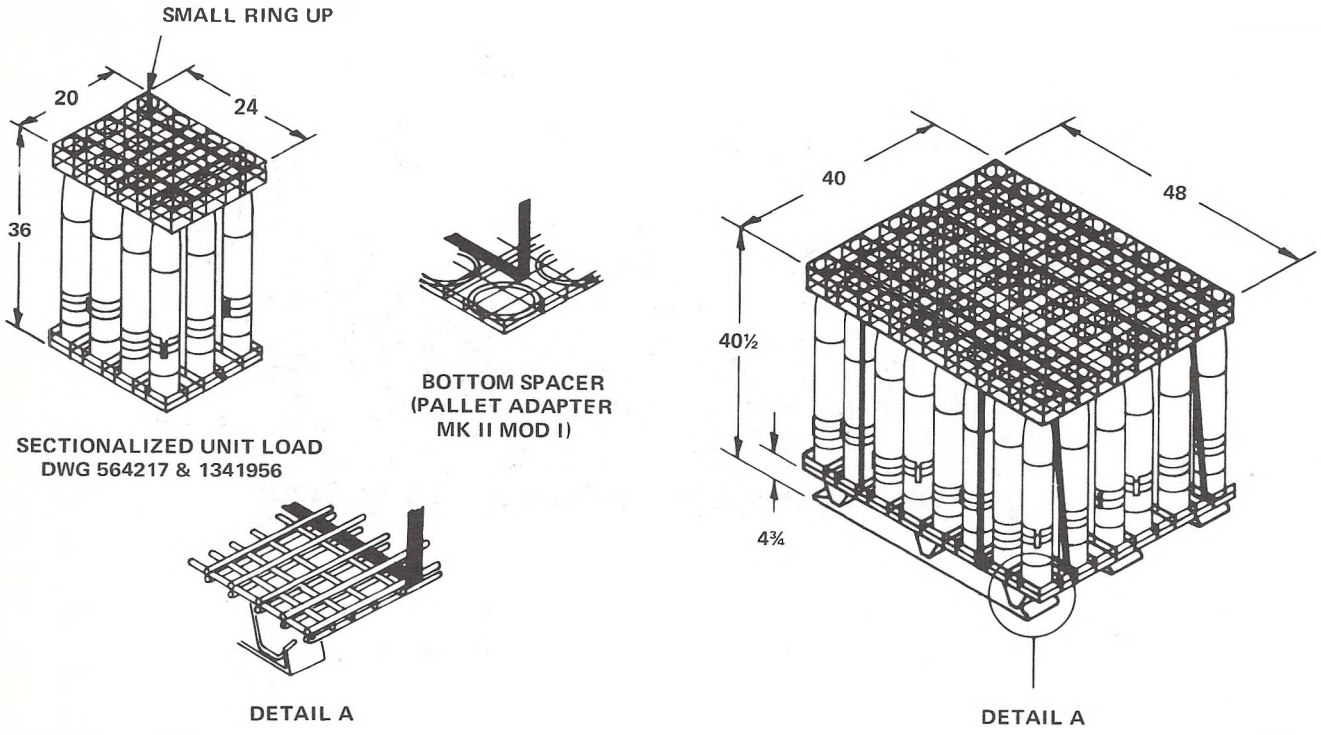



*Figure 4-32. 5.0-Inch Warhead Palletizing*

# SECTION V

# ROCKET MOTORS

## 5-1. INTRODUCTION.

5-2. Rocket motors currently used in the 2.75-inch and 5.0-inch naval air launched rocket systems are solid propellant free-standing grain configurations utilizing folding fins. A description of each of the rocket motors is provided in this section.

**WARNING**

During handling of rocket motors or assembled rockets use extreme care to avoid rough handling. If a motor is dropped and any portion impacts after falling 2 feet or more, do not use. Rocket motors that are damaged are hazardous and shall be disposed of in accordance with current directives. Anytime a rocket motor is not in a launcher, a shorting clip (2.75) or a shielding band (5.0) shall be installed.

## 5-3. 2.75-INCH ROCKET MOTOR.

5-4. The principle components of the 2.75-inch rocket motor are shown in figure 5-1 and include the motor tube, igniter, propellant, stabilizing rod and nozzle and fin assembly. A general description of these components is provided in paragraph 5-5 through 5-17.

**NOTE**

The overall firing temperature range of the 2.75-inch rocket motor is -65°F to +150°F. The storage temperature limits are -65°F to +165°F. The firing temperature must be maintained for 24 hours prior to aircraft take-off.

**5-5. MOTOR TUBE.** The 2.75-inch rocket motor tube (figure 5-1) is basically an aluminum tube. There are two types of motor tubes, the integral bulkhead and the non-integral bulkhead. The center portion of the motor tube contains the propellant. The nozzle and fin assembly attaches to the aft end by a lockwire in a groove inside the tube.

**5-6. Motor Forward End.** The forward end of the motor tube (figure 5-1) contains the head closure and threaded portion for attachment of the warhead. Two types of head closures are used in 2.75-inch rocket motors; the integral bulkhead closure with motor tube threaded to accept warheads, and a two-piece closure. These closures are shown in figure 5-2. The two-piece head closure incorporates a thin blowout disc that will blow out in case of ignition prior to assembly of the warhead to the rocket motor. The two-piece head closure is secured to the motor tube by a lockwire and is threaded to accept the warhead. The integral bulkhead closure will not rupture when accidentally fired without a warhead and will become propulsive when ignited.

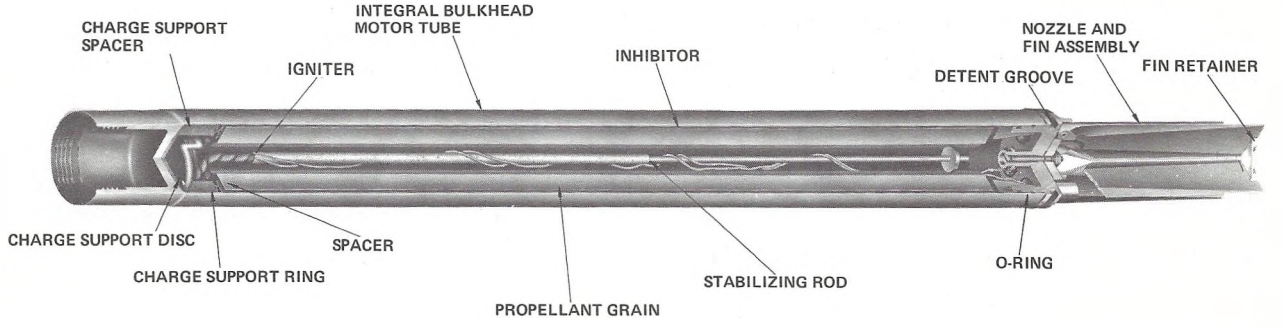
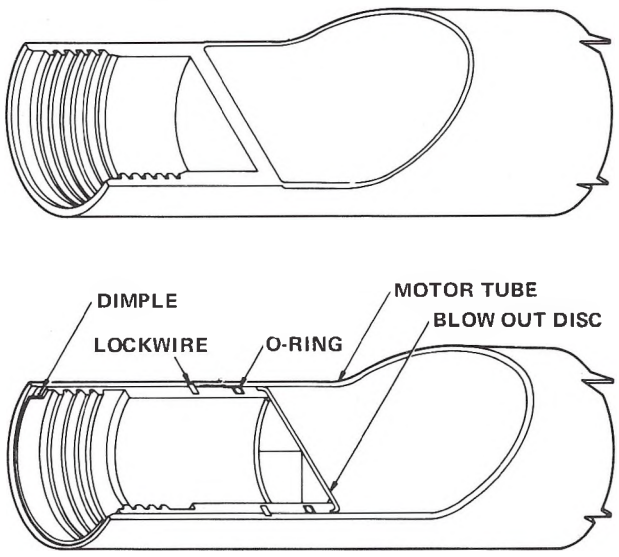



*Figure 5-1. Typical Rocket Motor*

INTEGRAL BULKHEAD CLOSURE (PROPULSIVE)




TWO-PIECE BULKHEAD CLOSURE (NON-PROPULSIVE)

*Figure 5-2. Typical Head Closures*

**5-7. Motor Center Section.** The center section of the motor tube (figure 5-1) is the combustion chamber and contains the igniter, propellant, stabilizing rod, and associated hardware.

**WARNING**

Testing the rocket ignition circuit is not permitted because of the danger of accidental ignition of the motor.

**5-8. Igniter.** The igniter heats the propellant grain to ignition temperature. The igniter is a disc shaped metal container containing a black powder and magnesium charge, a squib, and lead wires which extend from the squib through the wall of the igniter and out through the propellant perforation to the nozzle and fin assembly. One of the wires is connected to the nozzle plate, and the other passes through either one of the nozzles (figure 5-3 View A) or the fin actuating piston (figure 5-3 View B) to the contact disc on the fin retainer.

5-9. *Propellant Grain.* The propellant grain contained in the 2.75-inch rocket motor is an internal burning, star perforation, double base solid propellant. The star perforation is designed to produce a nearly constant thrust level. The external portion of the grain is covered with an inhibitor to control the burning surface. A typical propellant grain is shown in figure 5-4.

5-10. *Stabilizing Rod.* The salt coated stabilizing rod in the perforation of the motor propellant grain prevents unstable burning of the propellant, and reduces flash and after burning which contribute to compressor stall and flameout of jet aircraft engines.

**5-11. Motor Aft End.** The aft end of the motor tube is grooved internally to accept a lockwire which attaches the nozzle and fin assembly (figure 5-1).

**5-12. Nozzle and Fin Assembly.** The nozzle and fin assembly, shown in figure 5-5, attaches to the aft end of the motor tube and consists basically of a nozzle plate, four nozzle inserts, fin-actuating mechanism, four fins, and a fin retainer and contact disc.

**5-13. Nozzle Plate and Nozzle Inserts.** In the aft end of the nozzle plate are four nozzle inserts (figure 5-6) and a central fin actuating cylinder. In the nozzle inserts are fitted either thin steel cups cemented into the exit cones of the nozzle or a coined seal which is cemented, or soldered, to the interior base of the nozzle (figure 5-7). These seals are weathertight and allow pressurization of the motor interior by the igniter to insure ignition. The nozzle plate has a detent groove, by which the rocket is held in position after it is loaded into a launcher.

**5-14. Fin Actuating Mechanism.** The fin-actuating mechanism (figure 5-8) consists of a steel cylinder and a piston with a crosshead attached to its aft end. Gas pressure from the motor operates the piston and crosshead, pushing the crosshead against the heels of the fins and thereby causing the fins to open after the rocket leaves the launcher. After the fins have opened, the crosshead moves into position to prevent the fins from closing. Operation of the fins is shown in figure 5-9.

**5-15. Fins.** The fins are attached by pivot pins to lugs machined on the aft part of the nozzle plate. When folded, the fins lie within the 2.75-inch diameter of the rocket. The

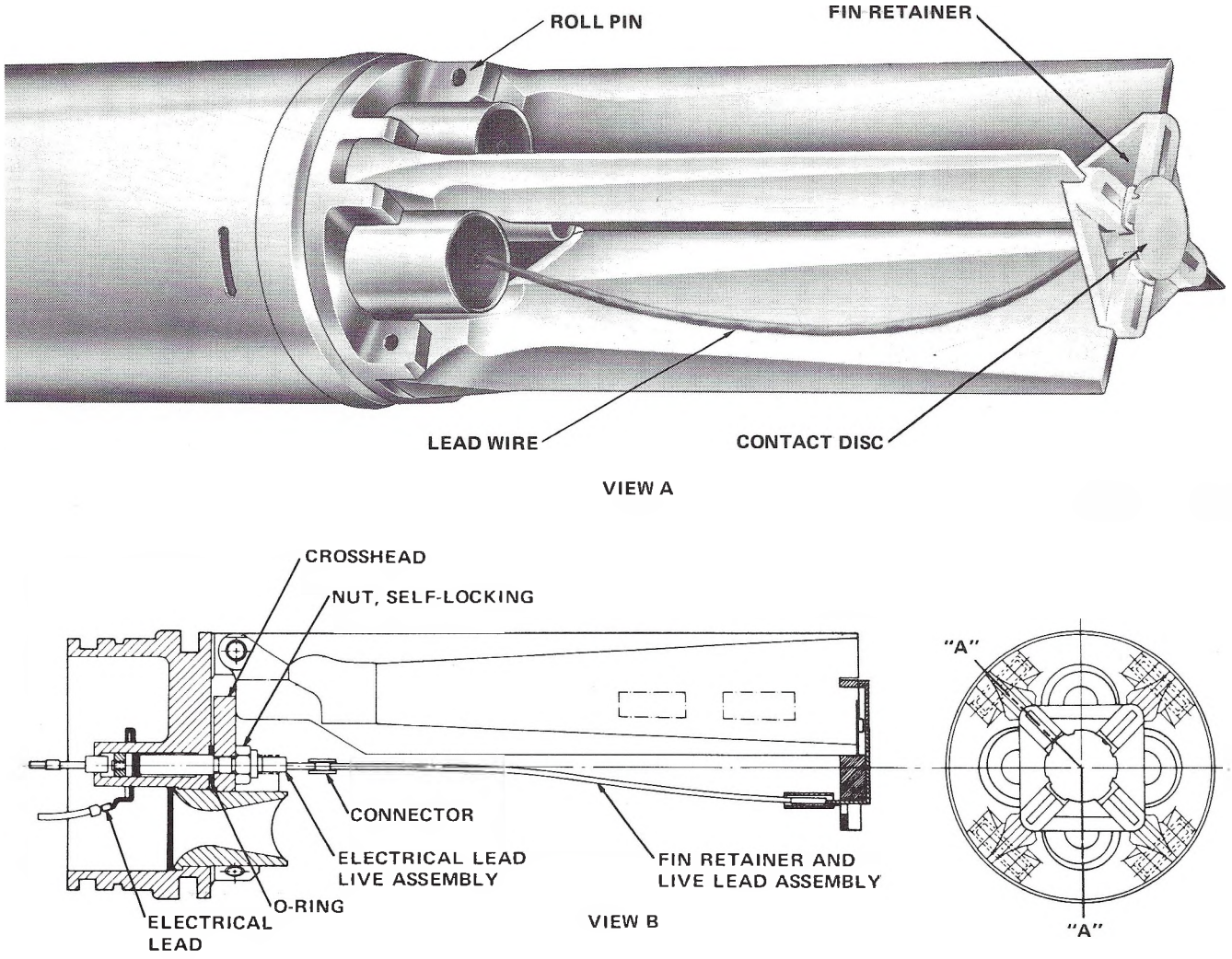



*Figure 5-3. Typical Center Lead Wire Connection*

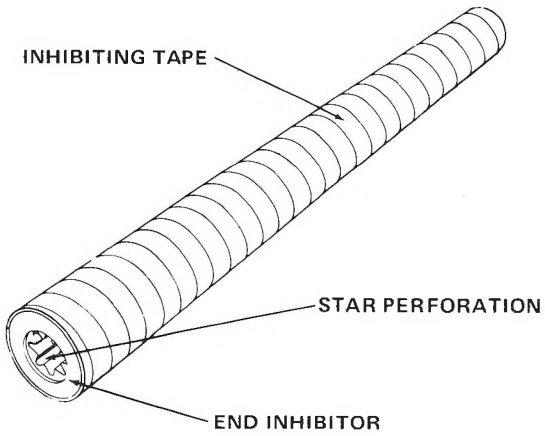



*Figure 5-4. Typical Propellant Grain*

fins are notched at the tips to allow attachment of a fin retainer.

**5-16. Fin Retainer and Contact Disc.** The fin retainer (figure 5-9) is a 1-1/4-inch square frame which engages the notches in the tips of the fins and holds the fins in the folded position which permits insertion of the rocket into the launching tubes of the rocket launcher. The retainer is fitted with an insulated contact disc which connects to the igniter lead wire.

**5-17. SAFETY AND PROTECTIVE DEVICES.** Either a fin protector or a shorting clip shall be installed whenever 2.75-inch motors are outside of the launcher. The fin protector incorporates a shorting device.

