Naval Education and Training Command

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Training Manual
(TRAMAN)

Aviation Ordnanceman 3, 2, & 1

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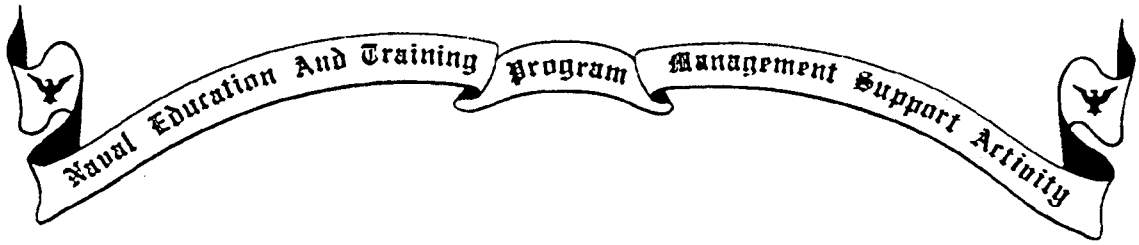

AVIATION ORDNANCEMAN 3, 2, & 1

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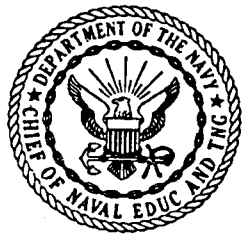

1996 Edition Prepared by
AOC(AW) Michael A. Howard

PREFACE

This Training Manual (TRAMAN) is designed to be used with both the Aviation Ordnanceman 3 & 2, NAVEDTRA 72309, and the Aviation Ordnanceman 1, NAVEDTRA 82309, Nonresident Training Courses (NRTCs). The NRTCs include questions designed to lead students through the TRAMAN. The Aviation Ordnanceman 3, 2, and 1 occupational standards (OCCSTDS) were used in the preparation of this manual. The OCCSTDS are contained in the *Manual of Navy Enlisted Manpower and Personnel Classifications and Occupational Standards,* NAVPERS 18068.

Each chapter in this TRAMAN contains review questions and answers. The student should attempt to answer the questions before referring to the answers. The questions are designed to broadly cover the material in each chapter. Any questions that were answered incorrectly should be researched for thorough understanding. The questions in the TRAMAN chapters will help the student learn the information needed to successfully complete the NRTC assignments.

This TRAMAN and the NRTCs were prepared by the Naval Education and Training Program Management Support Activity, Pensacola, Florida, for the Chief of Naval Education and Training.

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THE UNITED STATES NAVY

GUARDIAN OF OUR COUNTRY

The United States Navy is responsible for maintaining control of the sea and is a ready force on watch at home and overseas, capable of strong action to preserve the peace or of instant offensive action to win in war.

It is upon the maintenance of this control that our country's glorious future depends; the United States Navy exists to make it so.

WE SERVE WITH HONOR

Tradition, valor, and victory are the Navy's heritage from the past. To these may be added dedication, discipline, and vigilance as the watchwords of the present and the future.

At home or on distant stations we serve with pride, confident in the respect of our country, our shipmates, and our families.

Our responsibilities sober us; our adversities strengthen us.

Service to God and Country is our special privilege. We serve with honor.

THE FUTURE OF THE NAVY

The Navy will always employ new weapons, new techniques, and greater power to protect and defend the United States on the sea, under the sea, and in the air.

Now and in the future, control of the sea gives the United States her greatest advantage for the maintenance of peace and for victory in war.

Mobility, surprise, dispersal, and offensive power are the keynotes of the new Navy. The roots of the Navy lie in a strong belief in the future, in continued dedication to our tasks, and in reflection on our heritage from the past.

Never have our opportunities and our responsibilities been greater.

CONTENTS

CHAPTER Page

1. Bombs, Fuzes, and Associated Components 1-1
2. Aircraft Rockets and Rocket Launchers 2-1
3. Air-Launched Guided Missiles and Guided Missile Launchers 3-1
4. Pyrotechnics 4-1
5. Air-Laid Mines and Torpedoes 5-1
6. M61Al Gun Installation 6-1
7. Ammunition Loading 7-1
8. Targets and Associated Equipment 8-1
9. Ammunition Handling Equipment 9-1
10. Suspension, Arming, and Releasing Equipment 10-1
11. Ammunition Storage and Handling Afloat 11-1
12. Ammunition Storage and Handling Ashore 12-1
13. Weapons Assembly 13-1
14. Aircraft Loading and Unloading Procedures 14-1
15. Aircraft Weapons Systems 15-1
16. Aircraft Weapons Systems Test Equipment 16-1
17. Ammunition Administration Ashore and Afloat 17-1

APPENDIX

I. Glossary and Acronyms AI-1

II. References Used to Develop This TRAMAN AII-1

INDEX INDEX-1

CHAPTER 1

BOMBS, FUZES, AND ASSOCIATED COMPONENTS

Bombs must be manufactured to withstand reasonable heat and be insensitive to the shock of ordinary handling. They must also be capable of being dropped from an aircraft in a safe condition when in-flight emergencies occur.

Bomb detonation is controlled by the action of a fuze. A fuze is a device that causes the detonation of an explosive charge at the proper time after certain conditions are met. A bomb fuze is a mechanical or an electrical device. It has the sensitive explosive elements (the primer and detonator) and the necessary mechanical/electrical action to detonate the main burster charge. The primer is fired by a mechanical action or an electrical impulse, which causes the detonator to explode. The primer-detonator explosion is relayed to the main charge by a booster charge. This completes the explosive train.

FUZE TERMINOLOGY AND BASIC FUZE THEORY

LEARNING OBJECTIVE: *Describe the operation of mechanical and electrical fuzes. Identify special safety features that are inherent in bomb fuzes.*

This chapter will introduce you to some of the common terms and acronyms associated with fuzes used in the Navy. Basic fuze theory, general classes of fuzes, and the various types of fuzes are also discussed in this chapter.

FUZE TERMINOLOGY

Some of the most common fuze terms that you should know are defined as follows:

Arming time. The amount of time or vane revolutions needed for the firing train to be aligned after the bomb is released, or from time of release until the bomb is fully armed. It is also known as *safe separation time (SST).*

Delay. When the functioning time of a fuze is longer than 0.0005 second.

External evidence of arming (EEA). A means by which a fuze is physically determined to be in a safe or armed condition.

Functioning time. The time required for a fuze to detonate after impact or a preset time.

Instantaneous. When the functioning time of a fuze is 0.0003 second or less.

Nondelay. When the functioning time of a fuze is 0.0003 to 0.0005 second.

Proximity (VT). The action that causes a fuze to detonate before impact when any substantial object is detected at a predetermined distance from the fuze.

Safe air travel (SAT). The distance along the trajectory that a bomb travels from the releasing aircraft in an unarmed condition.

BASIC FUZE THEORY

Fuzes are normally divided into two general classes-mechanical and electrical. These classes only refer to the primary operating principles. They maybe subdivided by their method of functioning or by the action that initiates the explosive train—impact, mechanical time, proximity, hydrostatic, or long delay. Another classification is their position in the bomb-nose, tail, side, or multipositioned. Mechanical and electrical fuzes are discussed in the following text.

Mechanical Fuzes

In its simplest form, a mechanical fuze is like the hammer and primer used to fire a rifle or pistol. A mechanical force (in this case, the bomb impacting the target) drives a striker into a sensitive detonator. The detonator ignites a train of explosives, eventually firing the main or filler charge. A mechanical bomb fuze is more complicated than the simple hammer and primer. For safe, effective operation, any fuze (mechanical or electrical) must have the following design features:

- It must remain safe in stowage, while it is handled in normal movement, and during loading and downloading evolutions.
- It must remain safe while being carried aboard the aircraft.
- It must remain safe until the bomb is released and is well clear of the delivery aircraft (arming delay or safe separation period).
- Depending upon the type of target, the fuze may be required to delay the detonation of the bomb after impact for a preset time (functioning delay). Functioning delay may vary from a few milliseconds to many hours.
- It should not detonate the bomb if the bomb is accidentally released or if the bomb is jettisoned in a safe condition from the aircraft.

To provide these qualities, a number of design features are used. Most features are common to all types of fuzes.

Electrical Fuzes

Electrical fuzes have many characteristics of mechanical fuzes. They differ in fuze initiation. An electrical impulse is used to initiate the electrical fuze rather than the mechanical action of arming vane rotation.

An electrical pulse from the delivery aircraft charges capacitors in the fuze as the bomb is released from the aircraft. Arming and functioning delays are produced by a series of resistor/capacitor networks in the fuze. The functioning delay is electromechanically initiated, with the necessary circuits closed by means of shock-sensitive switches.

The electric bomb fuze remains safe until it is energized by the electrical charging system carried in the aircraft. Because of the interlocks provided in the release equipment, electrical charging can occur only after the bomb is released from the rack or shackle and has begun its separation from the aircraft; however, it is still connected electrical y to the aircraft's bomb arming unit. At this time, the fuze receives an energizing charge required for selection of the desired arming and impact times.

SPECIAL SAFETY FEATURES

Some fuzes incorporate special safety features. The most important safety features are detonator safe, shear safe, and delay arming.

Detonator safe fuzes do not have the elements of their firing train in the proper position for firing until the fuze is fully armed. The elements remain firmly fixed and out of alignment in the fuze body while the fuze is unarmed. This increases safety during shipping, stowing, and handling of the fuze. The arming action of the fuze aligns the firing train.

A shear-safe fuze does not become armed if its arming mechanism is damaged or completely severed from the fuze body, The arming mechanism of the fuze protrudes from the bomb, and it might be severed from the fuze body if the bomb is accidentally dropped. Shear-safe fuzes give additional security for carrier operations and for externally mounted bombs.

Delay arming mechanically or electrically slows the arming of the fuze. It keeps a fuze in the safe condition until the bomb falls far enough away from or long enough from the aircraft to minimize the effects of a premature explosion. Delay arming helps to make carrier operations safe because a bomb accidentally released during landing or takeoff ordinarily will not have sufficient air travel, velocity, or time to fully arm the fuze.

REVIEW NUMBER 1

Q1. Name the device that controls bomb detonation.

Q2. The time or number of vane revolutions needed for the firing train to align after a bomb is released is the _____.

Q3. Describe the functioning time of a fuze.

Q4. The distance along the trajectory that a bomb travels from the releasing aircraft in an unarmed condition is the_____.

Q5. List the two basic classes of fuzes.

Q6. Describe the basic principle of the mechanical fuze.

Q7. What means is used to initiate an electrical fuze ?

Q8. List the three special safety features incorporated into fuzes.

MECHANICAL FUZES

LEARNING OBJECTIVE: *Identify the various types of mechanical fuzes to include their physical description and functional operation.*

There are many fuzes in use by the Navy today. Some of the commonly used fuzes are discussed in this TRAMAN. To keep up with current fuzes, you should refer to *Aircraft Bombs, Fuzes, and Associated Components,* NAVAIR 11-5A-17, and *Airborne Bomb and Rocket Fuze Manual,* NAVAIR 11-1F-2.

M904E2/E3/E4 MECHANICAL IMPACT NOSE FUZE

The M904 (series) fuze (fig. 1-1) is a mechanical impact nose fuze used in the Mk 80 (series) low-drag general-purpose (LDGP) bombs. The M904 (series) fuze is installed in the nose fuze well of the bomb and requires the use of an adapter booster. The fuze is detonator-safe, and it contains two observation windows through which you can determine the safe/arm condition of the fuze. There is no special locking feature designed into the fuze for shear safety if the bomb is accidentally dropped. However, detonation is unlikely if the collar (forward end of the fuze) is sheared off by the accidental drop before arming is complete.

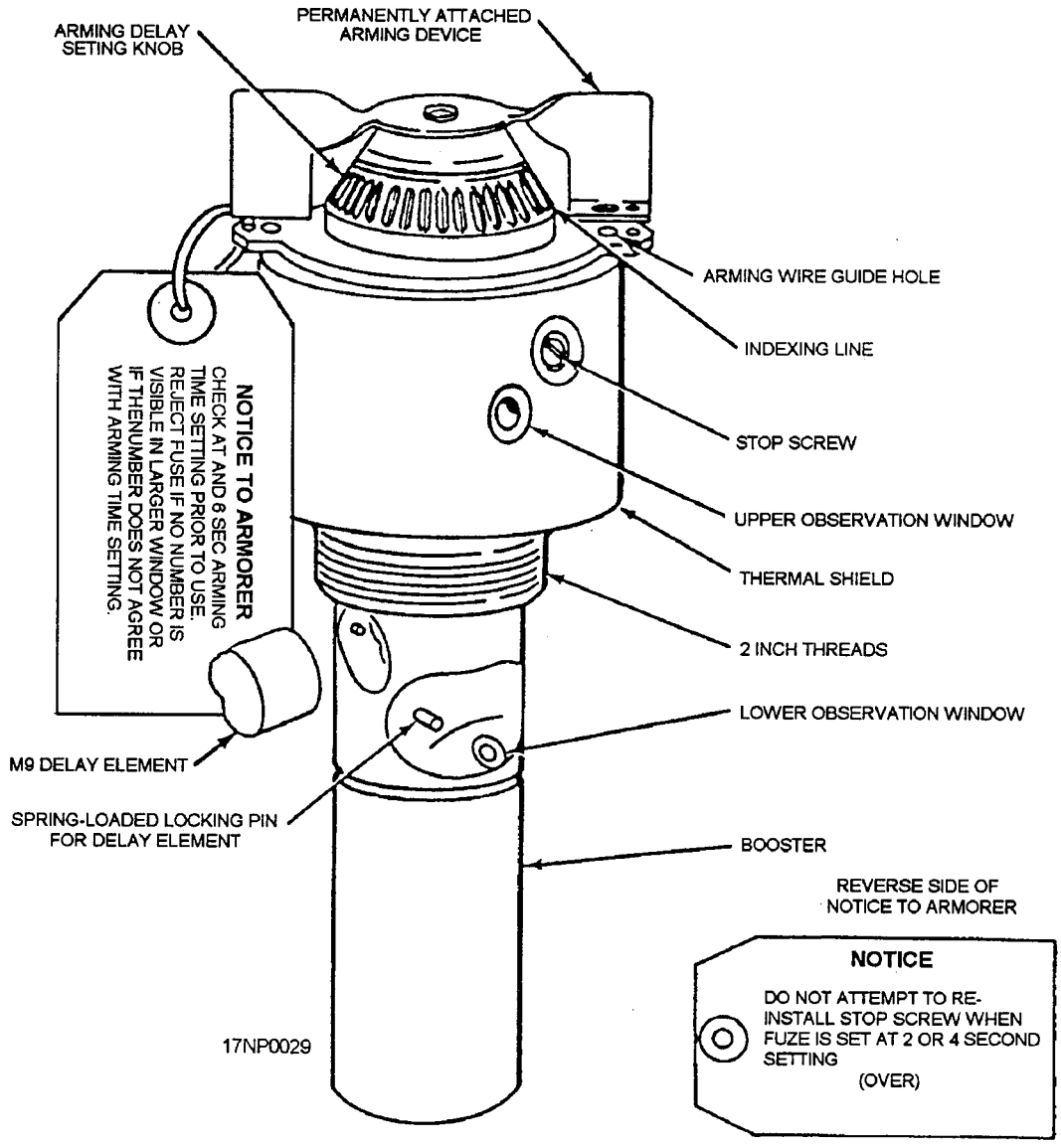


Figure 1-1—Mechanical impact nose fuze M904 (series).

The fuze may be configured for a number of preselected arming and functioning delays needed by a mission. There are nine arming delays from 2 to 18 seconds in 2-second increments, and any combination of six functioning delays from instantaneous to 250 milliseconds (0.250 seconds) may be selected. An internal governor, driven by the permanently mounted arming vane, allows relatively constant arming times at release speeds ranging from 170 to over 525 knots.

Functioning times are determined by the installation of an M9 delay element. Anyone of six delay elements may be installed. Each delay element is identified by the functioning delay time stamped on the element body—NONDELAY (instantaneous), 0.01, 0.025, 0.05, 0.1, or 0.25 second.

Physical Description

The M904 (series) fuze contains approximately 1 1/2 ounces of tetryl in the booster, which is located at the base of the fuze body. The entire fuze weighs about 2 1/3 pounds and is 9 1/4 inches long.

The M904E4 is a thermally protected fuze. It is especially designed for use with the thermally protected Mk 80 (series) general-purpose bombs and the thermally protected M148E1 adapter booster. This significantly increases the cook-off time (table 1-1) of the bombs subjected to intense heat or flame.

ARMING DELAY TIMES.— Arming delay times are inscribed into the face of the forward nose retaining ring. A white indexing line is scribed on the knurled delay setting knob below the arming vane. The white indexing line must be matched to one of the indicated arming times to select the desired arming delay. To select the required arming delay time, depress the setting index locking pin and rotate the knurled arming delay setting knob until the white indexing line is aligned with the desired arming delay time stamped on the nose retaining ring. The 2- and 4-second arming times are for use with retarded weapons, and are only set by removing the stop screw located next to the setting index locking pin. Never try to reinstall the stop screw when either of these two settings are used. The stop screw may be reinstalled at any delay setting of 6 seconds or more.

IDENTIFICATION OF ARMED FUZES.— There are three conditions of the M904 fuze—safe, partially armed, and fully armed. You can verify the fuze conditions by looking through the two observation windows in the fuze body (fig. 1-1). To check the fuze condition, hold the fuze vertically and look through the windows perpendicular to the fuze body. Look at

REVIEW NUMBER 1 ANSWERS TO QUESTIONS Q1. THROUGH Q8.

A1. A fuze controls bomb detonation.

A2. The time or number of vane revolutions needed for the firing train to align after a bomb is released is the arming time.

A3. The time required for a fuze to detonate after impact or a preset time is known as the functioning time.

A4. The distance along the trajectory that a bomb travels from the releasing aircraft in an unarmed condition is known as the safe air travel (SAF).

AS. The two basic classes offices are electrical and mechanical.

A6. The force used to initiate the mechanical fuze is like the hammer and primer used to fire a rifle. A mechanical force drives a striker into a sensitive detonator.

A7. An electrical impulse initiates an electrical fuze.

A8. The three special safety features incorporated into fuzes are detonator safe, shear safe, and delay arming features.

Table 1-1.–LDGP and Fire Bomb Cook-Off Times

Item	Ordnance	Fuze/Adapter Booster	Average Reaction (Min & Sec)	Shortest Reaction Time	Bomb Initiated Reaction	Fuze Booster Initiated Reaction*
Bomb H6 filled	Mk 81	All	2+34	2+00	Deflagration to explosion	Deflagration to detonation (after 5 minutes)
		All	3+30	2+30	Deflagration to explosion	Deflagration to detonation (after 5 minutes)
	Mk 82 Mod 1 thermally protected	All	4+30	3+30	Deflagration	Deflagration to detonation (after 5 minutes)
	Mk 82 Mod 2** thermally protected	M904E4 with M48E1 Adapter, Mk 344, Mk 376, FMU-139/B	10 + 00	8+00	Deflagration	Deflagration to detonation (after 12 minutes)
		M904E2/E3 with M148/T45	6+00	5+00		Deflagration to detonation
		Mk 346 with M150/T46	7+00	3+30		Deflagration to detonation (detonation may occur after 5 minutes)
		Mk 346 with Mk 68 thermal shield	17 + 04	12 + 50		Deflagration to detonation
		M148/T45 (no fuze)	3+04			Deflagration to detonation (detonation may occur after 5 minutes)
	Mk 83 Mod 5 thermally protected	M904E4 with M148E1/M150 Adapter, Mk 346 with Mk 68 thermal shield, Mk 344, Mk 376, or FMU-139/B	10 + 00	8+49	Deflagration	Deflagration to detonation (after 12 minutes)
	Mk 84 Mod 3 thermally protected	M904E4 with M148E1 Adapter, Mk 344, Mk 376, or FMU-139/B	10 + 00	8+45	Deflagration	Deflagration to detonation (after 12 minutes)

* Fuze or booster initiated reaction. Frequency of detonation reaction is small.

** Chips in exterior coating and/or groove for retarding fin cut to bare steel do not change cook-off time.

table 1-2. It shows you what you would see through the observation windows of the M904E3/4 fuze at various time settings and fuze conditions.

Also, check the M904E4 to make sure the thermal sleeve is firmly bonded to the fuze collar and is not cracked.

NOTE: If the safe condition of any fuze is in doubt, explosive ordnance disposal (EOD) personnel should be notified immediately.

Functional Description

The M904 fuze arms and functions by the rotation of the arming vane and alignment of its internal components. When the fuze is released from the aircraft, the fuze arming wire is withdrawn from the fuze arming vane, and the arming vane is rotated by the airstream. Arming vane rotation is controlled by the constant arming action of the governor in the fuze. The arming vane continues to rotate until the preselected arming delay period (2 to 18 seconds) elapses (ends). Once the arming delay period elapses, the firing train is in full alignment and ready to function.

At impact, the forward part of the fuze body drives the striker body and firing pin down into the M9 delay element. After the proper delay, the M9 delay ignites the relay, detonator, lead, and booster, which sets off the main charge.

REVIEW NUMBER 2

Q1. What kind of fuze is the M904?

Q2. What bomb series is the M904 fuze used with?

Q3. The M904 fuze has _____ arming delays, which you can set for 2 to 18 seconds in _____ increments; there are any combination of _____ functioning delays from instantaneous to 250 milliseconds.

Q4. The M904 is thermally protected. Why is this important?

Q5. Describe the means you use to check the condition of the M904 fuze.

Q6. If you can't tell if a fuze is "safe," you should notify _____.

Q7. The M904 arms and functions by _____.

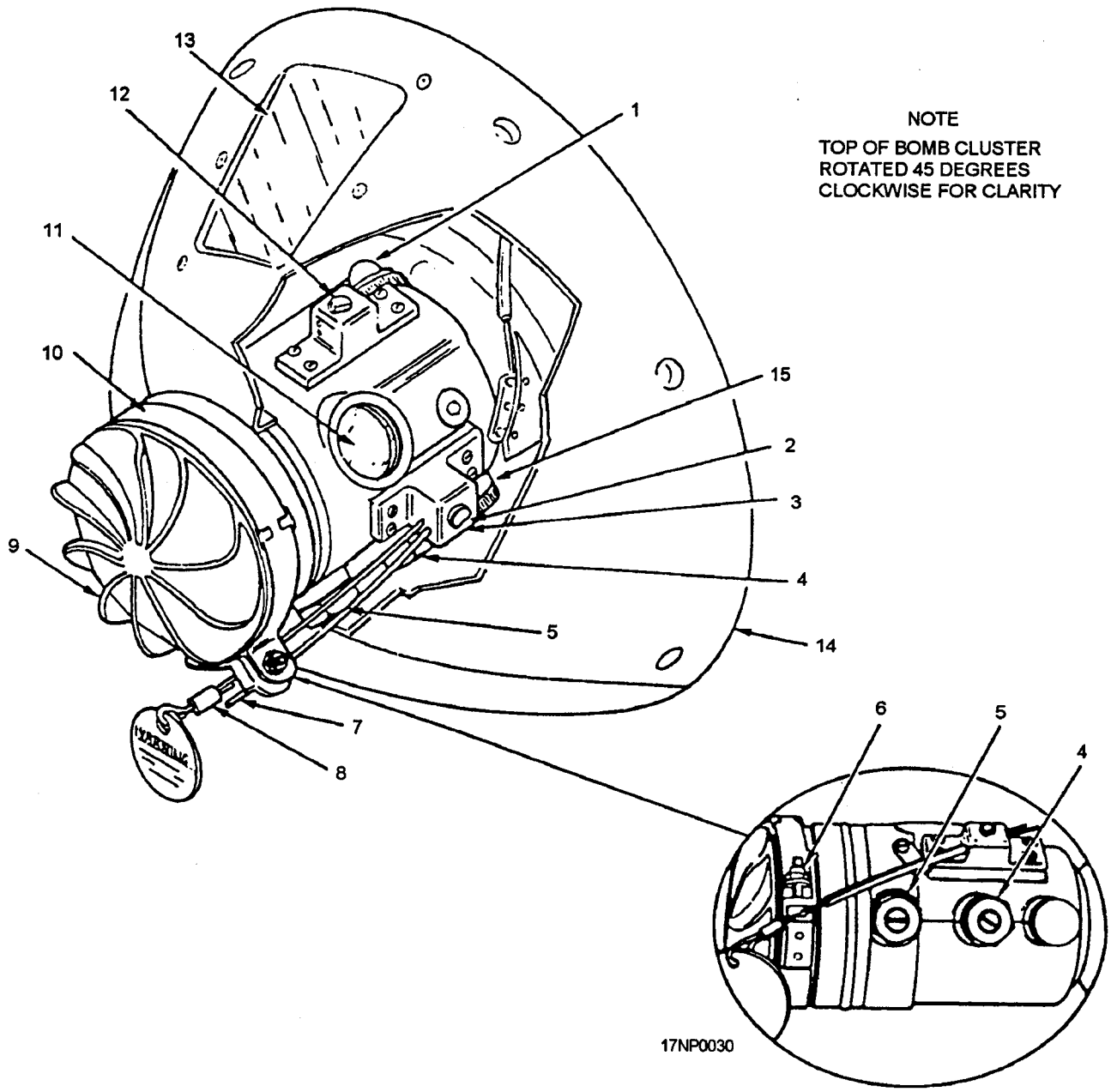
MK 339 MOD 0 AND MOD 1 MECHANICAL TIME FUZES

The Mk 339 Mod 0 mechanical time fuze (fig. 1-2, without the option time wire), Mod 0 and Mod 1 (fig. 1-3) are used with dispenser weapons and have the following characteristics:

- Nose-mounted
- Air-enabling
- Detonator-safe

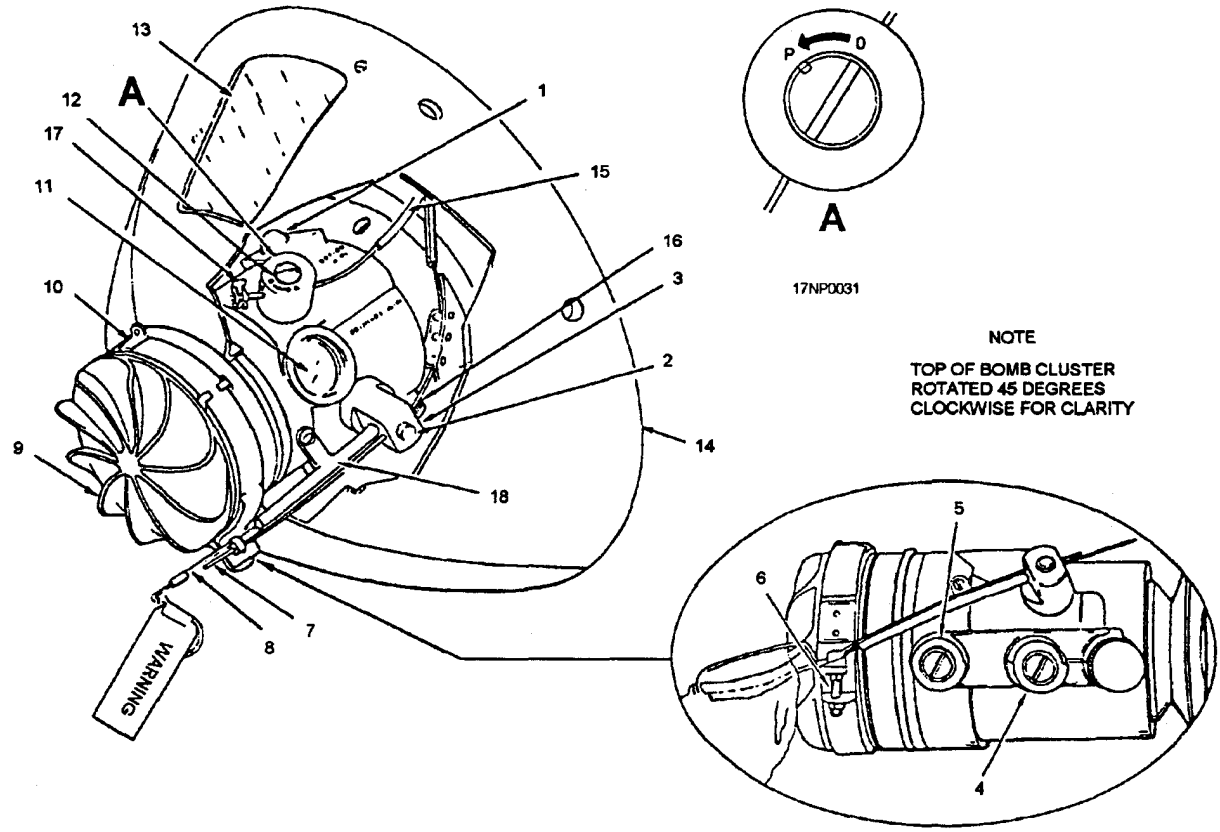
Table 1-2.—Indications for Determining Conditions of M904E3/4 Nose Fuzes

Condition	Time Setting	Upper Window	Lower Window
Safe	18 Seconds	White number "18" on green background.	Vacant or dark in color.
	6 Seconds	White number "6" on green background.	
Partially Armed	18 and 6 Seconds	Green background with no numbers visible. (If numbers appear at other than" 18" or "6" second setting or if numbers do not match settings, fuze is partially armed)	Vacant or dark in color.
Armed	Any setting. (Time setting cannot be changed.)	*Red with black letter "A." (Some green may show at top of window.)	*Red with black Letter "A."



1. Fuze safe/arm indicator
2. Timer starting pin
3. Timer starting pin bracket
4. Option time setting adjustment
5. Primary time setting adjustment
6. Band release stud and nut
7. Fuze arming wire
8. Safety pin assembly
9. Impeller
10. Impeller band assembly
11. Time setting observation window
12. Option time pin
13. Indicator observation window
14. Nose fairing
15. Slider retainer

Figure 1-2.—Installed mechanical time fuze Mk 339 Mod 0 (without option time bomb cluster Mk 20 Mod 2 only).



1. Fuze safe/arm indicator
2. Timer starting pin
3. Timer starting pin bracket
4. Option time setting adjustment
5. Primary time setting adjustment
6. Band release stud and nut
7. Fuze arming wire
8. Safety pin assembly
9. Impeller
10. Impeller band assembly
11. Time setting observation window
12. Option time pin
13. Indicator observation window
14. Nose fairing (reference)
15. Option time wire
16. Retainer slide
17. Clip
18. Safety pin assembly guide tube

Figure 1-3.—Installed mechanical time fuze Mk 339 Mod 1 (with option time wire bomb clusters Mk 20 Mods 3, 4, and 6.

REVEIW NUMBER 2 ANSWERS TO QUESTIONS Q1. THROUGH Q7.

A1. The M904 is a detonator-safe, mechanical impact nose fuze.

A2. The M904 series fuze is used with Mk 80 (series) bombs.

A3. The M904 fuze has nine arming delays, which you can set for 2 to 18 seconds in 2-second increments; there are any combination of six functioning delays from instantaneous to 250 milliseconds.

A4. It is important for the M904 to be thermally protected because it increases the "cook-off" time of bombs subjected to intense heat or flame.

A5. There are three conditions of the M904 fuze—safe, partially armed, and fully armed. You can check for these conditions by looking in the two observation windows in the fuze body.

A6. If you can't tell if a fuze is "safe," you should notify explosive ordnance disposal (EOD) personnel.

A7. The M904 arms and functions by rotation of arming vanes and alignment of internal components.

The Mod 0 and Mod 1 fuzes are installed in the Mk 20 Mods 2,3,4, and 6 bomb clusters. The Mod 0 fuze without the option time wire configuration is used only in the Mk 20 Mod 2 bomb cluster. The Mk 339 Mod 0 and Mod 1 fuzes are installed in the bomb clusters during assembly by the manufacturer; therefore, the following information on these fuzes is limited.

Physical Description

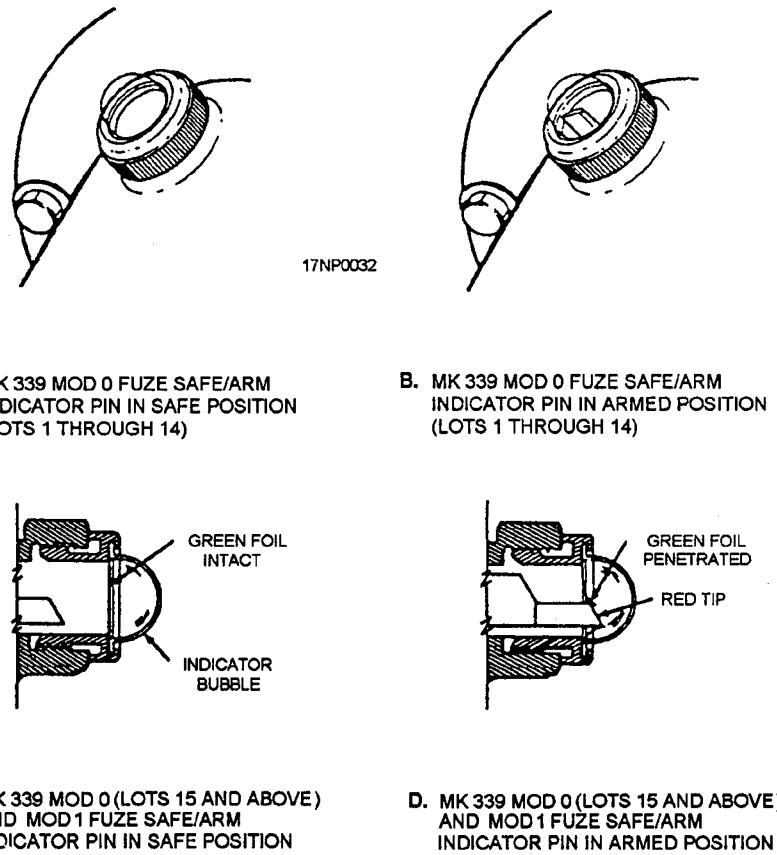
The Mk 339 Mod 1 fuze is similar to the Mod 0 fuze. Several improvements are discussed in the following paragraphs.

The primary and option functioning delays are preset during assembly at the factory for both the Mod 0 and Mod 1 fuzes. The fuzes are preset at 1.2 seconds for primary delay, and the option delay is preset at 4.0 seconds. The Mod 0 fuze (without the option time wire) is preset at 4.0 seconds on the option delay. The primary delay is not used on this fuze The primary delay is set at zero time.

You already know the primary and option delays for the Mod 0 and Mod 1 fuzes are preset at the factory. These time delays can be reset during weapon preparation to meet various tactical requirements. The primary and option time delays for the Mod 0 fuze can be adjusted from 1.2 to 50.0 seconds by adjusting the primary time setting dial and the option time setting dial, respectively. The functional delays for both the primary and option modes of the Mod 1 fuze can be adjusted from 1.2 to 100 seconds in the same manner.

You can tell if the fuze has shifted from the primary to the option mode by the functional mode indicator. You do this by checking the time setting observation window for both the Mod 0 and Mod 1 fuzes. If the arming wire has been accidently pulled during handling, the fuzes shift to the option mode. Once the option wire is pulled, the Mod 0 fuze is committed to the option mode and cannot be reset to the primary mode. However, the Mod 1 fuze can be reset to the primary mode by reinstalling the option time wire.

The fuze safe/arm indicator (callout 1 of figs. 1-2 and 1-3) provides external evidence of arming (EEA) for the Mk 339 Mod 0 and Mod 1 fuzes. The fuze safe/arm indicator is viewed through the indicator observation window in the upper nose fairing. Mod 0 fuzes (lots 1 through 14) are in a safe condition when the tip of the indicator pin does not extend into the bubble (fig. 1-4, view A). The fuze is in an armed



A. MK 339 MOD 0 FUZE SAFE/ARM INDICATOR PIN IN SAFE POSITION (LOTS 1 THROUGH 14)

B. MK 339 MOD 0 FUZE SAFE/ARM INDICATOR PIN IN ARMED POSITION (LOTS 1 THROUGH 14)

C. MK 339 MOD 0 (LOTS 15 AND ABOVE) AND MOD 1 FUZE SAFE/ARM INDICATOR PIN IN SAFE POSITION

D. MK 339 MOD 0 (LOTS 15 AND ABOVE) AND MOD 1 FUZE SAFE/ARM INDICATOR PIN IN ARMED POSITION

Figure 1-4.—Mechanical time fuze Mk 339 safe/arm indicator pin in safe and armed positions,

condition when the indicator pin extends into the bubble (fig. 1-4, view B). On newer models (lots 15 and above of Mod 0 and Mod 1 fuzes), there is a layer of green foil at the base of the indicator bubble. The fuze is in a safe condition when the green foil is intact (fig. 1-4, view C), and it is armed when the green foil is pierced by the indicator pin (fig. 1-4, view D).