## 5-18. MK 4 MODS ROCKET MOTORS.

**5-19. INTRODUCTION.** The Mk 4 Mods rocket motors (figure 5-10) are used with all configurations of the 2.75-inch FFAR and are intended for use on all high speed aircraft.

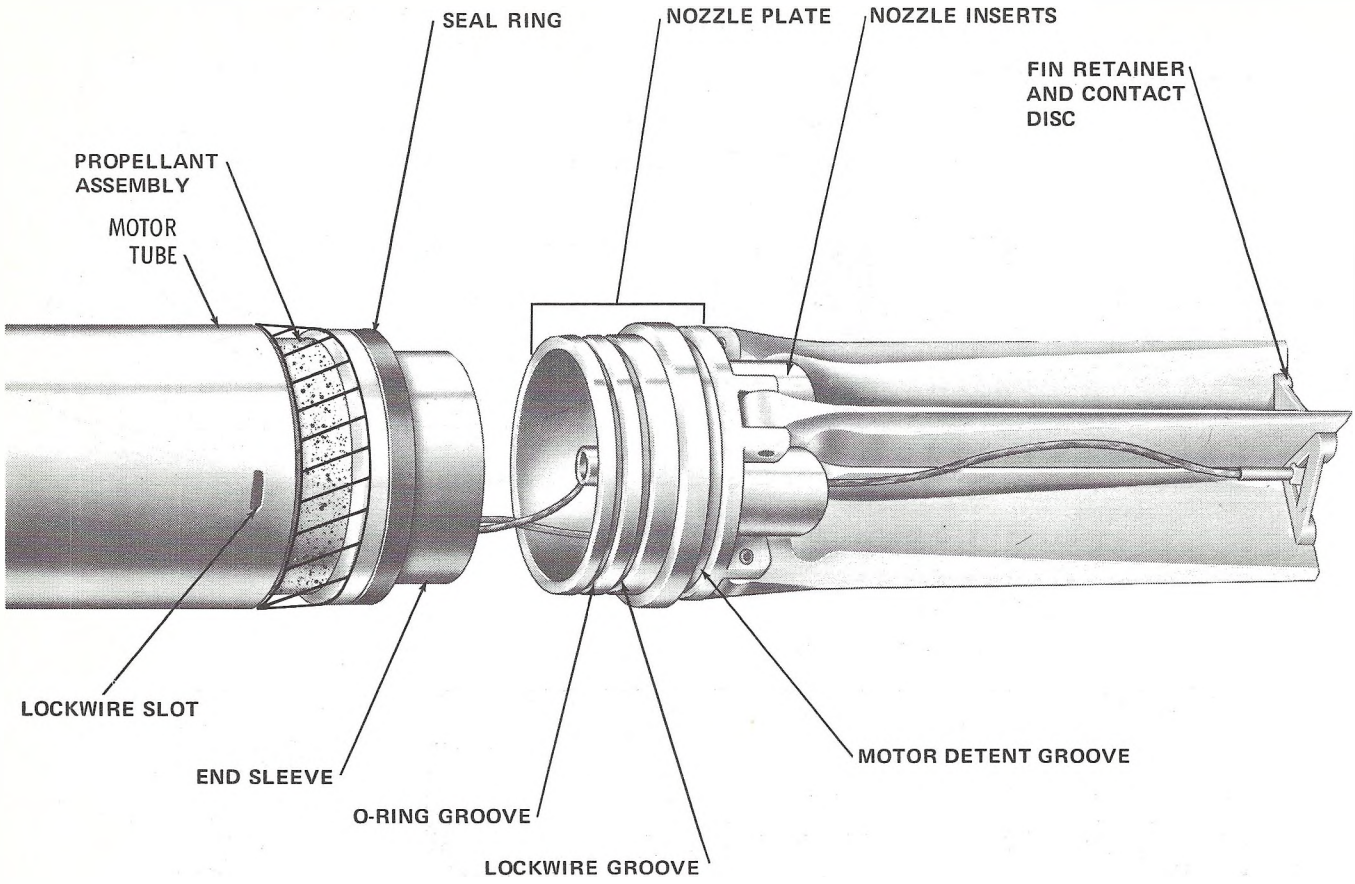



*Figure 5-5. Nozzle and Fin Assembly*

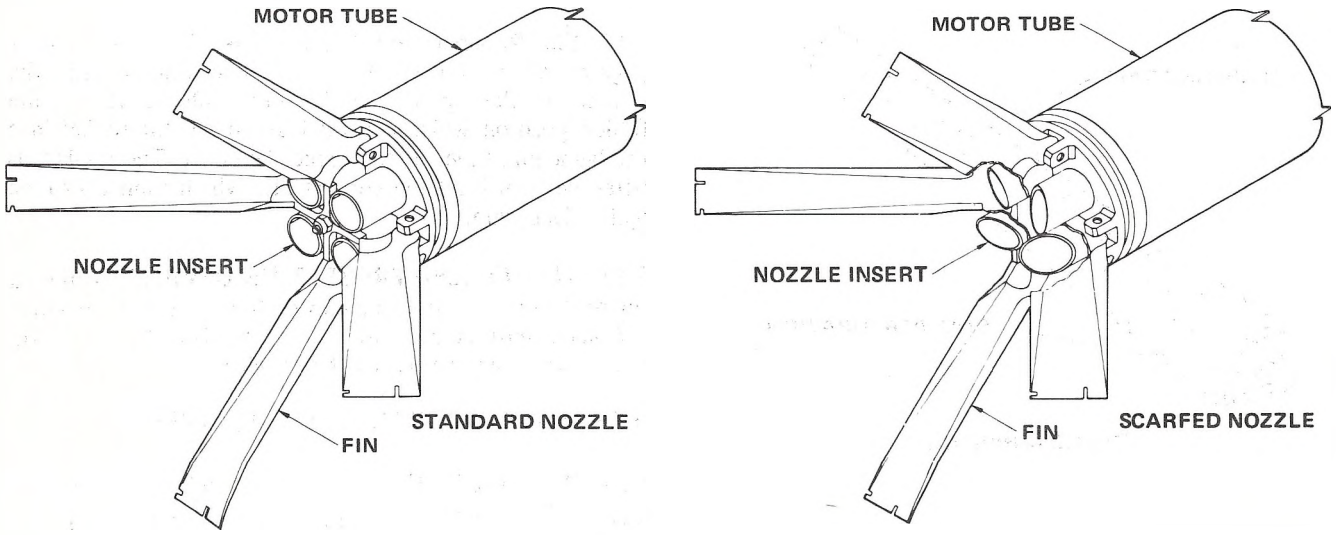
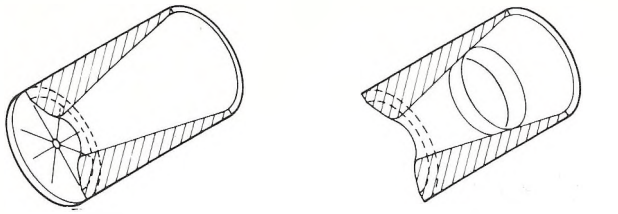



*Figure 5-6. Nozzle Inserts*



COIN TYPE
BLOW OUT SEAL
USED IN MK 40 MOD 3
AND MK4 MOD 10

CUP TYPE
BLOW OUT SEAL
USED IN MK 4 MODS 1-8
AND MK 40 MODS 0 AND 1

*Figure 5-7. Nozzle Blowout Seal*

*Table 5-1. Mk 4 Mods Motor Characteristics*

| | | |
|---|---|---|
| Mod | 1 thru 8 | 10 |
| Overall Length Shipped (in.) | 39.92 | 39.92 |
| Overall Length without Details (in.) | 39.36 | 39.36 |
| Largest Diameter Shipped (in.) | 3.01 | 3.01 |
| Nominal Weight Shipped (lb) | 12.70 | 12.70 |
| Nominal Weight Fired (lb) | 11.40 | 11.40 |
| Thrust (lb) | 720 | 720 |
| Burning Time (sec) | 1.69 | 1.69 |
| Propellant (Mk/Mod) | 43/1 | 43/1 |
| Igniter (Mk/Mod) | 125/4 | 125/5 |
| Nozzle | Standard | Standard |

**5-20. CHARACTERISTICS AND DESCRIPTION.** Characteristics for the Mk 4 Mods motors are listed in table 5-1. A general description of the motors is provided in paragraphs 5-5 through 5-17.

**5-21. CONFIGURATION.** Configuration of the Mk 4 Mod 8 motor is shown in figure 5-11. The Mod 1 through 6 motors are functionally the same as the Mod 8 except that they have a two-piece head closure rather than an integral bulkhead. The Mod 10 motor incorporates a coined blow out type nozzle seal, electrical lead through the piston, and the Mk 125 Mod 5 igniter, as well as the integral bulkhead.

**5-22. SAFETY.** No specific safety precautions other than those described in section II, and those normally observed in the handling of explosive materials, are required for the Mk 4 Mods.

**5-23. PREPARATION FOR USE AND ASSEMBLY.** No specific preparation for use or assembly procedures is required for the Mk 4 Mods.

**5-24. HANDLING.** No specific handling procedures are required for the Mk 4 Mods.

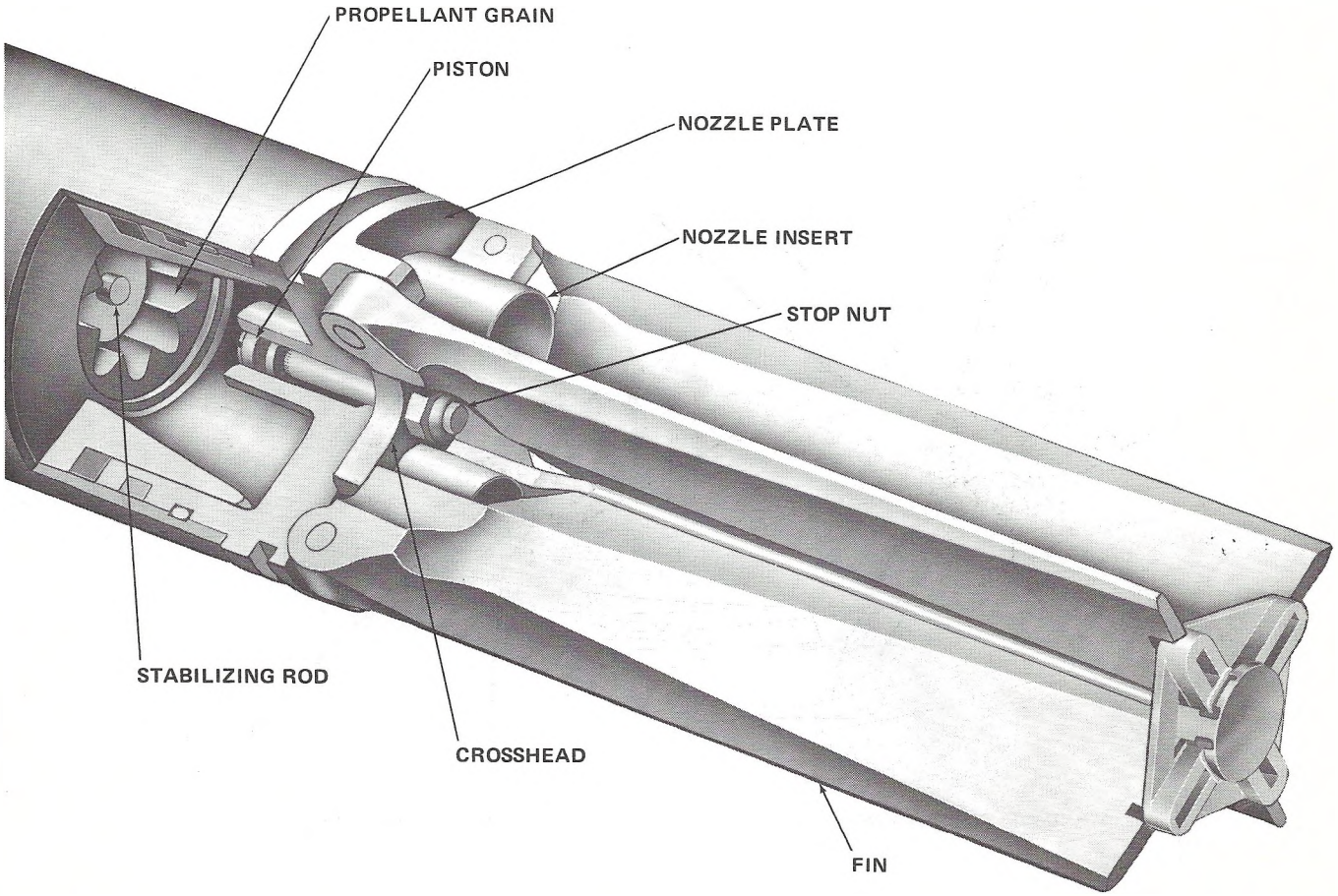
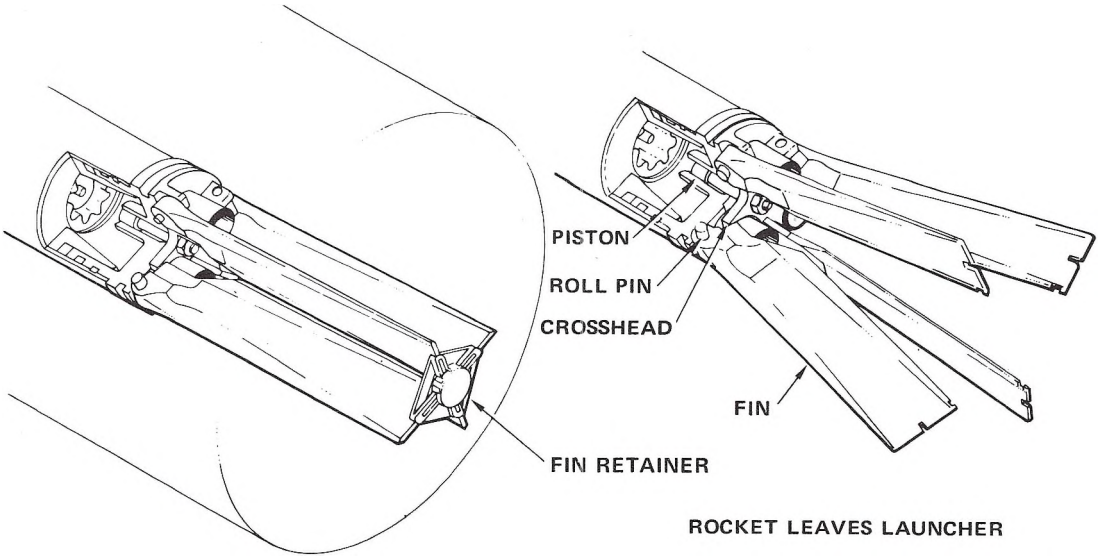



*Figure 5-8. 2.75-Inch FFAR Fin Actuating Mechanism*



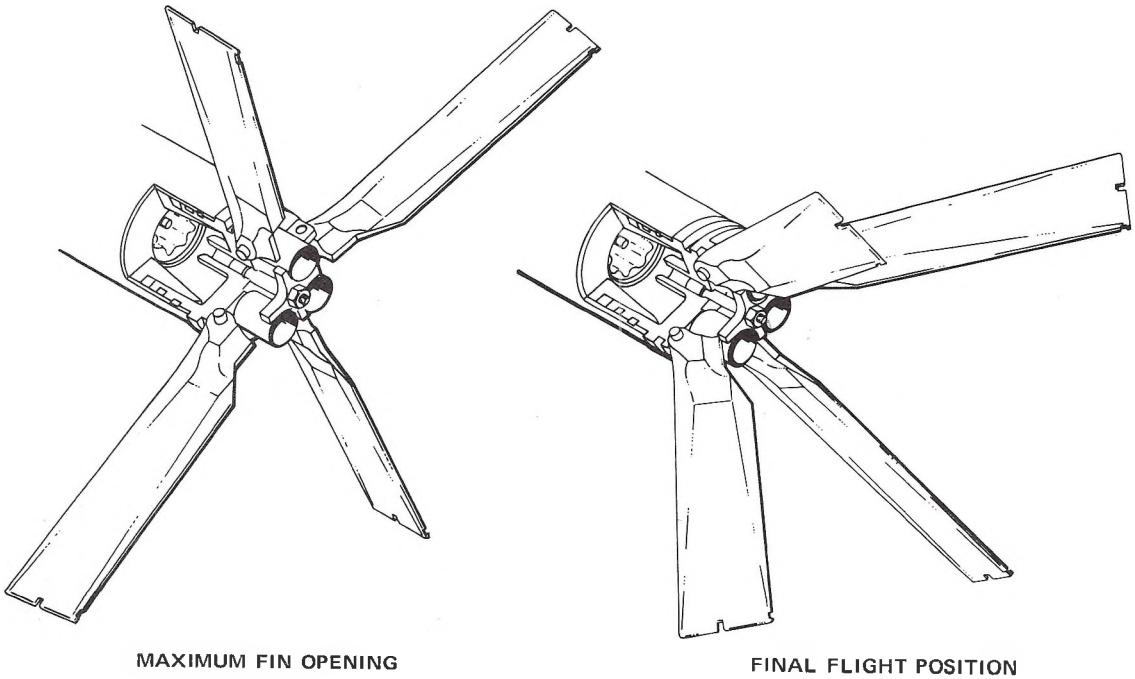




*Figure 5-9. FFAR Fin Operation*

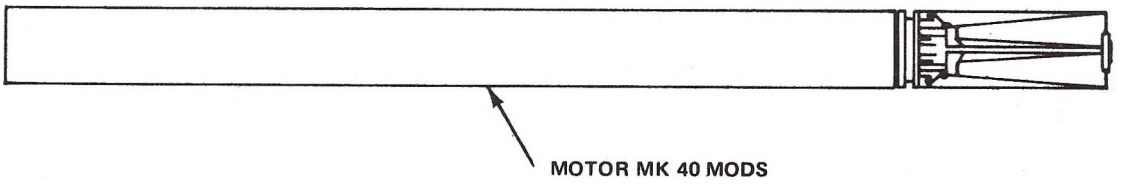



*Figure 5-10. Mk 40 Mods and Mk 4 Mods 2.75-Inch Rocket Motors*

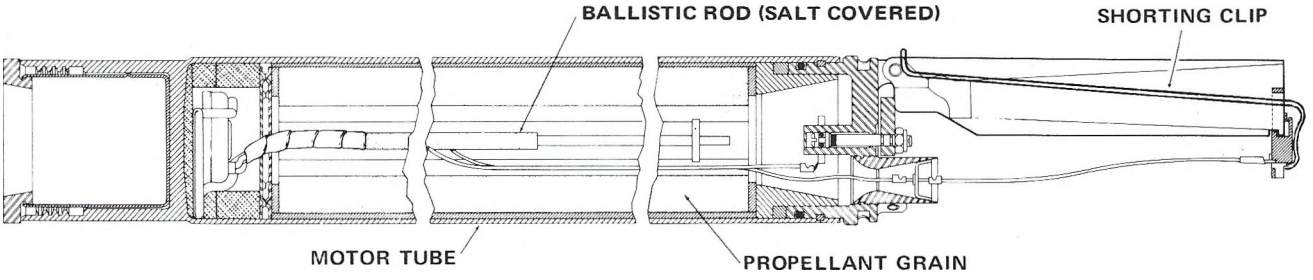



*Figure 5-11. Mk 4 Mod 8 Rocket Motor Configuration*

**5-25. EMERGENCY PROCEDURES.** No specific procedures are required for the Mk 4 Mods motors, beyond those normally required for rocket motors.

## 5-26. MK 40 MODS ROCKET MOTORS.

**WARNING**

Mk 40 motors shall not be fired from high speed aircraft or from pair-firing launchers.

**5-27. INTRODUCTION.** The Mk 40 Mods rocket motors (figure 5-10) are used with all configurations of the 2.75-inch LSFFAR.

**NOTE**

The 2.75-inch rocket motors Mk 40 Mod 0, 1, and 3 are designed for firing from helicopters and low-speed aircraft. The nozzle inserts have their expansion cones cut at an angle (scarfed) and are installed in an arrangement which gives the rocket a rotation during free flight. This rotation during flight tends to stabilize the rocket when fired at low initial launch velocities.

**5-28. CHARACTERISTICS AND DESCRIPTION.** Characteristics for the Mk 40 Mods motors are listed in table 5-2. A general description of the motors is provided in paragraphs 5-5 through 5-17.

*Table 5-2. Mk 40 Mods Motor Characteristics*

| | | |
|---|---|---|
| Mod | 0–1 | 3 |
| Overall Length Shipped (in.) | 39.92 | 39.92 |
| Overall Length without Details (in.) | 39.36 | 39.36 |
| Largest Diameter Shipped (in.) | 3.01 | 3.01 |
| Nominal Weight Shipped (lb) | 12.70 | 12.70 |
| Nominal Weight Fired (lb) | 11.40 | 11.40 |
| Thrust (lb) | 720 | 720 |
| Burning Time (sec) | 1.69 | 1.69 |
| Propellant (Mk/Mod) | 43/1 | 43/1 |
| Igniter (Mk/Mod) | 125/4 | 125/5 |
| Nozzle | Scarfed | Scarfed |

**5-29. CONFIGURATION.** Configuration of the Mk 40 Mod 1 motor is shown in figure 5-12. The Mk 40 Mod 0 motor is identical to the Mk 4 Mod 6 motor except that the nozzles are scarfed which causes it to rotate in flight. The Mk 40 Mod 1 motor is identical to the Mk 4 Mod 8 motor except that the nozzles are scarfed. The Mk 40 Mod 3 motor is identical to the Mk 4 Mod 10 motor except that the nozzles are scarfed.

**5-30. SAFETY.** No specific safety precautions other than those described in section II, and normally observed in the handling of explosive materials, are required for the Mk 40 Mods motors.

**5-31. PREPARATION FOR USE AND ASSEMBLY.** No specific preparation for use or assembly procedures is required for the Mk 40 Mod 0 through Mod 3 motors.

**5-32. HANDLING.** No specific handling procedures are required for the Mk 40 Mods motors.

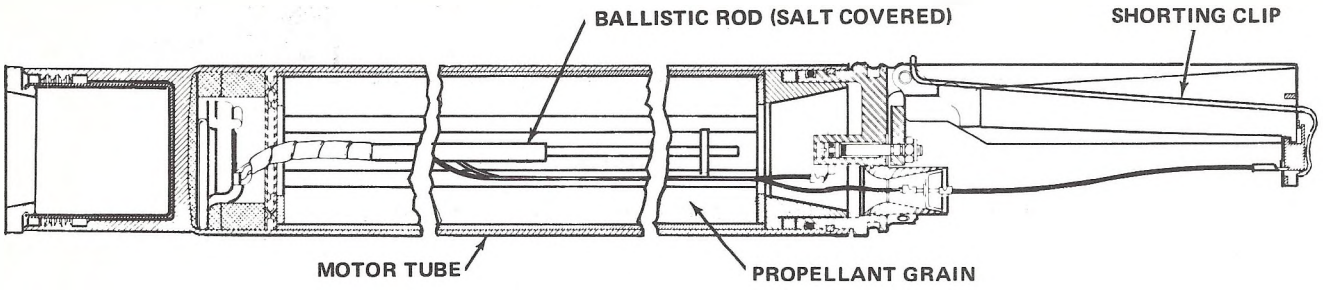



*Figure 5-12. Mk 40 Mod 1 Rocket Motor Configuration*

**5-33. EMERGENCY PROCEDURES.** No specific procedures are required for the Mk 40 Mods motors, beyond those normally required for rocket motors.

## 5-34. 5.0-INCH FFAR MOTOR.

5-35. The principle components of the 5.0-inch FFAR motor are the motor tube, igniter, propellant, stabilizing rod, and nozzle and fin assembly. A general description of these components is provided in paragraphs 5-36 through 5-44.

**NOTE**

The overall firing temperature range for the 5.0-inch rocket motor is -30°F to +165°F. The storage temperature limits are 0°F to +120°F. The storage temperature limits must be maintained for 24 hours prior to aircraft take-off.

**5-36. MOTOR TUBE.** The 5.0-inch FFAR motor is basically an aluminum tube with an integral bulkhead closure. The center portion of the motor tube contains the propellant. The nozzle and fin assembly threads into the aft end of the tube.

**5-37. Motor Forward End.** The forward end of the motor tube contains the head closure, igniter contact band, RADHAZ barrier and a threaded portion for attachment of the warhead (figure 5-13).

**5-38. Motor Center Section.** The center section of the motor tube is the combustion chamber and contains the igniter, propellant, stabilizing rod, and associated hardware.

5-39. *Igniter.* The igniter heats the propellant grain to ignition temperature. The igniter is a disc shaped metal

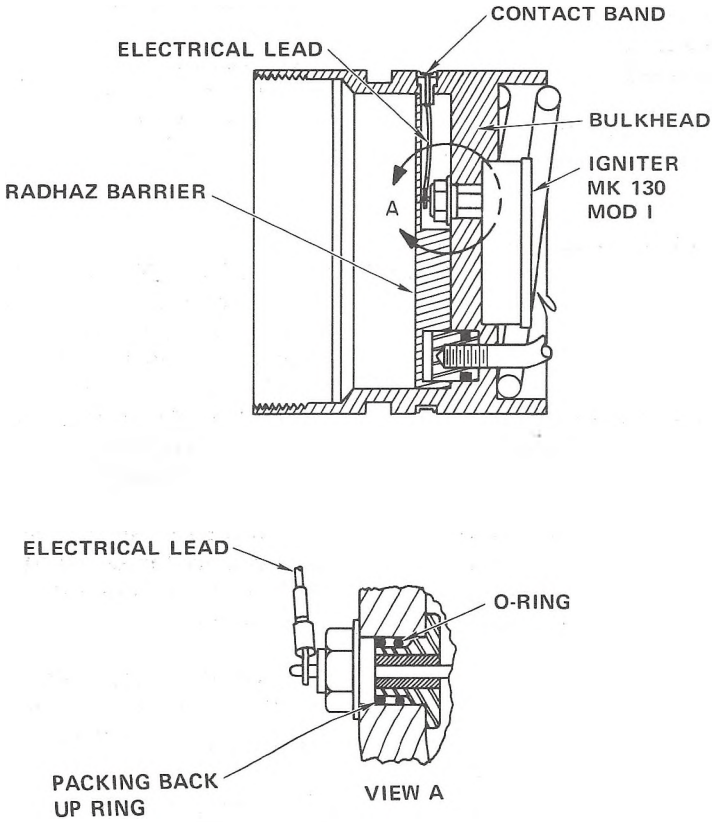



*Figure 5-13. Motor Forward End*

container containing a black powder and magnesium charge, two squibs, and a lead wire post which protrudes through the head closure. The closure igniter hole is sealed by an O-ring to prevent combustion gas leakage. An electrical lead wire connects the igniter to the contact band (figure 5-13).

5-40. *Propellant Grain.* The propellant grain used in the 5.0-inch FFAR motor is an internal burning, star perforation, double base, solid propellant. The star perforation is designed to produce a nearly constant thrust level. The external portion of the grain is covered with an inhibitor to control the burning surface. A typical propellant grain is shown in figure 5-4.

5-41. *Stabilizing Rod.* The salt coated stabilizing rod in the perforation of the motor propellant grain prevents unstable burning of the propellant, and reduces flash and after burning which contribute to compressor stall and flameout of jet aircraft engines.

**5-42. Motor Aft End.** The aft end of the motor tube is threaded internally to accept the nozzle and fin assembly.

**5-43. NOZZLE AND FIN ASSEMBLY.** The nozzle and fin assembly, shown in figure 5-14 attaches to the aft end of the motor tube by threads and consists basically of a steel nozzle, four aluminum-alloy fins, and steel fin-locking pawls. A light plastic retainer holds the fins folded within the 5-1/8 inch diameter of the rocket. On ignition, the fin retainer is blown off, and gas pressure on the heels of the fins pushes them open after emergence from the rocket launcher tube. The fins open to flight position in about 20 milliseconds, or about 4 feet of travel, after emerging from the launcher. The spring-loaded pawls then hold the fins locked in flight position. The action of the fins is depicted in figure 5-9. To protect the propellant grain from moisture the nozzle opening is closed by a thin metal seal soldered in place and protected by a styrofoam plug.

**5-44. SAFETY DEVICES.** A shielding band shall be installed whenever 5.0-inch motors are outside of the launcher. This band prevents contact with the electrical contact on the motor.

## 5-45. MK 16 MOD 1 THROUGH MOD 3 ROCKET MOTORS.

**5-46. INTRODUCTION.** The Mk 16 Mods 1, 2 and 3 rocket motors are designed for use with the 5.0-inch FFAR (figure 5-15).

**5-47. CHARACTERISTICS AND DESCRIPTION.** Characteristics for the Mk 16 Mod 1 through Mod 3 motors are listed in table 5-3. General description of the motor is provided in paragraphs 5-36 through 5-44.

**5-48. CONFIGURATION.** The Mk 16 Mod 3 motor differs from the Mod 1 and 2 by the addition of the electromagnetic radiation barrier in the forward end of the motor (see figure 5-13) and the installation of the improved shielding band on individually shipped motors. Motors marked Mk 16 Mod 2 may contain electromagnetic radiation barriers because of a retrofit program.

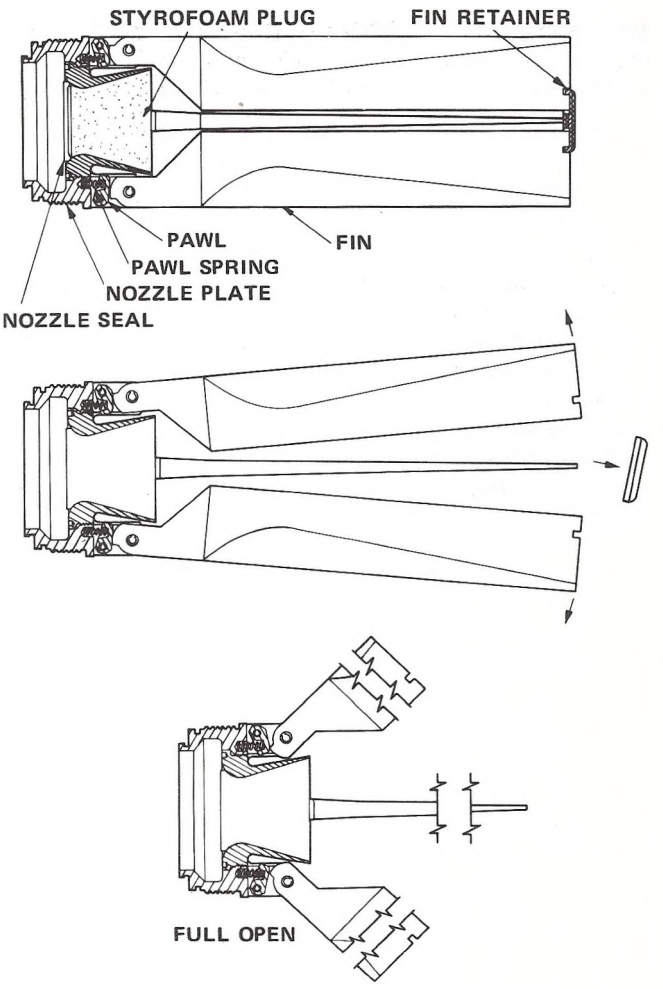



*Figure 5-14. 5.0-Inch FFAR Nozzle and Fin Assembly*

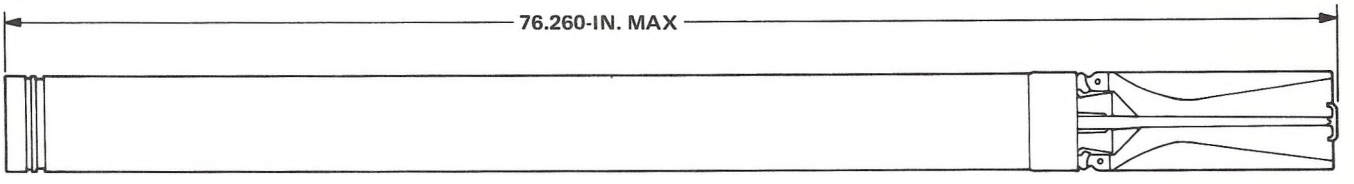



*Figure 5-15. Mk 16 Mods 1 through 3, 5.0-inch FFAR Motor*

**5-49. SAFETY.** No specific safety precautions other than those described in section II, or those normally observed in the handling of explosive materials, are required for the Mk 16 Mods 1 through 3 motors.