Functional Description

The following paragraphs describe the sequence of events that must occur for Mk 339 fuzes to function.

MOD 0 (WITHOUT OPTION TIME WIRE).— When the Mk 20 bomb cluster is released in flight, an impeller band assembly secures the impeller until the fuze arming wire is pulled out. As the weapon is released from the aircraft, the arming wire is pulled from the impeller band assembly, freeing the air-driven impeller. The arming wire also passes through a time starting pin, which initiates the fuze timing mechanism when the arming wire is pulled out. The airstream rotates the impeller, which physically aligns the firing train, and allows the fuze to detonate at the preset time.

MOD 1 (WITH OPTION TIME WIRE).— This fuze is physically and functionally the same as the fuze described in the preceding paragraph except that an option wire is installed If the pilot selects the primary mode of delivery when the weapon is released from the aircraft, only the arming wire is pulled out and the primary mode of the fuze is initiated. If the pilot selects the option mode of delivery, both the arming wire and the option wire are pulled out, initiating the option time mode of the fuze. If only the option time wire is pulled out on airborne release, the fuze will dud. Both the fuze arming wire and option wire must be pulled out for the fuze to function in the option mode.

REVIEW NUMBER 3

Q1. What bombs are used with the Mk 339 mechanical time fuze ?

Q2. List the characteristics shared by Mod 0 and Mod 1 of the Mk 339 fuze.

Q3. The primary and option delays of Mod 1 and Mod 0 fuzes are set at the factory. What means can be used to change the settings for tactical requirements?

Q4. How can you tell if the fuze has shifted from the primary to the option delay?

Q5. Describe what you will see in the observation window of a Mk 339 Mod 0 fuze for the conditions listed below:

Safe

Armed

Q6. Describe what you will see in the observation window of a Mk 339 Mod 0 (lots 15 or above) or Mod 1 fuze for the conditions listed below:

Safe

Armed

MK 346 MOD 0 MECHANICAL LONG-DELAY TAIL FUZE

The mechanical long-delay fuze Mk 346 Mod 0 is an all-mechanical clockwork fuze that is used in the tail well of the Mk 80 (series) LDGP bombs. The functioning delays are preselected for the total number of hours, in increments of 15 minutes. The range of the functioning delay time is from 30 minutes to 33 hours.

Description

The Mk 346 fuze (fig. 1-5) is approximately 6 3/8 inches long and threaded for a 2-inch adapter booster well. For purposes of description, the terms *outer end* and *base end* are used. The outer end couples to the arming assembly; the base end fits into the adapter booster well.

The input shaft and the delay functioning setting shaft are located on the outer end of the fuze. The input shaft is coupled directly to a centrifugal clutch that engages the speed reduction gear assembly when the input shaft reaches 1,200 rpm. The input shaft is fitted with a key that engages a locking slot to prevent accidental rotation. The key is automatically freed when the arming assembly is fitted to the input shaft.

The delay function setting shaft is located in the outer end and may be rotated in either direction by a screwdriver. The setting shaft is coupled through a gear train to the dial, which is seen in the time delay observation window.

The safe-armed band, visible through the safe-arm window, is coupled to the speed reduction gear. The red band covers the window when the input shaft and clutch have rotated 45 revolutions, thus completing the first stage arming. The red band starts to appear after the input shaft and the clutch have rotated approximately 22 of the required 45 revolutions. A slip clutch lets the

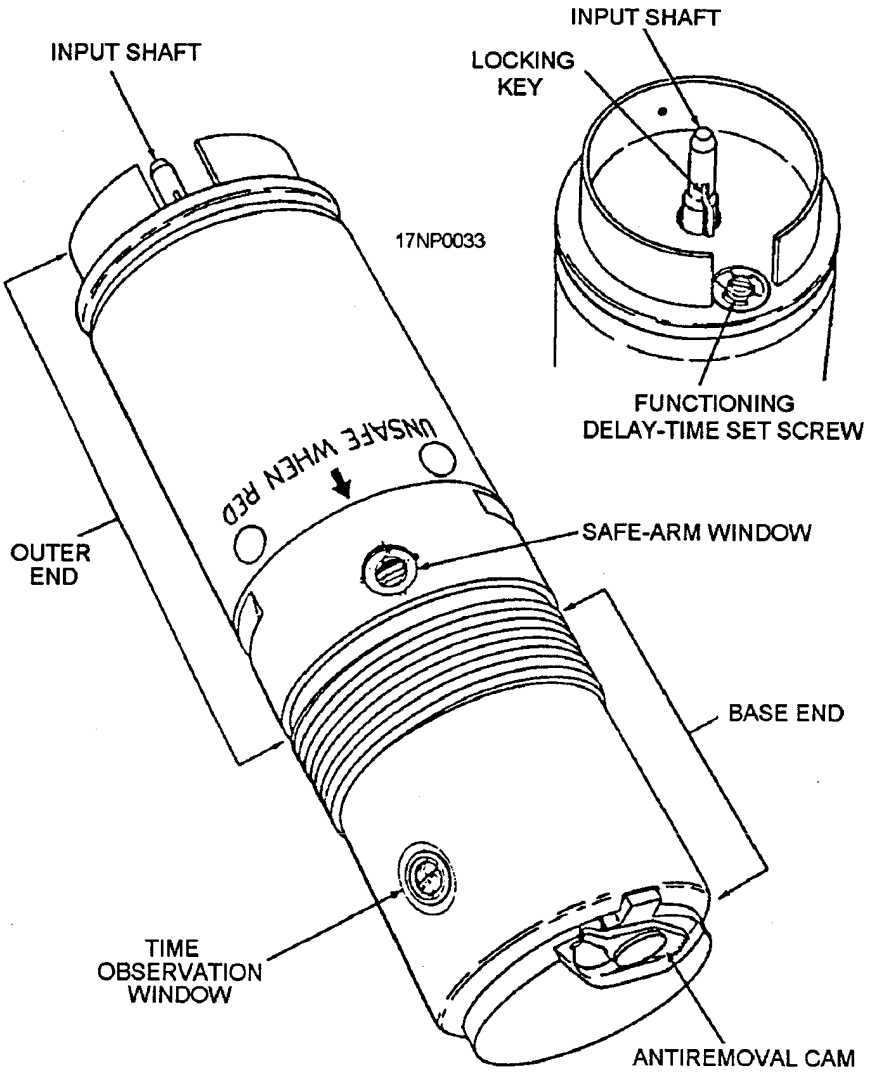


Figure 1-5.—Mechanical long-delay fuze Mk 346 Mod 0.

setting shaft rotate past the minimum or maximum delay setting without further rotation of the indicator dial or damaging the mechanism.

The base end of the fuze houses the timer, firing pin, detonator-rotor, lead-in, arming shaft, and the functioning delay indicator dial. On the face of the base end plate is the toothed cam, which operates as an antiremoval device. The arming shaft moves forward at impact to initiate the timer mechanism; this allows the detonator-rotor to align with the firing pin and release the antiremoval cam.

Operation

After the bomb is released from the aircraft, the arming assembly is freed from the arming wire and allowed to rotate. After approximately 45 revolutions of the input shaft at 1,200 rpm or more, first stage arming is complete. Usually this takes about 1.5 to 2 seconds. Upon impact, the second stage arming is initiated, which aligns the fuze firing train, starts the delay-to-burst timer, and releases the antiremoval cam. After the preselected time on the delay-to-burst timer has expired, the bomb detonates.

NOTE: First stage arming must be completed before impact, and impact must be sufficient to initiate second stage arming.

Arming Assemblies Mk 3, 4, and 5 Mods

Mk 3, 4, and 5 arming assemblies are used with the tail assemblies of LDGPs (except Mk 84) and Snakeye weapons. They provide arming action for the Mk 346 fuze. The arming assemblies consist of a Mk 5 Mod 1 or Mod 2 fuze drive, an adapter, an appropriate drive shaft, which couples to the input shaft of the fuze, and a funnel guide. The Mod of the drive unit denotes the Mod of the assembly.

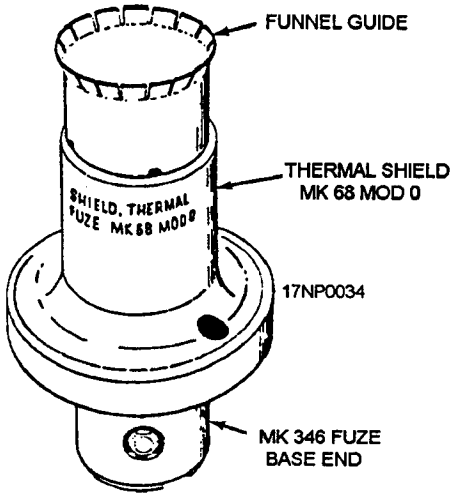


Figure 1-6.—Mk 346 fuze with Mk 68 thermal shield installed.

The Mk 68 thermal shield (fig. 1-6) protects the fuze and adapter booster when used in the Mk 82 Mod 2 thermally protected bomb. The fuze is hand-pressed into the booster. The base of the shield covers the exposed portion of the adapter booster after fuze/shield installation.

Identification of a Fully or Partially Armed Fuze

Normally, the Mk 346 fuze is removed from an unused bomb, returned to its shipping container, reset, and reinstalled for a subsequent mission. However, if an arming wire is lost or the arming wire installation is faulty, first stage arming can occur while the bomb is aboard the aircraft. You can identify the first stage arming condition by the red band covering all or part of the safe-arm observation window on the body of the fuze. You should examine all unused bombs returned from a mission as soon as possible. If evidence of a malfunction is present, immediately remove the fuze from the bomb while on the flight deck. A partially armed fuze is safe for handling and disposal; however, if the fuze is jarred or dropped, complete arming may result.

Second stage arming of the fuze does not occur unless first stage arming is complete and the fuze is accidentally jolted or jarred. Then, the fuze is locked in the bomb and isn't easily removed. This condition is unlikely, but it could happen with a hung bomb, or with a bomb that is inadvertently released because of a bomb rack structural failure. This is a dangerous situation. If a safe condition is in doubt, immediately notify explosive ordnance disposal (EOD) personnel.

REVIEW NUMBER 4

Q1. What is the range of the functioning delay time on the Mk 346 mechanical long-delay tail fuze ?

Q2. At what point does second-stage arming of the Mk 346 fuze begin?

Q3. The difference between the Mk 3, 4, and 5 arming assemblies is the_____.

REVIEW NUMBER 3 ANSWERS TO QUESTIONS Q1. THROUGH Q6.

A1. The *Mk 20 and Mods* *are used with the Mk 339 mechanical time fuze*

A2. The characteristics shared by Mod 0 and Mod 1 of the Mk 339 fuze are nose-mounted, air-enabling, and detonator-safe.

A3. The primary and option delays of the Mod 0 and Mod 1 fuzes can be changed by adjusting the primary and option time-setting dials.

A4. You can tell if the fuze has shifted from the primary to the option delay by checking the time setting observation windows of the fuzes.

A5. Safe— Tip of indicator pin does not extend into bubble.

Armed— Indicator pin extends into bubble.

A6. Safe— Green foil is intact.

Armed— Green foil is pierced by the indicator pin.

Q4. What device is used to thermally protect the Mk 82 Mod 2 bomb?

Q5. How can you tell if first stage arming of the Mk 346 fuze occurs?

ADAPTER BOOSTERS

An adapter booster is needed to install mechanical fuzes in the Mk 80 (series) general-purpose bombs. The adapter boosters currently in use are the M148/T45E, M148E1 (nose), and the M150/T46 (tail).

M148/M148E1/T45 (Series) Adapter Booster

The M148/M148E1/T45 (series) adapter booster (fig. 1-7) permits the use of mechanical nose fuzes in the Mk 80 (series) bombs. The adapter booster is externally threaded for installation in the bomb fuze well and internally threaded for installation of the fuze. The casing contains the booster charge and is threaded onto the base of the adapter.

The M148E1 adapter booster is similar in external appearance to the earlier M148/T45 (series). Differences are the nomenclature marking on the face of the adapter booster collar, the words THERMALLY PROTECTED in bold black letters, and a yellow band around the adapter booster casing, which indicates that it is loaded with explosives. The M148E1 was developed for use with thermally protected bombs.

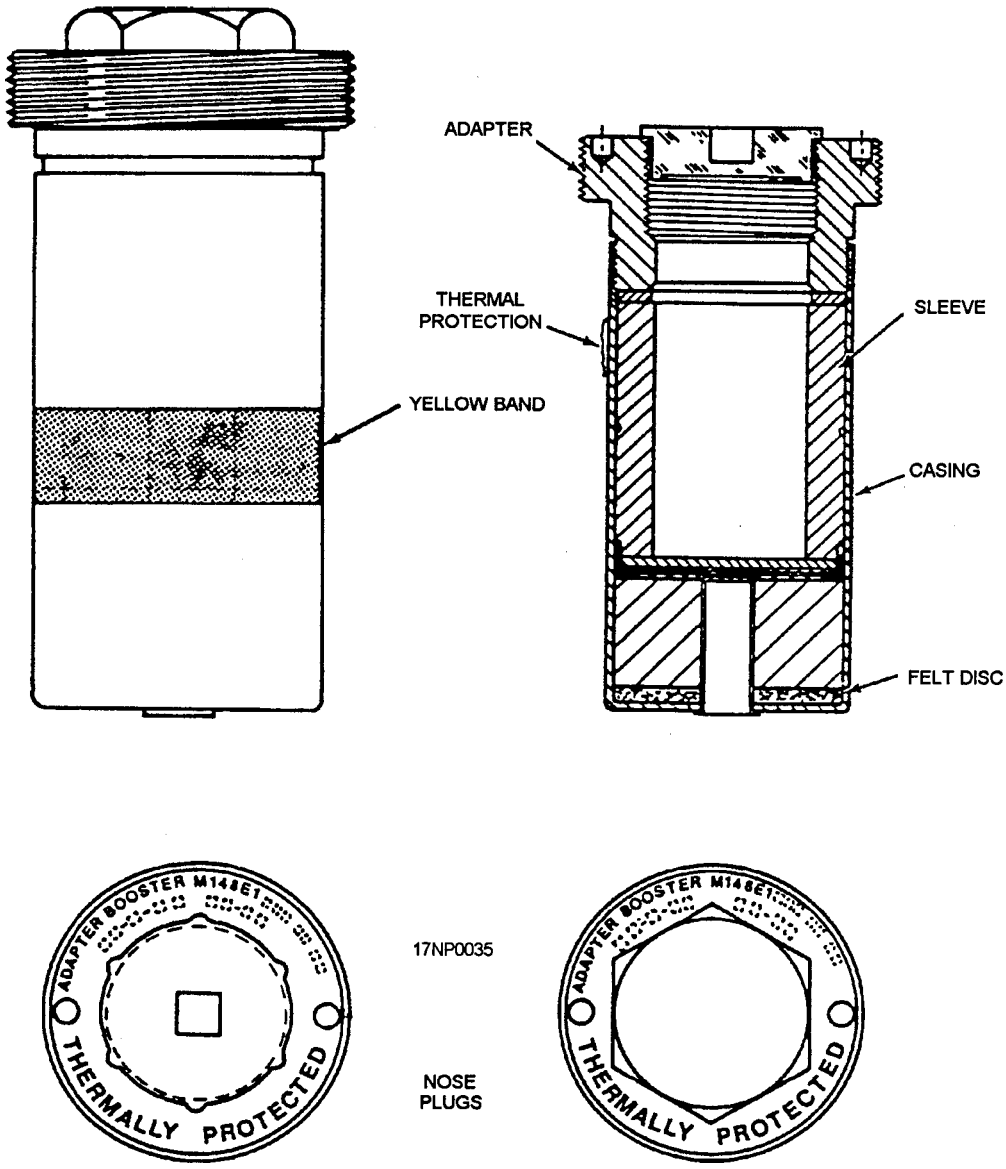


Figure 1-7.—Adapter-booster M148/E1 (series).

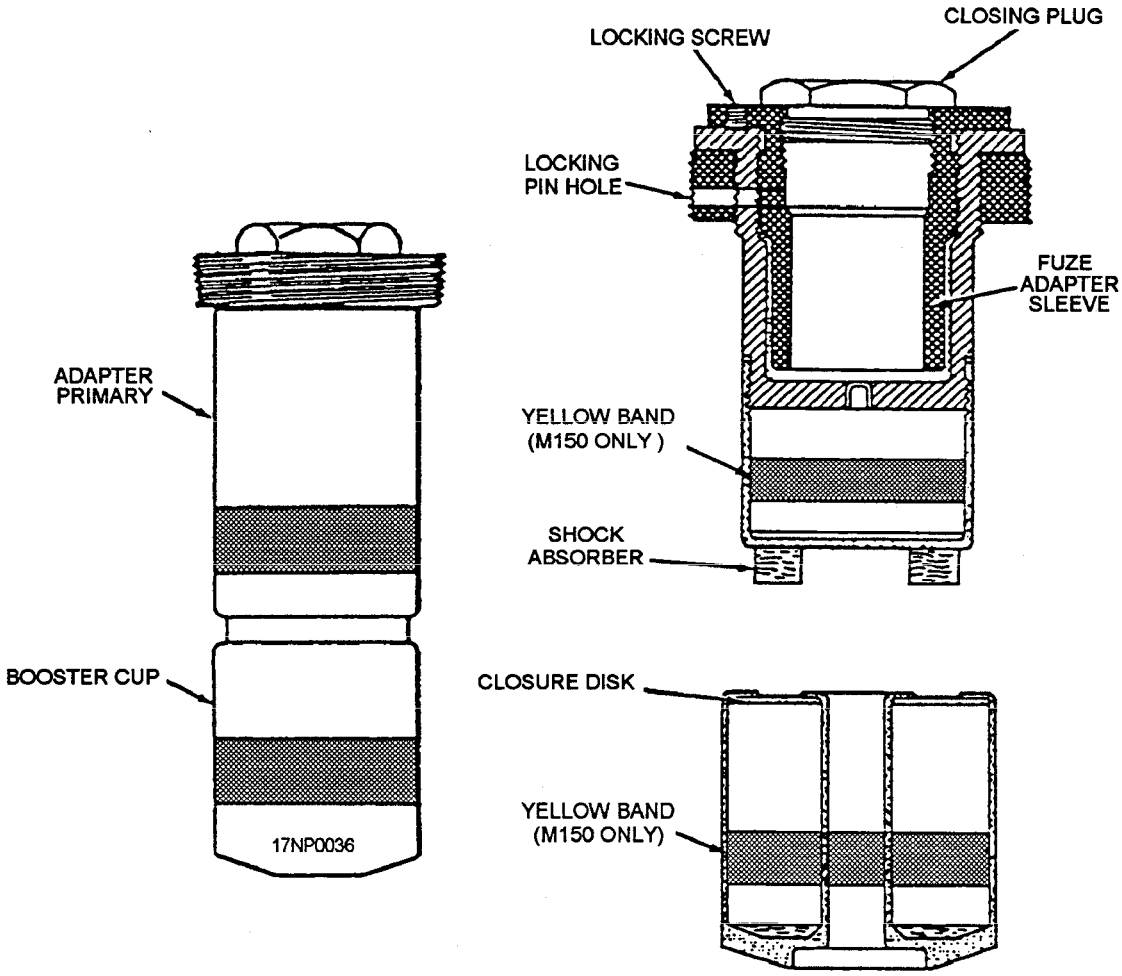


Figure 1-8.—Adapter-booster M150/T46 (series).

Adapter booster M150/T46 (Series)

The adapter booster M150/T46 (series) (fig. 1-8) permits use of mechanical tail fuzes with Mk 80 (series) bombs. The M150/T46 adapter boosters differ only in internal construction, and they may be used interchangeably.

The M150/T46 (series) adapter boosters consist of two separate explosive components. The primary adapter booster receives a 2.0-inch diameter fuze. The

REVIEW NUMBER 4 ANSWERS TO QUESTIONS Q1. THROUGH Q5.

A1. The range of the functioning delay time on the Mk 346 mechanical long-delay tail fuze is 30 minutes to 33 hours, in 15-minute increments.

A2. Second-stage arming of the Mk 346 fuze begins upon impact with the target.

A3. The difference between the Mk 3, 4, and 5 arming assemblies is the length of the drive shaft.

A4. The Mk 68 Mod 0 thermal shield is used to thermally protect the Mk 82 Mod 2 bomb.

A5. You can tell if first stage arming of the Mk 346 fuze has occurred by looking in the safe-arm observation window in the bomb body. If a red band covers all or part of the safe-arm window, first stage arming is complete.

T46 (series) contains a fuze adapter sleeve for use with the 1. 5-inch diameter fuze. A hole is drilled through the threads of the primary adapter booster for insertion of a locking pin for use with the long-delay fuze This pin locks the adapter booster to the base plug of the bomb and prevents removal of the adapter booster while the fuze is installed. The M150 has a yellow band around the adapter booster casing, which indicates that it is loaded with explosives.

ELECTRICAL FUZES

LEARNING OBJECTIVE: *Identify the various types of electrical fuzes to include their physical description and functional operation.*

The Mk 344 (fig. 1-9) and Mk 376 (fig. 1-10) electric bomb fuzes provide an all-electric capability for the Mk 80 (series) bombs with either conical or retarding fins, thermally protected bombs, and laser-guided bombs (LGB). Electric fuzes require an electric pulse from the aircraft fuze function control (FFC) system.

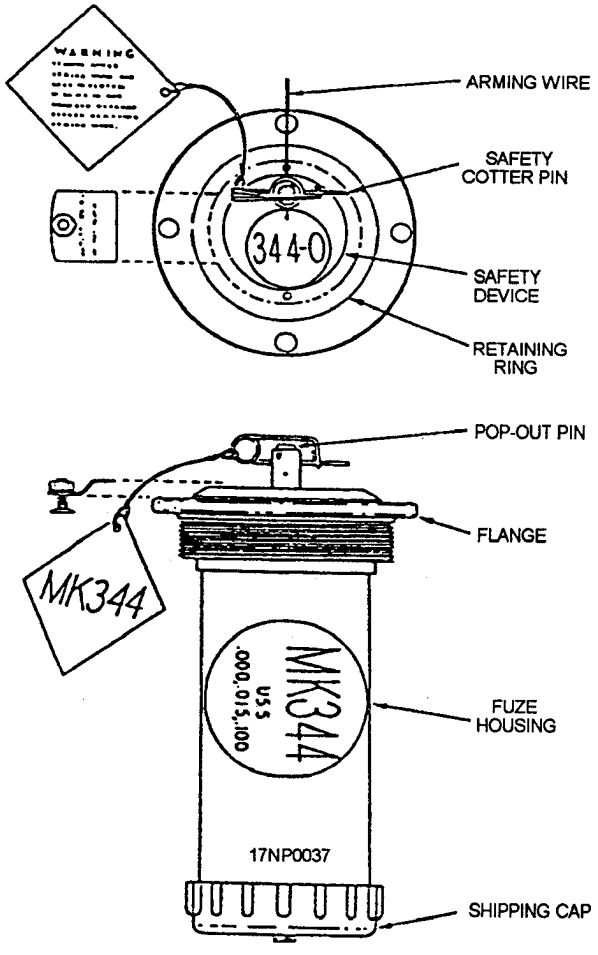


Figure 1-9.—Mk 344 Mods 0 and 1 electric fuzes.

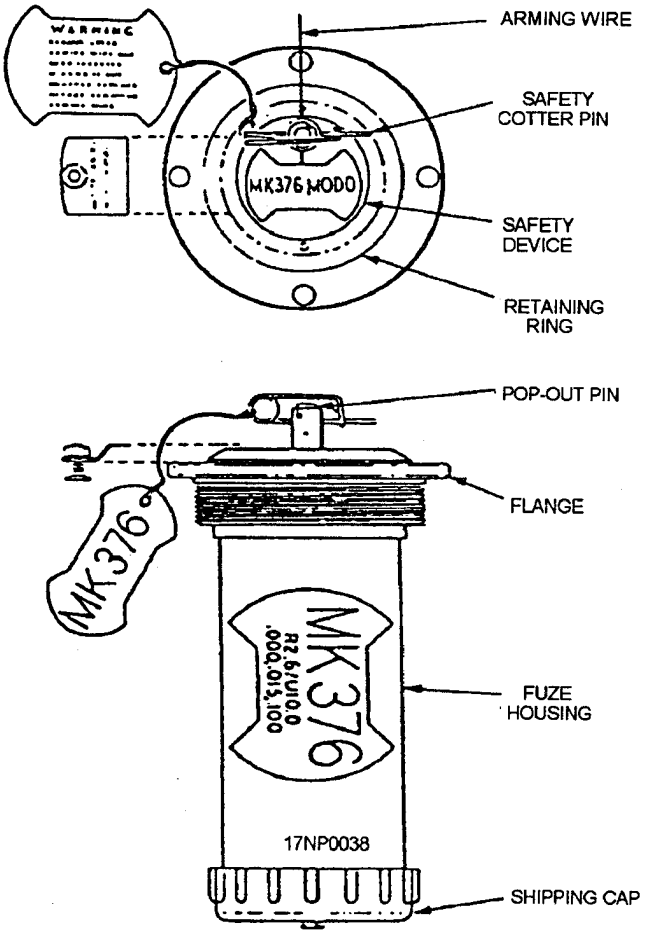


Figure 1-10.—Mk 376 Mod 0 electric fuze.

The FFC gives in-flight selection of function delay and arming delay times. The Mk 344 and 376 fuzes are used with the Mk 43 target-detecting device for airburst capability. They may also be used with mechanical nose fuzes for additional fuzing options.

DESCRIPTION

The Mk 344 Mod 0 and Mod 1 and Mk 376 Mod 0 electric tail fuzes are detonator safe. The boosters contain 4.3 ounces of tetryl explosive. They are classified HERO SAFE, and no unusual RADHAZ precautions are required under normal operating conditions. The Mk 344 Mod 0 and Mod 1 fuzes are identical, except that the retard sensor has been removed from the Mod 1. The Mk 344 Mod 0 or Mod 1 is not used in the retarded mode of delivery and should never be configured for this type of delivery. The fuzes are similar in appearance, but they are readily identifiable by decals.

Four discreet dc voltages for in-flight selection of functioning delay times are used in the Mk 344 Mods and Mk 376 fuzes. Arming delay times are automatically selected by the Mk 31 safety device.

MK 31 SAFETY DEVICE

The Mk 31 safety device is used to adapt the fuze to the fuze well of the bomb, provide mechanical safing of the fuze and unlock the timer-decelerometer. The safety device contains a pop-out pin that locks the fuze in an unarmed condition. The spring-loaded pin is held in the safe position by either a safety cotter pin or an arming wire. When the weapon is released from the aircraft, the arming wire is pulled from the pop-out pin, allowing the pin to pop out, unlock the decelerometer, thus initiating the arming time. When using the Mk 344 Mod 0 or Mod 1 fuze, the arming is completed 5.5 seconds after the pop-out pin is released. For the Mk 376 fuze, arming is completed 10.0 seconds after release from the aircraft if the free-fall mode of delivery is used. If the Mk 31 safety device senses weapon deceleration (Snakeye fins open), the internal circuits of the fuze are switched, and the fuze becomes armed in 2.6 seconds. The quicker arming time is required to ensure the fuze is fully armed for low-altitude delivery. If deceleration is not sensed by 2.6 seconds, the fuze arming delay continues to the 10.0-second arming time.

FUNCTIONAL OPERATION

The following description applies specifically to the Mk 376 fuze. However, the Mk 344 fuze operates identically to the Mk 376, except that it is operationally restricted to the unretarded (5.5-second delay) delivery mode only.

Two arming delays are used in the Mk 376 fuze—2.6 seconds for retarded delivery and 10.0 seconds for unretarded delivery. The appropriate arming delay is automatically selected by the fuze according to the actual delivery mode of the weapon. That is, if the weapon does not retard, whether intentionally or unintentionally, the fuze automatically provides a 10.0-second arming delay.

At release, the arming wire is withdrawn and a charging voltage (+300, +195, –195, or –300 Vdc) is applied to the fuze. The pilot selects the voltage in flight by the fuze function control set located in the cockpit. The fuze polarity and level of the fuze charging voltage is important only with respect to functioning delay. Arming is the same in any case. A regulator in the fuze converts the applied voltage to the required level and polarity. It is then applied to the energy storage unit and the 2.6-second timer. If the weapon decelerates, the Mk 31 safety device senses the deceleration and causes the retard switch to close. At 2.6 seconds, the timer completes its cycle and transfers the voltage to the rotor-actuating bellows. The bellows operate and turn the rotor to the armed position.

If the weapon does not decelerate, the retard switch does not close. The 2.6-second timer continues to run. At 3.8 seconds, the Mk 31 safety device causes the voltage to transfer to the input of the rotor-actuating bellows. At 10.0 seconds, the bellows operates and turns the rotor to the armed position.

FMU-143E/B ELECTRIC TAIL FUZE

The FMU- 143E/B fuze (fig. 1-11) is used with the GBU-24B/B. It is initiated by the FZU-32B/B initiator which is used to generate and supply power to arm the fuze. The safe condition is verified by the presence of a safety pin or arming wire through the pop-out pin (gag rod).

FMU-139 (SERIES) ELECTRONIC BOMB FUZE

The FMU-139 (series) electronic bomb fuze (fig. 1-12) is an electronic impact or impact-delay fuze. It is used in Mk 80 series general-purpose bombs, including laser guided bombs. The arming times are in-flight selectable, and the functioning delay must be set during weapon assembly. There are three arming times (2.6, 5.5, and 10.0 seconds) and four functioning delay settings (10, 25, and 60 milliseconds, and instantaneous). Only 2.6/60, 2.6/25, 2.6/10, and 2.6/inst high drag arm/delay switch positions are authorized for Navy/Marine Corps use. The low drag arm time switch should always be in the X position. The low drag arm time rotary switch is positioned at X for shipping, storage, and all FFCS (fuze function control set) use. The FMU-139 fuze differs from the Mk 344 and Mk 376 fuzes in that the gag rod and arming wire housing are located in the center of the faceplate (fig. 1-13).

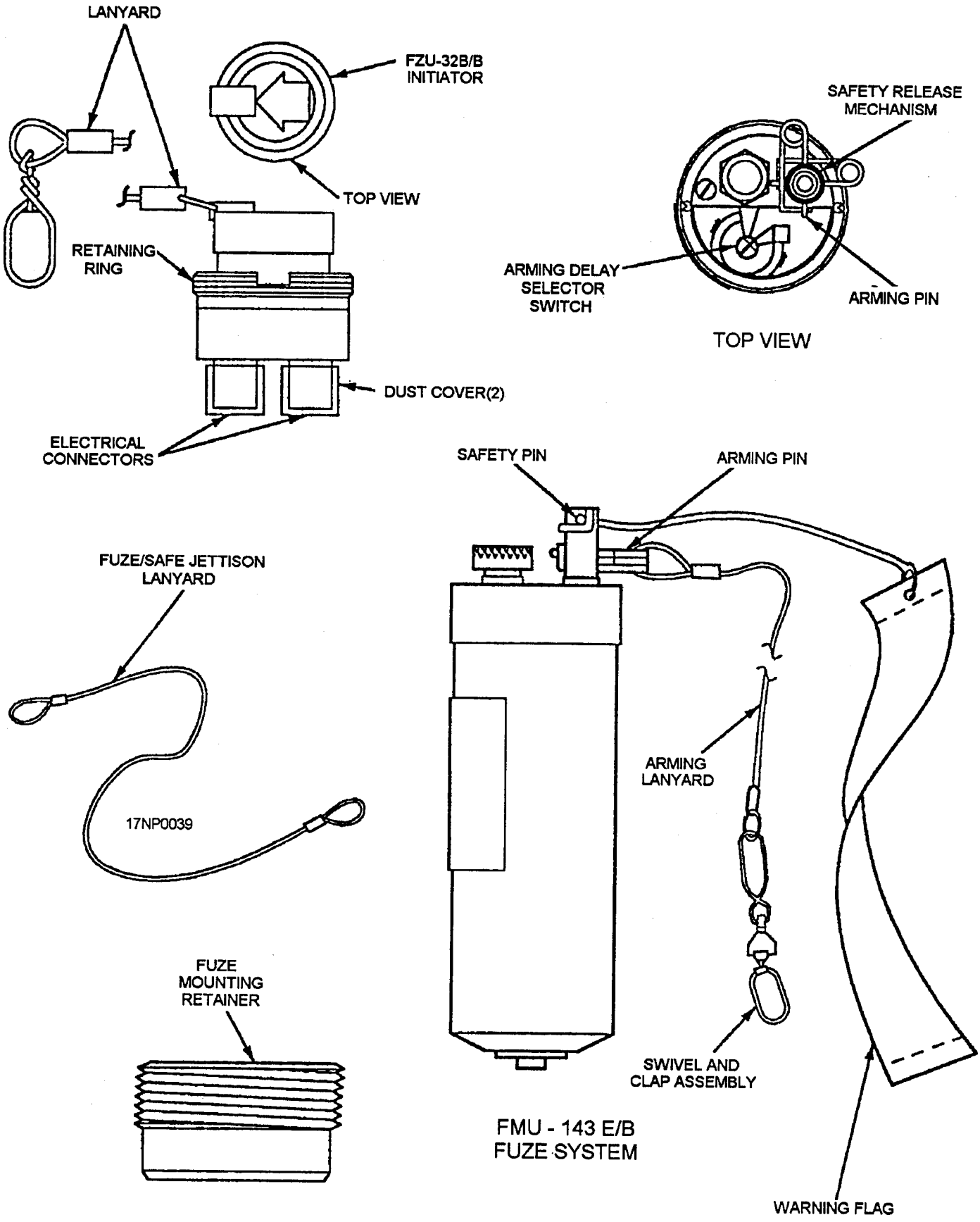


Figure 1-11.—FMU-143E/B electric tail fuze,

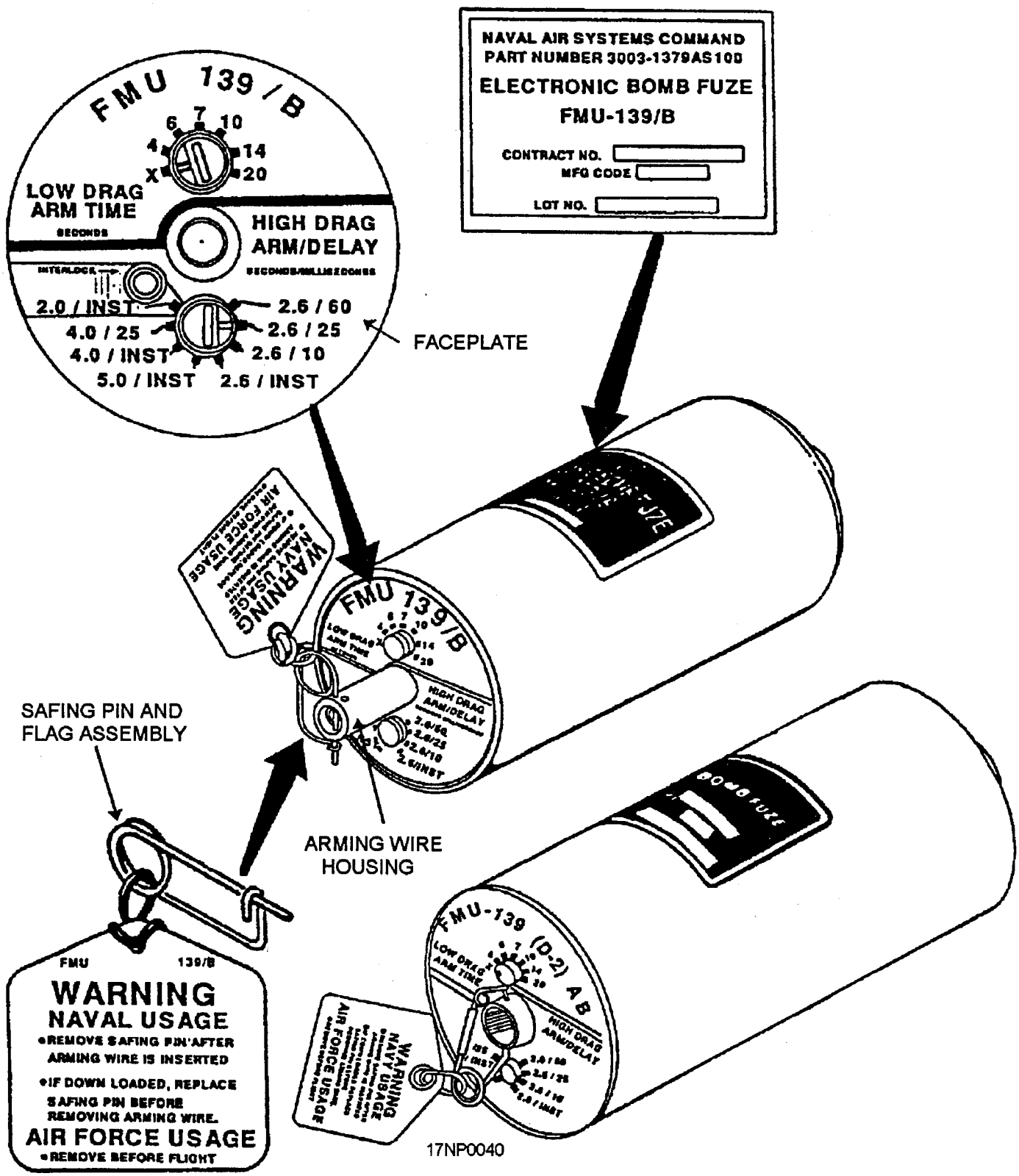


Figure 1-12.—FMU-139 (series) electronic bomb fuze.