**5-50. PREPARATION FOR USE AND ASSEMBLY.** No specific preparation for use or assembly is required for the Mk 16 Mods 1 through 3 motors.

**5-51. HANDLING.** No specific handling procedures are required for the Mk 16 Mods 1 through 3 motors.

**5-52. EMERGENCY PROCEDURES.** No specific procedures are required for the Mk 16 Mods 1 through 3 motors beyond those normally required for rocket motors.

## 5-53. 2.75-INCH AND 5.0-INCH ROCKET SHIPPING CONTAINERS.

5-54. The 5.0-inch rocket motors are shipped in a LAU-10 type launcher or in individual wooden containers, and may be stored as received. The 2.75-inch rocket motors are shipped in various launchers as assembled rounds, or in wooden containers either as assembled rounds or individual motors, and may be stored as received. Typical shipping containers for the 2.75-inch and 5.0-inch FFAR motors are shown in figure 5-16. Rocket motors shall be stored in accordance with NAVORD OP4 and OP5.

**NOTE**

The overall storage temperature range for the 5.0-inch rocket is $0^{o}$ to $120^{o}$F and for the 2.75-inch rocket $-65^{o}$F to $165^{o}$F.

*Table 5-3. Mk 16 Mods 1, 2, and 3 Motor Characteristics*

| Mod | 1 | 2 | 3 |
|---|---|---|---|
| Overall Length Shipped (in.) | 77.107 | 77.107 | 77.107 |
| Overall Length Without Details (in.) | 76.260 | 76.260 | 76.260 |
| Fin Diameter (in.) | 27.171 | 27.171 | 27.171 |
| Maximum Diameter (in.) | 5.125 | 5.125 | 5.125 |
| Nominal Weight Shipped (lb) | 56.5 | 56.5 | 56.5 |
| Thrust (lb) | 7500 | 7500 | 7500 |
| Burning Time (sec) | 1.04 | 1.04 | 1.04 |
| Propellant (Mk/Mod) | 49/0 | 49/1 | 49/1 |
| Igniter (Mk/Mod) | 130/1 | 130/1 | 130/1 |

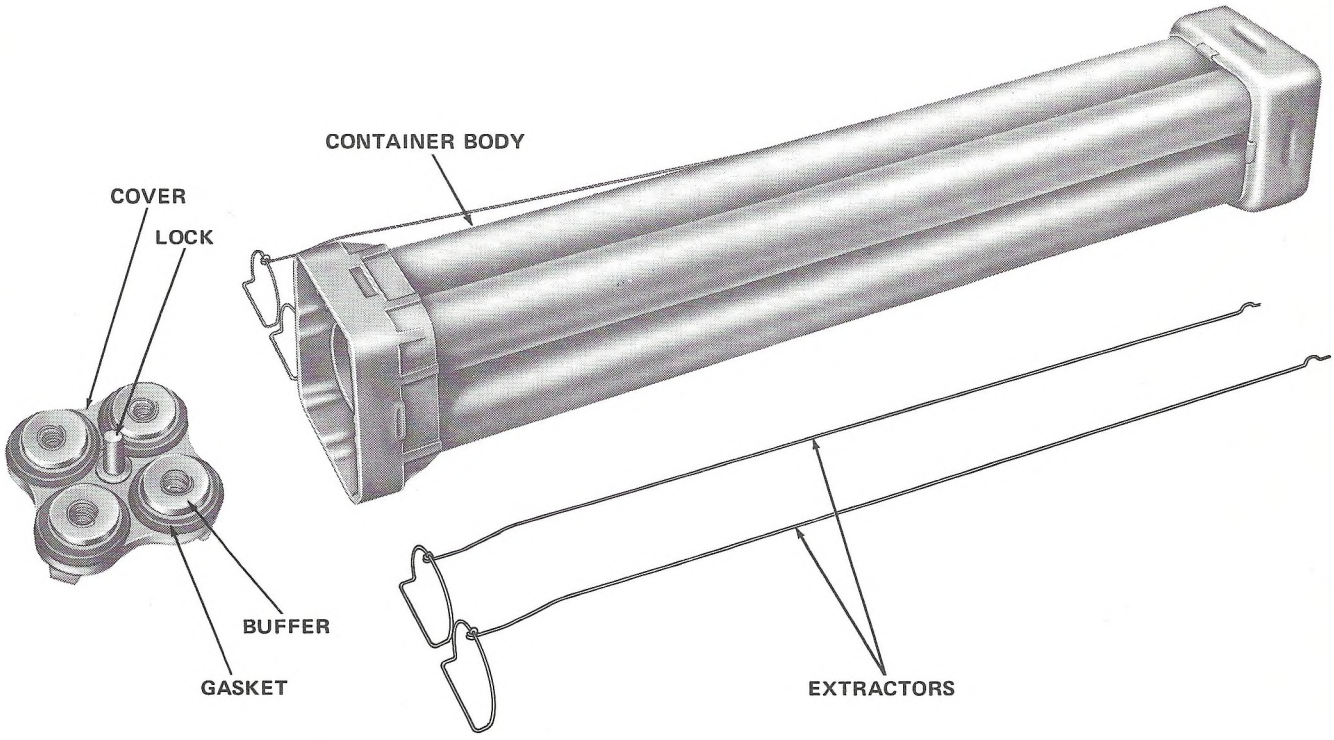



*Figure 5-16. Typical Shipping Containers*

# SECTION VI

# AUTHORIZED AIRBORNE ROCKET ASSEMBLIES

## 6-1. INTRODUCTION.

6-2. Airborne rockets, consisting of fuzes, warheads, and motors (described in sections III, IV and V) are combined and assembled in various configurations to meet specific tactical requirements. This section covers the receiving, inspection, and assembly, shipping, and storage procedures for the 2.75-inch and the 5.0-inch airborne rockets.

## 6-3. SAFETY PRECAUTIONS.

6-4. When handling or assembling airborne rockets, observe the following precautions:

**WARNING**

If a rocket or rocket motor, crated or uncrated, is dropped a distance exceeding 2 feet on a hard surface such as wood, concrete, metal, or hard-packed earth, reject the rocket or rocket motor, and dispose of in accordance with current directives. Any damage to the thin rocket motor tube may produce a weak spot, causing the motor tube to split during ignition and result in an explosion. Any motors with nicked, dented or damaged motor tubes shall not be used. If a fuze-warhead combination, crated or uncrated, is dropped a distance exceeding 5 feet on a hard surface such as wood, concrete, metal, or hard-packed earth, reject the fuze-warhead combination and dispose of in accordance with current directives.

1. Fully assembled folding-fin airborne rockets are Class A explosive ordnance. Handle with care and observe all regulations governing the handling of explosive ordnance.

**WARNING**

To avoid possible injury to personnel and damage to equipment, in any operation involving assembly, disassembly, fuzing, defuzing, cleaning, or painting, the work shall be done in a designated area, safely removed from other explosives and away from vital installations. The smallest number of rockets practicable shall be exposed. Only authorized personnel essential to the work shall be in the vicinity. Refer to NAVAIR 16-1-529/NAVORD OP3565 for RADHAZ procedures and precautions.

2. The number of personnel and the quantity of explosives present in a given area should be kept to the minimum required.

3. Assembled rocket ammunition should be moved to the designated storage area as soon as practicable after completion of assembly operations.

4. Personnel assembling rocket ammunition shall wear appropriate protective clothing. Insofar as is practicable, all work shall be performed from the side of the rocket.

5. Rocket warheads shall be inspected to verify that the base plug or base fuze, if required, is properly in place before assembling warheads to rocket motors.

6. Do not remove safety and protective devices from rocket motors until loading into rocket launcher. Shorting clips and shielding band shall be replaced when rockets are removed from launcher. (Refer to Safety and Protective Devices for each type of rocket, paragraphs 5-17 and 5-44.)

7. Use only authorized tools and equipment for assembly or disassembly.

**WARNING**

Loose fuze adapters are dangerous and may cause detonation if attempt is made to tighten or remove.

8. If a fuze adapter becomes loose while removing the fuze, stop the operation. This is a defective warhead and is not to be repaired. If grains of explosive are lodged between the adapter threads and warhead threads, unscrewing of the adapter may pinch and initiate the explosive.

9. Do not remove base fuzes, base plugs, base adapters or nose fuze adapters from rocket warheads at any time.

10. Do not disassemble rocket motor components.

11. Fuzes or firing mechanisms for rockets shall not be removed (except certain nose fuzes), disassembled, repaired, or in any way altered.

12. Upon removal of components from the rocket, inspection of those parts of the components which could not be inspected when the rocket was assembled shall be made before the components are returned to storage.

13. Assembled rockets should be covered or protected from direct rays of the sun.

## 6-5. 2.75-INCH ROCKET AUTHORIZED ASSEMBLIES.

**6-6. 2.75-INCH FFAR ASSEMBLIES.** Table 6-1 lists the completely assembled 2.75-inch folding-fin aircraft rocket (FFAR) combination for use with high-speed aircraft. Only those rockets listed in the table shall be assembled.

**6-7. 2.75-INCH LSFFAR ASSEMBLIES.** Table 6-2 lists the completely assembled 2.75-inch low spin folding fin aircraft rocket (LSFFAR) combinations for low speed aircraft and helicopter use. Only those rockets listed in the table shall be assembled.

**6-8. 2.75-INCH FFAR CONFIGURATIONS.** Typical configurations of the FFAR are shown in figures 6-1 through 6-5.

**6-9. 2.75-INCH LSFFAR CONFIGURATIONS.** Typical configurations of the LSFFAR are shown in figures 6-6 through 6-11.

**6-10. PREPARATION FOR USE AND ASSEMBLY PROCEDURES FOR 2.75-INCH ROCKETS.** The ensuing paragraphs set forth the procedures to be followed by Navy activities for receiving, assembling, storing, and maintaining the 2.75-inch airborne rocket. Rocket launcher details, installation of launchers on an aircraft, and use of the rocket as part of a weapon system are not included in this manual. For this type of information, refer to rocket launcher handbook, applicable Airborne Weapons/Stores Loading Manual, and specific Aircraft Tactical Manual.

6-11. The 2.75-inch airborne rocket is received from the supply activity as follows:

1. Complete rockets in a 7-tube or 19-tube launcher, see section VII, or in wooden boxes.

2. Rocket motors in a 7-tube launcher, and the fuze-warhead combinations for these motors in separate shipping containers.

3. Separate rocket components in authorized shipping containers.

6-12. Upon receipt of the loaded shipping container or launcher, remove from shipping pallet and examine for damage or evidence of rough handling. If there is damage, the rocket or rocket components must be removed from the shipping container or launcher and examined for defects in accordance with paragraphs 6-17 through 6-21 or 6-26. If there is no damage, move the container or launcher

*Table 6-1. 2.75-Inch FFAR Assemblies with Mk 4 Mods Motors for Use with High-Speed Aircraft*

| Type | Warhead | Fuze | NALC |
|---|---|---|---|
| HE-FRAG | Mk 1 | Mk 176 | H836 |
| | | Mk 178 | H837 |
| | | M427 | --- |
| | Mk 64 | M427 | --- |
| | M151 | M427 | H842 |
| FLECHETTE | WDU-4 | Model 113A | |
| HEAT | Mk 5 | Mk 181 | H837 |
| SMOKE | Mk 67 | M427 | H861 |
| | M156 | M427 | H855 |
| RED MARKER | M157 | M427 | H856 |
| | M158 | M427 | H858 |
| YELLOW MARKER | M158 | M427 | H846 |
| PRACTICE | Mk 1 (Inert) | Mk 178 (Inert) | H835 |
| | Mk 5 (Inert) | Mk 188 (Inert) | |
| | Mk 61 (Dummy) | --- | |
| | M151 (Inert) | M435 (Dummy) | H832 |
| | M230 (Inert) | M435 (Dummy) | H831 |
| | WTU 1/B (Dummy) | --- | H663 |

*Table 6-2. 2.75-Inch LSFFAR Assemblies with Mk 40 Mods Motors for Use on Low-Speed Aircraft and Helicopters*

| Type | Warhead | Fuze | NALC |
|---|---|---|---|
| HE-FRAG | Mk 1 | Mk 176 | H836 |
| | | Mk 178 | H838 |
| | | M423 | H848 |
| | | M427 | H847 |
| | Mk 64 | M423 | --- |
| | | M427 | --- |
| | M151 | M423 | H843 |
| | | M427 | H842 |
| | M229 | M423 | H534 |
| | | M427 | --- |
| | | M429 | H863 |
| FLECHETTE | WDU-4A/A | Model 113A | HY 71 |
| HEAT | Mk 5 | Mk 181 | H837 |
| SMOKE | Mk 67 | M423 | --- |
| | | M427 | H861 |
| | M156 | M423 | H849 |
| | | M427 | H855 |
| RED MARKER | M158 | M423 | |
| | | M427 | |
| | M157 | M423 | |
| | | M427 | |
| YELLOW MARKER | M158 | M423 | |
| | | M427 | |
| PRACTICE | Mk 1 (Inert) | Mk 178 (Dummy) | H835 |
| | Mk 5 (Inert) | Mk 181 (Dummy) | --- |
| | Mk 61 (Dummy) | --- | --- |
| | M230 (Inert) | Mk 435 (Dummy) | H831 |
| | M229 (Inert) | Mk 435 (Dummy) | --- |
| | WTU 1/B (Dummy) | --- | H663 |

NOTE: Due to their longer arming distances, the use of the Mk 176, Mk 178, and M427 fuzes may result in dud rounds when fired from helicopter or low speed aircraft.

to storage. Damaged items shall be disposed of in accordance with current directives.

**6-13. Unpacking Rockets and Rocket Components.** Deliver the rockets and rocket components to the unpacking area and segregate complete rockets and component rocket motors by the rocket motor lot number. Maintain the segregation of rockets and component rocket motors by rocket motor lot number throughout the unpacking operation.

**WARNING**

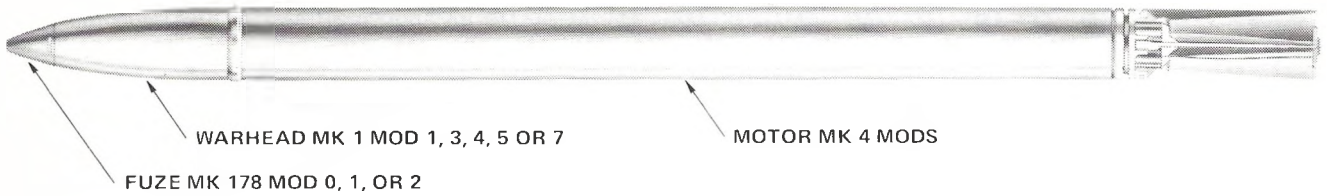
Banding straps are under tension. Care must be used in cutting to prevent injury.

6-14. Open wooden shipping crates using hand tools such as shears or steel strap cutters or untwist the securing wires from metal containers with shears or pliers. Remove the end pans from the launcher shipping containers (see section VII).

**CAUTION**

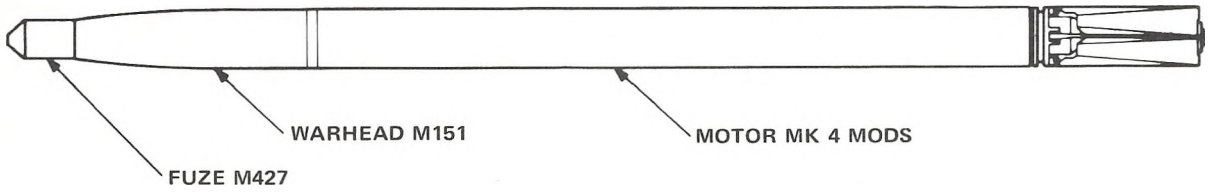
Use extreme care when unpacking a rocket that uses a wire shorting clip rather than a fin protector to avoid damage to the rocket fins.

**6-15. Removing Assembled Rockets or Rocket Components From Containers.** When opening containers, use nonsparking tools. Keep containers in a horizontal position



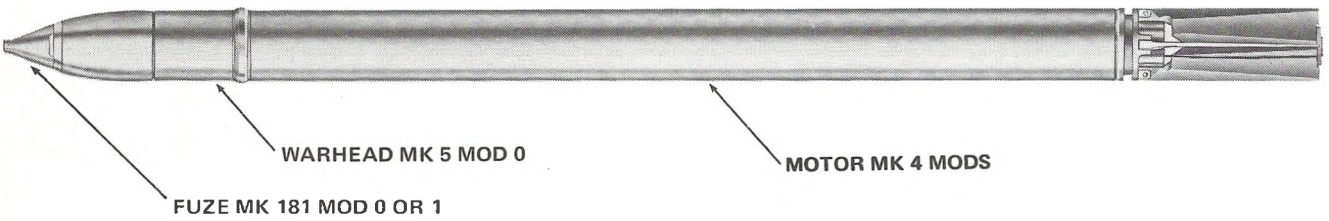

OVERALL LENGTH (IN.) – 47.85
NOMINAL WEIGHT (LB) – 17.92

*Figure 6-1. 2.75-Inch FFAR HE-FRAG Configuration (Mk 4 Motor, Mk 1 Warhead, Mk 178 Fuze)*



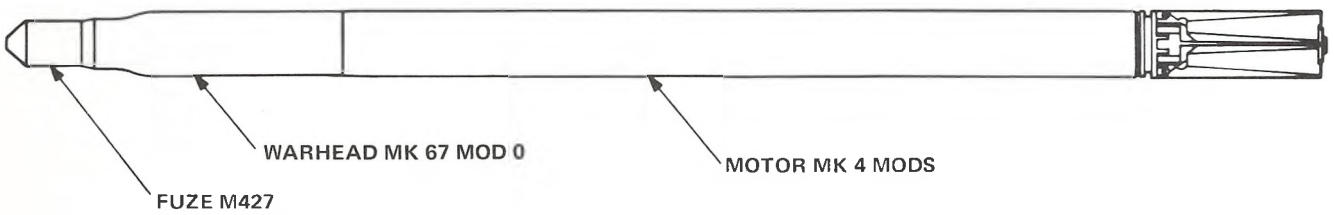

OVERALL LENGTH (IN.) – 52.69
NOMINAL WEIGHT (LB) – 16.56

*Figure 6-2. 2.75-Inch FFAR HE-FRAG Configuration (Mk 4 Motor, M151 Warhead, M427 Fuze)*



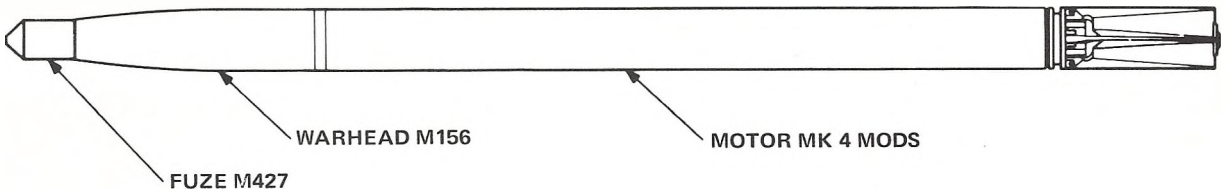

OVERALL LENGTH (IN.) – 47.93
NOMINAL WEIGHT (LB) – 17.92

*Figure 6-3. 2.75-Inch FFAR HEAT Configuration (Mk 4 Motor, Mk 5 Warhead, Mk 181 Fuze)*



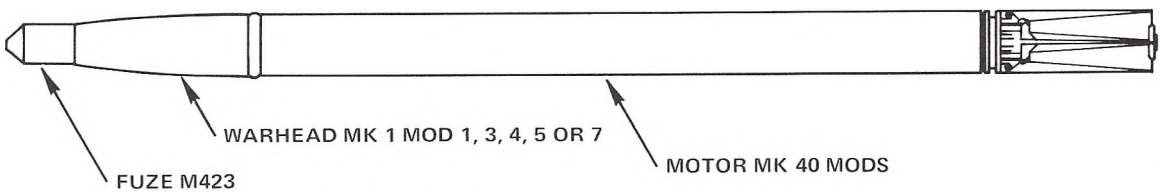

OVERALL LENGTH (IN.) – 52.69
NOMINAL WEIGHT (LB) – 16.56

*Figure 6-4. 2.75-Inch FFAR Smoke Configuration (Mk 4 Motor, Mk 67 Warhead, M427 Fuze)*



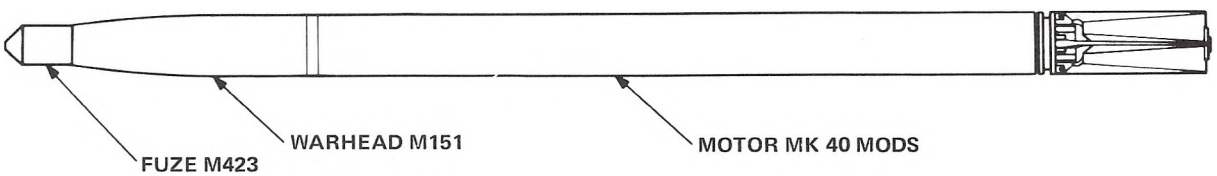

OVERALL LENGTH (IN.) – 53.43
NOMINAL WEIGHT (LB) – 20.56

*Figure 6-5. 2.75-Inch FFAR Smoke Configuration (Mk 4 Motor, M156 Warhead, M427 Fuze)*



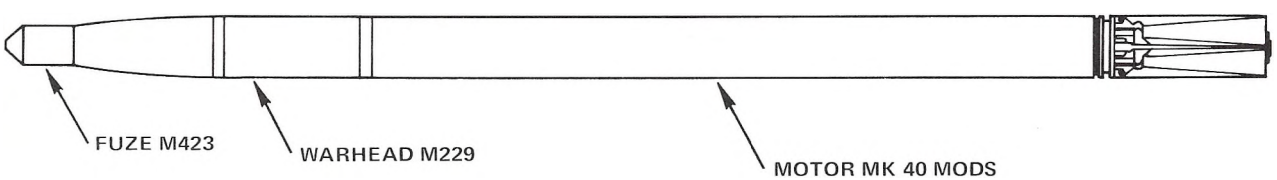

OVERALL LENGTH (IN.) _____ 48.87
NOMINAL WEIGHT (LB ) _____ 17.92

*Figure 6-6. 2.75-Inch LSFFAR HE-FRAG Configuration (Mk 40 Motor, Mk 1 Warhead, M423 Fuze)*



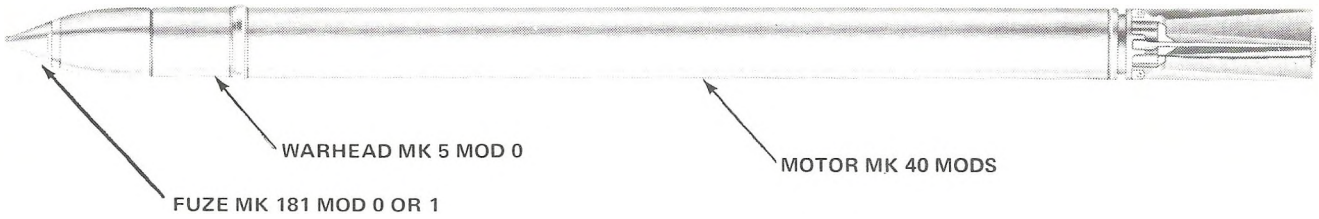

OVERALL LENGTH (IN.) – 52.69
NOMINAL WEIGHT (LB) – 16.56

*Figure 6-7. 2.75-Inch LSFFAR HE-FRAG Configuration (Mk 40 Motor, M151 Warhead, M423 Fuze)*



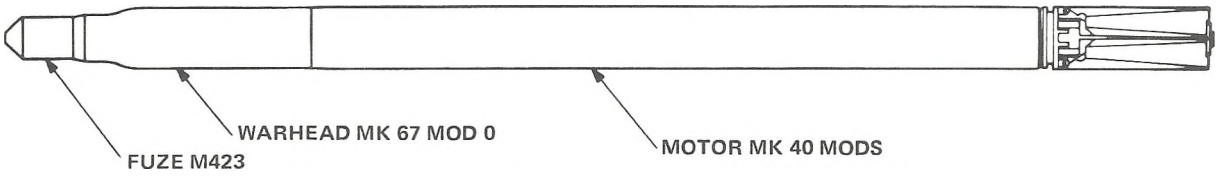

OVERALL LENGTH (IN.) _____ 65.37
NOMINAL WEIGHT (LB ) _____ 27.92

*Figure 6-8. 2.75-Inch LSFFAR HE-FRAG Configuration (Mk 40 Motor, M229 Warhead, M423 Fuze)*



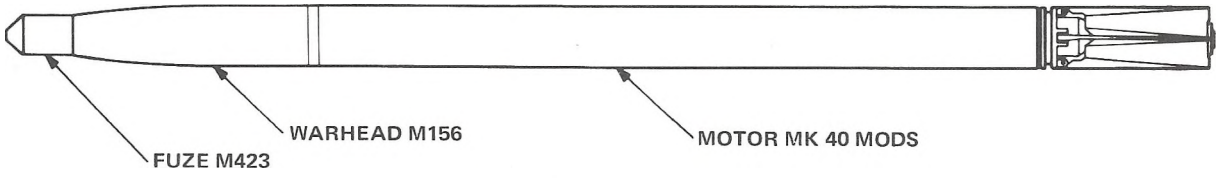

OVERALL LENGTH (IN.) – 47.93
NOMINAL WEIGHT (LB) – 17.92

*Figure 6-9. 2.75-Inch LSFFAR HEAT Configuration (Mk 40 Motor, Mk 5 Warhead, Mk 181 Fuze)*




OVERALL LENGTH (IN.) – 52.69
NOMINAL WEIGHT (LB) – 21.06

*Figure 6-10. 2.75-Inch LSFFAR Smoke Configuration (Mk 40 Motor, Mk 67 Warhead, M423 Fuze)*




OVERALL LENGTH (IN.) – 53.43
NOMINAL WEIGHT (LB) – 20.56

*Figure 6-11. 2.75-Inch LSFFAR Smoke Configuration (Mk 40 Motor, M156 Warhead, M423 Fuze)*

while opening. During the assembly procedure, keep the rocket warheads and motors in a horizontal position to decrease the possibility of accidents.

6-16. All items such as metal boxes, wooden boxes, spacers, and thread protectors that are removed from components in preparation for assembly will be disposed of in accordance with current directives.

**6-17. Inspecting Components.** As assembled rockets or rocket components are removed from their containers, inspect them according to the following instructions. Dispose of defective items in accordance with current directives.

**WARNING**

To avoid injury to personnel and damage to equipment, in any operation involving assembly, disassembly, fuzing, defuzing or cleaning, the work shall be done in a designated area, safely removed from other explosives and away from vital installations. The smallest number of rockets practicable shall be exposed. Only authorized personnel essential to the work shall be in the vicinity. Refer to NAVAIR 16-1-529/NAVORD OP3565 for RADHAZ procedures and precautions.

6-18. *Fuze Inspection.* Inspect the fuze as follows:

**WARNING**

Fuzes that are damaged are hazardous. Detonation may occur upon handling.

1. Verify that the fuze body is not damaged.

2. Check the fuze threads for damage, rust or corrosion.

NOTE

Refer to paragraph 6-53 for cleaning instructions.

6-19. *Warhead Inspection.* Inspect the warhead as follows:

**WARNING**

Warheads that are damaged are hazardous. Detonation may occur upon handling.

1. Verify that the warhead is not damaged.

2. Verify that the warhead base and fuze cavity threads are not damaged, rusted or corroded.

3. Examine interior of fuze cavity to verify that no obstructions are present.

NOTE

Refer to paragraph 6-52 for cleaning instructions.

**WARNING**

Warheads that are damaged or have damaged fuzes are hazardous. Detonation may occur.

6-20. *Fuze and Warhead Assembly Inspection.* Inspect as follows:

1. Verify that the fuze and warhead assembly is not damaged.

**WARNING**

Warheads without fuze cavity liners that have a space between the fuze and warhead are hazardous and shall not be used. Detonation may occur.

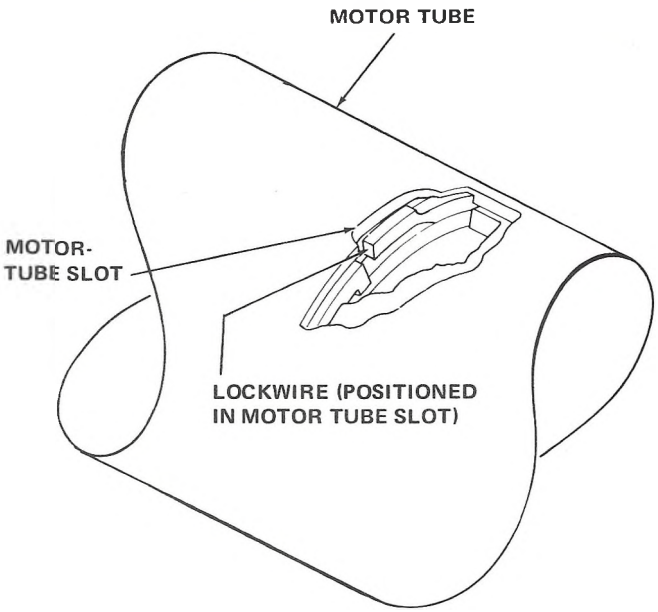



*Figure 6-12. 2.75-Inch Rocket Motor Tube Lockwire Slot*

2. Verify that fuzes are securely seated on the warheads for a full 360°. Those fuzes without fuze cavity liners that are not seated shall be disposed of in accordance with current directives.

3. Verify that external threads are not damaged, rusted, or corroded.

6-21. *Motor Inspection.* Inspect the motors as follows:

1. Verify that motor tube is not dented, deeply scratched, gouged or corroded.

2. Verify that safety devices are in place.

3. Verify that the head closure and nozzle seals are in place.

4. Verify that fins are not bent or broken and that roll pins are intact and do not protrude more than 1/16 inch. (See section V, figure 5-3, View A.)

5. Verify that the electrical connector and electrical lead wire is not broken or the insulation damaged.

6. Verify that threads are free from damage such as nicks, burrs and dents, or corrosion.

7. Verify that lockwires do not protrude beyond the motor tube (see figure 6-12).

6-22. Upon completion of the inspection, move undamaged rocket components to storage in undamaged containers. Damaged components shall be disposed of in accordance with current directives.

**6-23. ASSEMBLY PROCEDURES.** The following paragraphs describe the procedures necessary to assemble the 2.75–inch airborne rocket.

**NOTE**

The tools required for assembly of 2.75-inch airborne rockets are included in torque fixture kit, 2.75-inch rocket warhead APE 2075M1, FSN 4925-781-6511. This kit includes holding fixture, crowfoot and torque wrench. This kit not for use with WDU-4/A and WDU-4A/A flechette warheads.

**WARNING**

Do not attempt to remove or install fuzes on warheads that do not have fuze cavity liners, removal or installation could cause detonation.

**6-24. Assembly of Fuzes to Warheads.** When assembling fuzes and warheads packaged separately, install fuzes hand-tight in the warhead.