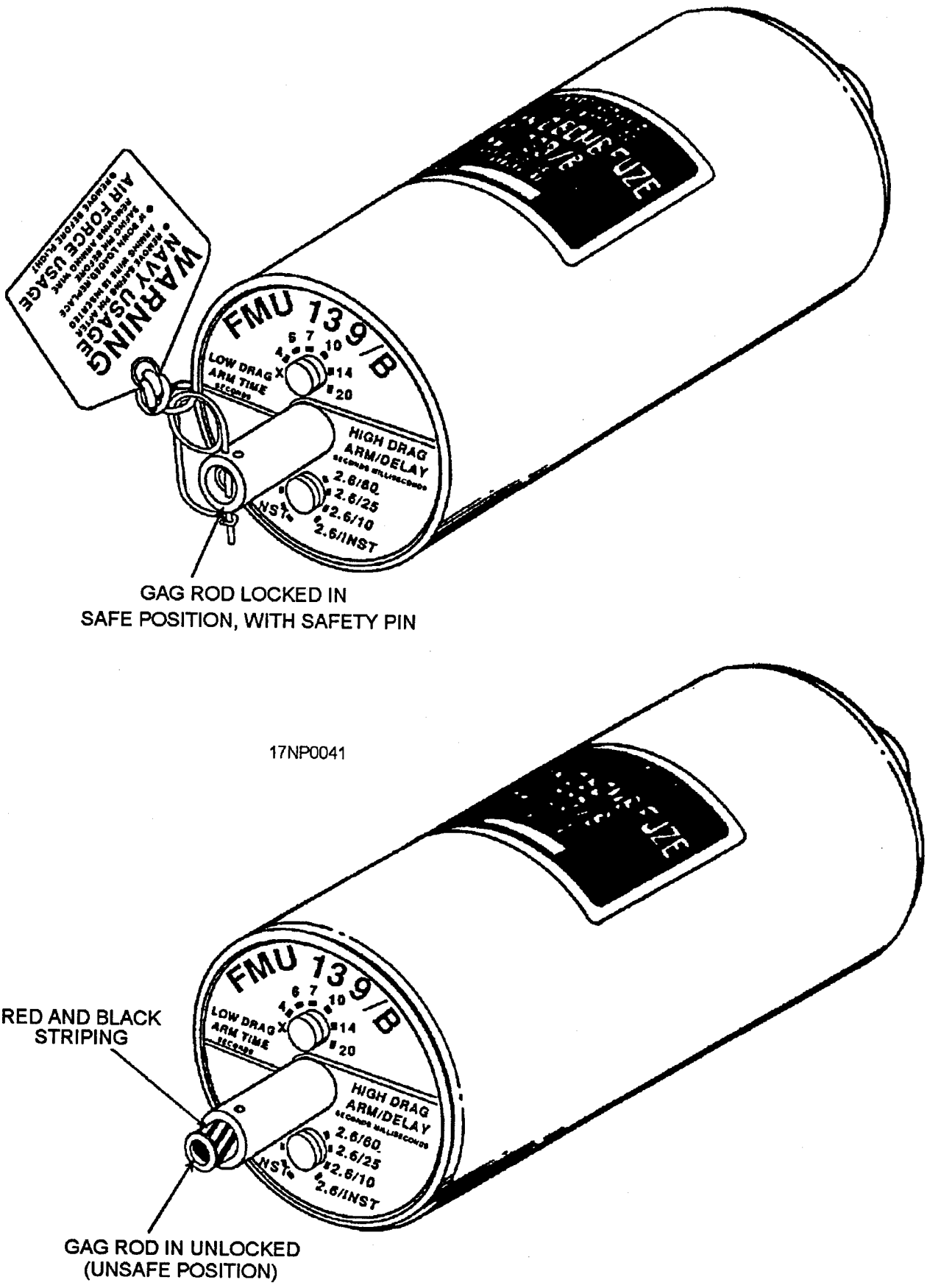


Figure 1-13.—FMU-139 (series) electronic bomb fuze gag rod in safe and unsafe positions.

ARMING SAFETY SWITCH MK 122 MOD 0

The Mk 122 Mod 0 arming safety switch (fig. 1-14) connects the fuze control circuits of the bomb in the aircraft to the electric fuze circuits in the bomb. This switch provides an open circuit and a RADHAZ shield to prevent electromagnetic radiation from entering the fuze circuits.

While the weapon is loaded, the coaxial cable of the switch is plugged into the receptacle of the aircraft's electrical arming unit. When the bomb is suspended from the rack, the lanyard is attached to a fixture on the rack or pylon. Upon bomb release, the lanyard pulls the lanyard pin and closes the fuze circuit. The lanyard is long enough so the weapon separates from the bomb rack suspension hooks before the lanyard pin is pulled from the switch. This ensures that the fuze does not receive charging voltages in case of weapon release failure. The coaxial cable is longer than the lanyard, which permits sufficient time for the charging voltage to pass from the electrical arming unit on the aircraft to the fuze electric circuits on the bomb before the cable is pulled free or breaks from the arming unit receptacle.

NOTE: The Mk 122 Mod 0 switch must be installed and removed in a RADHAZ-free environment.

MK 43 MOD 0 TARGET DETECTING DEVICE

The Mk 43 Mod 0 target detecting device (fig. 1-15) is a proximity variable time (VT) nose element that gives airburst capability for electric-fuzed Mk 80 (series) bombs.

The Mk 43 Mod 0 VT element is compatible with all electric tail fuzes and is identified by the dark green color of the nose cone. Its internal circuitry is powered by a thermal battery. The thermal battery is initiated by +300 volts dc or by the striker rod.

The Mk 43 is initiated mechanically (striker rod) only when a delay airburst is desired. This is the alternate method used to provide VT operation when the fuze is not initiated with the +300 volts dc. The conventional VT mode is selected by initiating the fuze with +300 volts dc. When the fuse is initiated with +300 volts dc, the Mk 43 operates automatically.

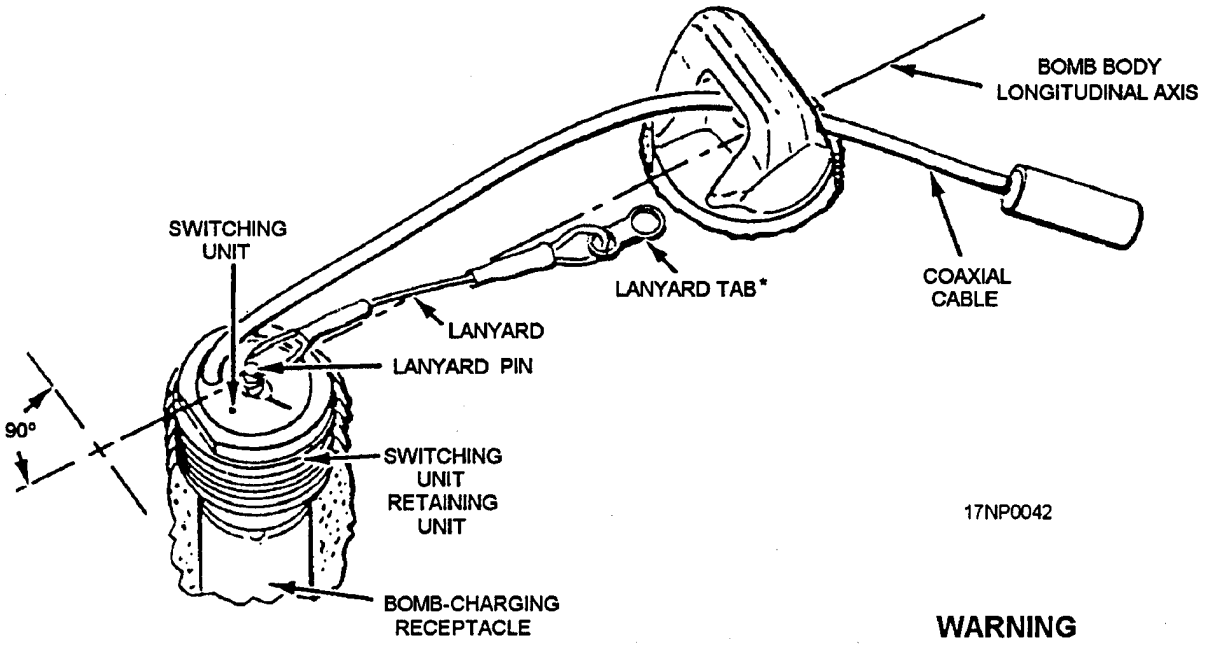


Figure 1-14.—Mk 122 Mod 0 arming safety switch.

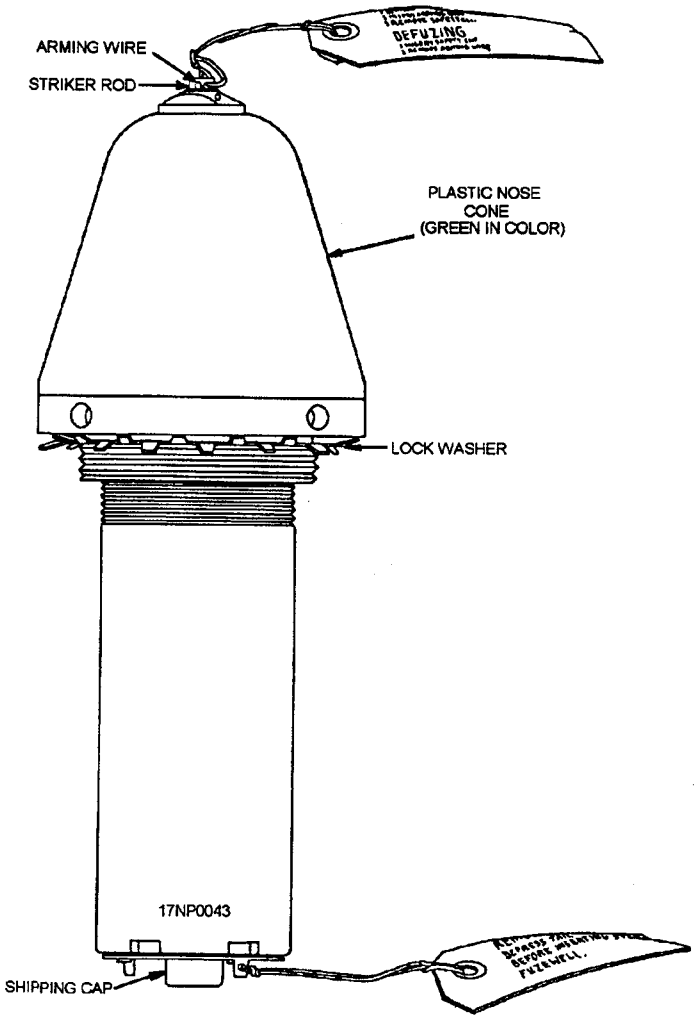


Figure 1-15.—Mk 43 Mod 0 target detecting device.

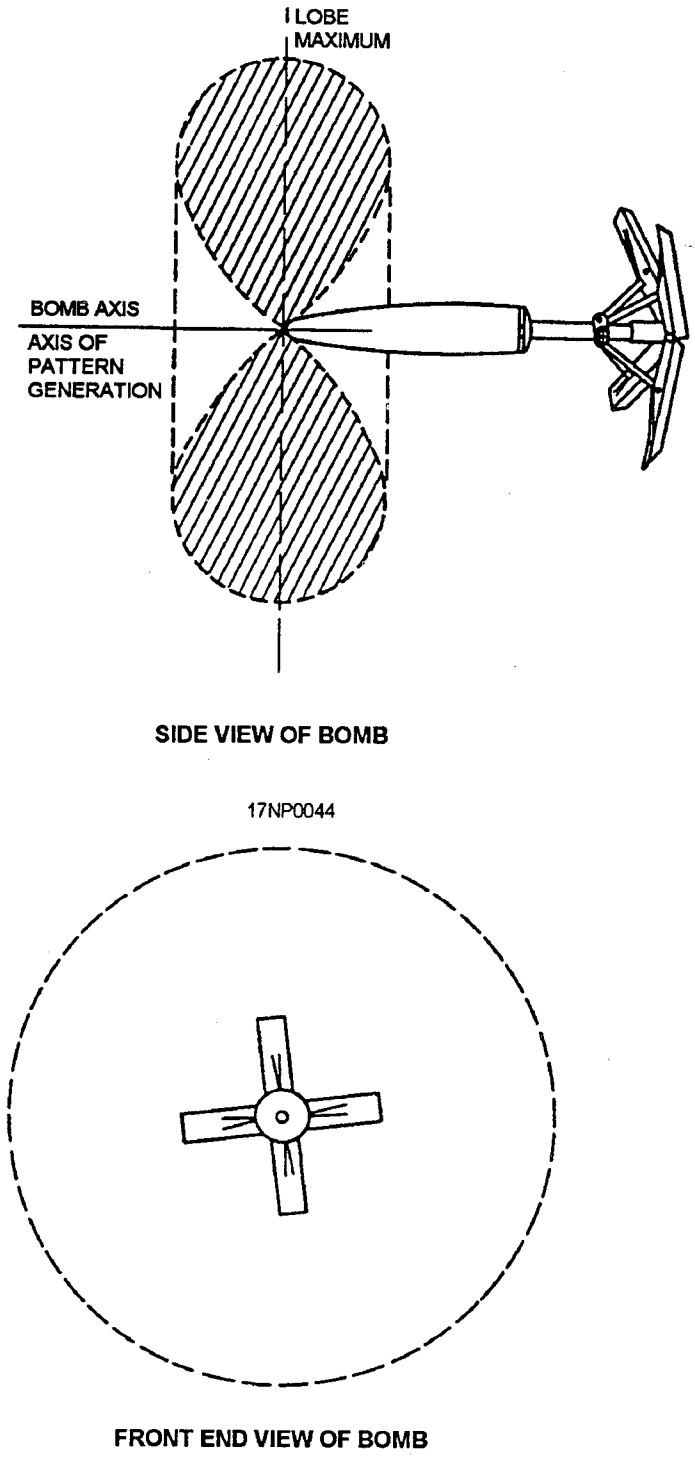


Figure 1-16.—Mk 43 Mod 0 target detecting device antenna pattern.

The fuze circuitry produces a lobe pattern. It radiates a pattern at right angles (fig. 1-16) to the longitudinal axis of the weapon.

When the Mk 43 is initiated by the conventional method, fuze functioning occurs instantaneously when a firing pulse is received from the thermal battery. If the alternate method is used (striker rod), the fuze is set for either of the two functioning delays—DLY 1 for 0.015-second delay or DLY 2 for 0.100-second delay. Detonation of the bomb is delayed by either 0.015 second or 0.100 second, depending on the delay that is selected.

M20 AND M20A1 SENSING ELEMENT PROXIMITY FUZE

The M20 is identifiable by the tan color of its plastic nose cone. The nose cone of the M20A1 is brick red. The only difference between the two sensing elements

(fig. 1-17) is the number of burst height ranges and the type of plastic employed in the nose cone. The sensing elements are not classified as a fuze because they do not contain an explosive train. They must be used with an impact tail fuze. The impact fuze provides the explosive train and safety for the combination. The sensing element can be activated by either an electrical signal or via the withdrawal of an arming wire from the striker rod release mechanism. Presently, the only method used for activation is mechanical. The sensing elements employ a longitudinal loop antenna (fig. 1-18). The burst height range is between 100 feet and 160 feet for the "HI" setting and between 20 feet and 60 feet for the "LO" setting. The M20A1 has only one range (equal to the M20 "LO" setting).

FMU-140/B DISPENSER PROXIMITY FUZE

The FMU-140/B (fig. 1-19) has an optional arm and fire (timer) mode. It is used with the rockeye II

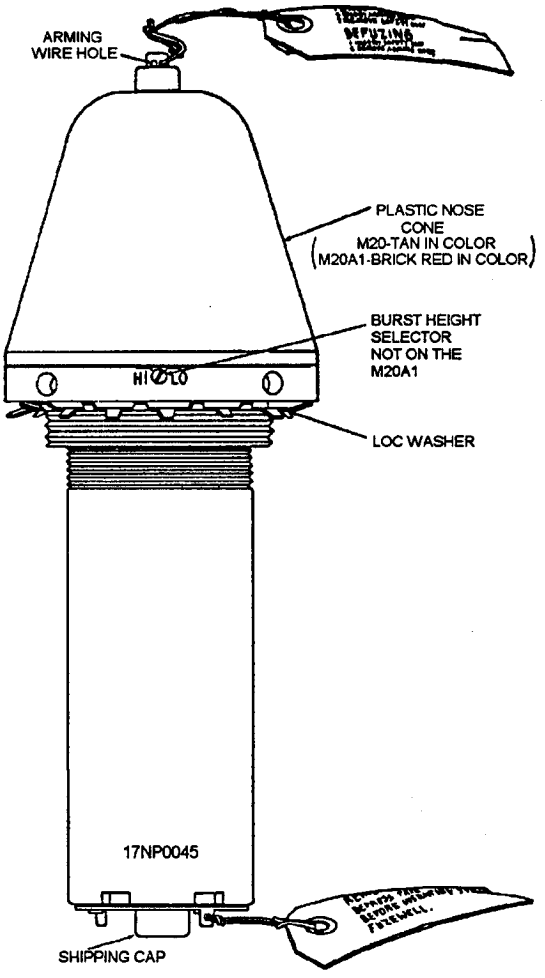


Figure 1-17.—M20 and M20A1 sensing element proximity fuze.

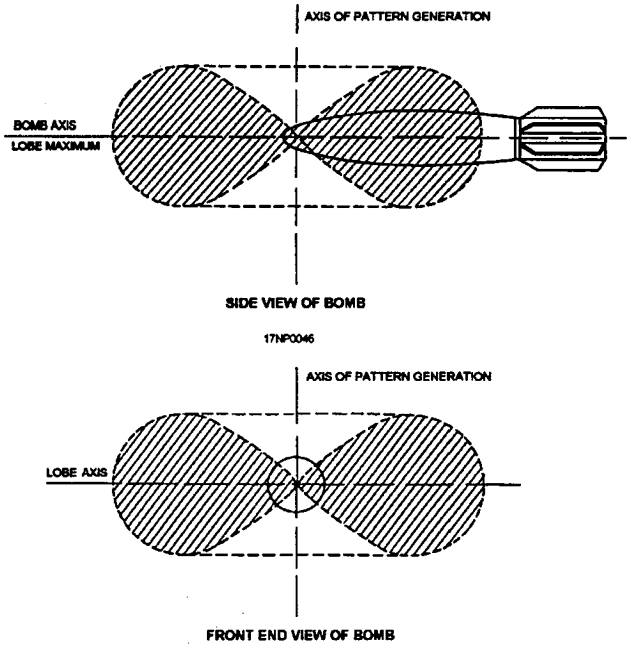


Figure 1-18.—M20 and M20A1 sensing element antenna pattern.

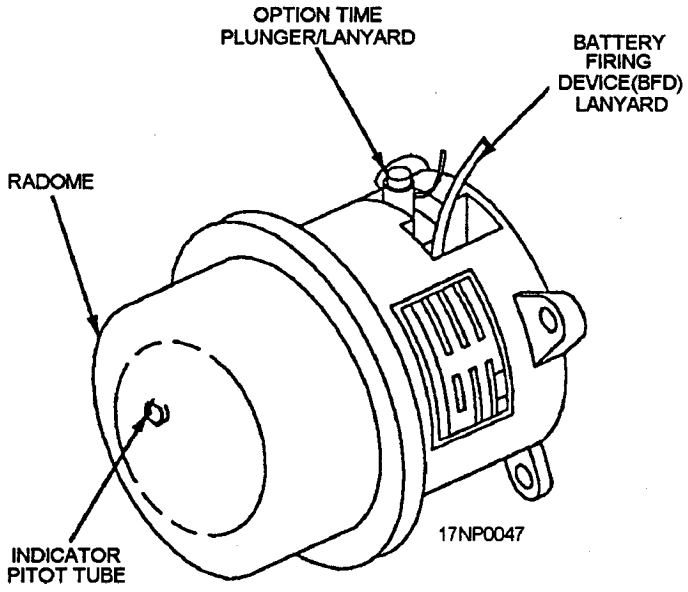


Figure 1-19.—FMU-140/B dispenser proximity fuze.

and Gator weapons. The FMU-140/B is a self-powered doppler radar device acting as a radar altimeter. Arming times and functioning altitudes are variable and are preflight selectable on the fuze faceplate, located on the side of the fuze. In the proximity mode, if the preselected altitude is reached before the fuze has had time to arm, or the dispenser is released below the pre-selected altitude, the fuze will have the potential to function anytime after arming. If the fuze has not functioned by the time it reaches an altitude of 300 ±25 feet, it will function at that time.

REVIEW NUMBER 5

Q1. All electric capability for Mk 80 with either conical or retarding fins, thermally protected bombs, and laser-guided bombs is provided by _____.

Q2. No unusual RADHAZ precautions are taken when using Mk 344 or Mk 376 fuzes because they are classified as_____.

Q3. Name the electric fuze that is used for retarded delivery of the Mk 80 (series) bomb.

Q4. List the functions of the Mk 31 safety device.

Q5. What is the purpose of the Mk 122 Mod 0 arming safety switch ?

Q6. What is the purpose of the Mk 43 Mod 0 target detecting device?

Q7. What is used to power the internal circuitry of the TDD?

AIRCRAFT BOMB AMMUNITION AND ASSOCIATED COMPONENTS

LEARNING OBJECTIVE: *Identify the purpose and types of aircraft bombs, the safety procedures to be followed during bomb shipment, and the methods used to carry bombs.*

Aircraft bombs are released over enemy targets to reduce and neutralize the enemy's war potential. This is done by destructive explosion, fire, nuclear reaction, and war gases. Aircraft bomb ammunition is used strategically to destroy installations, armament, and personnel; and tactically in direct support of our land, sea, and air forces engaged in offensive or defensive operations.

For safety reasons, some bomb ammunition is shipped and stowed without the fuzes or arming assemblies and associated components installed. This ammunition must be assembled before use. Other types, such as cluster bomb units (CBUs), are shipped and stowed as complete assemblies, with fuzs or arming assemblies and associated components installed.

Bombs are designed to be carried either in the bomb bay of aircraft or externally under the wings or fuselage. The general characteristics and basic principles of operation of bomb ammunition and its associated components are described in this chapter. Bombs assembly procedures are discussed in chapter 13 of this manual.

GENERAL-PURPOSE BOMBS AND FIN ASSEMBLIES

LEARNING OBJECTIVE: *Identify the purpose and use of general-purpose bombs to include shipping configuration, fuze wells and charging circuits, suspension lugs, arming wire assemblies, and fin assemblies.*

Low-drag, general-purpose (LDGP) bombs are used in most bombing operations. Their cases (bomb body) are aerodynamically designed, relatively light, and approximately 45 percent of their weight is made of explosives. General-purpose bombs may use both nose and tail mechanical or electric fuzes and conical or Snakeye fins.

The general-purpose bombs currently in use are the LDGP Mk 80 (series). The specifications for the

individual bombs are listed in fig 1-20. The basic difference between the bombs listed in fig 1-20 is their size and weight. The following description of the Mk 80 (series) bomb is applicable to all bombs within the Mk 80 (series) unless otherwise noted.

SHIPPING CONFIGURATION

The bomb body (fig. 1-21) is shipped with a plastic plug installed in the nose and tail fuze well to prevent damage to the internal threads and to keep out moisture. The aft end of the bomb body has a metal shipping cap installed. Plastic lug caps are installed in the suspension lug wells, and a plastic plug is installed in the fuze charging receptacle well. Some bombs contain a hoisting lug packaged in the tail fuze well.

Bombs are shipped on metal pallets. The number of bombs loaded on each pallet depends on the bomb size. For example, six Mk 82 bombs can be shipped on a pallet, three Mk 83 bombs can be shipped on a pallet, and two Mk 84 bombs can be shipped on a pallet. Refer to *Airborne Weapons Packaging/Handling/Stowage,* NAVAIR 11-120A-1.1 or appropriate MIL-STD for more information on shipping configurations.

FUZE WELLS

The bomb body is designed with a nose and tail fuze well. These wells are internally threaded to receive either mechanical or electric fuzes.

FUZE CHARGING CIRCUIT

The forward and aft charging tubes are installed at the factory and contain the electric fuze wire harness. When electric fuzing is used, the wire harness provides a path for the charging current from the fuze charging receptacle to the forward and aft fuze wells.

SUSPENSION LUGS

There are two suspension lug wells for the installation of suspension lugs. The suspension lugs are spaced 14 or 30 inches apart, depending upon the size

REVIEW NUMBER 5 ANSWERS TO QUESTIONS Q1. THROUGH Q7.

A1. All electric capability for Mk 80 with either conical or retarding fins, thermally protected bombs, and laser-guided bombs is provided by Mk 344 and Mk 376 electric bomb fuzes.

A2. No unusual RADHAZ precautions taken when using Mk 344 or Mk 376 fuzes because they are classified as HERO SAFE.

A3. The Mk 376 electric fuze is used for retarded delivery of the Mk 80 (series) bomb.

A4. The functions of the Mk 31 safety device are to adapt the fuze to the fuze well of the bomb, mechanically safe the fuze and to unlock the timer-decelerometer.

A5. The Mk 122 Mod 0 arming safety switch is used to open a circuit and provide a RADHAZ shield to prevent electromagnetic radiation from entering the fuze circuits.

A6. The Mk 43 Mod 0 target detecting device is used to provide airburst capability for electrically fuzed Mk 80 bombs.

A7. A thermal battery, initiated by a +300 volts dc or striker rod, is used to power the internal circuitry of the TDD.

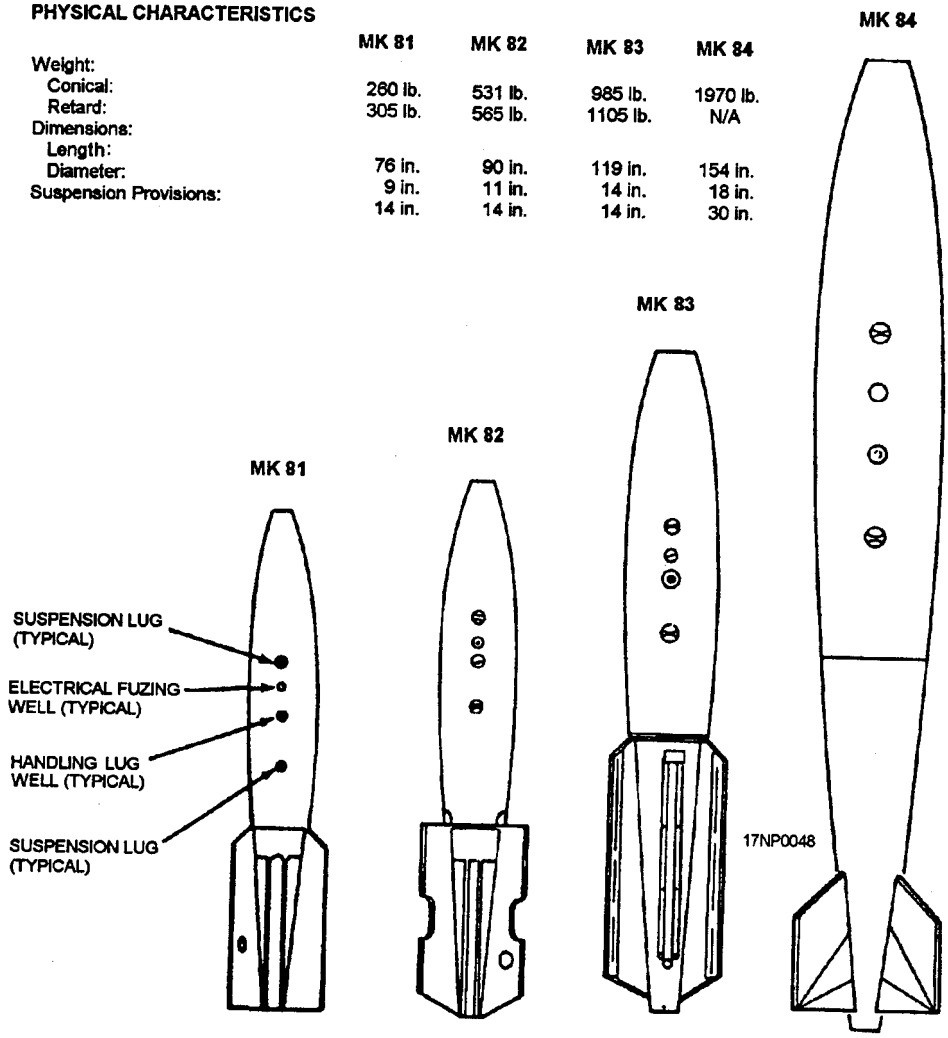


Figure 1-20.—Specifications for general-purpose bombs.

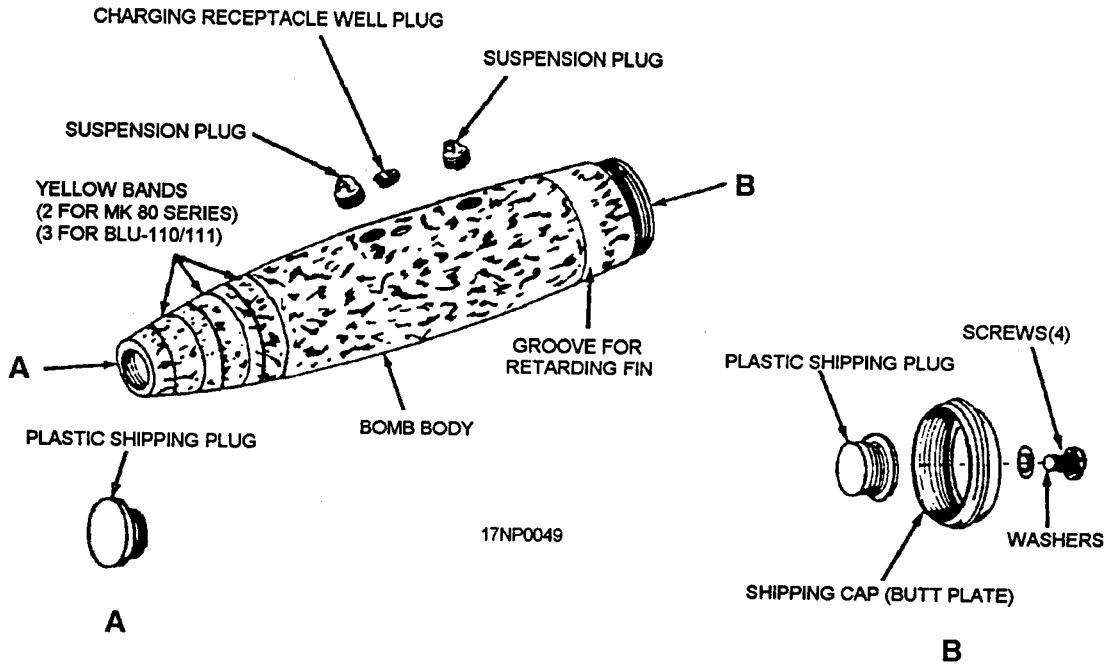


Figure 1-21.—LDGP bomb Mk 80 (series—exploded view (shipping configuration).

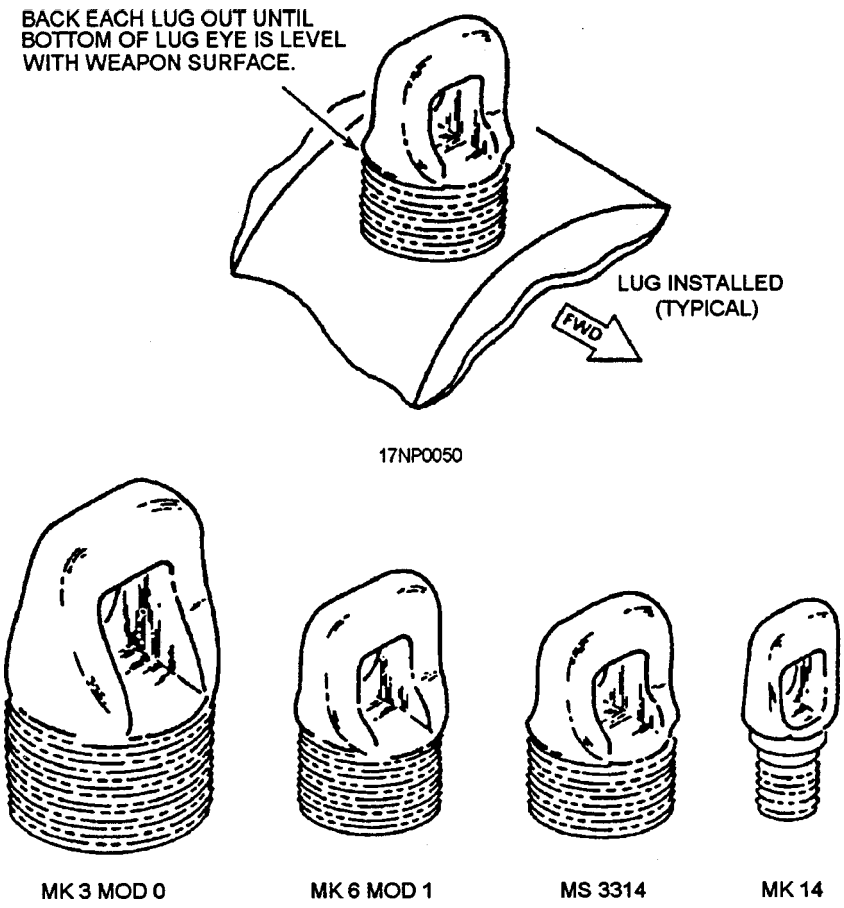


Figure 1-22—Suspension lug installation.

of the bomb. Suspension lugs (fig. 1-22) are used to attach the weapon to the aircraft bomb racks. An internally threaded well for the installation of a hoisting lug is located between the suspension lugs, at the center-of-gravity (CG) position on the bomb. The hoisting lug is used for handling purposes only.

NOSE PLUGS

There are two basic nose plugs (fig. 1-23) used in general purpose bombs, solid nose plug (MXU-735/B and MXU-735A/B), and the ogive nose plug. The ogive nose plug provides a pointed arch. A support cup is used in the nose well with the ogive nose plug to provide a solid structure to the bomb. The MXU-735 solid nose plug is designed to provide better penetration of hard targets, without the likelihood of nose plug shearing during oblique impact. The MXU-735 replaces the ogive nose plug and support cup.

IDENTIFICATION

The high-explosive filler of the bomb (Tritonal 80-20 or H-6) is identified by the yellow stenciled nomenclature on the bomb body and yellow band(s) around the nose. The lot number is stenciled in white ink on the forward end of the bomb. All Mk 80 (series)

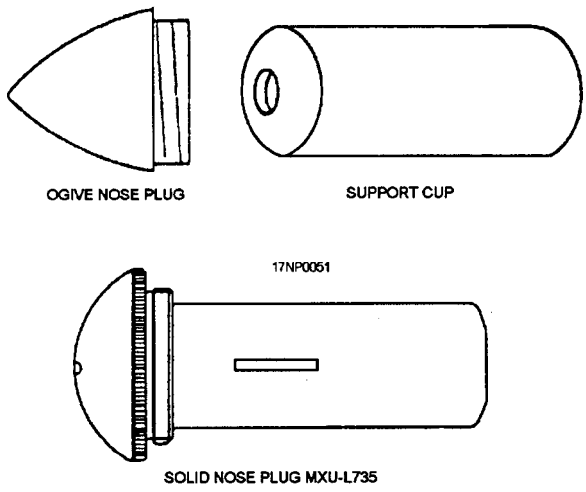


Figure 1-23.—Nose plugs.

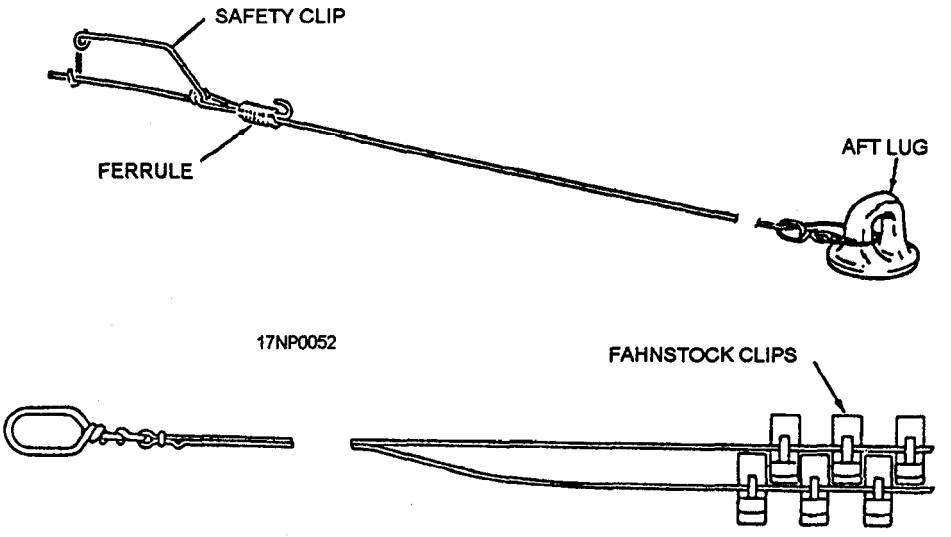


Figure 1-24.—Arming wire assemblies.

general-purpose bombs currently being used aboard ships are required to be thermally protected. Thermally protected Mk 80 series bombs can be identified by the words THERMALLY PROTECTED in the identification legend, a bumpy exterior surface, and two yellow bands around the nose.

ARMING WIRE ASSEMBLIES

Arming wire assemblies (fig. 1-24) are used for arming procedures during ordnance evolutions. The primary function of arming wire assemblies is to maintain ordnance components in a safe condition until actual release of the bomb from the aircraft.

Normally, the wires consist of one or two brass or steel metal strands attached to a swivel loop. Safety Fahnstock clips (fig. 1-24) or safety clips, MAU 166/182, are attached to the ends of the arming wires after installation. They prevent premature or accidental withdrawal of the arming wires from the component.

NOTE: Safety clips are used vice Fahnstock clips unless otherwise specified.

Normally, arming wire assemblies are shipped in spiral-wound fiber tubes, overpacked in a wooden box. Generally, the safety Fahnstock clips are packed in the tubes with the arming wires. The most commonly used arming wire assemblies are listed in table 1-3.

Arming wire installation procedures are discussed in the TRAMAN where the use of arming wire assemblies is required.

FIN ASSEMBLIES

Fin assemblies, used with the Mk 80 (series) LDGP bombs, provide stability to the bomb. They cause the bomb to fall in a smooth, definite curve to the target, instead of tumbling through the air.

The fin assemblies, except the MAU-91A/B, are shipped on metal pallets. Each individual fin is crated

Table 1-3.—Arming Wire Data

Arming Wires/Hardware	Type	Material	Dia. (in.)	Leg Lengths (in.)
Mk 1 Mod 0	Single	Brass	0.064	57.0
Mk 2 Mod 0	Double	Brass	0.064	57.0
Mk 3 Mod 0	Single	Steel	0.032	57.0
Mk 4 Mod 0	Double	Brass	0.064	96.0
Mk 9 Mod 0	Single	Brass	0.064	90.0
MAU-182/A Swivel & Loop Assembly Ferrule Safety Clip	Arming Wire Accessory Kit			
MAU-166 Swivel & Loop Assy only Arming Adapter Self Adjusting				

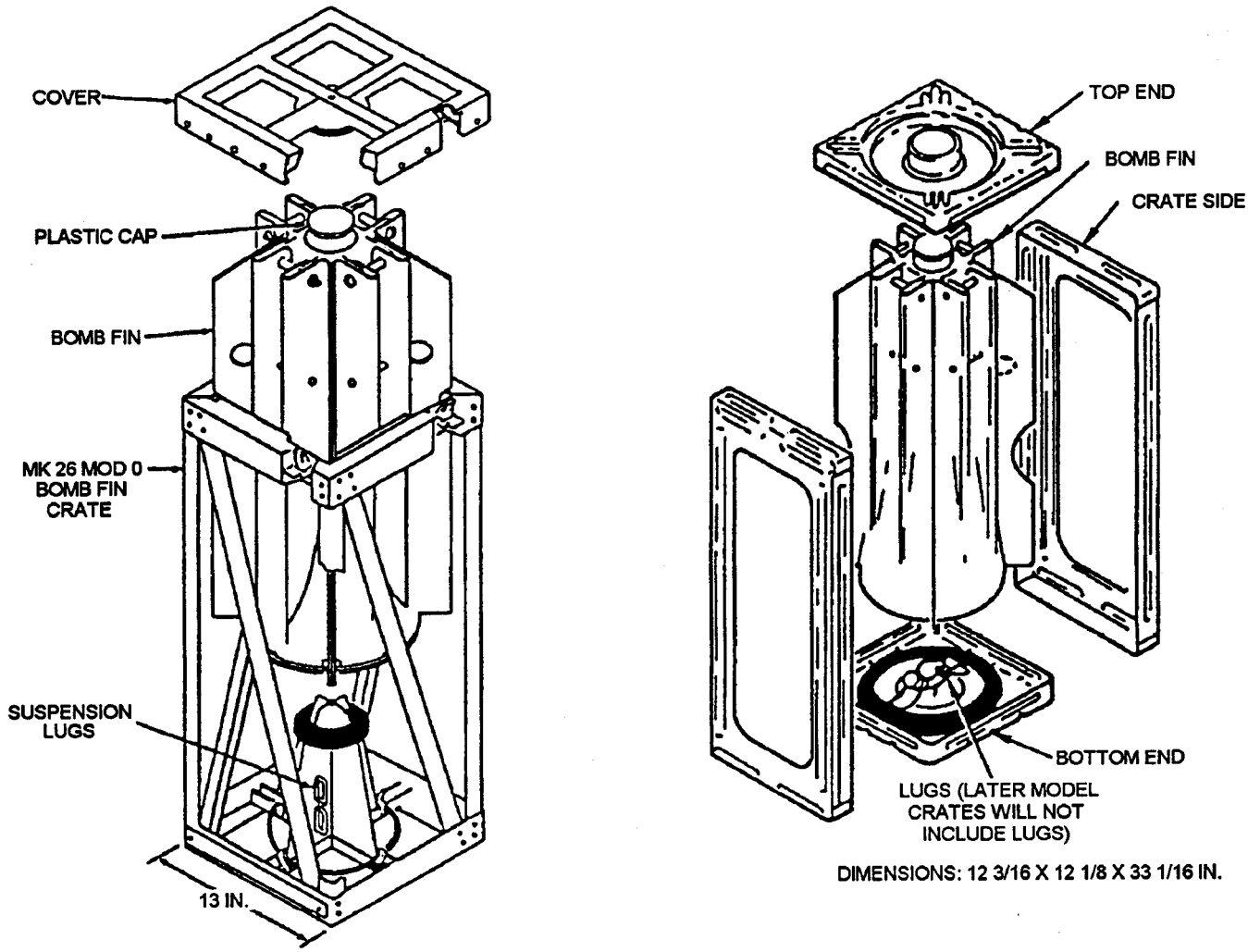


Figure 1-25.—Fin shipping configurations.

in a lightweight, disposable metal crate (fig. 1-25). Some fin assemblies are shipped with bomb lugs attached to the shipping crate, depending upon the particular Navy Ammunition Logistics Code (NALC).

Two types of fins are described in this part of the TRAMAN—conical and Snakeye. The conical fin is used for the unretarded mode of delivery, and the Snakeye fin assembly can be used for either the unretarded or retarded mode of delivery.

Conical Fin

The typical BSU-33 conical fin assembly (fig. 1-26) is steel, conical in shape, and has four fins to provide stability. Access covers, attached by quick-release screws, are located on the sides of the fin body, providing access for dearming and inspections. There is a drilled or punched hole at the top and bottom of the forward end of the fin body. This hole is used to install an arming wire when the bomb is being configured for electric tail fuzing. The fin is attached to the aft end of the bomb, and is secured in place by tightening the fin setscrews into the V-groove of the bomb.

The conical fin may be used with all Mk 80 (series) bombs. The basic difference between the types of conical fins is their physical size; the larger the bomb, the larger the fin.

Snakeye Fin Assemblies

Snakeye fin assemblies are used with the Mk 82 and Mk 83 LDGP bombs. They are capable of delivering bombs at high speed and low altitude without the danger of damaging the aircraft from ricocheting bombs or fragments, A physical description of both fin assemblies and the principles of operation are discussed in the following paragraphs.

MK 15 AND MODS SNAKEYE FIN ASSEMBLY.— The Mk 15 and Mods bomb fin

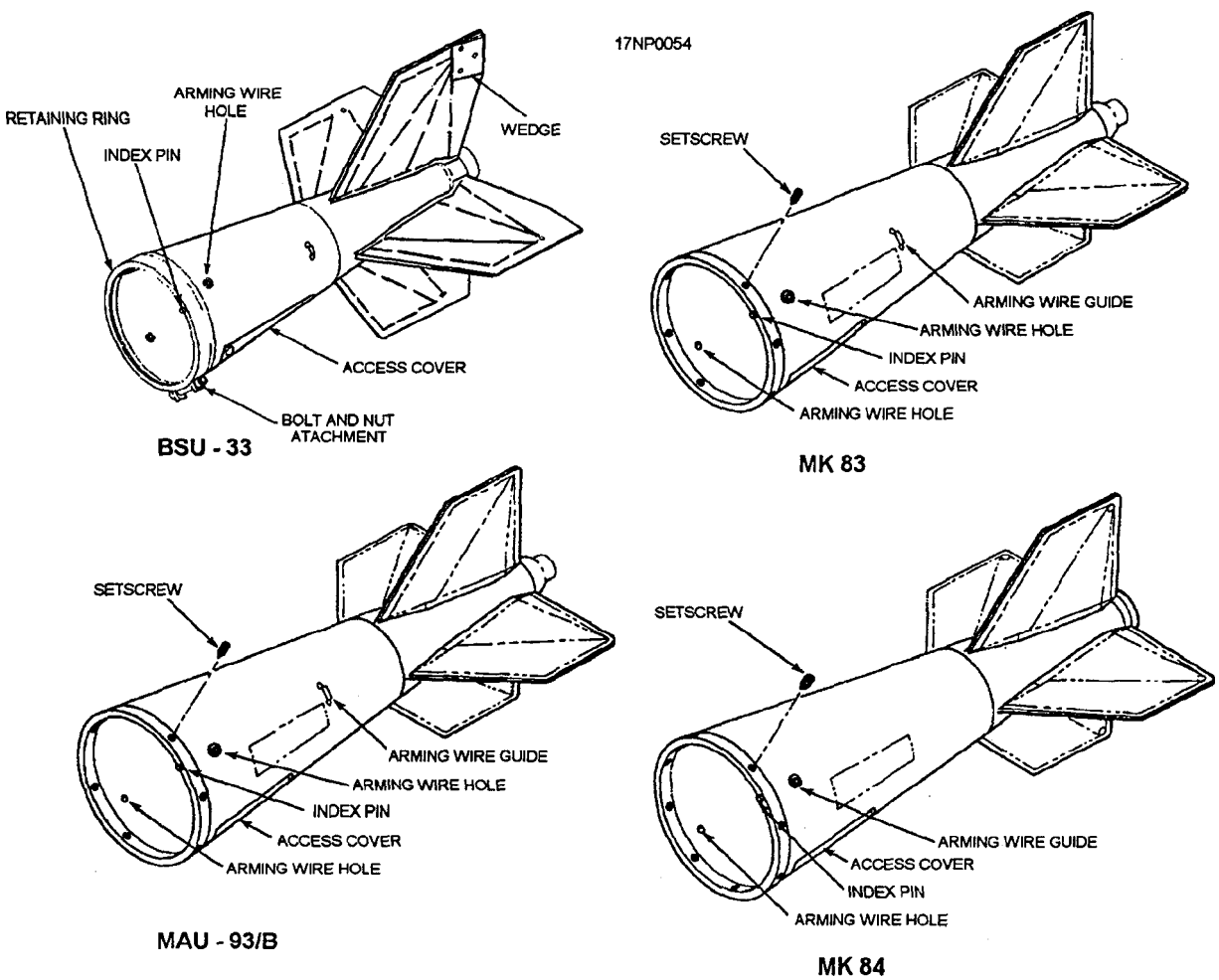


Figure 1-26.—Typical fin assemblies.

assembly (fig. 1-27) is a retarding fin. It is used with the 500-pound LDGP, Mk 82 and Mods bomb. The fin assembly presents a low-drag configuration when dropped in the unretarded position and a high-drag configuration when in the retarded position.

The fin support tube is the main structure of the fin. It provides a means of attaching the fin assembly to the bomb. On Mod 4 and Mod 4A fins, the fin is attached by eight setscrews (fig. 1-28).

On the Mod 4 and Mod 4A fins, the shock is absorbed by the crushing of a convoluted steel tube. The fin support tube has a fuze mounting ring for attaching the tail drive of a mechanical tail fuze

The fins are spring-loaded and secured in the closed position by a spring-loaded release band. The release band lever (fig. 1-28) is prevented from opening by a cotter pin which stays installed until an arming wire is installed. The fin assemblies have drilled holes at the top and bottom of the forward end for installation of arming wires when the weapon is being configured for electric tail fuzing.

MAU-91A/B FIN ASSEMBLY.— The MAU-91A/B fin assembly (fig. 1-29) is a retarded tail fin used with the 1,000-pound LDGP bomb Mk 83 and Mods. This fin assembly can be dropped in either the retarded or unretarded position.

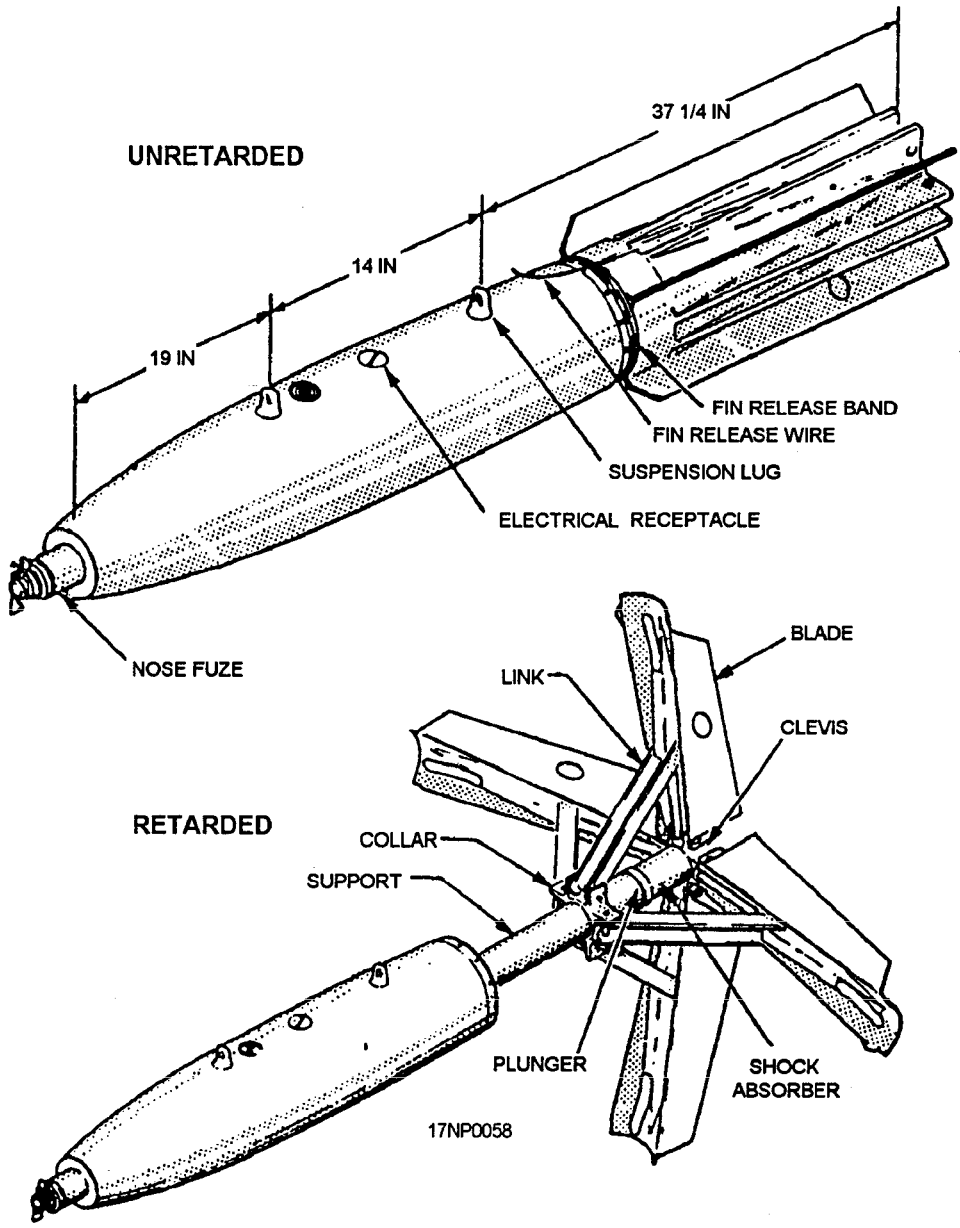


Figure 1-27.—Mk 15 fin with Mk 82 bomb body.

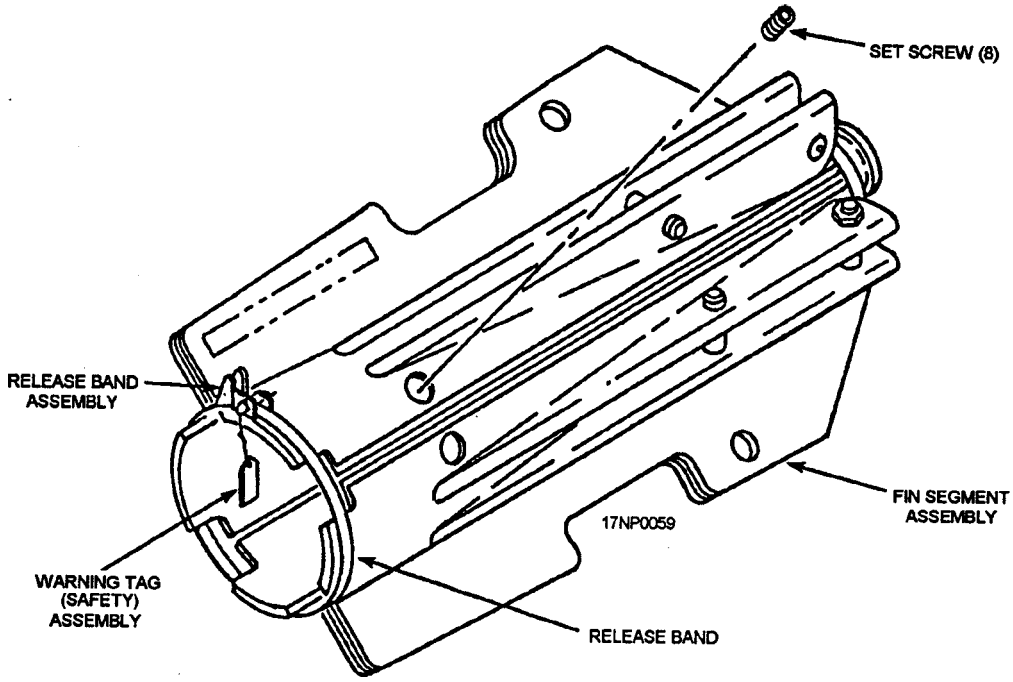


Figure 1-28.—Fin release band for Mk 15 fin.

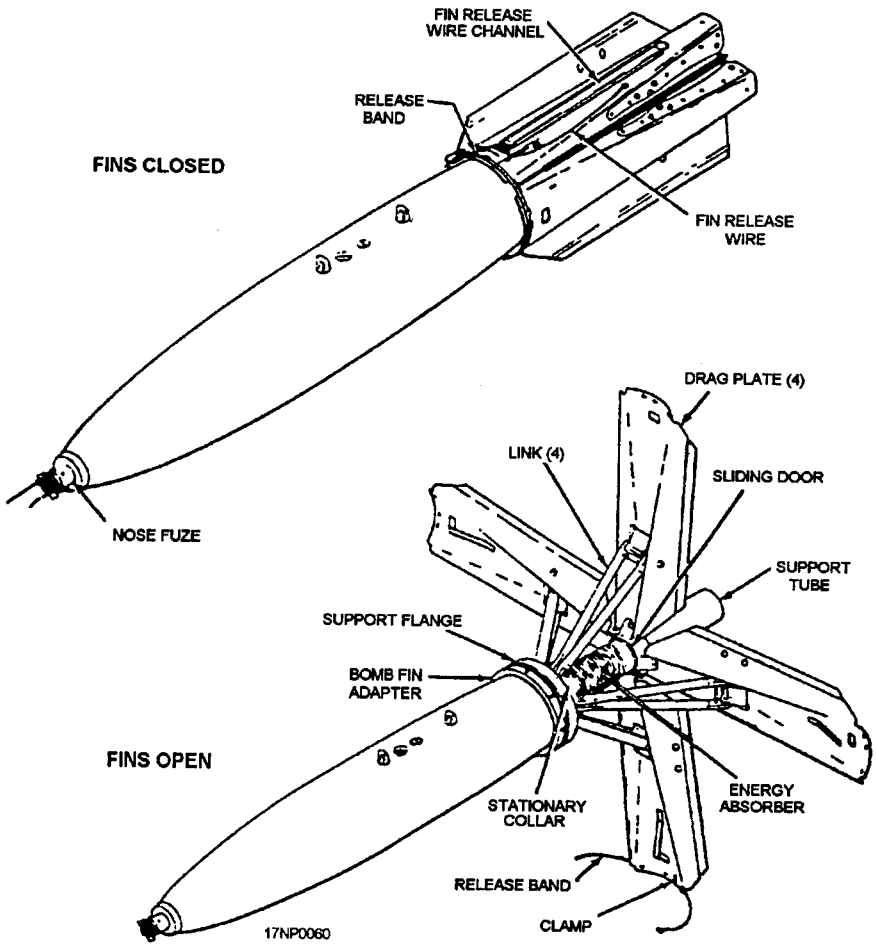


Figure 1-29.—Typica1 MAU-91A/B fin with ADU-320/B adapter on Mk 83 bomb body.

The MAU-91 fin consists of four folding drag plates with links, a support flange, and a support tube. An energy absorber, made of aluminum honeycomb tubing, is located on the support tube between the stationary collar and the sliding collar. The sliding collar is driven against the energy absorber, causing it to compress and deform. A channel located on the top drag plate holds the fin release wire until it is pulled out at bomb release. The drag plates are held in the closed position by a release band that is secured by a fin release wire pin located in the latch of the release band. The band tabs fit into slots located near the end of each drag plate. The band is securely attached to the bottom drag plate by a stainless steel clamp, which prevents damage from the band striking the aircraft after release.

The MAU-91 fin is attached to the Mk 83 bomb by fin adapter ADU-320/B. The adapter is secured to the aft end of the bomb by eight setscrews. The fin support flange has eight teeth that mate to ears on the fin adapter. A garter spring is forced into the gap between the flange teeth and the adapter, making sure that the teeth fit tightly against the ears. Two locking pins, which fit through matching holes in the flange and adapter, prevent rotation of the fin.

The MAU-91 fin assembly is shipped in a wooden shipping and storage container. Included in the container are eight suspension lugs, one spare garter spring, and a spare locking pin.

Principles of Operation

There are three modes of delivery available for the Snakeye fin assembly. They are retarded, unretarded, and in-flight selection (pilot option) of either mode.

RETARDED MODE.— In the retarded mode of delivery, the fins open to retard or slowdown the weapon. Since the aircraft and the weapon are traveling at the same speed when the weapon is released, the weapon and the aircraft arrive at the target at the same time. During low-level bombing, the aircraft could be damaged; therefore, the retarded mode of delivery is used during low-level bombing.

The fin assembly is positively armed in the retarded configuration. In this configuration, the fin release arming wire is looped over a permanent structure on the bomb rack. As the weapon is released from the aircraft, the arming wire is pulled from the fin release band, and the spring-loaded fins pop open. The fins are forced to the full-open position by the airstream, which causes the weapon to rapidly decelerate and allows the releasing aircraft sufficient time to safely clear the target area.

UNRETARDED MODE.— In the unretarded mode of delivery, the weapon is released from the aircraft, and the fins remain in the closed position. The weapon free falls to the target. In the unretarded mode of delivery (without pilot option), the cotter/ safety pin installed in the fin release band is not removed or replaced with an arming wire. However, the safety tag that reads REMOVE BEFORE FLIGHT is removed.

IN-FLIGHT SELECTION.— The most frequently used mode for delivery is the in-flight selection (pilot option) mode. The pilot can drop the weapon in the retarded or unretarded mode. This is possible by connecting the swivel loop of the fin release arming wire to the tail arming solenoid of the bomb rack. If the pilot energizes the arming solenoid upon weapon release, the arming wire remains connected to the arming solenoid and is pulled from the fin release band at weapon release, which allows the fins to pop open and results in a retarded delivery. If the pilot does not energize the arming solenoid upon weapon release, the arming wire is pulled free of the arming solenoid. This allows it to remain in the fin release band, preventing the fins from opening, which results in an unretarded delivery.

BSU-85/B Air Inflatable Retarder

The BSU-85/B bomb fin attaches to the Mk 83 general-purpose bomb. It is an air-inflatable retarder designed for very low altitudes. It can be dropped in either high-drag (retarded) or low-drag (unretarded) mode (fig. 1-30). The BSU-85/B fin

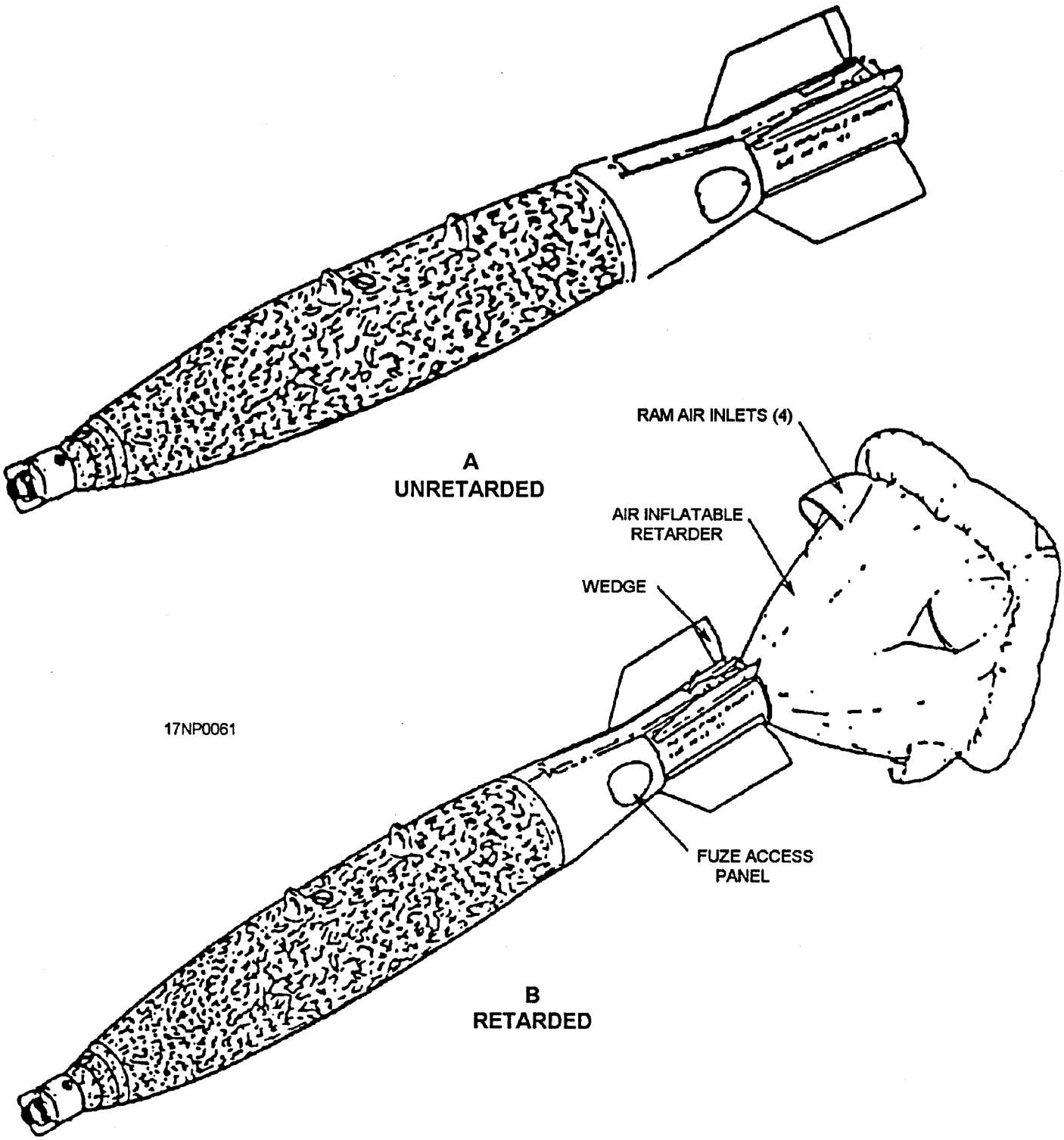


Figure 1-30.—Typical BSU-85/B air-inflatable retardable fin with high and low drag configurations.

(fig. 1-31) attaches to the bomb body by eight setscrews. It is a self-contained unit that consists of a stabilizer assembly (canister housing) with four fixed fins (X-shaped) and a lanyard assembly (fig. 1-31, views A and B). The four fixed fins provide low-drag aerodynamic stability. The wedges installed on the trailing edges provide stabilizing spin during a low-drag release. When stored in its original shipping/storage

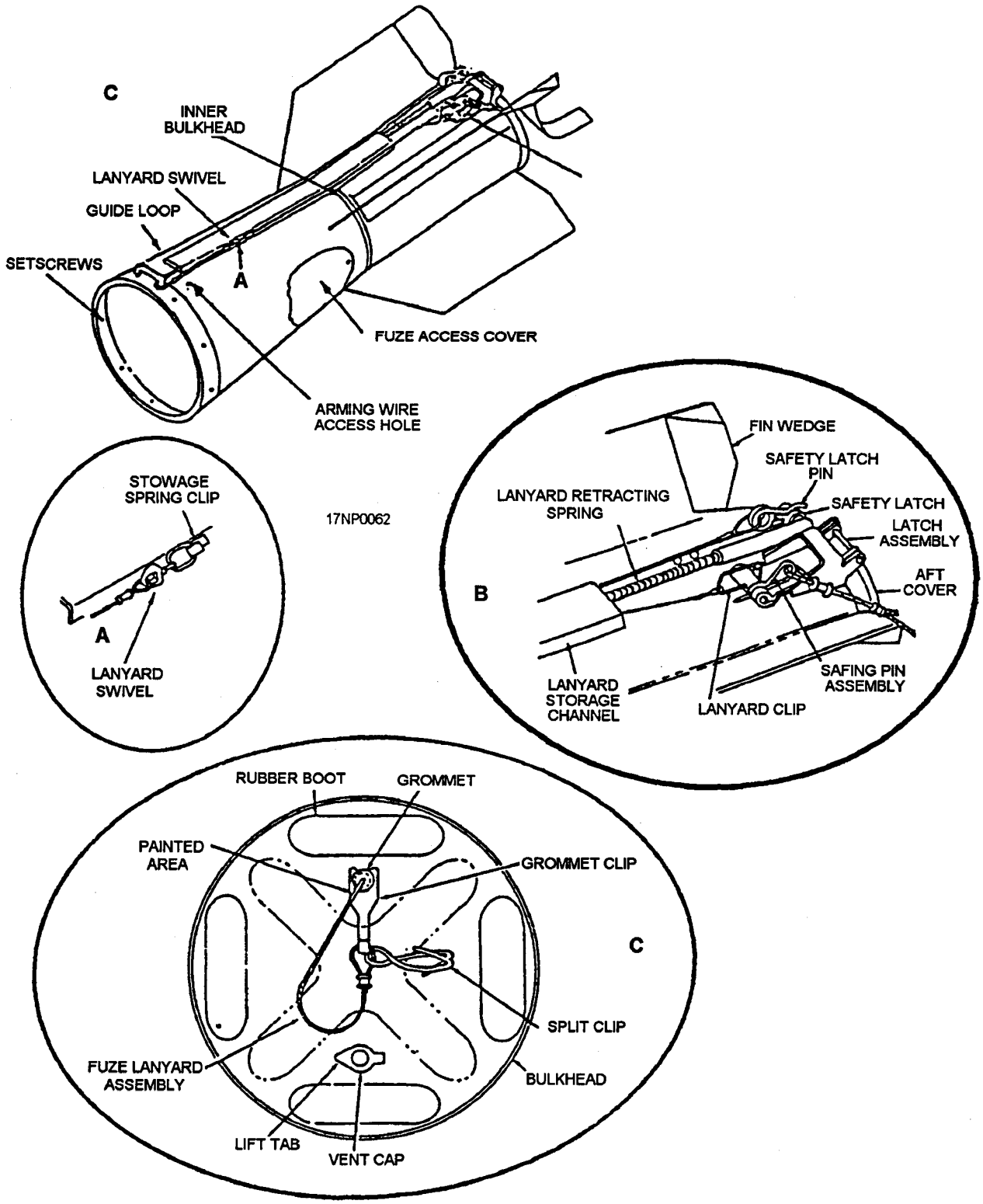


Figure 1-31.—BSU-85/B air-inflatable retarded fin (top and rear view).

container, its shelf life is 10 years. Its service life is 1 year when exposed to adverse environmental conditions, but it maybe extended by visual inspection at 1-year intervals.