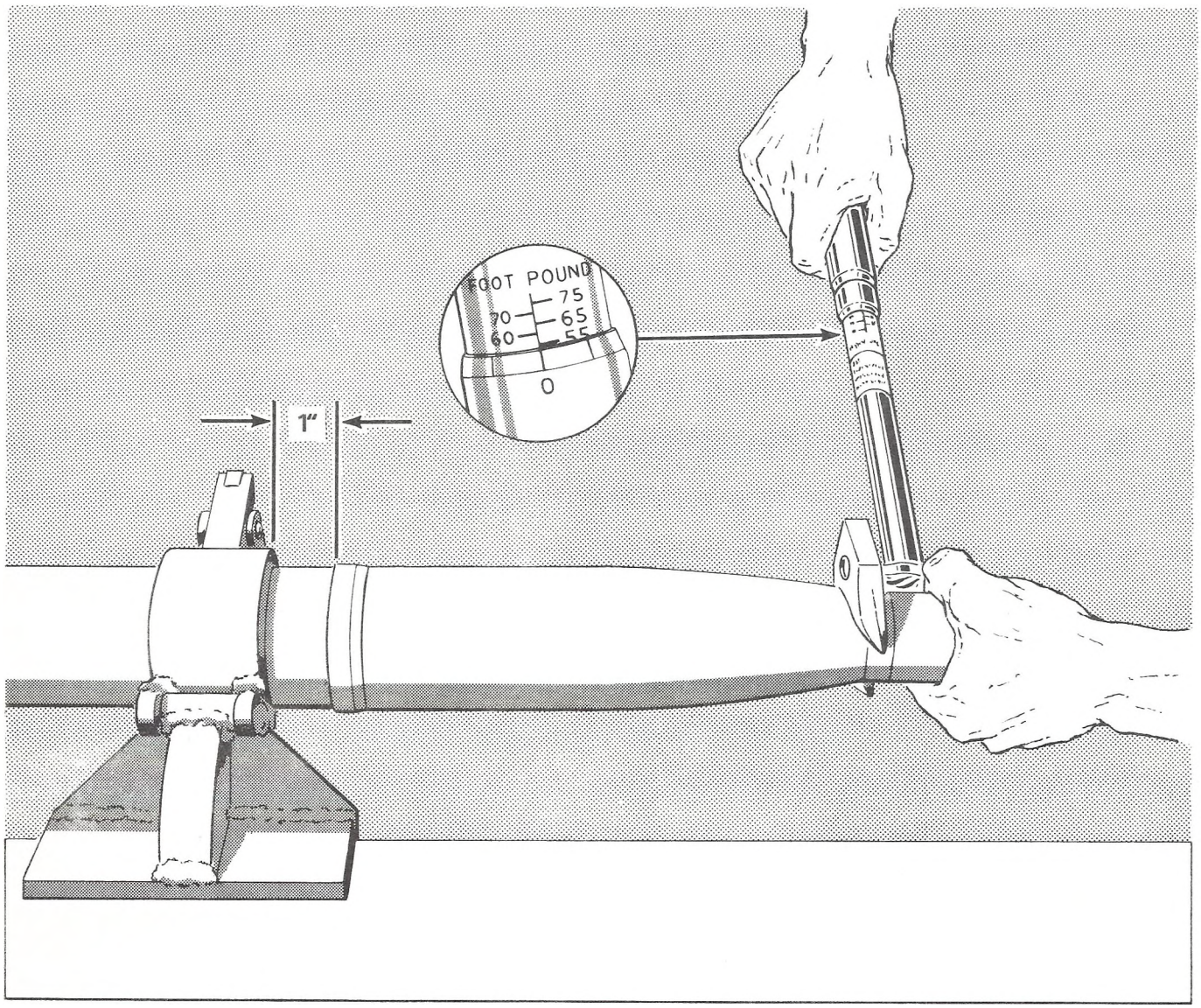



*Figure 6-13. Holding Fixture Assembly*

**6-25. Assembly of Fuzed Warheads to Motors.** Install the fuzed warhead on the rocket motor as follows:

1. If installed, remove warhead shipping support or shipping and retaining plug from warhead closure of the rocket motor.

2. If present, remove the rubber gasket and shim from warhead closure.

3. If present, remove excessive grease and clear warhead. Refer to paragraph 6-51 for cleaning instructions.

4. Place forward end of rocket motor body between clamp fixture jaws of holding fixture assembly so that motor is clamped within 1.0 inch of forward end (the area containing the warhead closure) and tighten clamp (see figure 6-13).

5. Hand tighten warhead to motor.

**WARNING**

Do not exceed 65 foot-pounds maximum torque on non-integral bulkhead motors as the lockwire tab may be forced out of the motor tube slot (see figure 6-12). Failure to tighten warhead to rocket motor to required 55 +10/-0 foot-pounds torque may result in loss of warhead in flight.

6. Using torque wrench and crowfoot wrench, at the wrenching points provided on the fuze, tighten warhead to 55 +10/-0 foot-pounds of torque (see figure 6-13).

**WARNING**

If a gap exists between the forward end of the rocket motor and warhead or between the fuze and the warhead after applying torque, do not use. A gap is considered to exist after torque has been applied if seating does not exist for a full 360 degrees.

7. Verify there is no gap between the fuze and warhead or warhead and motor.

**6-26. ROCKET ASSEMBLY INSPECTION.** Inspect the completely assembled 2.75-inch airborne rockets as follows:

1. Remove rocket from container or from launcher, in accordance with appropriate launcher manual.

**WARNING**

Install fin protector or shorting clip on all rocket motors and complete rocket assemblies whenever they are removed from launchers. These devices serve to short circuit the igniter circuit and prevent premature ignition.

2. Remove fin protector, if applicable, and inspect the fins to verify that the fins are not broken, bent, or misaligned and that no corrosion is present.

3. Examine the exterior igniter lead for breaks and abrasions.

4. Verify that the nozzle seals and fin retainer are in place.

5. Reinstall fin protector if applicable.

6. Verify that lockwires are properly installed (see figure 6-12).

7. Verify that all external rocket surfaces are free from cracks, deep scratches, gouges, cuts, dents, or corrosion.

**WARNING**

If a gap exists between the fuze and the warhead or between the warhead and motor, do not use. A gap is considered to exist if seating does not exist for a full 360 degrees.

8. Verify that there is no gap between the fuze and warhead or warhead and motor.

9. Upon completion of examination of rockets, place undamaged rockets in undamaged containers and move to storage.

**NOTE**

Reject and segregate damaged rockets, rocket components, and rockets with a gap between the warhead and rocket motor or between fuze and warhead. Dispose of defective rockets and components in accordance with current directives.

10. If rockets are to be loaded into launchers, refer to the applicable launcher manual. Move loaded launchers to storage.

**6-27. DISASSEMBLY OF 2.75-INCH ROCKETS.** If it is necessary to disassemble fuzes from warheads that were originally received unassembled, proceed as follows:

1. Remove rocket from launcher in accordance with applicable launcher handbook.

2. Install fin protector or shorting clip.

3. Place rocket motor in holding fixture assembly (figure 6-13).

**WARNING**

Do not remove fuze from warheads which do not contain fuze cavity liners. Attempted removal could cause detonation.

4. Holding the warhead with a strap wrench, and using a crowfoot wrench, unscrew the fuze from warhead.

5. Lightly coat threads with grease (MIL-G-7711) and return to storage.

**6-28. DISASSEMBLY OF FUZED WARHEADS FROM MOTORS.** Should it become necessary to remove or replace the warhead from completely assembled rockets, proceed as follows:

1. Remove rocket from launcher in accordance with applicable launcher manual.

2. Install fin protector or shorting clip.

3. Place rocket motor in holding fixture assembly (figure 6-13).

**WARNING**

Do not remove fuze from warheads which do not contain fuze cavity liners. Attempted removal could cause detonation.

Place strap wrench as far aft as possible on the Mk 67 smoke head. Wrenching from other locations may damage the thin casing and expose the white phosphorus filler.

4. Unscrew warhead from motor using a strap wrench FSN 5120-262-8491 (figure 6-23), or equivalent.

5. Lightly grease (MIL-G-7711) threads of warhead and return to storage.

## 6-29. 5.0-INCH FOLDING FIN AIRCRAFT ROCKET (FFAR) AUTHORIZED ASSEMBLIES.

6-30. Table 6-3 lists the completely assembled 5.0-inch folding-fin aircraft rockets (FFAR) with required fuze, warhead, and motor, by Mk and Mod numbers. Only those rockets listed in this table shall be assembled.

6-31. Descriptions of the types of fuzes, warheads, and motors for the 5.0-inch FFAR are provided in sections III, IV and V, respectively.

**WARNING**

No attempt should be made to remove the Mk 191 base fuze used with the Mk 24 Mod 0 service warhead. If base fuze hole is uncovered or has any other plug or cover other than the Mk 191 base fuze, the warhead shall be disposed of in accordance with current directives. The base fuze hole in Mk 24 Mod 0 plaster-filled practice heads must be plugged with base fuze plug, Piece No. 457600. This piece is indent-stamped FOR INERT LOADED HEADS ONLY.

**6-32. 5.0-INCH FFAR CONFIGURATIONS.** Typical configurations of 5.0-inch rockets are shown in figures 6-14 through 6-21.

**6-33. PREPARATION FOR USE AND ASSEMBLY PROCEDURES FOR 5.0-INCH AIRBORNE ROCKETS.** The following paragraphs provide specific information relative to receiving, assembling, storing and maintaining the 5.0-inch Folding Fin Aircraft Rocket (FFAR).

*Table 6-3. 5.0-Inch FFAR Assemblies with Mk 16 Mods Motor*

| Type | Warhead | Fuze |
|---|---|---|
| HE-FRAG | Mk 63 Mod 0 | Mk 93 Mod 0/M414A1 |
| HE-GP | Mk 24 Mod 0 | Mk 188 Mod 0 |
| | | Mk 93 Mod 0/M414A1 |
| | | Mk 191 Mod 1 (Permanently installed, used with nose ogive) |
| AT/APERS | Mk 32 Mod 0 | Mk 188 Mod 0 |
| | | Mk 93 Mod 0/M414A1 |
| SMOKE | Mk 34 Mod 0 | Mk 188 Mod 0 |
| FLARE | Mk 33 Mod 1 | Mk 193 Mod 0 (Permanently installed) |
| PRACTICE | Mk 6 Mod 1 | Nose plug |
| | Mk 24 Mod 0 | Nose plug |
| | | Nose ogive |
| | Mk 62 Mod 0 | None |

6-34. Rocket launcher details, installation of launchers on an aircraft, and use of the rocket as part of a weapon system are not included in this manual. For this type of information, refer to the Rocket Launcher Manual or the applicable Airborne Weapons/Stores Loading Manual.

6-35. The 5.0-inch FFAR is received from the loading activity as follows:

1. Rocket motors in a 4-round rocket launcher; the fuze-warhead combinations are shipped in separate shipping containers.

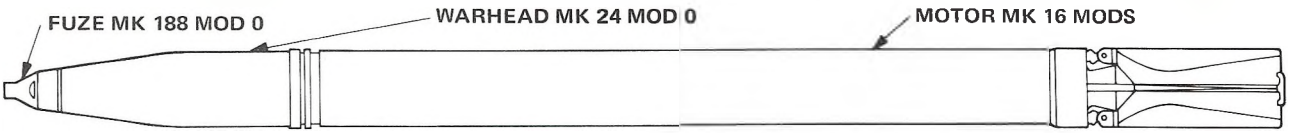
2. Separate rocket components in authorized shipping containers.

6-36. Upon receipt of the loaded shipping container or launchers, remove from pallets and examine for damage or evidence of rough handling. If there is damage, the rocket or rocket components must be removed from the shipping container or launcher and examined for defects. If there is no damage, move the container or launchers to storage. Damaged items shall be disposed of in accordance with current directives.

**6-37. Unpacking Rockets and Rocket Components.** Deliver the rockets and rocket components to the unpacking area and segregate complete rockets and component rocket motors by the rocket motor lot number. Maintain the segregation of rockets and component rocket motors by rocket motor lot number throughout the unpacking operation.

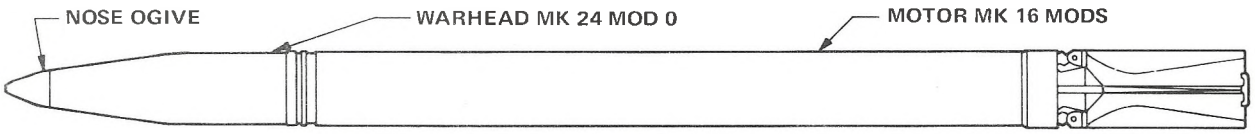
**WARNING**

Banding straps are under tension. Care must be used in cutting to prevent injury.



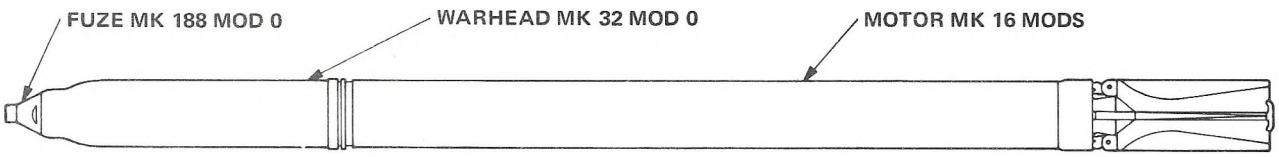

OVERALL LENGTH (IN.) – 100.00
NOMINAL WEIGHT (LB) – 107.00

*Figure 6-14. 5.0-Inch FFAR GP Configuration (Mk 16 Motor, Mk 24 Warhead, Mk 188 Fuze)*



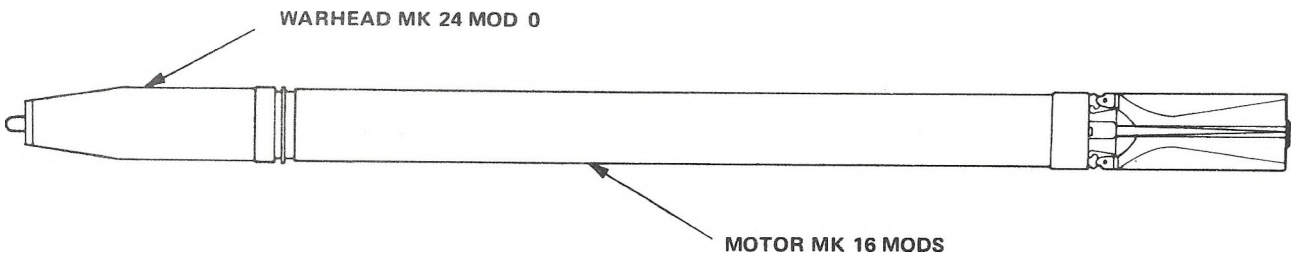

OVERALL LENGTH (IN.) – 100.00
NOMINAL WEIGHT (LB) – 107.00

*Figure 6-15. 5.0-Inch FFAR GP Configuration (Mk 16 Motor, Mk 24 Warhead, Nose Ogive)*



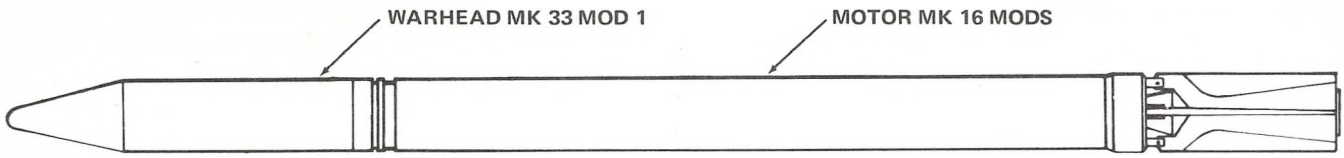

OVERALL LENGTH (IN.) – 110.00
NOMINAL WEIGHT (LB) – 107.00

*Figure 6-16. 5.0-Inch FFAR AT/APERS Configuration (Mk 16 Motor, Mk 32 Warhead, Mk 188 Fuze)*