BSU-86/B Bomb Fin

The BSU-86/B bomb fin is used with general-purpose bombs, Mk 82 Mods, or the practice bomb BDU-45/B (fig. 1-32). The fin provides a

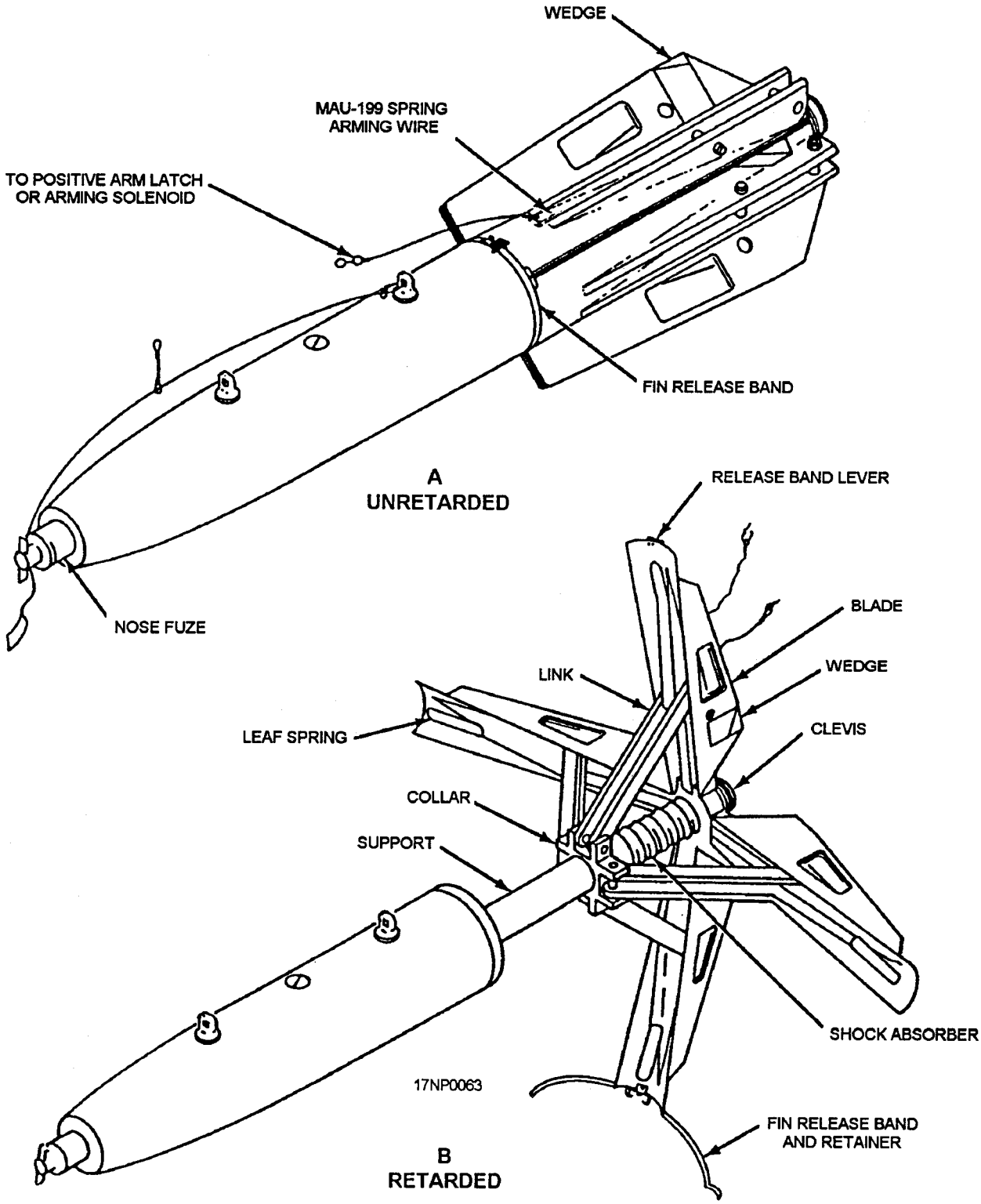


Figure 1-32.—BSU-86/B fin with Mk 82 bomb.

retarded (high-drag) or unretarded (low-drag) bomb delivery capability for the aircraft. The BSU-86/B fin is attached to the Mk 82 or BDU-45/B bomb by eight setscrews. A 25-degree wedge is located at the tips of each fin to impart spin. The airstream drives the fin open rapidly, when the MAU- 199/B spring arming wire (SAW) is activated Fin opening is initiated by the spring load under each fin blade.

REVIEW NUMBER 6

Q1. What type of bomb is used in most bombing operations?

Q2. Name the type of pallets on which bombs are shipped.

Q3. Bombs are shipped on metal pallets because _____.

Q4. List the two types of bomb fins.

Q5. The Mk fin is used with the _____ *LDGP bomb.*

Q6. What adapter is used to mate the MAU-91A/B fin to the Mk 83 bomb?

Q7. List the three modes of delivery used with Snakeye fins.

GUIDED BOMB UNITS

LEARNING OBJECTIVE: *Identify the different types, purpose, use, and operation of guided bomb units.*

GBU-12, GBU-16, AND GBU-10

The GBU-12, GBU-16, and GBU-10 guided bomb units (GBUs) (fig. 1-33) are Mk 82, Mk 83, and Mk 84 LDGP bombs modified to detect a target illuminated by a laser beam. The modification consists of a MAU-169 series computer control group (CCG) and MXU-650, 651, or 667 series airfoil group (AFG). Each AFG contains identical items; although they are different in physical size, they perform identical functions. A typical AFG is composed of a folding wing assembly,

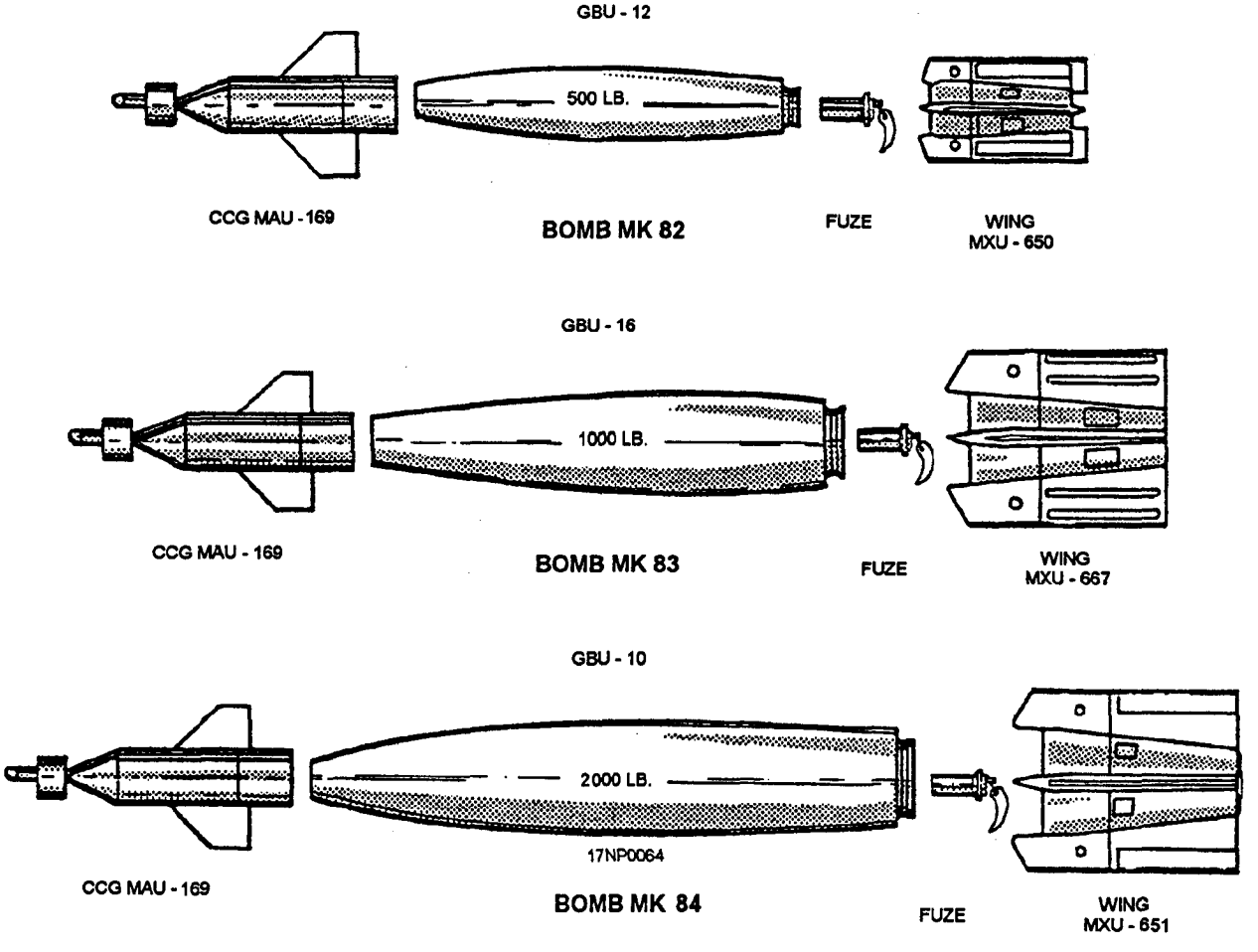


Figure 1-33.—Typical guided bomb unit configurations.

forward adapter assembly, guidance fins, and hardware required for assembly of laser-guided weapons.

The CCG mounts on the nose of the bomb body (this precludes the use of nose fuzing). The CCG detects a laser-illuminated target and provides weapon guidance signals to the moveable guidance fins.

The guidance fins (canards) attach to the CCG and the forward adapter assembly. The canards react to the signals received from the CCG to direct the weapon to the target. The canards are issued with fin extenders, which may be snapped off if wing extenders are not required.

The wing assembly is mounted on the aft end of the bomb body. It adds necessary aerodynamic stability and lift for in-flight maneuvering. An electric tail fuze is installed in the tail of the bomb.

Except for the glass nose of the CCG, all components are painted olive drab, and the bomb body has standard LDGP markings.

GBU-24B/B

The GBU-24B/B (fig. 1-34) is a converted BLU-109A/B 2000 pound class bomb designated as a hard target penetrator (HTP). The associated components required for conversion are fuze, air-foil group, FZU generator, adapter group, and guidance control unit. The heavy walled case of the bomb provides the penetration capability of 4 to 6 feet of reinforced concrete. The GBU-24B/B has a thermal protective coating applied to the surface to extend the cook-off time. The GBU-24B/B must not be missing more than 20 square inches of thermal coating in a single area or more than 40 square inches total.

REVIEW NUMBER 7

Q1. How do laser-guided bombs detect a target?

Q2. *What type of tail fuze is used with laser-guided bombs?*

Q3. Describe the location of the wing assembly used with laser-guided bombs.

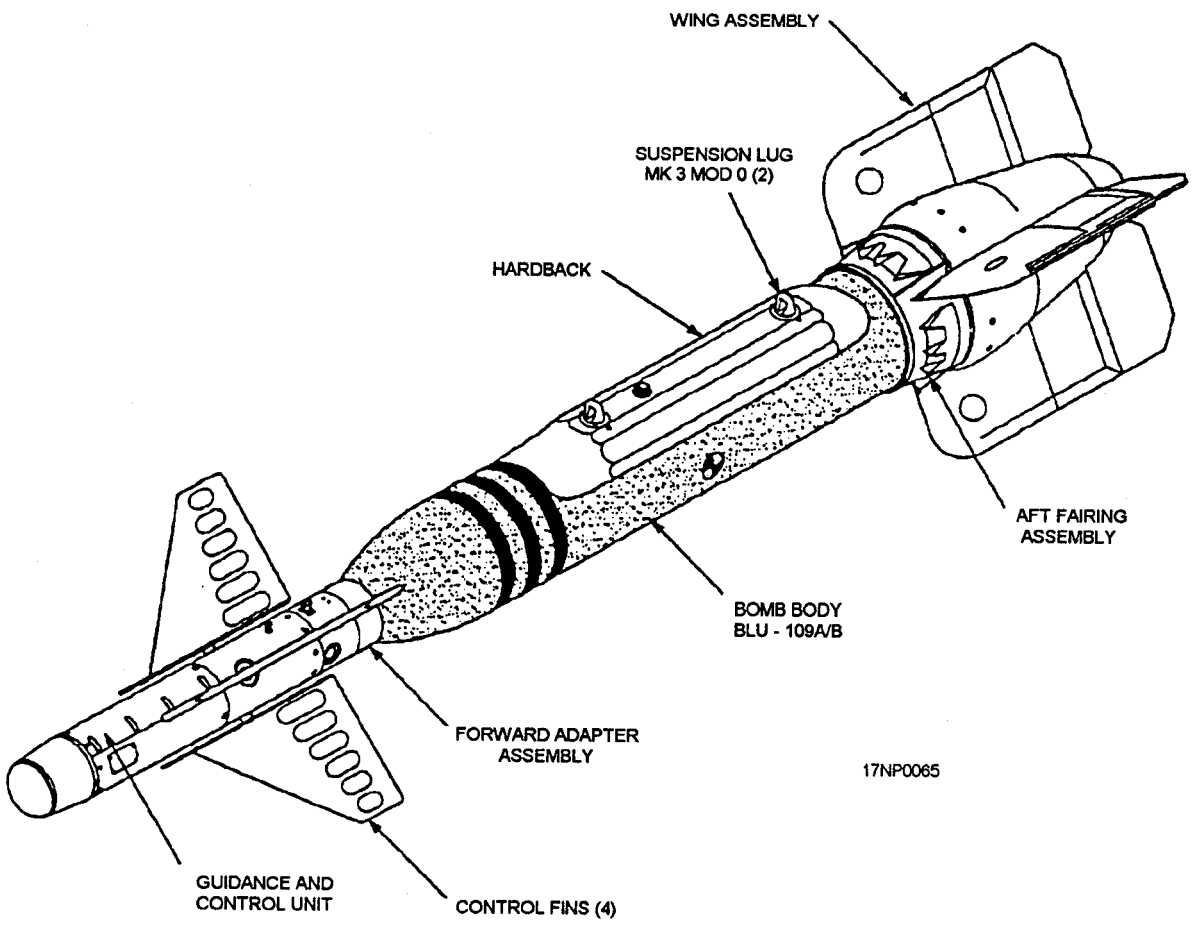


Figure 1-34.—GBU-24B/B.

DESTRUCTORS

LEARNING OBJECTIVE *Identify the types, purpose, and use of destructors (DSTs).*

The destructor mine consists of an LDGP aircraft bomb and a Mk 75 modification kit. The Mk 75 modification kit (fig. 1-35) contains the Mk 32 arming device, Mk 59 booster, Mk 42 firing mechanism, and all necessary hardware (less battery and fin assembly) to convert an LDGP bomb to an air-laid mine. The firing mechanism of the Mk 42 arming device requires the use of a Mk 95 battery, which must be installed during assembly procedures.

With the Mk 75 kit installed, a Mk 82 LDGP bomb (500 pounds) becomes a Mk 36 DST, a Mk 83 LDGP bomb (1,000 pounds) becomes a Mk 40 DST, and a Mk 84 LDGP bomb (2,000 pounds) becomes a Mk 41 DST. The Mk 36 and Mk 40 DSTs can be dropped in the retarded or nonretarded mode of delivery. The installation of a conical fin provides nonretarded (free-fall) delivery only. The installation of a Snakeye fin assembly provides the pilot with the in-flight option of releasing the DST in the retarded or nonretarded mode. The Mk 41 DST is configured with a conical fin for nonretarded delivery only. DSTs are identified by

REVIEW NUMBER 6 ANSWERS TO QUESTIONS Q1. THROUGH Q7.

A1. Normally low-drag general-purpose (LDGP) bombs are used in bombing operations. Currently, Mk 80 (series) LDGP bombs are used.

A2. Bombs are shipped on metal pallets because of their increased capacity and for grounding purposes over wooden pallets.

A3. Suspension lugs are used to fasten the weapons to the aircraft bomb racks.

A4. The two types of bomb fins are the conical and Snakeye fins.

A5. The Mk 15 fin is used with the Mk 82 bomb in either a low-drag or high-drag configuration.

A6. The ADU-320/B adapter is used to mate the MAU-91A/B fin to the Mk 83 bomb.

A7. The three modes of delivery used with Snakeye fins are the retarded mode, used during low-level bombing; nonretarded mode, in which the weapon free falls to the target; and the in-flight selected mode (pilot option), where the pilot selects either the retarded or nonretarded mode of delivery.

REVIEW NUMBER 7 ANSWERS TO QUESTIONS Q1. THROUGH Q3.

A1. Laser-guided bombs detect a target illuminated by a laser beam.

A2. Electrical tail fuzes are used in laser-guided bombs.

A3. The wing assembly is mounted on the aft end of the bomb body to add aerodynamic stability and lift for in-flight maneuvering.

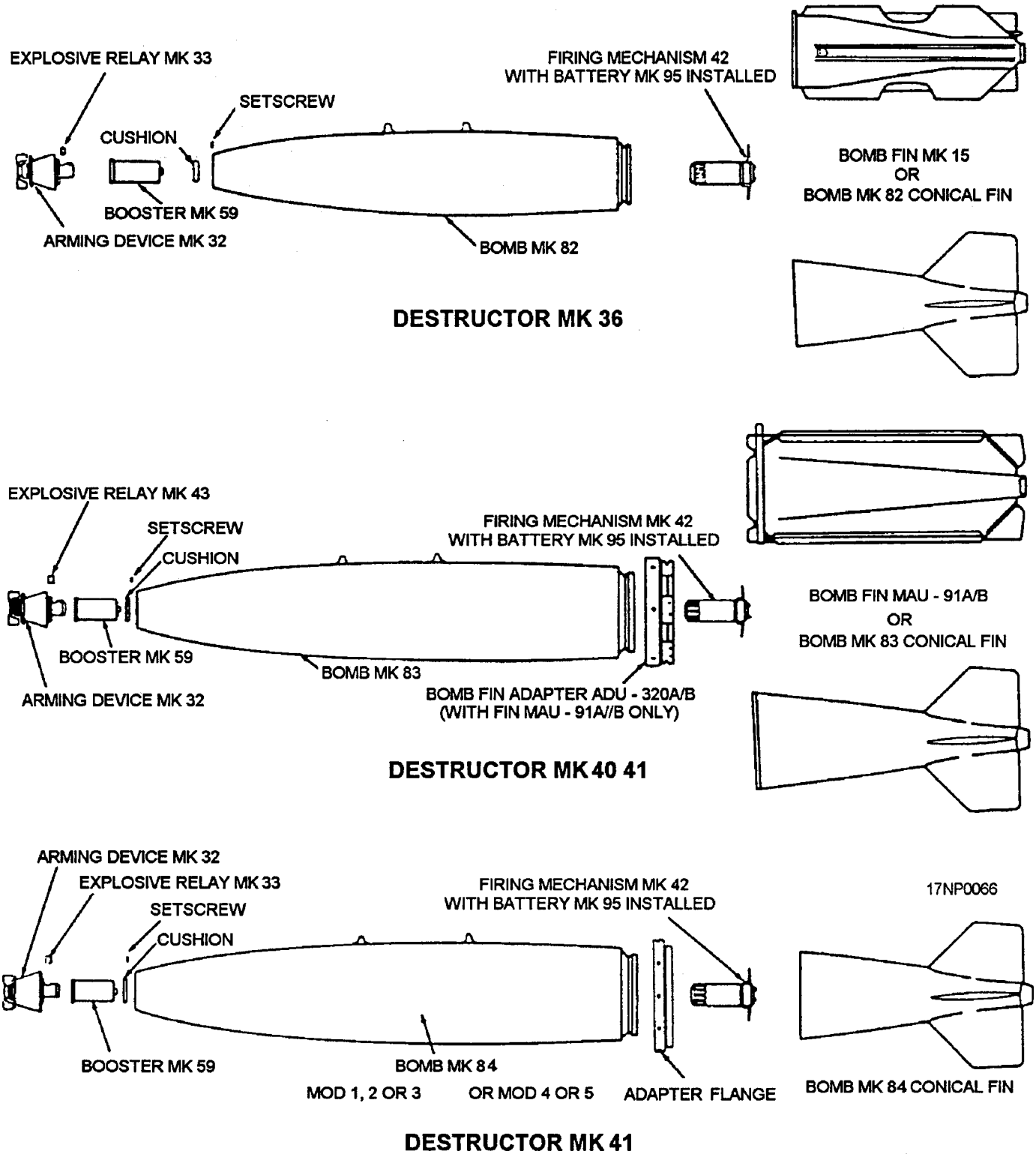


Figure 1-35.—Typical destructor configurations.

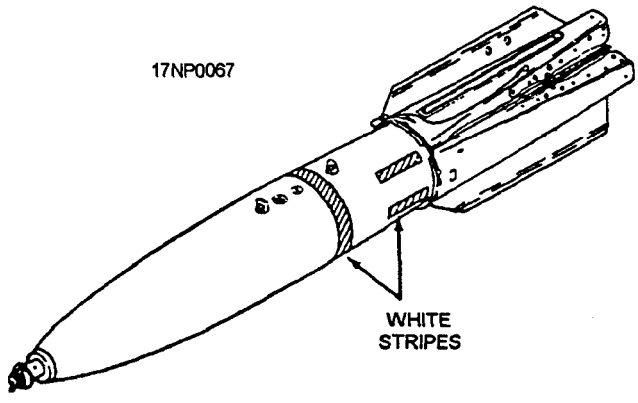


Figure 1-36.—DST identification markings.

the standard LDGP bomb markings plus white stripes (fig. 1-36).

Additional information on DSTs may be found in *Destructor Mk 36, 40, and 41, all Mods,* NAVSEA OP 3529.

REVIEW NUMBER 8

Q1. What modification kit is used to make LDGP bombs into destructor (DST) mines?

Q2. Name the bomb used to make the Mk 40 destructor

Q3. Name the DST that can only be dropped in the nonretarded mode.

ANTITANK BOMB CLUSTER MK 20, CBU-99, AND CBU-100 AND ANTIPERSONNEL/ANTIMATERIAL BOMB CLUSTER CBU-59/B

LEARNING OBJECTIVE: *Identify the purpose and use of the various configurations of the Mk 20, CBU-99, and CBU-100 antitank bomb clusters. Describe the functwn of the Mk 118 Mods 0 and 1 antitank bomb.*

The antitank bomb cluster (fig. 1-37) is an air-launched, conventional free-fall weapon. The Mk 20 and CBU-99/CBU-100 are used against armored vehicles.

The CBUs are delivered to the fleet as completely assembled all-up-rounds (AURs). Fuzes, suspension lugs, arming wires, wire extractors, and all other necessary components are installed.

The Mk 20 bomb cluster weighs 490 pounds and contains 247 Mk 118 antitank bombs. The information on configuration, functional description, and shipping and storage containers of the Mk 7 bomb dispenser and its associated components can be found in NAVAIR 11-5A-3.

MK 20 MODS/CBU-99/CBU-100, BOMB CLUSTER CONFIGURATIONS

The configurations of the Mk 20 Mods/CBU-99/CBU-100 are listed in (table 1-4).

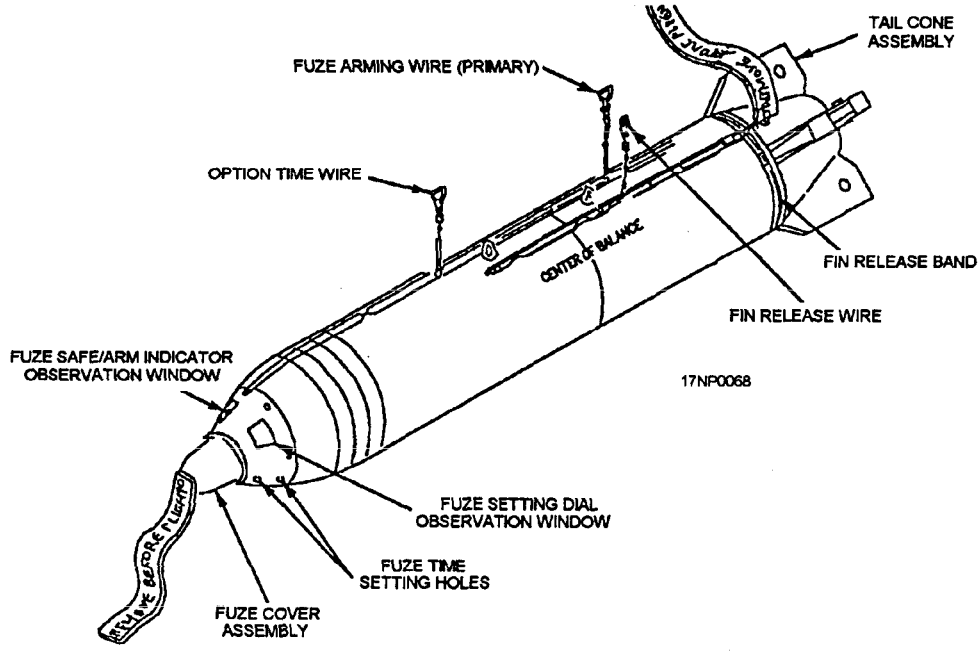


Figure 1-37.—Antitank bomb cluster Mk 20 Mods and CBU-99 and CBU-100.

Table 1-4.—Bomb Cluster Mk 20 Mods and CBU-99 and CBU-100 Configurations

BOMB CLUSTER	BOMB DISPENSER	FUZE	EXPLOSIVE PAYLOAD
Mk 20 Mod 2	Mk 7 Mod 2	Mk 339 Mod 0 Mechanical Time Fuze	247 Mk 118 Mod 0 antitank bombs with Mk 1 Mod 0 fuzing system
Mk 20 Mod 3	Mk 7 Mod 3	Mk 339 Mod 0/1 Mechanical Time Fuze	247 Mk 118 Mod 0 antitank bombs with Mk 1 Mod 0 fuzing system
Mk 20 Mod 4	Mk 7 Mod 4	Mk 339 Mod 0/1 Mechanical Time Fuze	247 Mk 118 Mod 1 antitank bombs with Mk 1 Mod 1 fuzing system
Mk 20 Mod 6	Mk 7 Mod 6 Thermally protected	Mk 339 Mod 1 Mechanical Time Fuze	247 Mk 118 Mod 1 antitank bombs with Mk 1 Mod 1 fuzing system
MJU-5/B	Mk 7 Mod 3	Mk 339 Mod 0/1 Mechanical Time Fuze	Chaff
CBU-78/B	SUU-58/B	Mk 339 Mod 1 Mechanical Time Fuze	45 BLU-91B AT/AV and 15 BLU-92/B AP
CBU-99	SUU-75/B Thermally protected	Mk 339 Mod 1	247 Mk 118 Mod 0 bombs
CBU-99	SUU-75A/B Thermally protected	FMU-140/B	247 Mk 118 Mod 0 bombs
CBU-100	SUU-76/B Thermally protected	Mk 339 Mod 1	247 Mk 118 Mod 0 bombs
CBU-100	SUU-76A/B Thermally protected	FMU-140/B	247 Mk 118 Mod 0 bombs

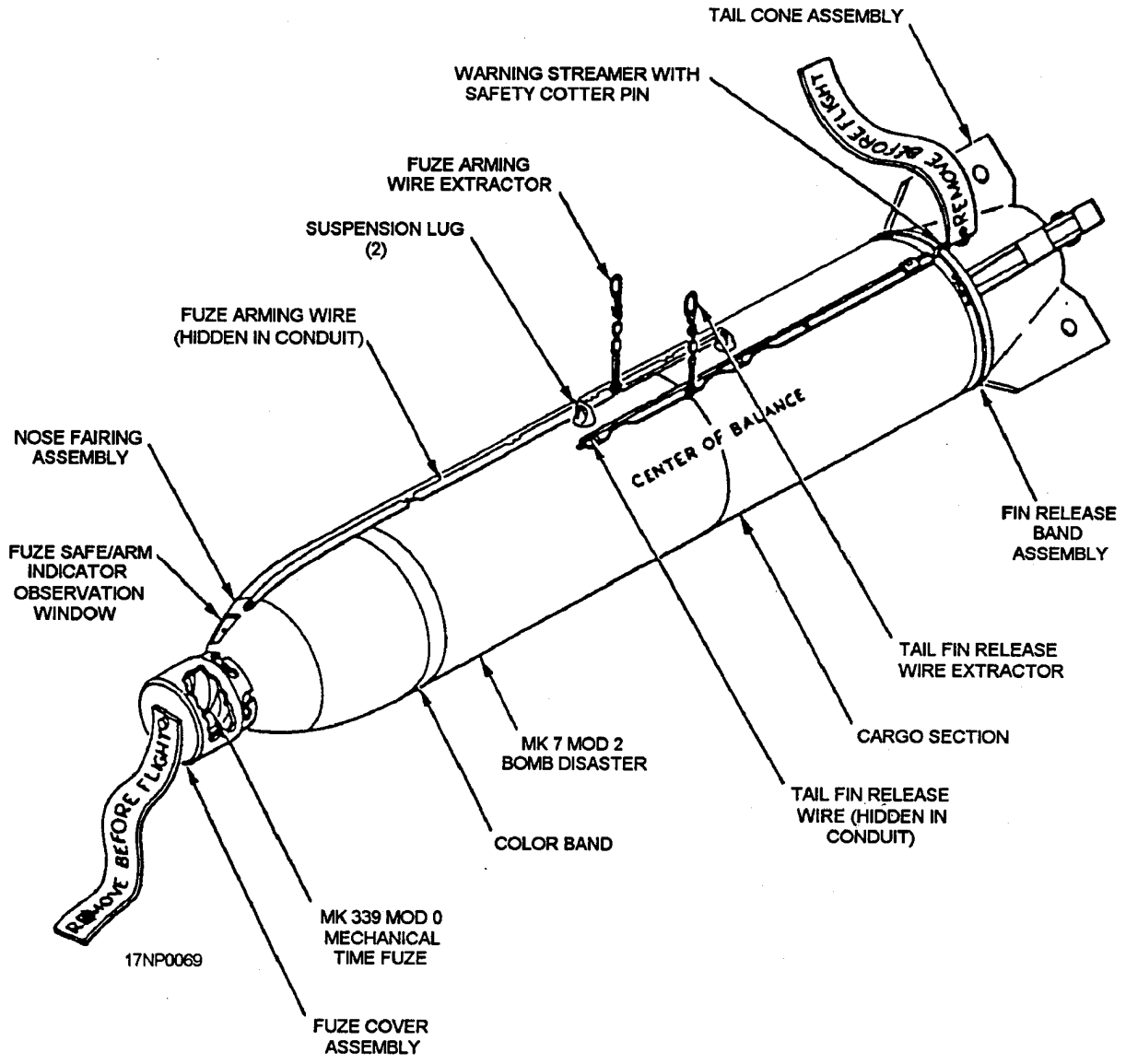


Figure 1-38.—Bomb cluster Mk 20 Mod 2 configuration.

Mk 7 and Mods Bomb Dispenser

The cargo section of the Mk 7 Mod 2 bomb dispenser (fig. 1-38) is the main structure of the weapon and contains the bombs/bomblets. A nose fairing is attached to the forward end of the cargo section for aerodynamics and fuze installation. It has an observation window for viewing the safe/arm indicator on the installed fuze. The mechanical time fuze Mk 339 Mod 0 is installed in the nose fairing and is protected during ground handling by the fuze cover assembly. The dispenser has two linear-shaped charges secured longitudinally inside the walls. When initiated, these shaped charges cut the dispenser in half, from front to

REVIEW NUMBER 8 ANSWERS TO QUESTIONS Q1. THROUGH Q3.

A1. The *Mk 75 modification kit* *is used to make destructor mines.*

A2. *When the Mk 75 modification kit is installed, the Mk 83 LDGP bomb becomes the Mk 41 DST.*

A3. *The Mk 41 DST can only be delivered in the nonretarded mode.*

rear, and the bombs/bomblets spread in free-fall trajectories.

To stabilize the weapon after release from the aircraft, a tail cone assembly is attached to the aft end of the cargo section. The tail cone assembly houses four, spring-actuated folding fins. The fins are spring-loaded to the open position and secured in the closed position during ground handling by a fin release-band assembly. The fin release band is secured in the closed position by a safety cotter pin and by the fin release wire.

The explosive content of the weapon is indicated by a yellow band around the forward end of the cargo section.

The Mk 7 Mods 3,4, and 6 bomb dispensers differ from the Mk 7 Mod 2, but the physical appearance of the dispenser remains basically the same. The most significant change incorporated on Mod 3 and later Mods is the Mk 339 Mod 1 fuze, which provides the pilot with in-flight selection of the fuze function time.

The Mk 7 Mod 4 bomb dispenser differs from the Mk 7 Mod 3 by modifying the dispenser and giving interface capabilities with a wider range of military aircraft. The Mk 7 Mod 6 bomb dispenser is the same as the Mk 7 Mod 3 except that the outside of the Mod 6 cargo section is coated with a thermal protective coating and has an additional yellow band around the forward end of the cargo section. The addition of the thermal coating increases the overall weight of the Mod 6 to 505 pounds.

Mk 339 Mods 0 and 1 Mechanical Time Fuze

The purpose of the Mk 339 Mods 0 and 1 mechanical time fuze is to initiate the linear-shaped charges located in the cargo section walls.

Mk 118 Mod 0 and Mod 1 Antitank Bomb

The antitank bomb Mk 118 Mod 0 (fig. 1-39) consists of a Mk 1 Mod 0 fuzing system, a shaped-charge warhead, and fixed stabilizing fins. It is loaded in the Mk 20 Mods 2 and 3 bomb clusters only. In the antitank bomb Mk 118 Mod 1, the fuzing system is a Mk 1 Mod 1, and the bombs are loaded in the Mk 20 Mods 4 and 6 bomb clusters only.

FUNCTIONAL DESCRIPTION

When the Mk 20 bomb cluster is released from the aircraft, the arming wires (primary and/or optional arming) are pulled sufficiently to arm the Mk 339 fuze and release the fins. The positive armed fin release arming wire frees the fin release band, and the movable fins snap open by spring-force.

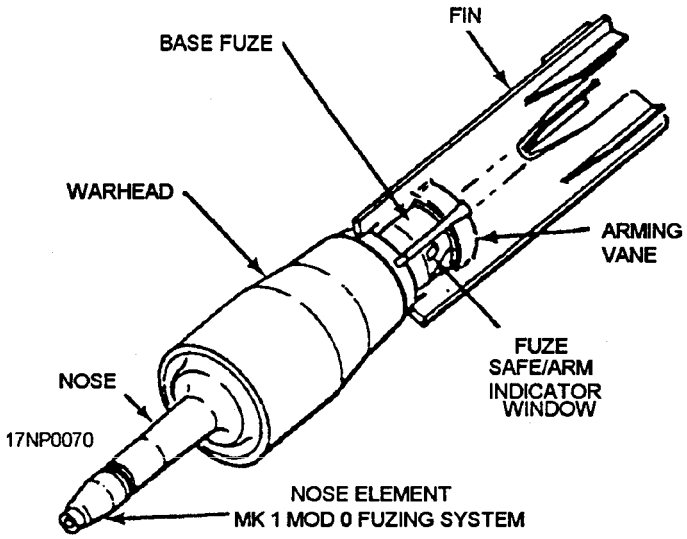


Figure 1-39.—Antitank bomb Mk 118 Mod 0 and Mod 1.

When the primary fuze arming wire is withdrawn from the Mk 339 Mod 0 fuze, the fuze will function after a 1.2-second (primary) or 4.0-second (option) delay, depending upon which setting was set in the fuze during weapon preparation. Functioning of the fuze initiates the linear-shaped charges in the dispenser; they cut the dispenser case in half, and disperse the bombs/bomblets. If the MK 339 Mod 1 fuze is used and only the primary fuze arming wire is pulled, the fuze will function 1.2 seconds after the arming wire has been extracted. If the pilot selects the option time (4.0 seconds), both the primary and option arming wires must be pulled. If the pilot selects the option time and the primary arming wire is not pulled, the fuze will be a dud.

Mk 118 Mods 0 and 1 Antitank Bomb

When the Mk 118 bomb separates from the dispenser case, the base fuze arming vane rotates and the fuze is armed. If the bomb strikes a hard target, such as concrete or armor, the electric detonator ignites the shaped-charge warhead immediately. If the bomb strikes a soft target, such as earth or sandbag, the bomb penetrates the targets until deceleration lets the inertia firing pin strike and initiate the stab detonator, causing warhead denotation.

SHIPPING AND STORAGE CONTAINERS

The Mk 427 Mod 0 and Mod 1 shipping and storage containers encase one fully assembled Mk 20 bomb cluster. The reusable containers consist of metal upper and lower shell assemblies that are secured with either 16 quick-release latches (Mod 0) or 18 "T" latches (Mod 1). A rubber gasket provides an environmental seal when the upper and lower shells are mated. External frame members are welded to each half of the container so the containers can be stacked six high and provide the necessary fittings for ground-handling equipment.

The reusable weapon cradle Mk 18 Mod 0 is used to ship and store two fully assembled Mk 20 bomb clusters. The cradle consists of plastic upper and lower shell assemblies, which are shock-mounted on a metal cradle assembly. The weapon cradle has forklift guides, lifting eyes, handtruck brackets, and lift devices to permit the use of handling equipment. Four supports are provided on each cradle to aid in stacking the cradle assemblies.

REVIEW NUMBER 9

Q1. Name the cluster bomb used against armored vehicles and the one used against light material and personnel targets.

Q2. Name the main structure of the Mk 7 Mod 2 bomb dispenser

Q3. The Mk 20 bomb cluster weighs _____ and contains _____ bombs.

Q4. Name the component used to stabilize the bomb after release from the aircraft.

Q5. Describe the purpose of the Mk 339 Mod 0 and Mod 1 mechanical time fuzes.

Q6. List the components of the Mk 118 Mod 0 and Mod 1 antitank bomb.

Q7. What shipping container is used to ship and store the Mk 20 bomb cluster?

CBU-78/B GATOR

The CBU-78/B gator weapon is delivered as an all-up-round (AUR) (fig. 1-40). The weapon consists

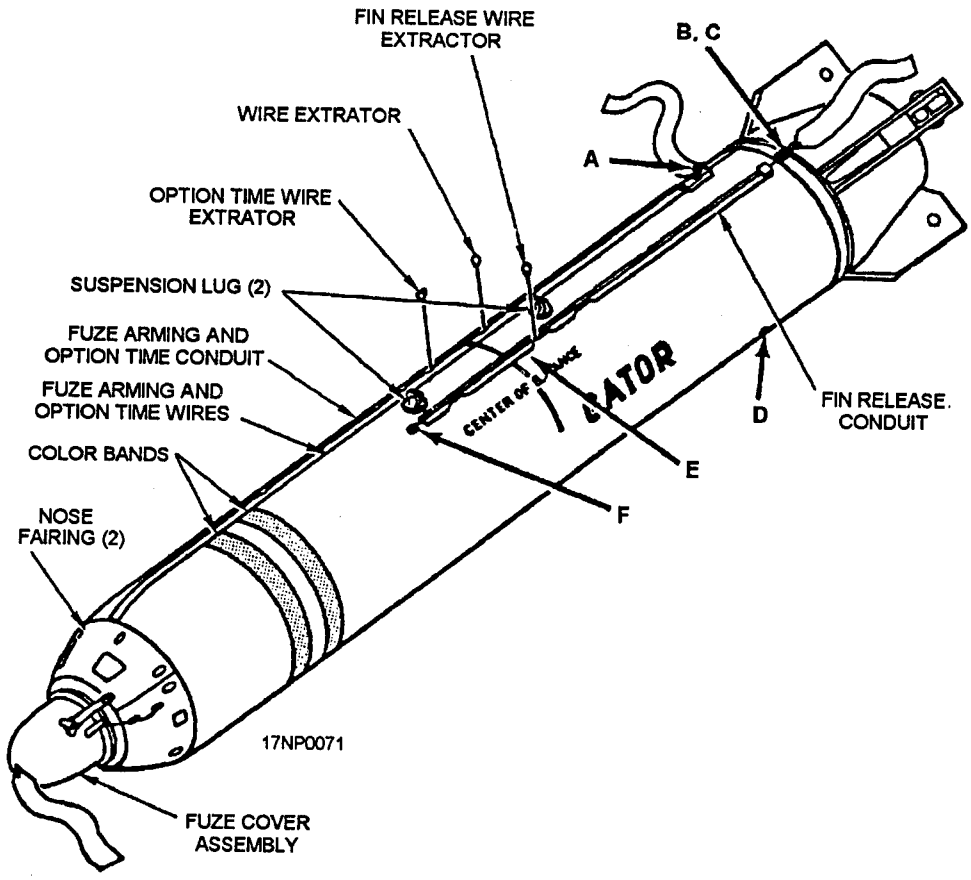


Figure 1-40.—CBU-78/B gator weapon,

of the SUU-58/B dispenser, Mk 339 Mod 1 fuze, Kit Modification Unit KMU-428/B, and 60 mines (45 BLU-91/B and 15 BLU-92/B). The fuze initiation time is preset and is activated upon weapon release from the aircraft. Fuze time settings are primary mode (1.2 seconds) and option mode (4.0 seconds). The KMU-428/B adapts the mines to the dispenser; it also provides mine activation/self-destruct time selection.

SUU-58/B Subsonic Free-Fall Dispenser

The SUU-58/B consists of a cargo section with a nose fairing assembly attached, a tail cone assembly, and fuze arming wires with extractors. There are two observation windows-one for viewing the safe/arm indicator and the other to observe the fuze time-setting dials. The cargo section houses the BLU-91/B and BLU-92/B mines. The tactical weapons have two yellow bands around the nose cone fairing.

BLU-91/B and BLU-92/B Mines

The target sensors are the primary difference between the two mines. The BLU-91/B uses an armor-piercing warhead and a magnetometer type of sensor; the BLU-92/B has a fragment type of warhead with trip wires as the primary target sensor.

PRACTICE BOMBS

LEARNING OBJECTIVE: *Identify the different types, purpose, and use of practice bombs to include subcaliber and full-scale practice bombs.*

Practice bombs are used to simulate the same ballistic properties of service bombs. Practice bombs are manufactured as either solid, cast-metal bodies or thin, sheet-metal containers. They can be filled with wet sand to obtain the necessary weight. Since practice bombs contain no explosive filler, a practice bomb signal cartridge (smoke) can be used for visual observation of weapon-target impact.

The primary purpose of practice bombs is safety when training new or inexperienced pilots and ground-handling crews. Other advantages of practice bombs include their low cost and an increase in available target locations.

Although not classified as practice bombs, the Mk 80 (series), inert filled, LDGP bombs are used for full-scale practice bombing. These bombs are physically the same as the Mk 80 (series) LDGP service bombs, but they do not contain explosive filler and are painted blue. These bombs provide full-scale training for assembly and loading crews and pilots.

The general types of practice bombs are subcaliber or full-scale practice bombs. Subcaliber means that the practice bomb is much smaller in size and weight than the service bomb it simulates. Full-scale practice bombs are representative of service bombs in their size and weight.

SUBCALIBER PRACTICE BOMBS

There are two types of subcaliber practice bombs-the Mk 76 Mod 5 and BDU-48/B. The two types are used for practice and are quite different in design and appearance from each other. Each type is discussed in the following paragraphs.

Mk 76 Mod 5

The Mk 76 Mod 5 is a 25-pound, solid, metal-cast, practice bomb (fig. 1-41). Its body is teardrop shaped and centrally bored to permit the insertion of a practice bomb signal cartridge. The afterbody, which covers the tail tube, is crimped to the bomb body and has welded-on conical tail fins. The bomb is designed with single lug suspension, using the Mk 14 suspension lug.

The Mk 76 Mod 5 practice bomb is designed for impact firing only. It uses the Mk 1 firing pin assembly to initiate the practice bomb signal cartridge. The bomb signal and the firing pin assembly are held in the bomb by means of a cotter pin.

The bomb is painted blue. The identification nomenclature is stenciled in white letters on the bomb body.

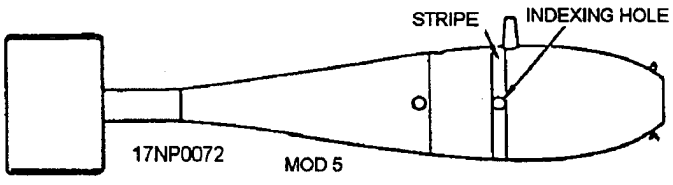


Figure 1-41.—Mk 76 Mod 5 practice bomb.

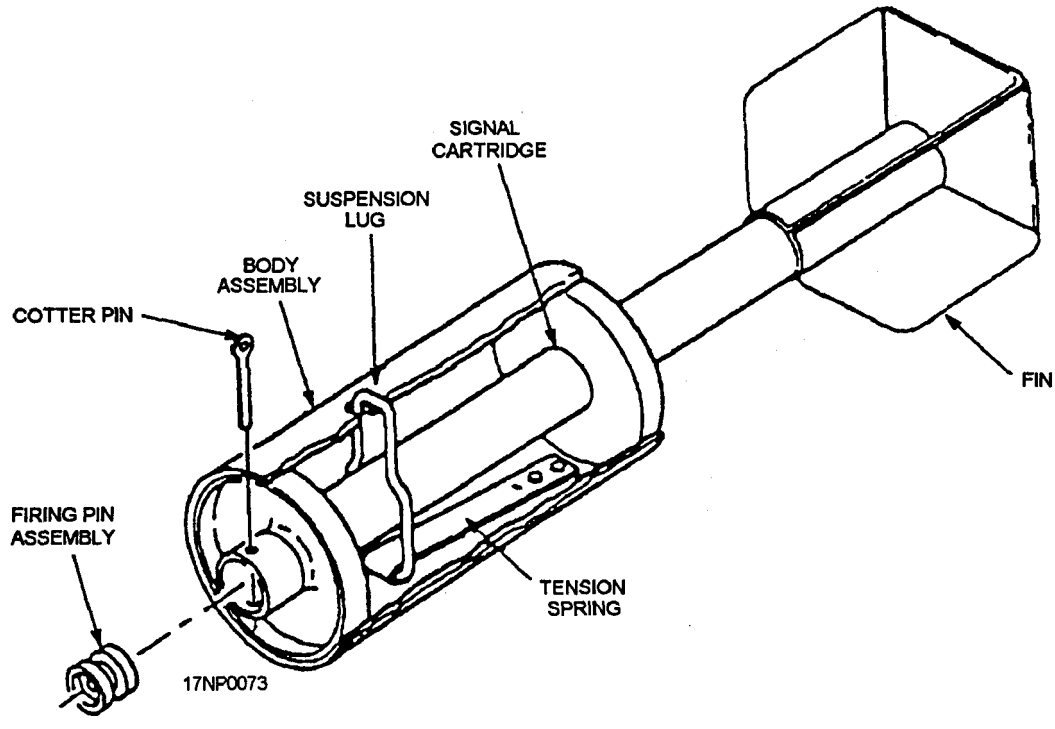


Figure 1-42.—BDU-48/B practice bomb.

BDU-48/B

The BDU-48/B is a 10-pound practice bomb (fig. 1-42). It is a thin-cased cylindrical bomb used to simulate retarded weapon delivery. The bomb is composed of the bomb body, a retractable suspension lug, a firing assembly, and box-type conical fins.

The firing device (fig. 1-42) consists of a firing pin assembly and a cotter pin. The BDU-48/B is painted

REVIEW NUMBER 9 ANSWERS TO QUESTIONS Q1. THROUGH Q7.

A1. The Mk 20 Mods 2, 3, 4, and 6 cluster bomb is used against armored vehicles.

A2. The cargo section is the main structure of the Mk 7 Mod 2 bomb dispenser

A3. The Mk 20 bomb cluster weighs 490 pounds and holds 247 Mk 118 antitank bombs.

A4. *The tail cone assembly, attached to the afl end of the cargo section, stabilizes the bomb after it is released from the aircraft.*

A5. The Mk 339 Mod 0 and Mod 1 mechanical time fuze is used to initiate the linear-shaped charges in the cargo section wall.

A6. The Mk 118 Mod 0 and Mod 1 antitank bombs contain the following:

Mk 1 Mod 0 fuzing system

Shaped-charge warhead

Fixed stabilizing fins

A7. The Mk 427 Mod 0 and Mod 1 shipping containers are used to ship and store Mk 20 bomb clusters.

blue. Identification nomenclature is stenciled in white letters on the bomb body.

The bomb can use signal cartridge Mk 4 Mod 3, or CXU-3A/B. While handling or transporting bombs, loaders should avoid placing their bodies in line with either end of the bomb.

FULL-SCALE PRACTICE BOMBS

Full-scale practice bombs have the same dimensions, weight factor, and configuration abilities as the service bombs they simulate. The bombs are filled with inert material to obtain the proper weight.

The full-scale practice bombs (fig. 1-43) currently in use are in the Mk 80 (series). They include the Mk 82, Mk 83, and Mk 84 LDGP bombs. These bombs are assigned a different NALC than their service counterpart to differentiate between inert and service bombs when requisitioning them through the supply system. They can be configured with the same bomb components (fuzes, fins, lugs, and so forth) that are used to configure service bombs. However, if the use of fuzes is not desired, a Mk 89 Mod 0 bomb spotting charge adapter can be installed in the tail fuze well of the practice bomb to provide visual observation of weapon/target impact.

The Mk 80 (series) inert LDGP bombs are painted blue. The new Mk 80 (series) inert LDGP bombs have an olive-drab colored exterior and are thermally protected, but they can be distinguished from service

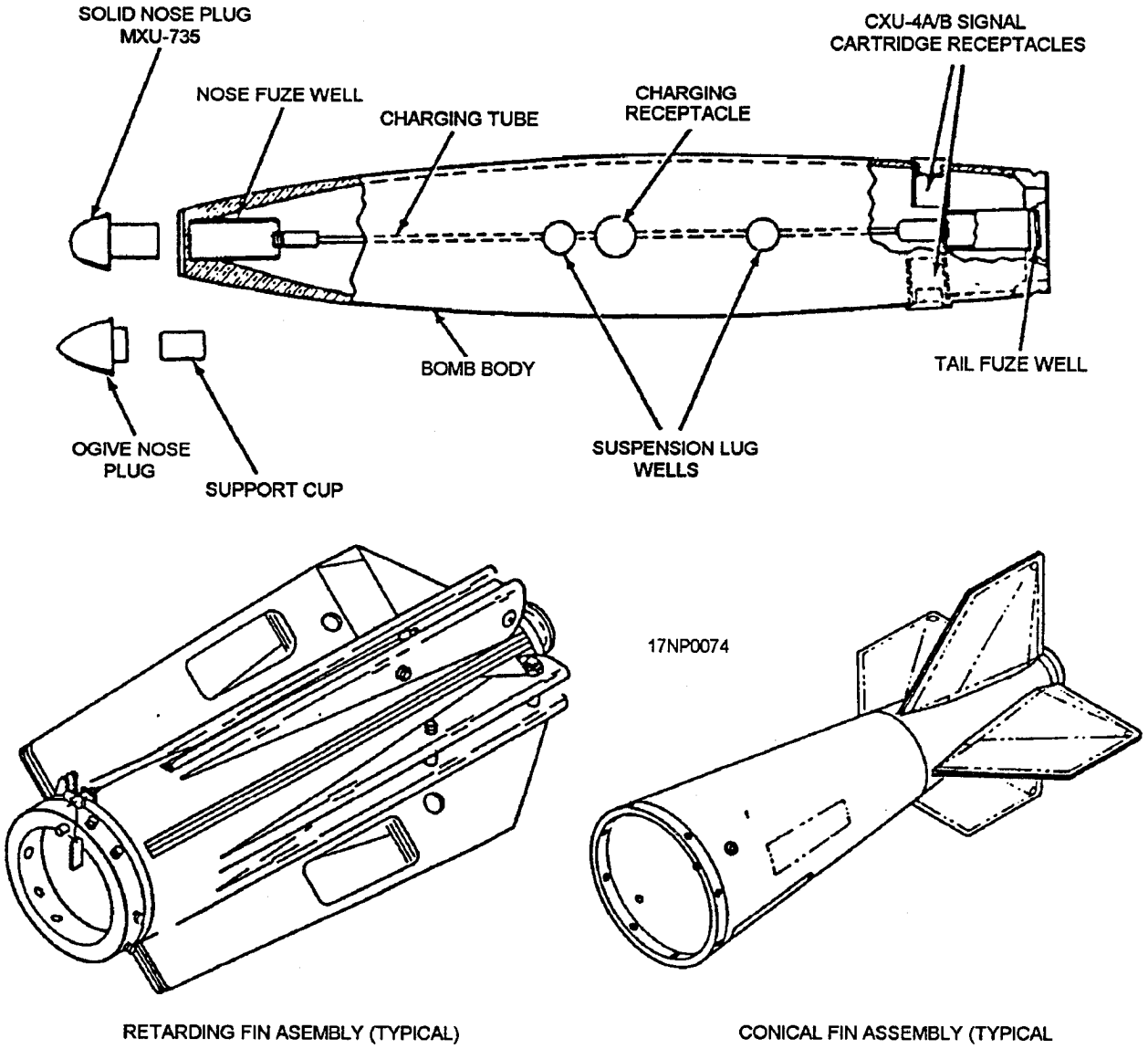


Figure 1-43.—BDU-45/B practice bomb.

bombs by a blue band around the nose and by the 1-inch letters INERT stenciled on the outside of the bomb body.

The Mk 89 Mod 0 bomb spotting charge adapter (fig. 1-44) is designed for use in the tail fuze well of the Mk 80 (series) LDGP inert bombs. A practice bomb signal cartridge is installed in the Mk 89 Mod 0, which provides visual observation (smoke) of weapon-target impact.

The bomb spotting charge adapter is kept in a safe condition during ground handling by the installation of a safety cotter pin in the safety pin sleeve. Once the arming wire has been installed through the arming wire hole in the safety pin sleeve, the safety cotter pin must be removed.

LASER GUIDED TRAINING ROUND (LGTR)

The LGTR (fig. 1-45) is designed to provide realistic laser guided bomb (LGB) tactical training. The training round consists of a guidance and control section, pneumatic controls for moveable control surfaces, power supply, and a standard practice bomb signal cartridge. Once initiated, the system cannot be reset. The signal cartridge (spotting charge) is impact initiated and does not require safety or cotter pins.

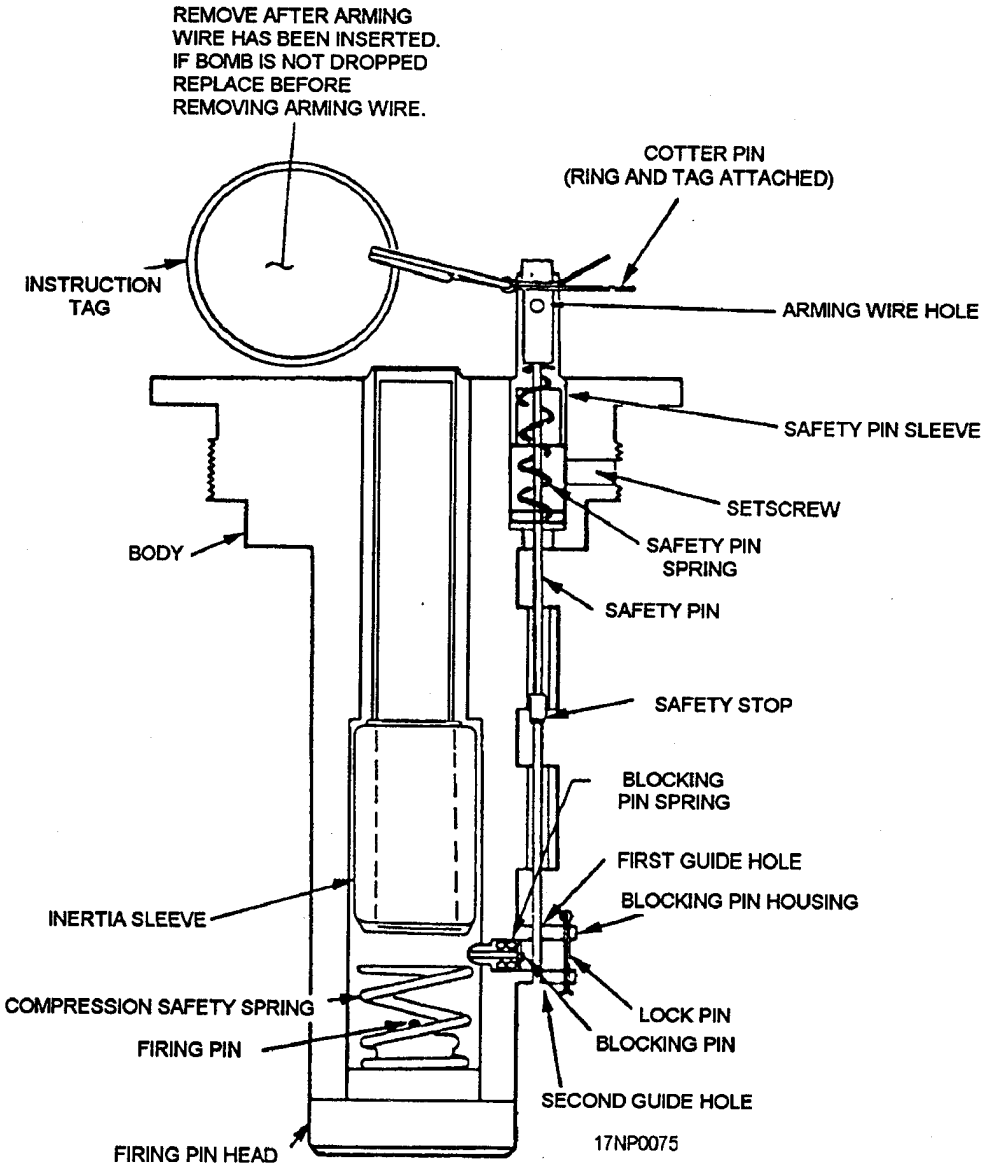


Figure 1-44.—Mk 89 Mod 0 bomb spotting charge adapter.

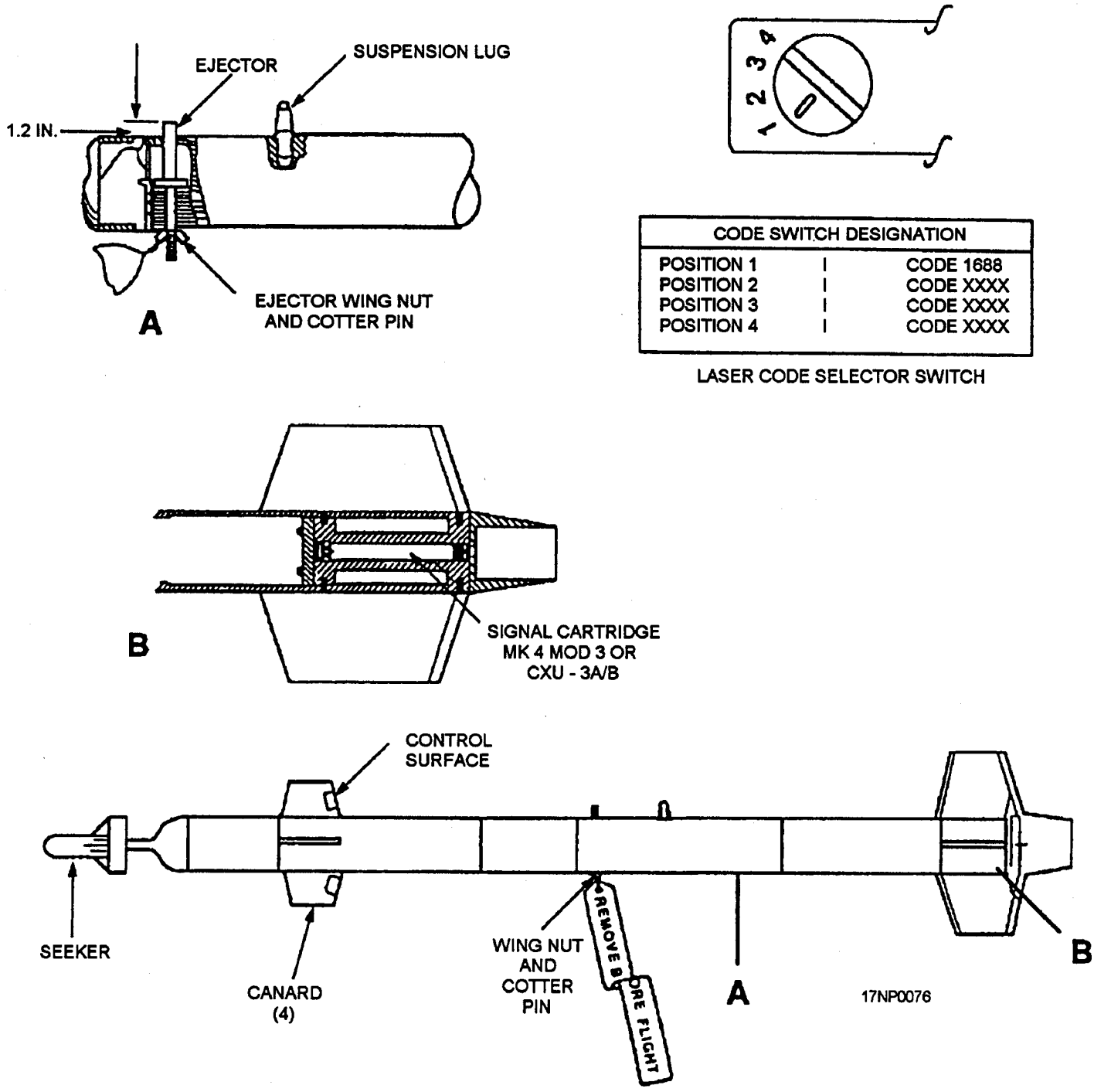


Figure 1-45.—Laser guided training round (LGTR).

REVIEW NUMBER 10

Q1. Describe the primary purpose of practice bombs.

Q2. List the two general types of practice bombs.

Q3. List the types of subcaliber practice bombs.

Q4. What color are Mk 80 (series) inert LDGP bombs painted?

CHEMICAL BOMBS/WEAPONS

LEARNING OBJECTIVE: *Describe the types, purpose, and use of chemical weapons.*

Chemical weapons are designed to disperse a chemical agent over a designated course. Some of the uses are defoliation, screening, and area denial.

MK 116 WETEYE CHEMICAL BOMB

The weteye (fig. 1-46) is a free-falling container that is designed to burst open as it falls, dispensing the chemical agent.

Physical Description

The WETEYE weighs approximately 500 pounds and contains approximately 347 pounds of chemical agent. The bomb is gray in color with a green band and a yellow band around the center of the body. The green band indicates a toxic chemical agent filler and the yellow band indicates a high explosive.

Functional Description

When the bomb is released from the aircraft, the arming wire is withdrawn, allowing the fuze to arm. At the same time, the fin-release wire is withdrawn, activating the spring-tension extendable fins. Upon impact the fuze functions, initiating the tetryl booster which ignites the burster. The burster explodes the bomb and disseminates the GB nerve agent.

MK 94 CHEMICAL BOMB

The Mk 94 is a Mk 82 low drag general purpose bomb casing that is modified to contain a chemical agent. The Mk 94 is intended for the aerial delivery of the toxic chemical agent on selected targets.

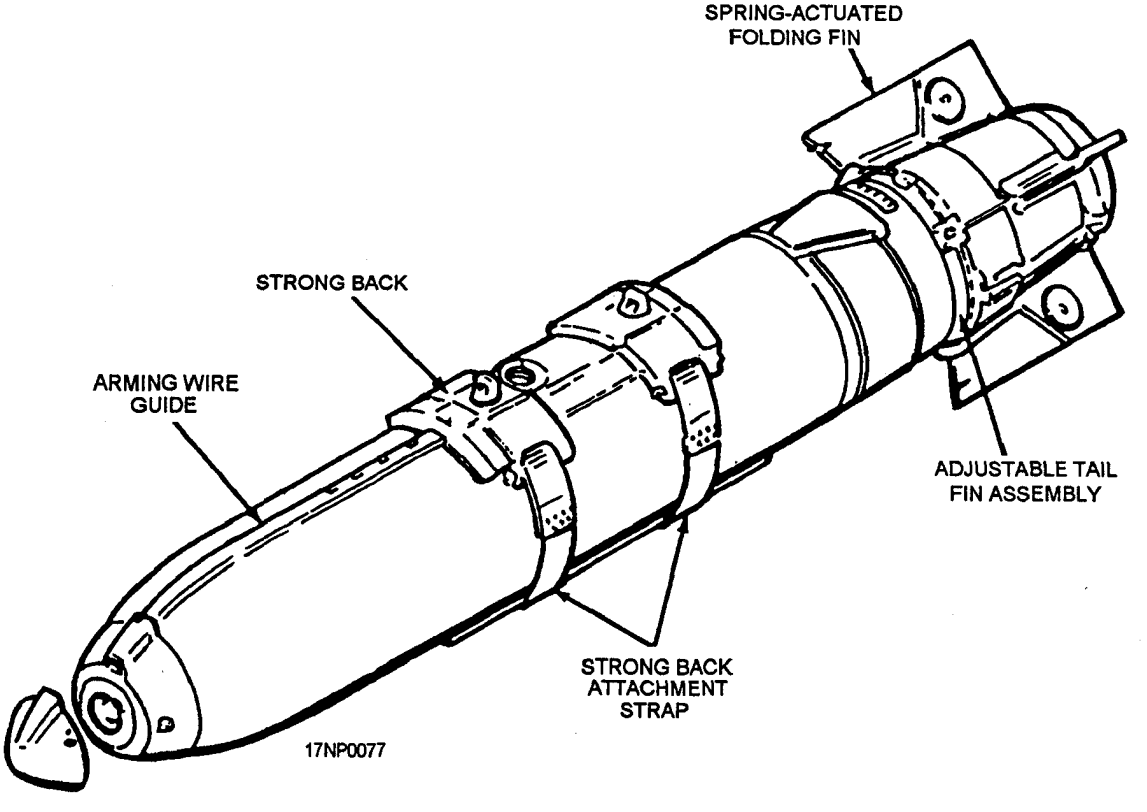


Figure 1-46.—Mk 116 Weteye chemical bomb.

CHEMICAL SPRAY TANKS

Chemical spray tanks are containers which are designed for external use on aircraft for the dissemination of toxic chemical agents, smoke, and incapacitating chemical agents.

Aero 14B Spray Tank

The Aero 14B spray tank is a pressure-controlled, combination storage container and airborne dispersion munition for chemical warfare agents,

Aero 12 Aircraft Chemical Tank

The Mk 12 chemical tank is designed to generate a smoke screen capability for high performance aircraft.

SAFETY PRECAUTIONS

LEARNING OBJECTIVE: *Recognize the safety precautions to follow when working with bombs, fuzes, and associated components.*

Most fuzes contain a charge of high explosives and must be handled carefully. When compared to the burster charge, the amount of explosives is small; however, the explosives in fuzes are much more sensitive. Fuzes are manufactured to meet all safety requirements when used properly. However, the safety features designed in any weapon or explosive component are only as reliable as the person using them.

Fuzes are packed in sealed, moistureproof containers, and should not be unsealed until they are required for use. Fuzes unpacked and not used should be returned to their original condition, repacked, and dated. Once the hermetic seal is broken, these fuzes should be used before those that are still hermetically sealed. Mk 344 or Mk 376 electric fuzes that have been removed from their sealed containers and whose shipping caps have been removed and repacked for more than 30 days must be disposed of according to current directives. Additionally, dispose of electric fuzes exposed to excessive moisture, regardless of length of time.

Fuzes must be handled carefully at all times and should never be dropped, tumbled, dragged, or thrown. They should not be struck with a hammer or any tool, either to open the container or to align them in a stowage rack.

Fuzes should not be packed or unpacked in the magazine. When a fuze is unpacked, it should be examined to ensure that the shipping seals are intact and that the arming stem is not unscrewed Safety cotter pins, shipping wires, and seals should be left in place until the arming wire is assembled into the fuze. Arming vane assemblies must not be bent or distorted.

The hazards of bomb ammunition will vary, depending on the types and quantities of explosives involved. Regardless of the particular weapons being handled, potential hazards are always present. Explosive bomb ammunition is hazardous because of its tendency, when detonated, to set off all explosive material that is near it.

Although bomb ammunition containing high explosives causes greater injury to personnel and loss of equipment, the improper handling of practice bombs causes more frequent injury to personnel. When handling practice bombs, the weight factor alone can cause severe injury or even loss of limb. Dropping a practice bomb, even a short distance, with a practice bomb signal cartridge installed can cause the cartridge to detonate, resulting in severe and permanent injury to personnel.

Accidents are prevented through good design, testing, and careful handling of ordnance. Safety precautions must be followed, All personnel involved in weapons handling must be briefed on particular safety precautions before actually handling weapons, All personnel who handle ordnance must be qualified and certified. Newly assigned personnel, still under training, are assigned as crew members and never permitted to work alone until they are fully qualified and certified.

Specific safety precautions for bomb ammunition are outlined in the publications for the specific ammunition and the aircraft loading manuals.

REVIEW NUMBER 11

Q1. What is the maximum length of time that the Mk 344 and Mk 376 electrical tail fuzes can be used after they are removed from their container?

Q2. In what location should you ***never*** *pack or unpack fuzes ?*

Q3. Why is explosive bomb ammunition hazardous?

Q4. Handling _____ causes more injuries than handling _____ .

REVIEW NUMBER 10 ANSWERS TO QUESTIONS Q1 THROUGH Q4.

A1. Practice bombs are primarily used for safety when training new or inexperienced pilots and ground-handling crews.

A2. The two general types of practice bombs are the subcaliber and the full-scale bombs.

A3. The Mk 76 Mod 5 subcaliber practice bomb is used for impact firing only.

The BDU-48/B subcaliber practice bomb is used to simulate retarded weapons delivery.

A4. Mk 80 (series) inert LDGP bombs are painted blue.

REVIEW NUMBER 11 ANSWERS TO QUESTIONS Q1. THROUGH Q4.

A1. Don't use a fuze that has been removed from its hermetically sealed container for over 30 days.

A2. Never unpack fuzes from their containers in the magazine.

A3. Explosive bomb ammunition is hazardous because of its tendency to set off all explosive material near it if it is detonated.

A4. Handling practice bombs causes more injuries than handling bomb ammunition containing high explosives.

CHAPTER 2

AIRCRAFT ROCKETS AND ROCKET LAUNCHERS

The history of rockets covers a span of eight centuries, but their use in aircraft armament began during World War II. Rockets answered the need for a large missile that could be fired without recoil from an aircraft.

Since the airborne rocket is usually launched at close range and measured in yards or meters, its accuracy as a propelled projectile is higher than a free-falling bomb dropped from high altitude.

AIRCRAFT ROCKETS

LEARNING OBJECTIVE: *State the principles of rocket propulsion. Identify rocket components to include motors, warheads, and fuzes. Identify the purpose and use of service rocket assemblies to include the 2.75-inch folding-fin aircraft rocket (FFAR), the low-spin folding-fin aircraft rocket (LSFFAR), and the 5.00-inch FFAR.*

There are two rockets currently used by the Navy. The first is the 2.75-inch, folding-fin aircraft rocket (FFAR) known as the Mighty Mouse. The second, a 5.0-inch, folding-fin rocket known as the Zuni. The Mighty Mouse and the Zuni are discussed in detail later in this chapter.

ROCKET AND ROCKET FUZE TERMINOLOGY

Some of the more common terms peculiar to rockets and rocket components used in this chapter are defined as follows:

Acceleration/deceleration. These terms apply to fuzes that use a gear timing device in conjunction with the setback principle. Prolonged acceleration completes arming the fuze, and deceleration or proximity initiates detonation.

Igniter. The initiating device that ignites the propellant grain. It is usually an assembly consisting of an electric squib, match composition, black powder, and magnesium powder.

Hangfire. A misfire that later fires from delayed ignition.

Misfire. A rocket does not fire when the firing circuit is energized.

Motor. The propulsive component of a rocket. It consists of the propellant, the igniter, and the nozzle(s).

Propellant grain. The solid fuel used in a rocket motor, which, upon burning, generates a volume of hot gases that stream from the nozzle and propel the rocket (also known as the propellant or propellant powder grain).

Rocket. A missile propelled by the sustained reaction of a discharging jet of gas against the container of gas.

Setback. This term is applied when internal parts react to the acceleration of the rocket. Setback is a safety feature designed into those fuzes that use a gear timing device.

Thrust. The force exerted by the gases produced by the burning of the rocket motor propellant.

PRINCIPLES OF ROCKET PROPULSION

Rockets are propelled by the rearward expulsion of expanding gases from the nozzle of the motor. The necessary gas forces are produced by burning a mass of propellant at high pressure inside the motor tube. Rockets function even in a vacuum. The propellant contains its own oxidizers to provide the necessary oxygen during burning.

As you read this section, refer to figure 2-1. To understand how a rocket operates, visualize a closed container that contains a gas under pressure. The pressure of the gas against all the interior surfaces is equal (view A). If the right end of the container is removed (view B), the pressure against the left end will cause the container to move to the left.

In the rocket motor, gases produced by the burning propellant are confined to permit a buildup of pressure to sustain a driving force. The size of the opening is restricted by a Venturi-type nozzle (view C). The Venturi-type nozzle decreases the turbulence of escaping gases and increases the thrust. In this design, gas pressure inside the container provides about 70 percent of the force, and the escaping gases provide about 30 percent of the force necessary to move the container forward.