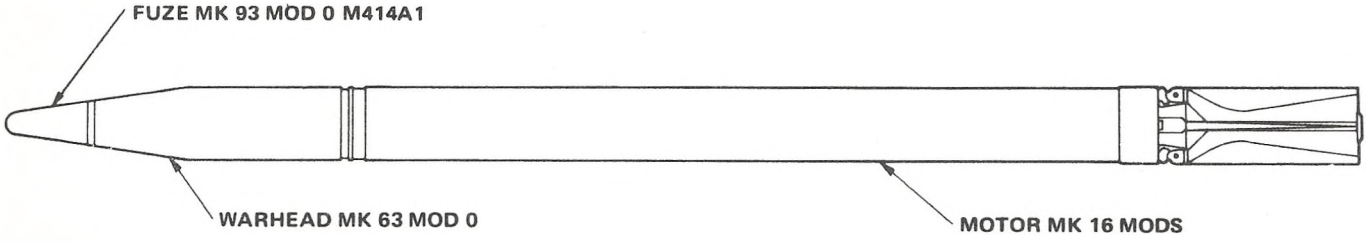

OVERALL LENGTH (IN.) – 97.50
NOMINAL WEIGHT (LB) – 107.00

*Figure 6-17. 5.0-Inch FFAR Practice Configuration (Mk 16 Motor, Mk 24 Warhead, Nose Plug)*



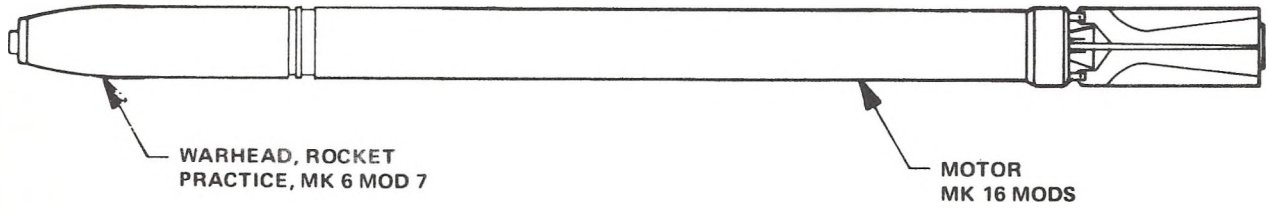

OVERALL LENGTH (IN.) – 107.90
NOMINAL WEIGHT (LB) – 100.50

*Figure 6-18. 5.0-Inch FFAR Flare Configuration (Mk 16 Motor, Mk 33 Warhead)*



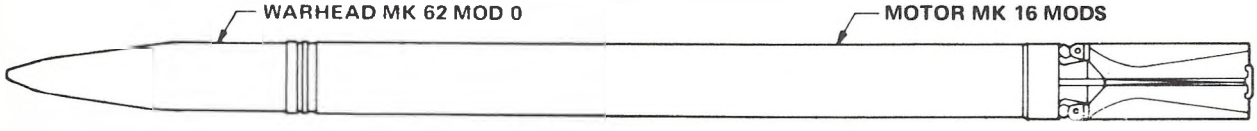

OVERALL LENGTH (IN.) – 109.38
NOMINAL WEIGHT (LB) – 114.60

*Figure 6-19. 5.0-Inch FFAR HE-FRAG Configuration (Mk 16 Motor, Mk 63 Warhead, Mk 93 Fuze)*




OVERALL LENGTH (IN.) – 94.75
NOMINAL WEIGHT (LB) – 104.50

*Figure 6-20. 5.0-Inch FFAR Practice Configuration (Mk 16 Motor, Mk 6 Warhead, Nose Plug)*




OVERALL LENGTH (IN.) – 95.50
NOMINAL WEIGHT (LB) – 102.90

*Figure 6-21. 5.0-Inch FFAR Practice Configuration (Mk 16 Motor, Mk 62 Warhead)*

6-38. Open wooden shipping crates using hand tools such as shears or steel strap cutters. Cut or untwist the securing wires from metal containers with shears or pliers. Remove the end pans from the launcher shipping containers.

**6-39. Removing Components From Containers.** When opening containers, use non-sparking tools. Keep containers in a horizontal position while opening. During the assembly procedure, keep the rocket warheads and motors in a horizontal position to decrease the possibility of accidents.

6-40. All retrograde items such as: metal boxes, wooden boxes, spacers, and thread protectors that are removed from components in preparation for assembly will be disposed of in accordance with current directives.

**6-41. Inspecting Components.** As the components are removed from their containers, inspect in accordance with the following instructions. Dispose of the defective items in accordance with current directives.

**WARNING**

To avoid injury to personnel and damage to equipment, in any operation involving assembly, disassembly, fuzing, defuzing or cleaning, the work shall be done in a designated area, safely removed from other explosives and away from vital installations. The smallest number of rockets practicable shall be exposed. Only authorized personnel essential to the work shall be in the vicinity. Refer to NAVAIR 16-1-529/NAVORD OP3565 for RADHAZ procedures and precautions.

6-42. Remove rocket components from shipping containers in accordance with paragraphs 6-37 to 6-40 or launcher container in accordance with the applicable launcher handbook.

6-43. *Warhead Inspection.* Inspect the warheads as follows:

**WARNING**

Warheads that are cracked or have a gap between the fuze adapter and warhead are hazardous.

1. Verify that warhead is not cracked and that there is no gap between the fuze adapter and warhead.

2. On Mk 32 warhead verify that fuze adapter is staked.

3. Verify that base and fuze cavity threads are not damaged, rusted or corroded.

**WARNING**

Do not use a warhead that does not have the base fuze hole closed by a steel plug or a base fuze. Base fuzes must not protrude more than 1/16 inch. Detonation could occur during handling or firing.

**NOTE**

Do not disassemble base adapters from warheads to check for base plugs.

4. Verify that warhead contains a base fuze or steel base plug, and if installed, the base fuze does not protrude more than 1/16 inch.

**NOTE**

Omit Step 5 if warhead received with fuze installed.

5. Examine interior of fuze cavity to verify that no obstructions are present.

**NOTE**

Refer to paragraph 6-52 for cleaning instructions.

6-44. *Fuze Inspection.* Inspect the fuzes as follows:

**WARNING**

Fuzes that are damaged are hazardous. Detonation may occur.

1. Verify that the fuze body is not damaged.

2. Check fuze threads for damage, rust or corrosion.

6-45. *Motor Inspection.* Inspect the motors as follows:

1. Verify that motor tube is not dented, deeply scratched, gouged or corroded.

2. Verify that shielding band and RADHAZ barrier are in place (see figures 5-13 and 6-22).

3. Verify that the nozzle plug is in place.

4. Verify that the fin retainer is in place and that the fins are not bent or broken and that roll pins are intact and do not protrude more than 1/16-inch (figure 5-14).

5. Motor contact bands, motor tube threads and nozzle and fin assembly must be clean and free from grease or other lubricants.

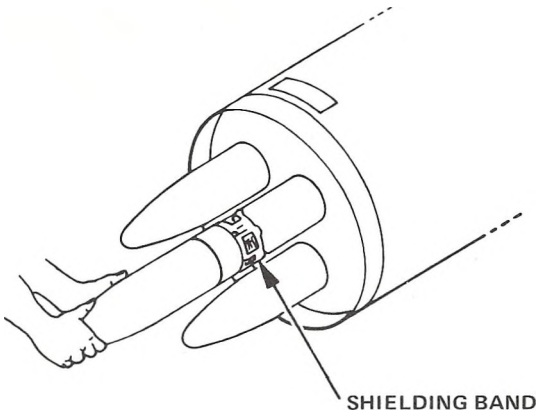



*Figure 6-22. 5.0-Inch FFAR Rocket RADHAZ and Electro Static Protection*

6. Verify that the electrical connector is not broken or the insulation damaged (on motors without RADHAZ barriers).

7. Check threads for damage or corrosion.

6-46. Upon completion of the inspection, move undamaged rocket components to storage in undamaged containers. Move loaded launchers to storage.

**6-47. ASSEMBLY PROCEDURES FOR 5.0-INCH FFARs.** The following paragraphs describe, in general, the procedures necessary to assemble an airborne rocket and include the special tools required.

**6-48. Assembly of Warheads and Fuzes to Motors.** The appropriate warheads are attached to the motors in the assembly area.

**CAUTION**

The motors shall be removed from the launcher for assembly of warheads to rocket motors to prevent damage to fins. Consult appropriate launcher manuals for detailed instructions before proceeding with the following general procedures.

1. Remove rocket motors from launcher or container. Shielding band must be in place whenever rocket motor is out of or protrudes from launcher.

**WARNING**

The shielding band does not touch the contact band, but covers it.

2. Install shielding band on rocket motors with latching tabs in launcher detent groove of motor and in accordance with instructions on shielding band.

**NOTE**

A special chain wrench (or strap wrench) is used to attach the warhead to the motor (see figure 6-23).

3. Install the warhead as follows:

**WARNING**

No attempt should be made to remove a base fuze. Attempted removal may cause detonation.

**CAUTION**

When installing Mk 34 and Mk 63 warheads, use chain wrench only in area indicated by the decal to prevent damage to warhead.

4. Holding the motor with a strap wrench, screw warhead into motor and tighten securely with chain wrench until the warhead seats on the motor for a full 360 degrees.

**NOTE**

A torque wrench (Part No. 4902408) and two crowfoot wrenches are used for tightening the fuze to the warhead. (Crowfoot, Part No. 4902204 is the Mk 188 fuze; Crowfoot, Part No. 4902205 is for Mk 93 and M414A1 fuzes.)

5. When directed to fuze the warhead, attach appropriate nose fuze and tighten with torque wrench and crowfoot adapter (see figure 6-24) to 55 ±5 foot-pounds, holding warhead by either strap or chain wrench.

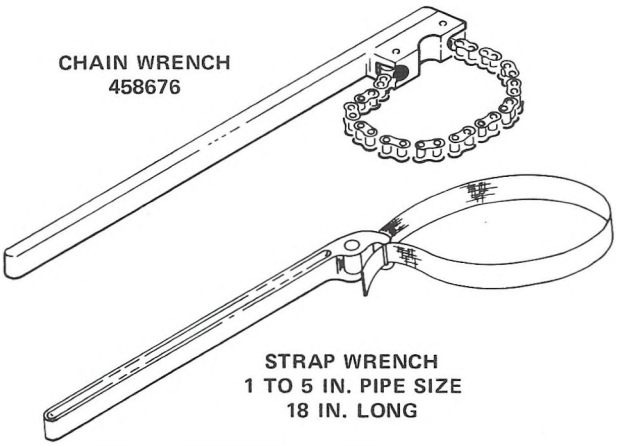



*Figure 6-23. Chain and Strap Wrenches*

**6-49. 5.0-INCH FFAR ASSEMBLY INSPECTION.** Inspect the completely assembled 5.0-inch folding fin aircraft rockets (FFAR) as follows:

**WARNING**

Fully assembled rockets are Class A explosive ordnance. Handle with care and observe all existing safety regulations governing the handling of explosive ordnance.

1. Verify that shielding band is in place (see figure 6-22).

2. Inspect the fins to ensure that the fins are not broken, bent, or out of alignment, that no corrosion is present, and that roll pins are intact and do not protrude.

3. Verify that the nozzle plug is in place.

4. Examine all external rocket surfaces for dents, cracks, deep scratches, gouges, cuts, or corrosion.

5. Verify there is no gap between the fuze and warhead or warhead and motor.

**WARNING**

Do not use a motor with a gap between the motor and the nozzle and fin assembly as the motor may explode upon ignition. A gap is considered to exist after torque has been applied if seating does not exist for a full 360 degrees.

6. Verify that there is no gap at the nozzle and fin assembly and motor junction and that the nozzle and fin assembly is properly staked to the motor tube.

7. Upon completion of inspection of rockets, issue for use, move to ready-service, or load into launchers in accordance with the applicable launcher manual.

**6-50. DISASSEMBLY PROCEDURE.** If rockets are to be disassembled, remove fuze and warhead in reverse of procedures given in paragraph 6-48, except that when removing fuzes from warhead with fuze adapters, secure the adapter with a spanner wrench to prevent loosening of the adapter.

## 6-51. CLEANING OF ROCKET COMPONENTS.

**6-52. WARHEADS.** Clean rocket warheads as follows:

**WARNING**

To prevent possible explosion, do not apply power-operated wire brushes to the surfaces of rocket warheads. Use a beryllium, non-sparking hand brush. If corrosion has caused the case of a thin-walled warhead to become dangerously thin, reject the item as unserviceable and dispose of in accordance with current directives. Do not attempt in any way to clean a warhead fuze cavity which does not have a cavity liner.

1. Clean exterior of warhead by scraping or brushing with nonsparking tools and brushes.

**WARNING**

Adequate ventilation must be maintained when working with solvents.

2. To clean the interior of a warhead fuze cavity which has a cavity liner, use a clean rag dipped in alcohol (O-E-760) or trichlorethylene (O-T-634) and carefully wipe the interior surface.

3. After cleaning and air-drying fuze cavities of warheads being returned to storage, coat threads with a thin film of grease (MIL-G-7711).

**NOTE**

Avoid placing an excessive amount of grease in the cavity and on the threads of warheads; only a thin film is required.

**6-53. FUZES.** Clean rocket fuzes as follows:

**WARNING**

To prevent possible explosion do not apply power-operated wire brushes to the surface of rocket fuzes. Use a non-sparking hand brush. If excessive corrosion is present reject the item and dispose of in accordance with current directives. Adequate ventilation must be provided when working with solvents.

1. Clean body and threads by scraping or brushing with non-sparking tools and brushes. Cleaning may also be

performed by use of a clean rag dipped in trichlorethylene (O-T-634) or alcohol (O-E-760).

2. After cleaning and air-drying fuzes being returned to storage, coat threads with a thin film of grease (MIL-G- 7711).

**6-54. MOTORS.** Clean rocket motors as follows:

**WARNING**

To prevent possible explosion do not apply power-operated wire brushes to the surface of rocket fuzes. Use a non-sparking hand brush. If excessive corrosion is present reject the item and dispose of in accordance with current directives. Adequate ventilation must be provided when working with solvents.

1. Clean body and threads by scraping or brushing with non-sparking tools and brushes. Cleaning may also be performed by use of a clean rag dipped in trichlorethylene (O-T-634) or alcohol (O-E-760).

2. After cleaning and air-drying motor, return to storage.

## 6-55. ASSEMBLED ROCKET SHIPPING CONTAINERS.

6-56. The 5.0-inch FFAR is not authorized to be shipped in the assembled configuration. Motor, warheads, and fuzes are shipped as separate components.

6-57. The 2.75-inch FFAR may be shipped in the assembled configuration either in shipper-launchers or in wooden boxes.

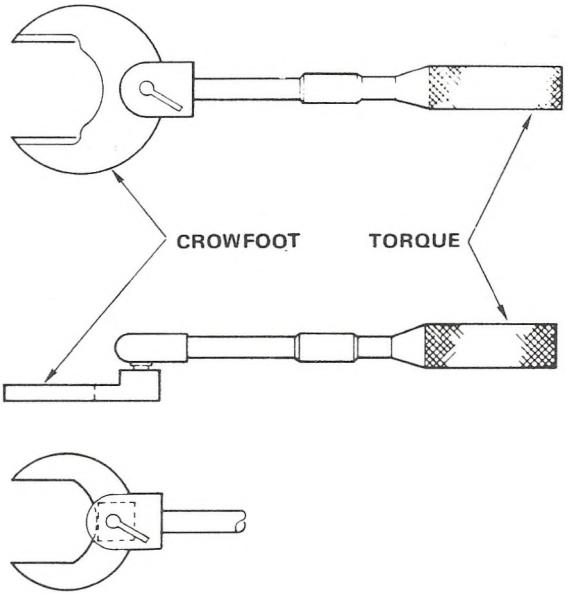



*Figure 6-24. Crowfoot and Torque Wrench*

# SECTION VII

# AIRBORNE ROCKET LAUNCHERS

## 7-1. INTRODUCTION.

7-2. The airborne rocket launchers covered in this manual are of two general types; nonreusable and reusable. See tables 7-1 and 7-2.