ROCKET COMPONENTS

A complete round of service rocket ammunition consists of three major components-the motor, the warhead, and a fuze. A general description of these components is given in the following paragraphs.

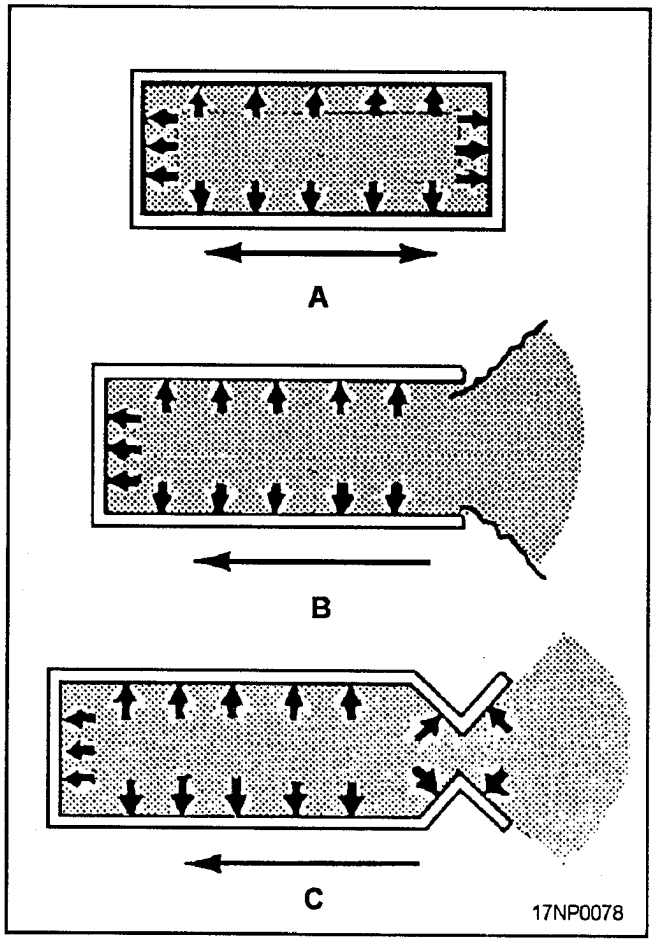


Figure 2-1.—Principles of rocket propulsion.

Motors

The rocket motor consists of components that propel and stabilize the rocket in flight. Not all rocket motors are identical, but they do have certain common components. These components are the motor tube, propellant, inhibitors, stabilizing rod, igniter, and nozzle and fin assembly. The rocket motors discussed in the following paragraphs are for the 2.75-inch Mk 4 Mods, Mk 40 Mods, the 5.0-inch Mk 16 Mods, and Mk 71 Mods.

MOTOR TUBE.— The motor tube (fig. 2-2) supports the other components of the rocket. Presently, all motor tubes are aluminum, threaded internally at the front end for warhead installation, and grooved or threaded internally at the aft end for nozzle and fin assembly installation.

The Mk 4 Mods 1 through 6 and the Mk 40 Mod 0 have a nonintegral (two-piece) bulkhead at the forward end of the tube. This bulkhead has a disc that blows out in case of accidental propellant ignition before installation of the warhead. This action neutralizes rocket thrust by allowing gas produced by the burning propellant to escape from both the forward and aft ends of the motor tube, making it nonpropulsive. **It is still a fire hazard.** All other Mark and Mod motors discussed in this chapter have tubes with integral bulkheads that do not rupture. In case of accidental propellant ignition, these motors are propulsive, becoming a missile hazard as well as a fire hazard.

PROPELLANTS.— The propellant grain (fig. 2-2) contained in the Navy's 2.75-inch and the 5.0-inch rocket motors is an internal burning, star perforation, double-base solid propellant. The star perforation is designed to produce a nearly constant thrust level.

The Mk 66 rocket motor has the star points machined off (conned) to reduce erosive burning. In addition this propellant grain is 5 inches longer than the Mk 4/40 propellant grain.

INHIBITORS.— Inhibitors restrict or control burning on the propellant surface. In the 2.75-inch and the 5.0-inch motors, the propellant grains are inhibited at the forward and aft ends, as well as the entire outer diametral surface. The forward and aft end inhibitors are molded plastic (ethyl cellulose) components bonded

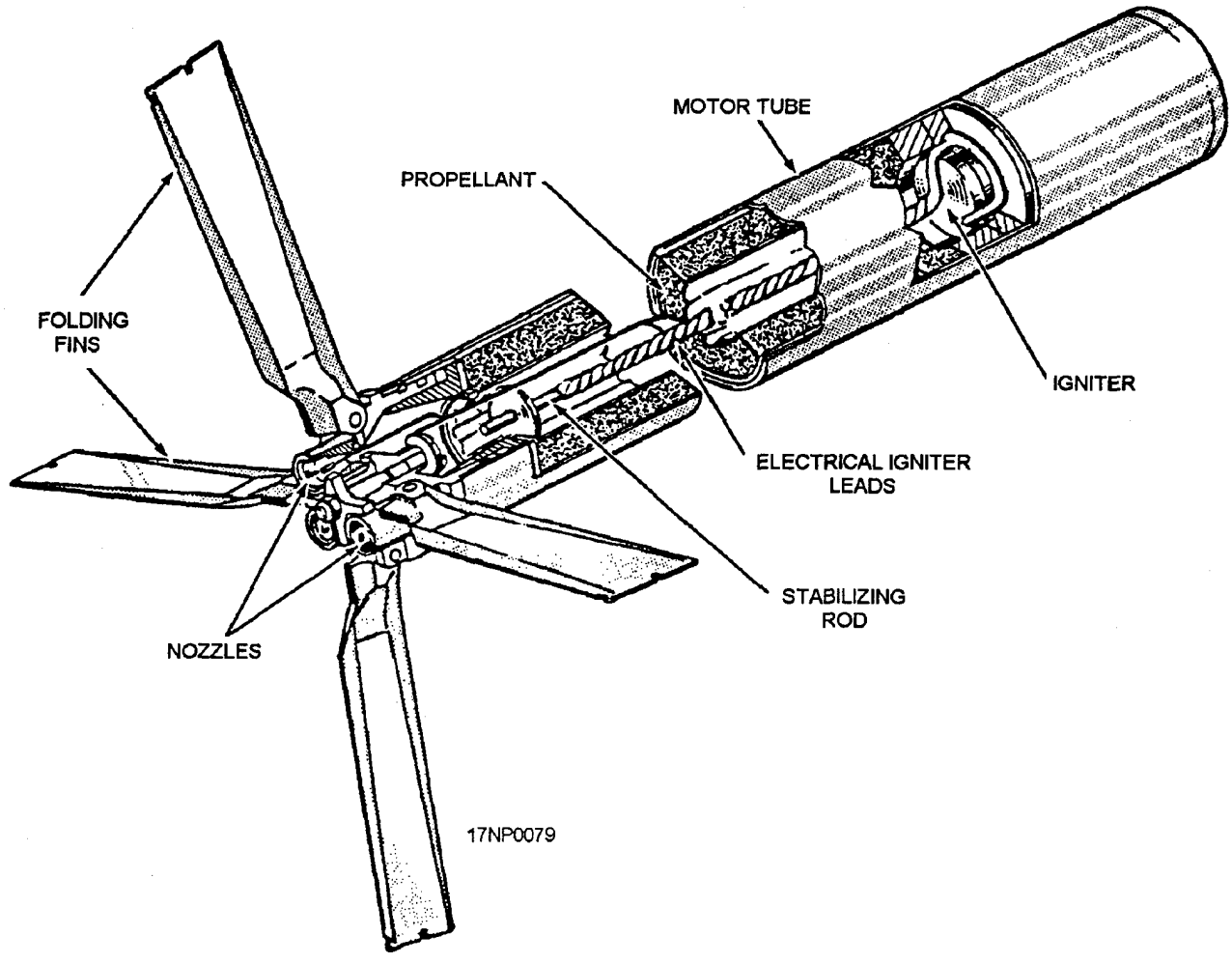


Figure 2-2.—Components of a typical rocket motor.

to the propellant ends. The outer surface inhibitor is spirally wrapped ethyl cellulose tape bonded to the propellant surface.

Inhibitors cause the propellant grain to burn from the center outward and from forward to aft uniformly. If inhibitors weren't used, the burning surface of the propellant grain would increase, and result in an increased burning rate. This could cause the motor tube to explode from excessive pressure. If a motor is accidentally dropped and the propellant grain is cracked, the crack in the grain increases the burning surface and an identical hazard exists.

STABILIZING ROD.— The stabilizing rod (fig. 2-2), located in the perforation of the motor propellant grain, is salt coated to prevent unstable burning of the propellant. It also reduces flash and afterburning in the rocket motor, which could contribute to compressor stall and flameout of the aircraft jet engines. When the propellant ignites, the stabilizing rod ensures that the grain ignites simultaneously forward and aft.

IGNITER.— The igniter (fig. 2-2) heats the propellant grain to ignition temperature. The igniter used in the 2.75-inch motor is a disc-shaped metal container that contains a black powder and magnesium charge, a squib, and electrical lead wires. It is located at the forward end of the motor. The igniter used in the 5.0-inch motor is a disc-shaped metal container that contains a powder or pellet charge, two squibs, and electrical lead wires. It is located at the forward end of the motor. A contact disc or a contact band transmits the firing impulses to the motor igniter.

The 2.75-inch motor has electrical leads that extend from the squib through the wall of the igniter. They are routed through the propellant perforation to the nozzle fin assembly. One of the wires is connected to the nozzle plate (ground), and the other passes through

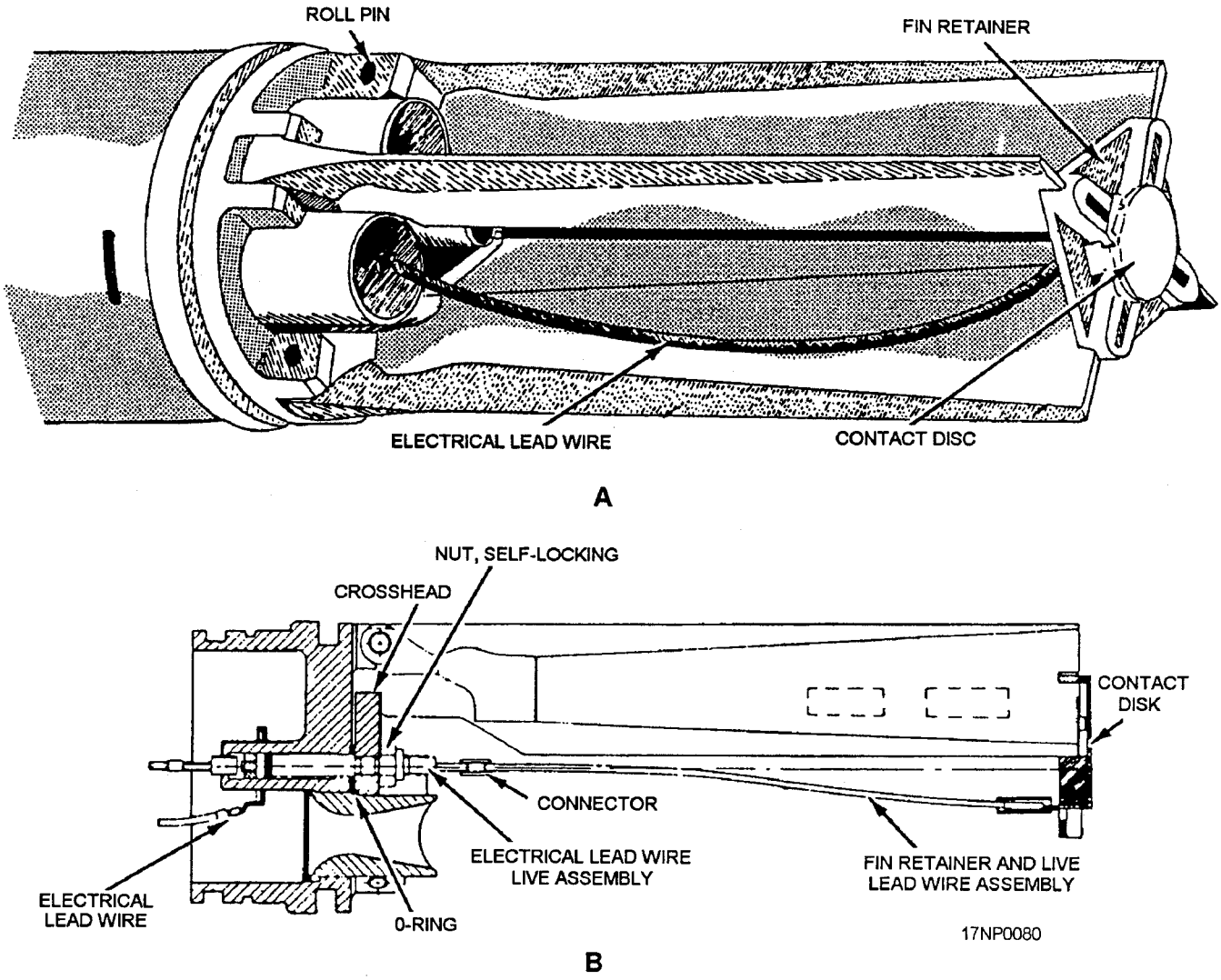


Figure 2-3.—Typical center electrical lead wire connection (2.75-inch motor),

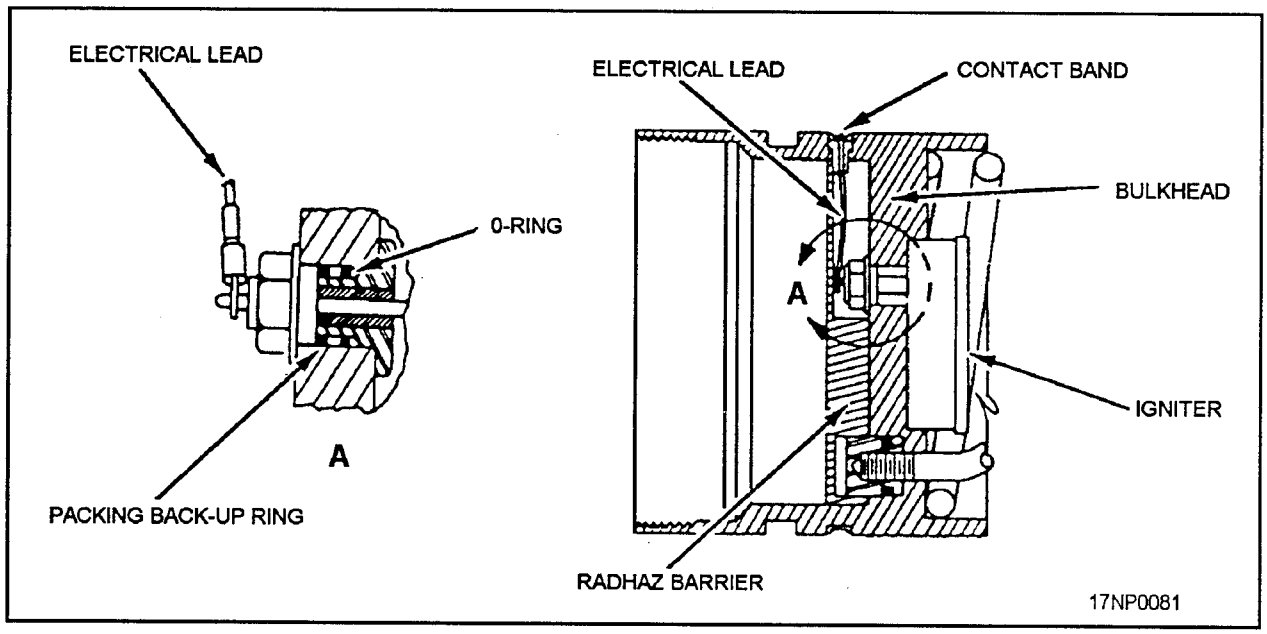


Figure 2-4.—Typical center electrical lead wire connection (5.0-inch motor).

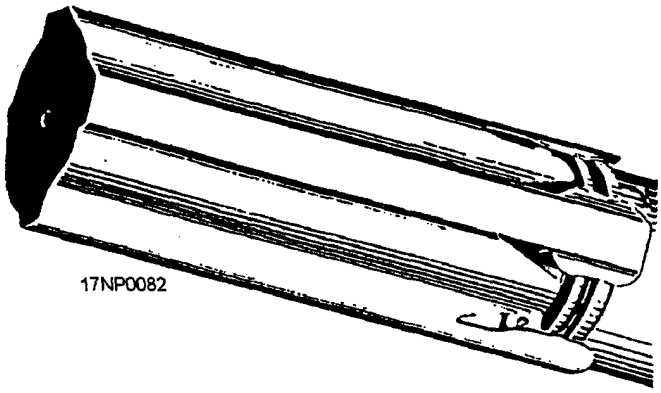


Figure 2-5.—Fin protector in place.

either one of the nozzles (fig. 2-3, view A) or the fin-actuating piston (fig. 2-3, view B) to the contact disc (fig. 2-3, views A and B) on the fin retainer. In the Mk 66 Mod 2, both lead wires are connected directly to the HERO filter wires which extend out of the forward end of the stabilizing rod. When the rocket is placed in the launcher, the contact disc is automatically in contact with an electrical terminal that transmits the firing impulse to the rocket.

The igniter in the 5.0-inch motor (fig. 2-4) has an electrical lead wire post that protrudes through the forward bulkhead closure. The electrical lead connects the igniter to the contact band. When the rocket is placed in the launcher, the contact band is automatically in contact with an electrical terminal, which transmits the firing impulse to the rocket.

Both the 2.75-inch and 5.0-inch rockets are susceptible to radio-frequency energy when they are not installed in the launchers.

When stowed and shipped separately from the launcher, the Mk 4 and Mk 40 motor fins are covered with a fin protector (fig. 2-5), which is an elongated steel can. A conical-coiled steel spring riveted to the center of the base inside the fin protector makes contact with the insulated contact disc at the aft end of the fins. This shorts out the igniter firing circuit to prevent accidental firing of the motor.

If Mk 16 and Mk 71 motors aren't shipped and stowed in a launcher, they are shipped and stowed in individual, padded, wooden crates. Fin protectors are not used. Until actually loaded into a launcher, a metal shielding band (fig. 2-6) is always in place over the ignition contact band.

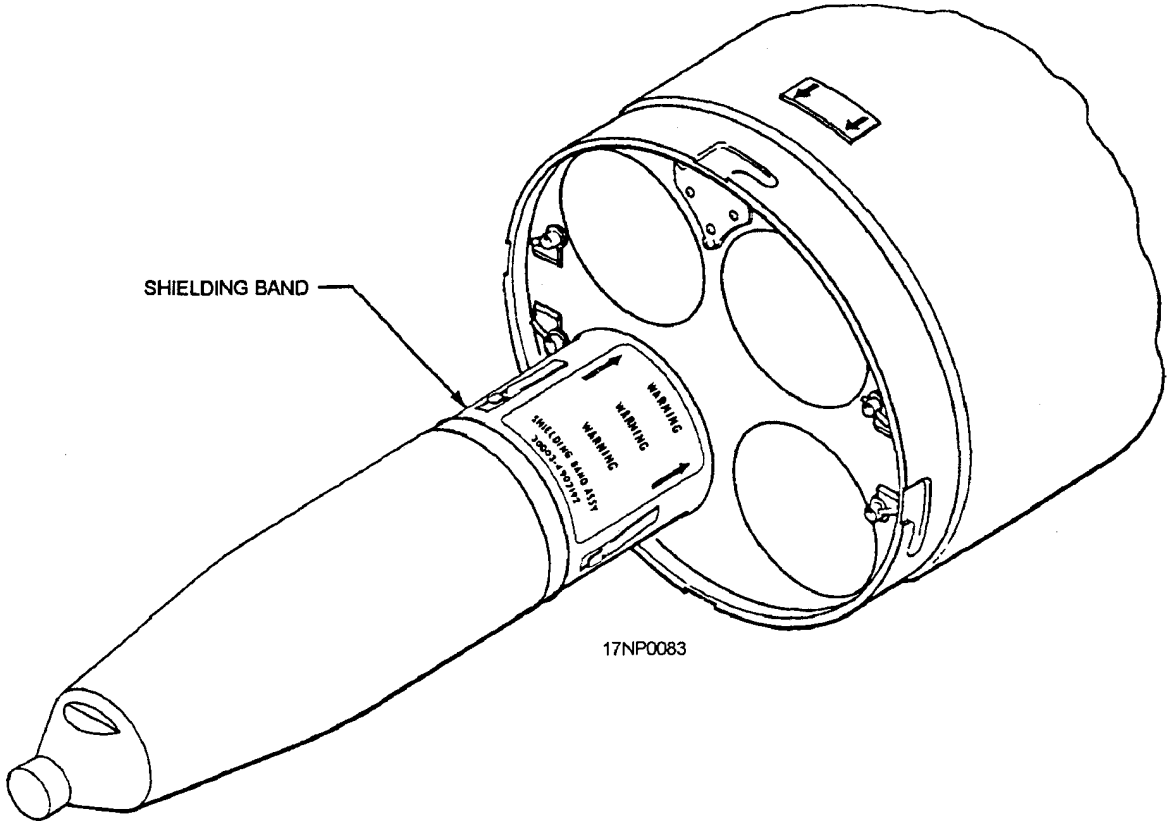


Figure 2-6.—Shielding band for 5.0-inch FFAR.

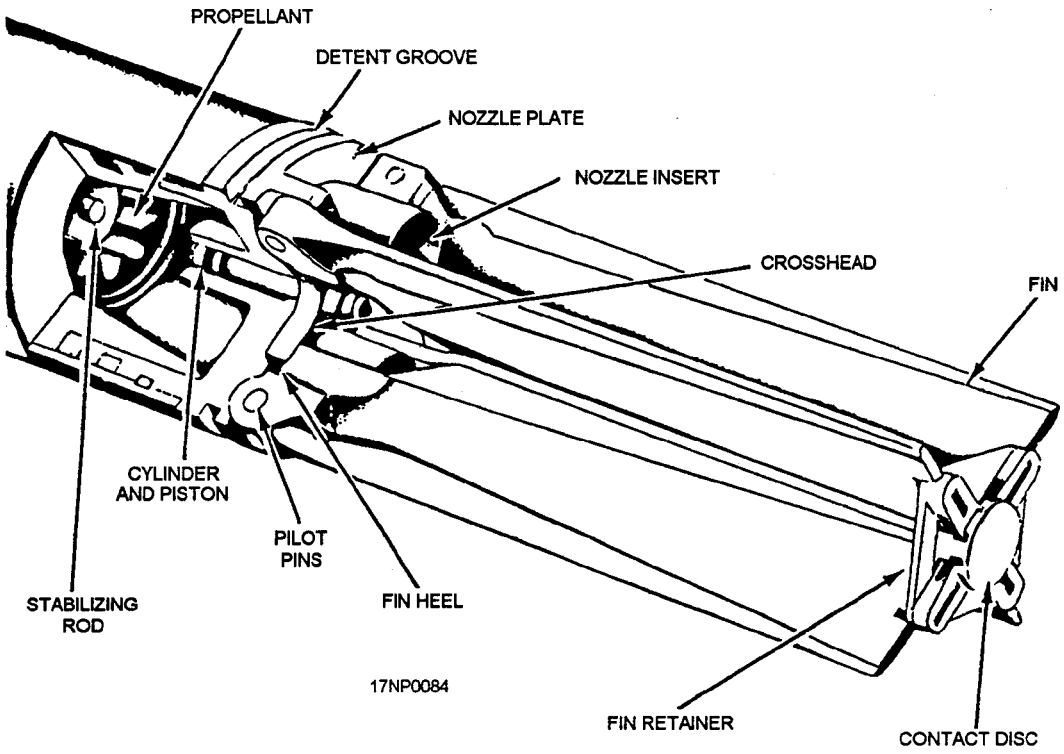


Figure 2-7.—Nozzle and fin assembly (2.75-inch).

NOZZLE AND FIN ASSEMBLIES.—The nozzle and fin assembly (fig. 2-7) used with the Mk 4 and Mk 40 motors consists of a nozzle plate, four nozzle inserts, a fin-actuating mechanism, four fins, and a fin retainer contact disc. The nozzle assembly for the Mk 66 consists of the nozzle body, carbon insert, fins, contact band assembly, and weather seal.

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

The fin-actuating mechanism is a steel cylinder and a piston with a crosshead attached to its aft end. When the rocket is fired, gas pressure from the motor operates the piston, cylinder, and crosshead. The crosshead is pushed against the heels of the fins, causing the fins to rotate on the fin pivot pins to the open position after the rocket leaves the launcher. After the fins have opened to the final flight position, the crosshead prevents the fins from closing.

There are four nozzle inserts and the detent groove in the aft end of the nozzle plate. They hold the rocket in position after it is loaded in the launcher (fig. 2-8). The major difference between the nozzle and fin assemblies used on the Mk 4 and Mk 40 motors is the type of nozzle inserts used.

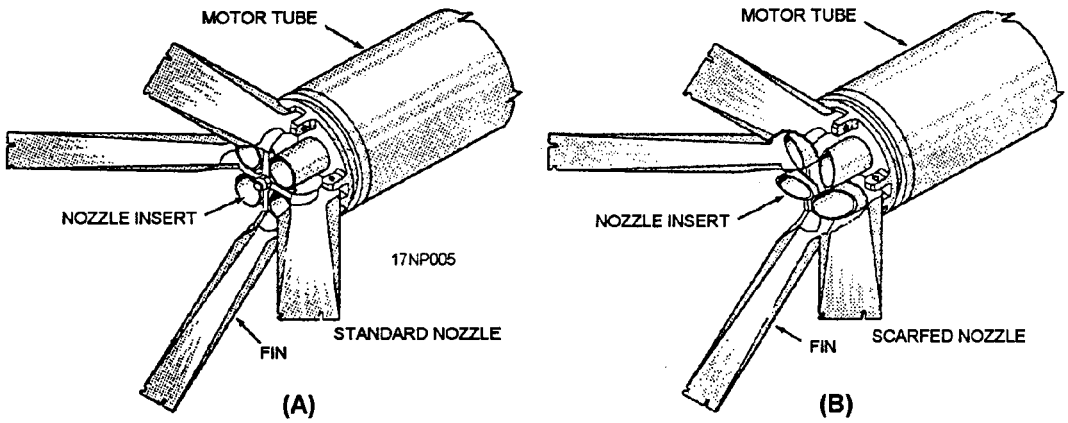


Figure 2-8.—Nozzle and fin assemblies. (A) Mk 4 Mods motor (B) Mk 40 Mods motor.

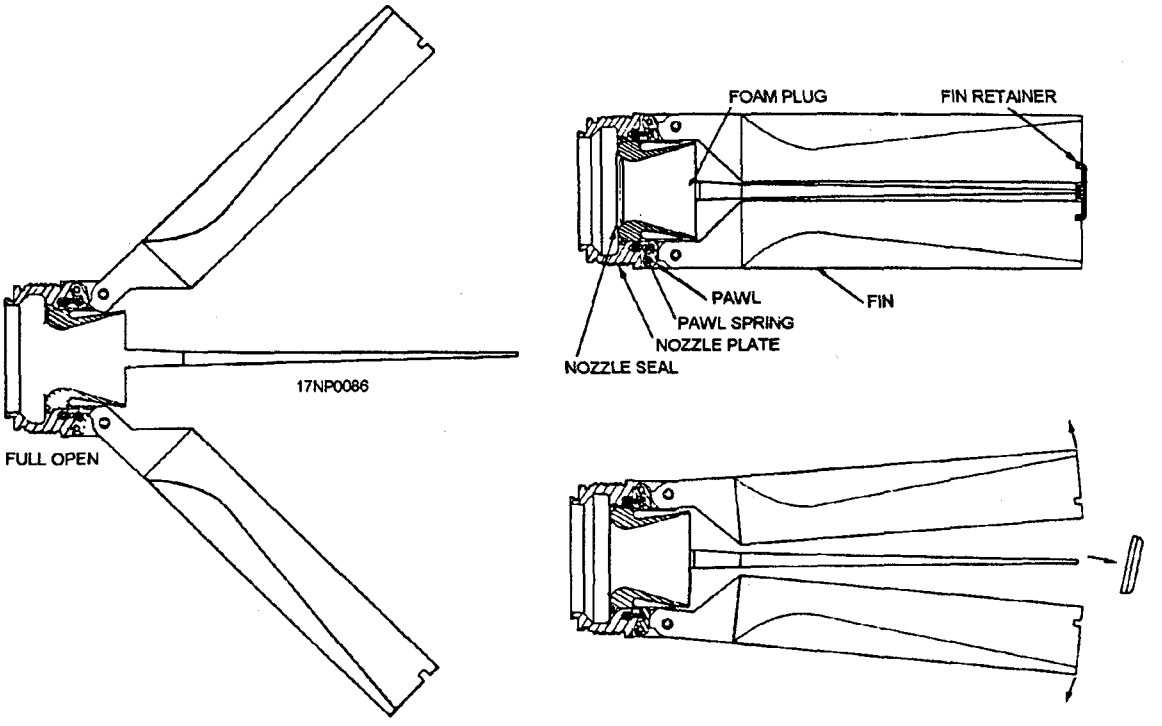


Figure 2-9.—Mk 16 motor, nozzle, and fin assembly.

The nozzle inserts of the Mk 4 motors are standard or straight cut (fig. 2-8, view A), while the Mk 40 motor nozzle inserts are scarfed or cut at an angle (fig. 2-8, view B). The scarfed nozzles used on the Mk 40 motor impart a stabilizing spin to the rocket when launched at low initial-launch speeds, such as from helicopters and low-speed aircraft. A rocket using the Mk 40 motor is designated a LSFFAR (low-speed, folding-fin, aircraft rocket) and is used only on helicopters or low-speed aircraft.

All Mk 16 motors have a single nozzle with four straight folding fins (fig. 2-9) that attach to the aft end of the motor tube by threads. To protect the propellant grain from moisture and to promote propellant grain ignition, the nozzle opening is closed by a thin metal seal and a foam plug. A light plastic fin retainer holds the fins folded within the diameter of the rocket until propellant ignition. On ignition, the fin retainer is blown off. Gas pressure exerted on the heels of the fins pushes the fins open as they emerge from the launcher tube. The fins are then locked in the flight position by the spring-loaded pawls.

The Mk 16 Mod motor has a modified igniter and a modified nozzle and fin assembly. The nozzle and fin assembly (fig. 2-10) contains four, spring-loaded, wraparound fins inside the motor diameter. The steel nozzle expansion cone has flutes that cause the rocket to spin during free flight. This permits the rocket to be launched from high-speed aircraft, helicopters, and low-speed aircraft.

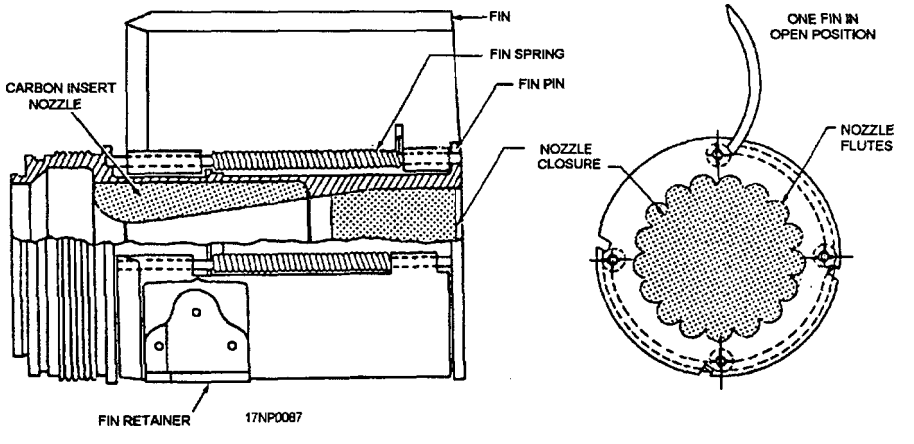


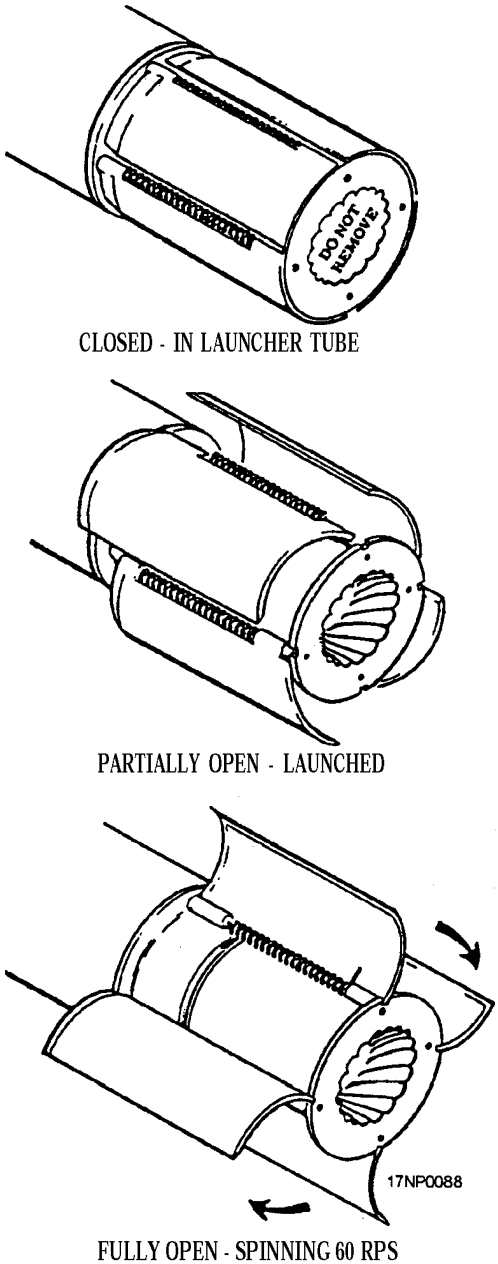
Figure 2-10.—Mk 71 Mod 0 motor, nozzle, and fin assembly.

The Mk 71 Mods spring-loaded fin (fig. 2-11) deploy after emerging from the rocket launcher tube. They lock in place (open) by sliding into a locking slot in the flange at the aft end of the fin nozzle assembly. When not actually installed in the launcher, the fins are held in the closed position by a fin retainer band, which must be removed when the rocket is installed into the launcher tube.

REVIEW NUMBER 1

Q1. List the two rockets currently used by the Navy.

Q2. *If a rocket does not fire when the firing circuit is energized, it is known as a _____ .*



CLOSED - IN LAUNCHER TUBE

PARTIALLY OPEN - LAUNCHED

FULLY OPEN - SPINNING 60 RPS

Figure 2-11.—Mk 71 Mods motor, nozzle, and fin assembly.

Q3. What is meant by the rockets thrust?

Q4. In rocket propulsion, the Venturi nozzle decreases turbulence of escaping gases and increases thrust. Gas pressure inside the container provides about _____, and the escaping gases provide about_____ to move the container forward.

Q5. List the three components of a rocket.

Q6. List the components of rocket motors.

Q7. What is the purpose of the inhibitor?

Q8. What rocket component is salt coated to prevent unstable burning of the rocket propellant?

Q9. When are rockets most susceptible to radio-frequency (RF) energy?

Q10. Name the type of nozzle installed in the Mk 40 rocket motor.

Q11. Explain the difference between the Mk 16 and Mk 71 rocket motors.

Q12. When should you remove the fin retainer band on a Mk 71 rocket motor?

Warheads

Different tactical requirements demand different types of rocket warheads be used with airborne rockets. Warheads are classified as either 2.75 inch or 5.0 inch warheads. They may be further classified as high-explosive, flechette, smoke, flare, or practice. Warheads for 2.75-inch rockets are normally received with the fuzes installed.

There are many different warheads, fuzes, and motor combinations available. Therefore, the following discussion is general. For specific component information, you should refer to *Airborne Rockets,* NAVAIR 11-85-5.

High-explosive warheads contain high-explosive material (generally comp-B) surrounded by a metal case. An internally threaded nose fuze cavity permits the installation of a nose fuze or an inert nose plug, depending on tactical requirements. Some warhead configurations require the use of a base fuze. Base fuzes are installed at the factory and should never be removed. High-explosive warheads are painted olive drab and may have a narrow yellow band around the nose.