**7-3. NONREUSABLE AIRBORNE ROCKET LAUNCHERS.** The nonreusable airborne rocket launcher is made of resin-impregnated paper tubes. The tubes are surrounded by an aluminum alloy casing or skin. The metal bulkheads are swaged to the tubes.

**7-4. REUSABLE AIRBORNE ROCKET LAUNCHERS.** The reusable airborne rocket launchers are constructed with aluminum tubes and have aluminum alloy casings or skins.

**7-5. FAIRINGS.** Both types of launchers may be equipped with frangible fairings over the ends of the launcher prior to aircraft takeoff. When attached, the fairings are flush with the outer diameter of the launcher to form an aerodynamically smooth joint.

**WARNING**

Failure to lock the launcher fairing into proper position may cause loss of fairing, which will endanger the aircraft and pilot.

7-6. The fairings shatter readily from the rocket impact or blast. Fairings for each respective launcher are stowed and shipped in a separate container. See figure 7-1 for typical airborne configuration of the rocket launchers.

**7-7. SHOCK PANS FOR SHIPMENT AND STOWAGE.** Shock pans are installed on each end of the launcher and are attached in the same manner as the fairings. Shock pans are rectangular or round metal parts used to support the launcher center section when it is packaged for shipment or storage. The shock pans give stability to the package for single or multiple stacking. The shock pan and cover assembly incorporate a rubber packing ring (O-ring) which converts the center section into a waterproof container for shipment and storage.

**7-8. DISPOSITION OF LAUNCHER SHIPPING PROTECTORS AND EXTRA SUSPENSION LUGS.** During any emergency or combat operation, all excess shipping gear may be jettisoned. During noncombat operation where return logistics are adequate and economical, retain shock pans and spare suspension lugs for palletizing and return shipment to the ammunition loading depot.

**7-9. LAUNCHER SUSPENSION PROVISIONS.** Several methods of launcher suspension are used. Refer to the applicable Airborne Weapons/Stores Loading Manual/ Checklist for the particular launcher.

## 7-10. ROCKET IGNITION.

**WARNING**

Never attempt to check continuity of firing circuits when rockets are in launcher tubes. Ignition will occur.

7-11. Airborne rocket ignition is accomplished by 28-volt direct current (vdc) supplied by the aircraft armament circuit. Multiple rocket 2.75-inch and 5.0-inch launchers employ some form of intervalometer to distribute ignition pulses to the rockets. Intervalometers are designed for firing rockets from the launchers at fixed intervals. Two firing modes are available; single and ripple.

**7-12. SINGLE FIRING.** Single-fire means firing either a single rocket or a single pair of rockets depending upon launcher design. When the rockets are single fired, the pilot activates the rocket ignition circuit for each firing pulse.

**7-13. RIPPLE FIRING.** Ripple fire means firing all rockets in the launcher with one firing impulse either singly or in pairs, depending on launcher design. During ripple firing all rockets are fired from the launcher at fixed intervals. The intervalometer in the launcher distributes the ignition current. The pilot activates the rocket ignition circuit only one time.

**7-14. PAIR FIRING.** The 19-rocket, 2.75-inch folding-fin aircraft rocket (FFAR) launchers are designed to fire the rockets in pairs. When the launcher is equipped with a shunt-fuze intervalometer, all rockets are ripple fired in pairs with one pulse from the ignition circuit. When equipped with a stepper switch type intervalometer and a selector switch with the selector switch set for single, a pair of rockets will fire with each ignition pulse.

## 7-15. ROCKET INSTALLATION AND REMOVAL.

**7-16. INSTALLATION.** Installation of rockets should always be done with the launcher in a horizontal position. Before starting an installation, make sure that the launcher is not connected to any sort of electrical energy; that prescribed safety devices are present and properly positioned, and there are no obstructions in any of the launcher tubes. Some launcher tubes are equipped with detents that always protrude into the tubes while others are equipped with detents that must be retracted for loading.

**CAUTION**

Check each rocket for detent locking. On all 2.75-inch rocket launchers, visually check to assure that physical contact is made between contact points and rocket fin-retainer contact button.

7-17. Some launcher tubes contain rocket stops in the aft end. The rocket should always be oriented so the fins will not strike the detent or the rocket stop and should be pushed slowly into the tube. Ramming the rocket into the tube or improper orientation of the rocket before insertion can result in damage to the detent or rocket fins or both.

**WARNING**

Removal shall always be done in a designated area that is safe from RADHAZ. Due to the fact that there is always a possibility of igniting a rocket motor by static electricity, personnel should never allow any part of their bodies, especially bare hands, to come into contact with any ignition contact point on the rocket motors. When removing the 5.0-inch FFAR, the shielding band shall be placed over the contact band concurrent with the removal of the rocket from the launcher.

**7-18. REMOVAL.** Before attempting to remove rockets from any launcher, be sure that the safe-arm device of the type prescribed for the particular launcher is present and properly positioned, and the electrical energy input source is disconnected from the launcher. Refer to handbook issued for each type of launcher for detailed removal instructions.

**CAUTION**

When launchers are loaded, they should never be shipped or stored in a vertical position, but always in a horizontal position. When stored in a vertical position the detent may become damaged and cause malfunction.

**7-19. AIRBORNE ROCKET LAUNCHER CONFIGURATION.** Launchers covered in this manual are for the 2.75-inch and 5.0-inch rockets. A typical airborne configuration is shown in figure 7-1. Typical shipping configurations are shown in figures 7-2 and 7-3.

## 7-20. 2.75-INCH AIRBORNE ROCKET LAUNCHERS.

**7-21. INTRODUCTION.** Detailed information for each 2.75-inch airborne rocket launcher is contained in the applicable operation and service handbook. See table 7-1 for configurations and specifications.

## 7-22. 5.0-INCH AIRBORNE ROCKET LAUNCHERS.

**7-23. INTRODUCTION.** Detailed information for each 5.0-inch airborne rocket launcher is contained in the applicable operations and service handbook. See table 7-2 for configurations and specifications.

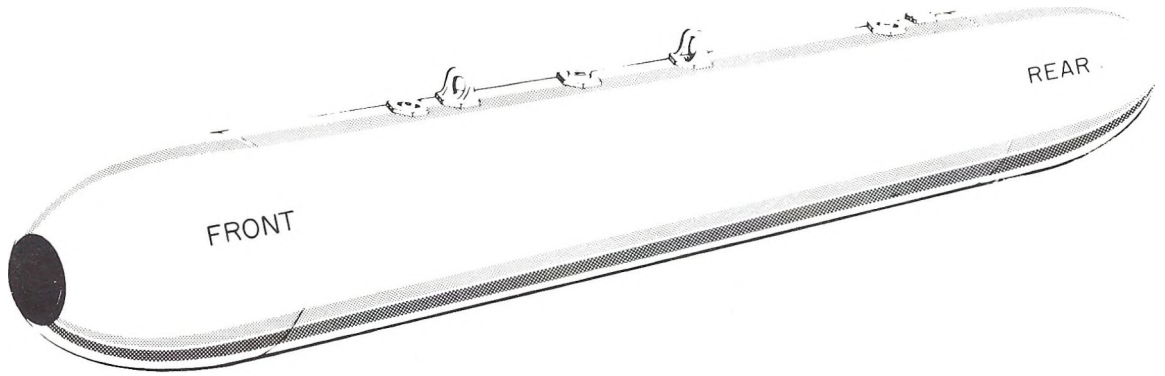



*Figure 7-1. Typical Airborne Configuration*

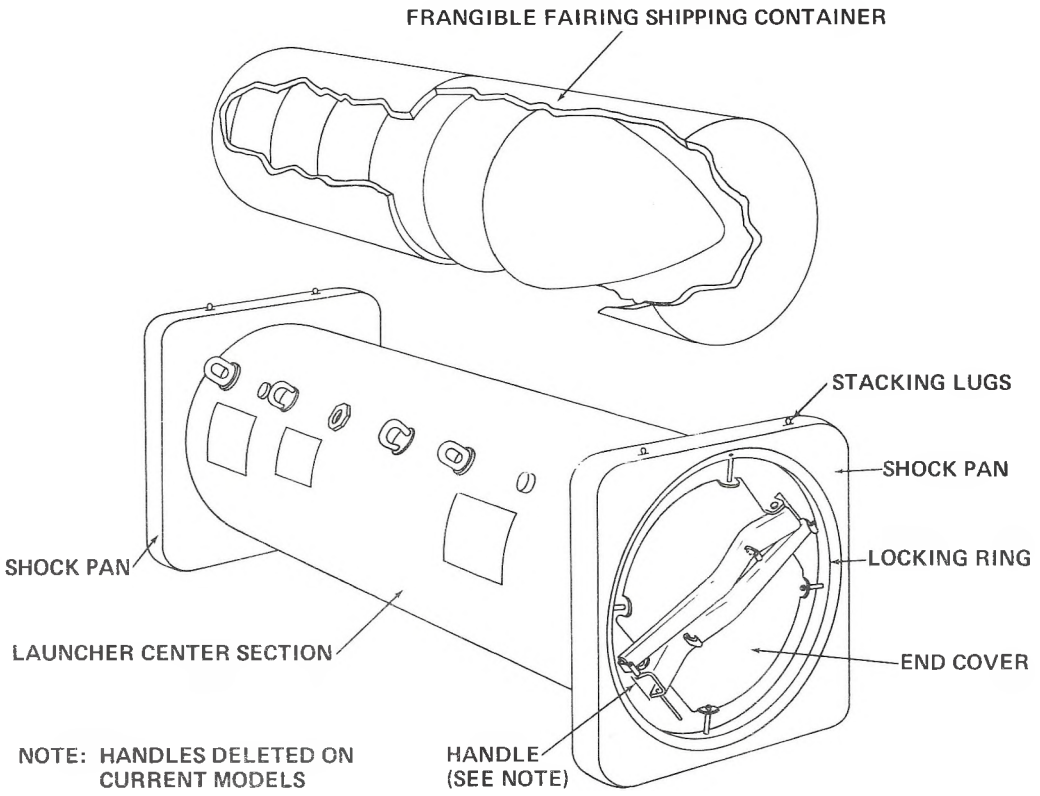



*Figure 7-2. Typical 2.75-Inch Launcher Shipping Containers*

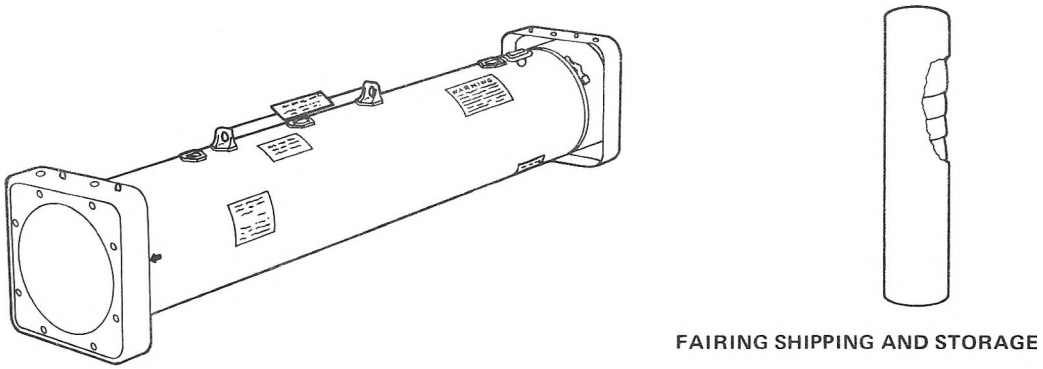



*Figure 7-3. Typical 5.0-Inch Launcher Shipping Containers*

*Table 7-1. 2.75-Inch FFAR Rocket Launcher Chart*

| Launcher Type | No. of Rockets | Tube Material | Reusable | Method of Firing | Firing Interval | Single Ripple Selector Switch | Safety Device | R-F Barrier | R-F Filter | Suspension | Shipping Configuration | Intervalometer |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AERO 7D | 19 | Paper | No | Ripple | 10 Millisec | No | Shorting Plug & Dust Cap | No | No | 14- & 30-Inch or Single | Completely Assembled Rockets | Shunt-Fuze (Replaceable) |
| LAU-3A/A | 19 | Paper | No | Ripple | 10 Millisec | No | Micro Switch with Pull Pin | Yes | Yes | 14-Inch or Single | Completely Assembled Rockets | Shunt Fuze (Replaceable) |
| LAU-32/A | 7 | Paper | No | Ripple | 10 Millisec | No | Micro Switch with Pull Pin | Yes | Yes | 14-Inch | Completely Assembled Rockets | Series-Parallel Spider |
| LAU-32A/A | 7 | Paper | No | Ripple | 10 Millisec | No | Micro Switch with Pull Pin | Yes | Yes | 14-Inch or Single | Completely Assembled Rockets | Shunt-Fuze (Replaceable) |
| LAU-32B/A | 7 | Alum. | Yes | Ripple or Single | 20 Millisec (Ripple Mode) | Yes | Micro Switch with Pull Pin | Yes | Yes | 14-Inch or Single | Completely Assembled Rockets | Stepping Switch (Built in) |
| LAU-56/A | 7 | Paper | No | Ripple or Single | 20 Millisec (Ripple Mode) | Yes | Micro Switch with Pull Pin | Yes | Yes | 14-Inch or Single | Completely Assembled Rockets | Stepping Switch (Built in) |
| LAU-60/A | 19 | Paper | No | Ripple | 10 Millisec | No | Micro Switch with Pull Pin | Yes | Yes | 14-Inch or Single | Completely Assembled Rockets | Shunt-Fuze (Replaceable) |
| LAU-61/A | 19 | Alum. | Yes | Ripple or Single | 20 Millisec (Ripple Mode) | Yes | Jack with Pull Pin | Yes (Aft Only) | No | 14-Inch | Completely Assembled Rockets | Stepping Switch (Built in) |
| LAU-68/A* | 7 | Alum. | Yes | Ripple or Single | 20 Millisec (Ripple Mode) | Yes | Jack with Pull Pin | Yes (Aft Only) | No | 14-Inch | Completely Assembled Rockets | Stepping Switch (Built in) |
| LAU-69/A | 19 | Paper | No | Ripple or Single | 20 Millisec | Yes | Jack with Pull Pin | Yes | No | 14-Inch | Completely Assembled Rockets | Stepping Switch (Built in) |

*Later model production allows removal and replacement of intervalometers.

*Table 7-2. 5.0-Inch FFAR Rocket Launcher Chart*

| Launcher Type | No. of Rockets | Tube Material | Reusable | Method of Firing | Firing Interval | Single Ripple Selector Switch | Safety Device | R-F Barrier | R-F Filter | Suspension | Shipping Configuration | Intervalometer |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LAU-10/A | 4 | Alum. | Yes | Ripple or Single | 95 Millisec (Ripple Mode) | Yes | Del Mar Safety Switch | No | No | 14- and 30-Inch or Single | Loaded (Motors Only) or Empty | Stepping Switch (Replaceable) |
| LAU-10A/A | 4 | Alum. | Yes | Ripple or Single | 95 Millisec (Ripple Mode) | Yes | Pull Pin Actuated Switch | No | No | 14- and 30-Inch | Loaded (Motors Only) or Empty | Stepping Switch (Replaceable) |
| LAU-33A/A (Aircraft Equipment) | 2 | Alum. | Yes | Ripple or Single | 95 Millisec (Ripple Mode) | Yes | Pull Pin Actuated Switch | No | No | Aero 3A or LAU-7/A | Empty | Stepping Switch (Replaceable) |
| LAU-35A/A (Aircraft Equipment) | 2 | Alum. | Yes | Ripple or Single | 95 Millisec (Ripple Mode) | Yes | Pull Pin Actuated Switch | No | No | Aero 3A or LAU-7/A | Empty | Stepping Switch (Replaceable) |

# ALPHABETICAL INDEX

## ALPHABETICAL INDEX (Continued)

## ALPHABETICAL INDEX (Continued)

## ALPHABETICAL INDEX (Continued)