There are several types of high-explosive warheads, and each is designed for a specific type of target.

HE-FRAG WARHEADS.— High-explosive fragmentation (HE-FRAG) warheads (fig. 2-12) are

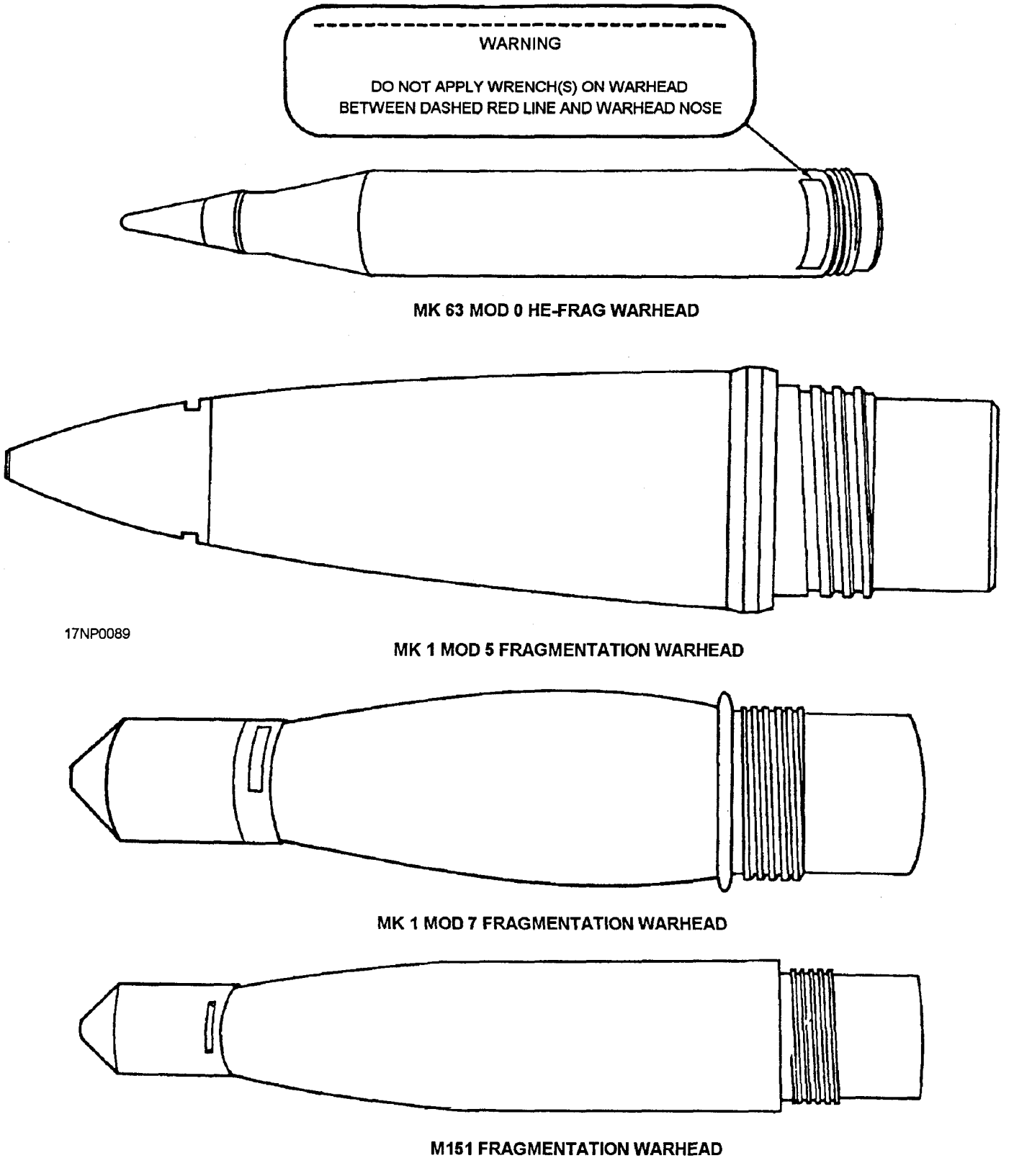


Figure 2-12.—High-explosive fragmentation (HE-FRAG) warheads.

used against personnel and light material targets, such as trucks and parked aircraft. Upon detonation, a large quantity of metal fragments accelerate to a high velocity. This action damages the target. The types of HE-FRAG warheads currently in use are listed in table 2-1.

HEAT WARHEADS.— High-explosive antitank (HEAT) warheads (fig. 2-13) are used against armored targets, such as tanks, bunkers, and armored vehicles. The warhead contains a shaped-charge. When detonated, it produces a high-energy jet that penetrates armored targets. The only HEAT warhead currently in use is the Mk 5 Mod 0.

AT/APERS WARHEAD.— The high-explosive antitank/antipersonnel (AT/APERS) warhead (fig. 2-14) combines the effectiveness of the HE-FRAG and HEAT warheads. The explosive shaped-charge in the AT/APERS warhead detonates at the aft end, producing

Table 2-1.—Service Warheads

TYPE	2.75-INCH	5.0-INCH
HE-FRAG	Mk 1 Mods 1, 3, 4, 5, and 7 M151	Mk 63 Mod 0
HEAT	Mk 5 Mod 0	----------
AT/APERS	----------	Mk 32 Mod 0
GP	----------	Mk 24 Mod 0
FLECHETTE	WDU-4A/A	----------
SMOKE	M156 Mk 67 Mod 0	Mk 34 Mods 0 and 1
FLARE	----------	Mk 33 Mod 1

REVIEW NUMBER 1 ANSWERS TO QUESTIONS Q1. THROUGH Q12.

A1. The two rockets currently used by the Navy are the 2.75-inch Mighty Mouse and the 5.0-inch Zuni.

A2. If a rocket does not fire when the firing circuit is energized, it is known as a misfire.

A3. Thrust is the force exerted by the gases produced by the burning of the rocket motor propellant.

A4. In rocket propulsion, the Venturi nozzle decreases turbulence of escaping gases and increases thrust. Gas pressure inside the container provides about 70% of the force, and the escaping gases provide about 30% of the force to move the container forward.

A5. The three components of a rocket are the motor, warhead, and fuze.

A6. The components of rocket motors include the motor tube, propellant, inhibitors, stabilizing rod, igniter and nozzle and fin assembly.

A7. The inhibitor restricts or controls burning on the propellant.

A8. The stabilizing rod is salt coated to prevent unstable burning of the rocket propellant.

A9. Rockets are most susceptible to radio-frequency (RF) energy when they aren't installed in the launcher.

A10. The scarfed nozzle installed in the Mk 40 rocket motor

A11. The Mk 16 rocket motor has a modified igniter nozzle, and fin assembly.

A12. You should remove the fin retainer band on the Mk 71 rocket motor when the rocket is installed into the launcher tube.

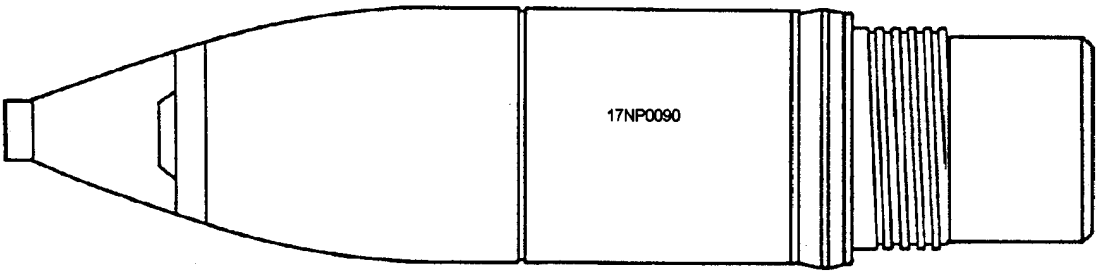


Figure 2-13.—Mk 5 Mod 0 high-explosive antitank warhead.

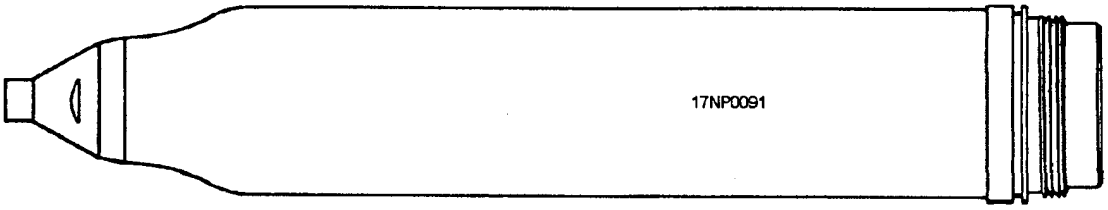


Figure 2-14.—Mk 32 Mod 0 AT/APERS warhead.

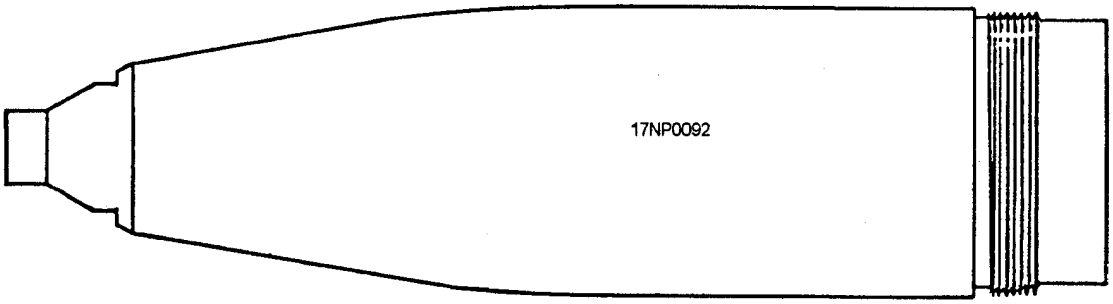


Figure 2-15.—Mk 24 Mod 0 high-explosive, general-purpose (GP) warhead.

the jet from the cone at the forward end. The booster in the aft end detonates the warhead by transmitting an explosive impulse along a length of detonating cord. It connects the booster charge to the initiating charge, which is next to the nose fuze. The combination of an instantaneous-acting nose fuze and rapid-burning detonating cord permits detonation of the explosive load in time for the shaped-charge to produce its explosive jet before being disintegrated upon target impact. The only AT/APERS warhead currently in use is the Mk 32 Mod 0.

GP WARHEAD.— The high-explosive, general-purpose (GP) warhead (fig. 2-15) is a compromise between the armor-piercing and the fragmentation designs. The walls and nose section are not as strong as those of an armor-piercing warhead, yet they are stronger than those of a fragmentation warhead. The explosive charge is greater than that in the armor-piercing warhead, but less than that in the fragmentation warhead.

The GP warhead is used against a variety of targets. Maximum penetration is obtained by using a solid nose plug and the delayed-action base fuze. Its maximum blast effect is obtained by using an instantaneous-acting nose fuze. The only GP warhead currently in use is the Mk 24 Mod 0.

FLECHETTE WARHEADS.— Flechette warheads (fig. 2-16) are used against personnel and light

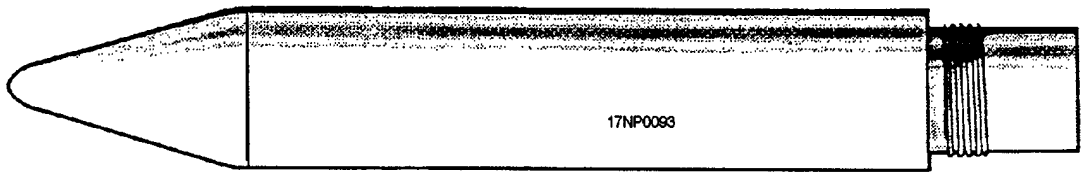


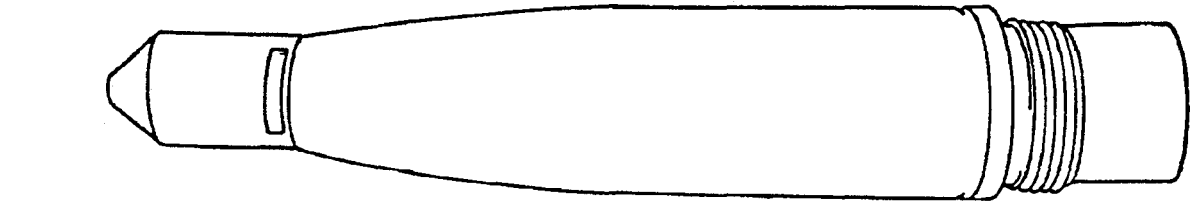
Figure 2-16.—WDU-A/A flechette warhead.

armored targets. These warheads contain a large number of small arrow-shaped projectiles. A small explosive charge in the base fuze of the warhead dispenses the flechettes through the nose of the warhead after rocket motor burnout. Target damage is caused by impact of the high-velocity flechettes.

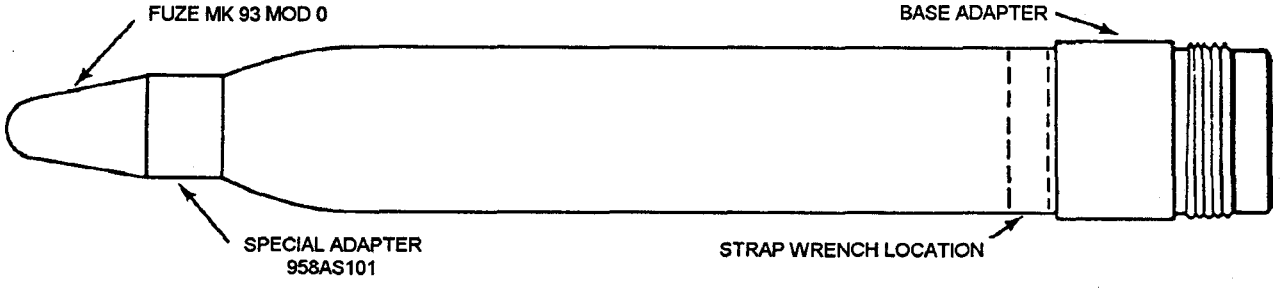
SMOKE WARHEADS.— Smoke warheads (fig. 2-17) are used to produce a volume of heavy smoke for target marking. The warhead contains a burster tube of explosives, usually comp-B, which bursts the walls of the warhead, dispersing the smoke. These warheads are designated SMOKE, followed by the abbreviation for the smoke producing agent it contains. For example, WP for white phosphorus, or PWP for plasticized white phosphorus. The types of smoke warheads currently in use are listed in table 2-1.

FLARE WARHEADS.— Flare warheads (fig. 2-18) are used to illuminate tactical operations. They consist of a delay-action fuze, an illuminating candle, and a parachute assembly. The fuze ignites the expelling charge, which separates the case from the candle and parachute assembly. The wind stream forces the parachute open, suspending the burning candle. The only flare warhead currently in use is the Mk 33 Mod 1.

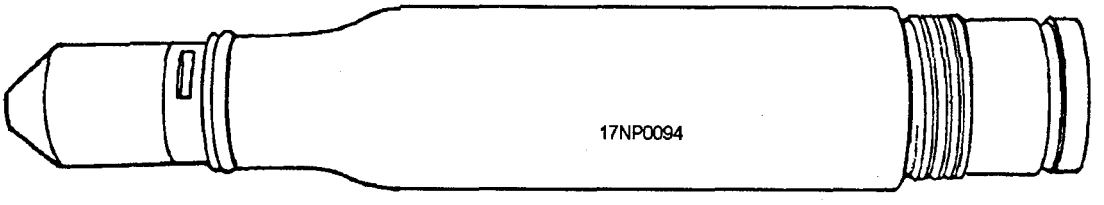
PRACTICE WARHEADS.— Practice warheads are either dummy configurations or inert-loaded service warheads. In the inert-loaded service warheads, the weight and placement of the filler gives the practice warhead the same ballistic characteristics as the explosive-loaded service warhead. A steel nose plug is assembled in the practice heads in place of the nose fuze. The entire surface, except for the stenciled marking, is painted blue. The practice warheads currently in use are listed in table 2-2.



M156 SMOKE WARHEAD



MK 34 MOD 0 WARHEAD



MK 67 MOD 0 SMOKE WARHEAD

Figure 2-17.—Smoke warheads.

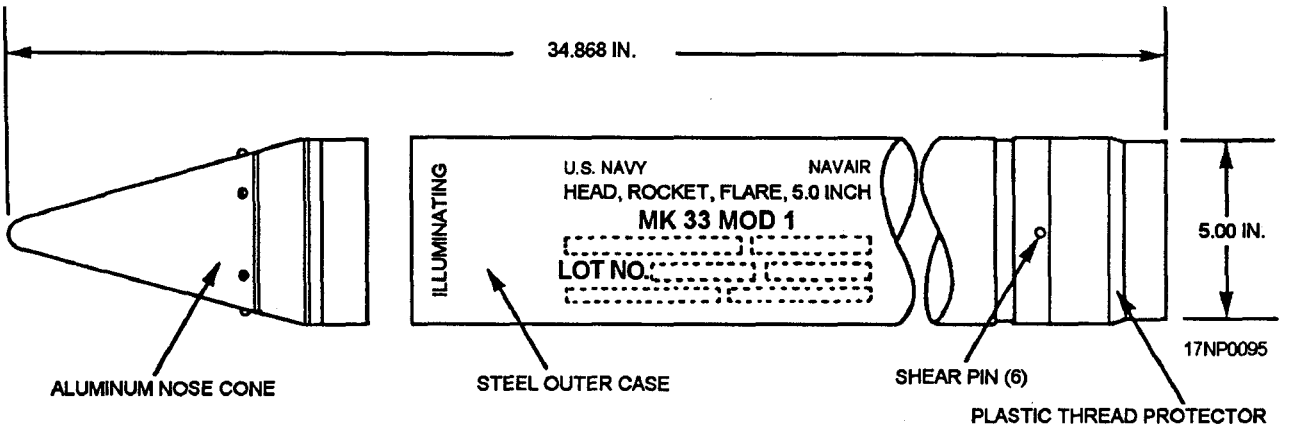


Figure 2-18.—Mk 33 Mod 1 flare warhead.

Table 2-2.—Practice Warheads

2.75-INCH	5-0-INCH
M 229	
Mk 1 Mods 1, 2, 3, 4, and 5	Mk 6 Mod 7
Mk 5	
WTU1/B	Mk 32 Mod 1
WTU-14/B	Mk 24 Mod 0
Mk 61 Mod 0	WTU-11/B

REVIEW NUMBER 2

Q1. What color are high-explosive rocket warheads?

Q2. What type of targets are HE-FRAG warheads used against?

Q3. The AT/APERS warhead is an effective combination of what other warheads?

Q4. What warhead contains a large number of small, arrow-shaped projectiles ?

Q5. Smoke warheads produce a volume of heavy smoke for____ .

Q6. What warhead is used to illuminate tactical operations?

Fuzes

Rocket fuzes are primarily classified by their location in the warhead; for example, nose fuze or base fuze. They are 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 launching of the complete rocket.

A representative fuze from each class is discussed in the following paragraphs. The fuzes currently in use and their primary application are listed in table 2-3. For more detailed information on fuzes, refer to *Airborne Rockets,* NAVAIR 11-85-5.

Table 2-3.—Rocket Fuzes

FUZE	CLASSIFICATION	APPLICATION	FIG
Mk 181 Mods 0 and 1	Nose impact (PD)	2.75-inch	
Mk 188 Mod 0	Nose impact (PD)	5.0-inch	
Mk 352 Mod 2	Nose impact (PD)	2.75-inch and 5.0-inch (Note 1)	
FMU-90/B	Nose impact (PD)	2.75-inch and 5.0-inch (Note 1)	
M423	Nose impact (PD)	2.75-inch (Note 2)	
M427	Nose impact (PD)	2.75-inch	
Mk 191	Base detonating impact (BD)	5.0-inch	
Mk 193 Mod 0	Mechanical time	5.0-inch	
Model 113A	Acceleration-decelera tion	2.75-inch	
Mk 93 Mod 0/ M414A1	Proximity	5.0-inch	
M429	Proximity	2.75-inch	

Note 1: Requires use of BBU-15/B adapter booster for 5.0-inch configurations.

Note 2: Designed for use with 2.75-inch LSFFARs only.

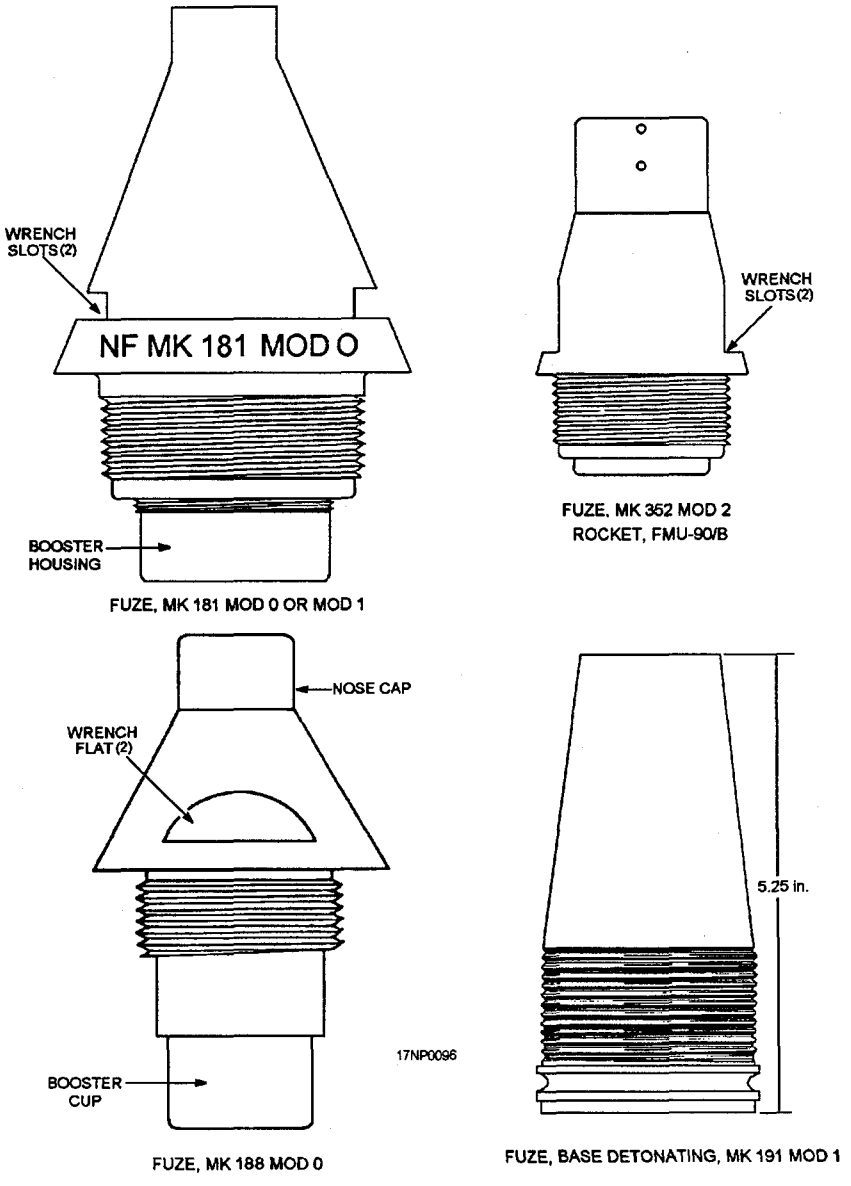


Figure 2-19.—Impact firing fuzes.

REVIEW NUMBER 2 ANSWERS TO QUESTIONS Q1. THROUGH Q6.

A1. High-explosive rocket warheads are painted olive drab and may have a narrow yellow band around the nose.

A2. HE-FRAG warheads are used against personnel and light material targets, such as trucks and parked aircraft.

A3. The AT/APERS warhead is an effective combination of the HE-FRAG and HEAT warheads.

A4. The flechette warhead contains a large number of small, arrow-shaped projectiles.

A5. Smoke warheads produce a volume of heavy smoke for target marking.

A6. The flare warhead is used to illuminate tactical operations.

IMPACT FIRING FUZES.— Impact firing fuzes (fig. 2-19) function when the rocket strikes a target that offers sufficient resistance to cause crushing or other disarrangement of actuating parts.

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. A given minimum acceleration over a given length of time is required to complete the arming cycle. If rocket acceleration is too low or extends over too short a period of time, the arming mechanism returns to the unarmed condition. The timing mechanism provides a safe separation distance from the launcher before arming.

When located in the nose of the warhead, impact firing fuzes are known as point-detonating (PD) fuzes. If they are located in the base of the warhead, they are known as base-detonating (BD) fuzes. Nose and base fuzes function either instantaneously or after a short delay that gives the warhead time to penetrate the target before functioning.

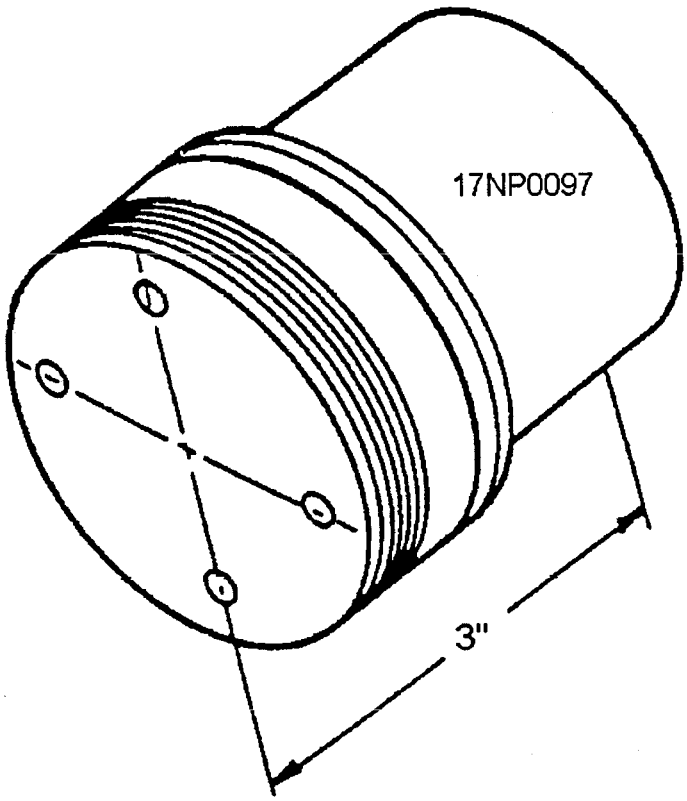


Figure 2-20.—Mk 193 Mod 0 mechanical time fuze.

MECHANICAL TIME FUZES.— Mechanical time fuzes (fig. 2-20) function by the action of a mechanical timer. 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.

The Mk 193 Mod 0 is the only mechanical time rocket fuze currently in use. It is permanently installed in the nose of the Mk 33 Mod 1 flare warhead.

ACCELERATION-DECELERATION FUZES.— Acceleration-deceleration fuzes are similar to impact and time fuzes because they require acceleration for a given time to complete the arming cycle. After the arming cycle is completed and the rocket velocity begins to drop, deceleration causes the fuze to function.

The Model 113A is the only acceleration-deceleration fuze in use by the Navy at this time. It is a base-mounted fuze that is permanently installed in the WDU-4A/A flechette warhead.

PROXIMITY FUZES.— Proximity fuzes, sometimes referred to as VT fuzes (figs. 2-21 and 2-22), initiate by "sensing," usually by electronic means, the presence and distance of a target. Proximity fuzes are primarily used in air-to-ground operations where air bursts above the target are desired. They are not suitable for use against targets that require penetration and detonation within the target for effective destruction.

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

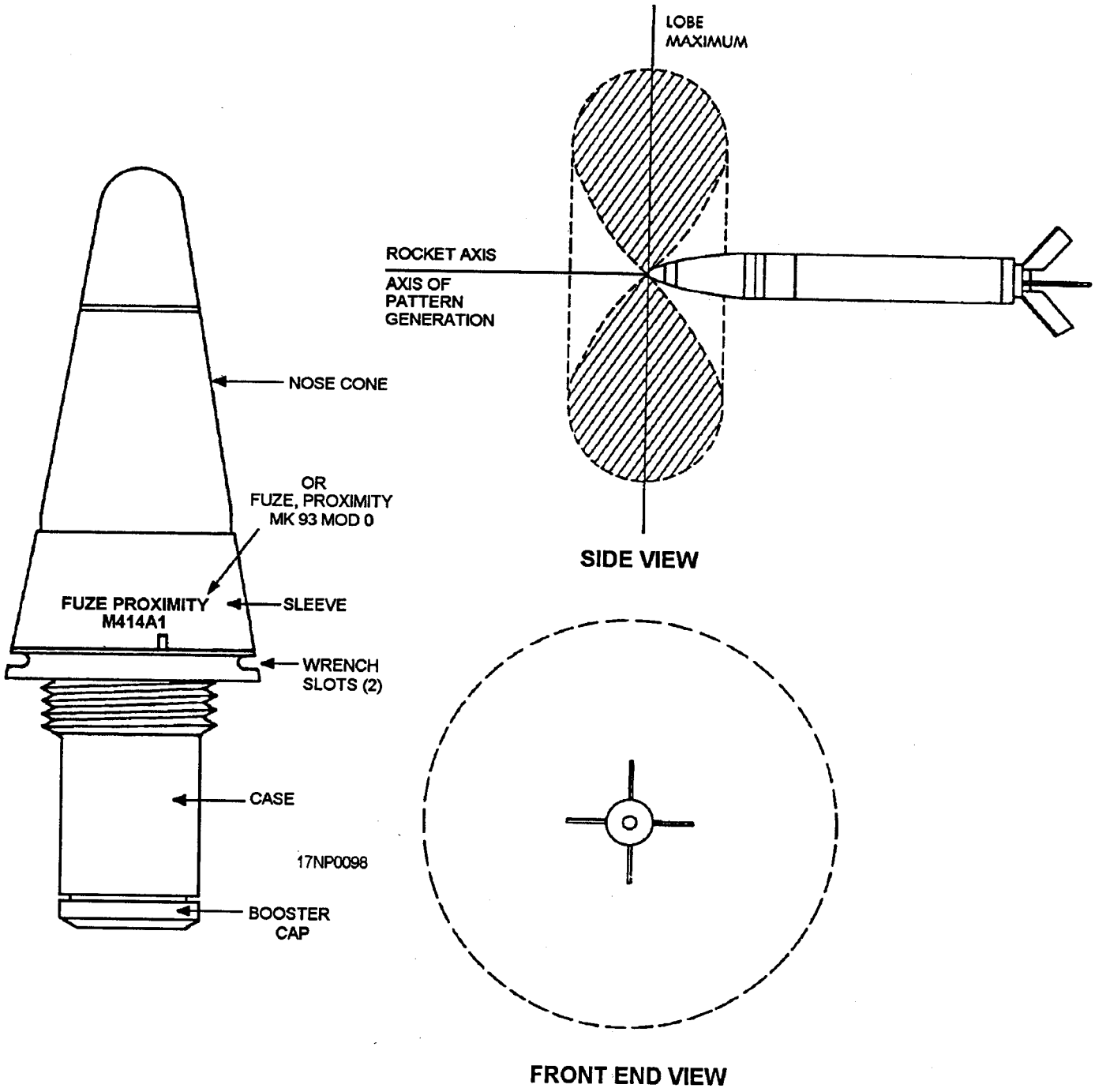


Figure 2-21.—Proximity fuze M414A1 or Mk 93 Mod 0.

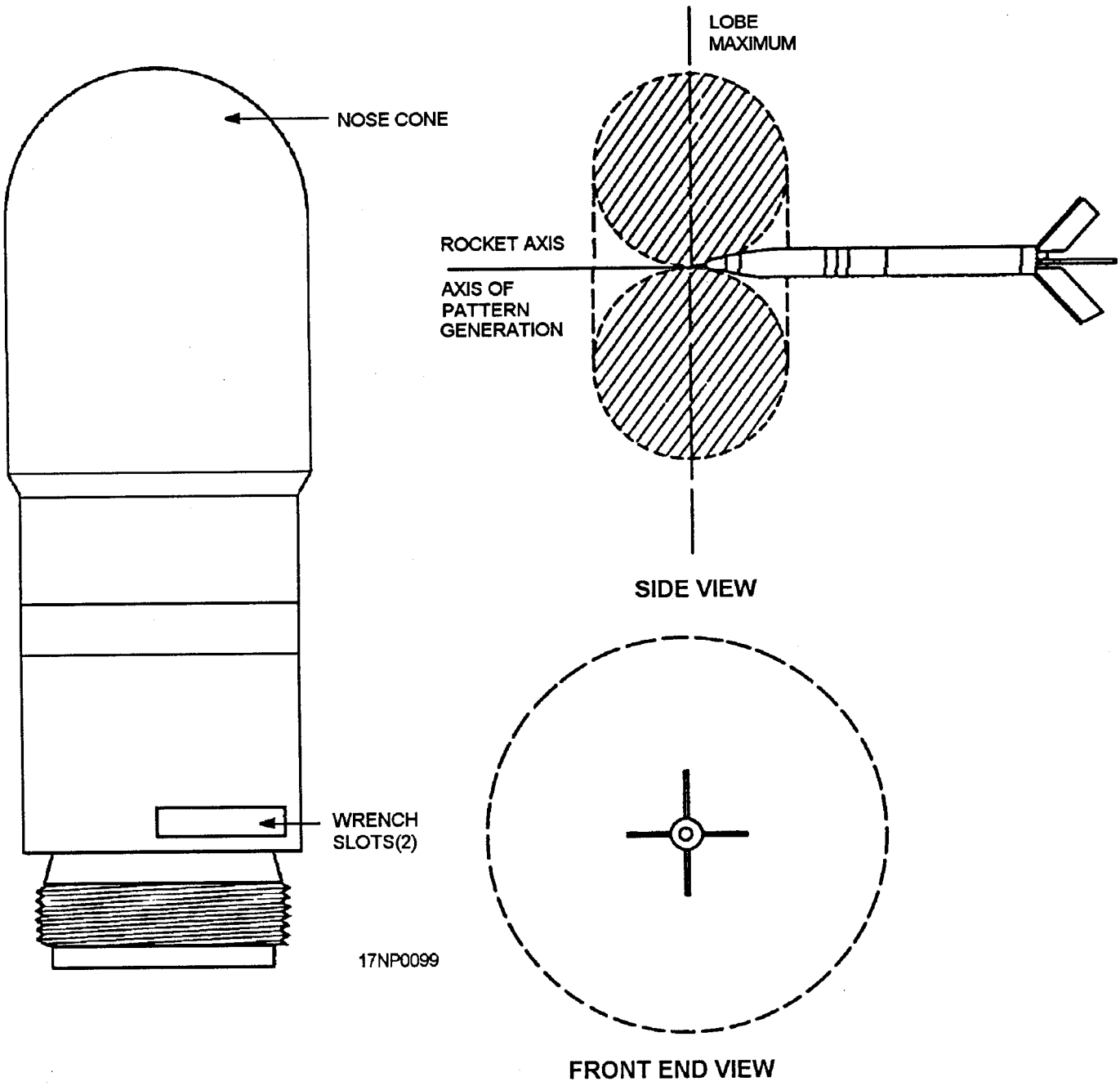


Figure 2-22.—Proximity fuze M429.

NOTE: Some rocket fuzes designed for use with 2.75-inch warheads can be used with the 5.0-inch warhead by using the BBU-15/B adapter booster (fig. 2-23).

REVIEW NUMBER 3

Q1. When classified by their mode of operation, fuzes are classified as_____.

Q2. At what point does the impact-firing fuze function?

Q3. List the two types of impact firing fizes.

Q4. At what point does the mechanical time fuze initiate the firing train?

Q5. In acceleration-deceleration fuzes, what force causes the fuze to function ?

Q6. Name the fuze that senses, usually by electronic means, the presence and distance of a target.

SERVICE ROCKET ASSEMBLIES

Airborne rockets, consisting of fuzes, warheads, and motors, are combined and assembled in various configurations to meet specific tactical requirements. For example, a rocket assembly that consists of a fragmentation warhead armed with a proximity fuze is entirely unsuitable for use against an armored tank or bunker. Likewise, the GP warhead fuzed only with the Mk 191 base fuze is relatively ineffective against personnel or unarmored targets. With each specific type of target, the right combination of warhead, fuze, and motor is assembled from the wide variety of components available.

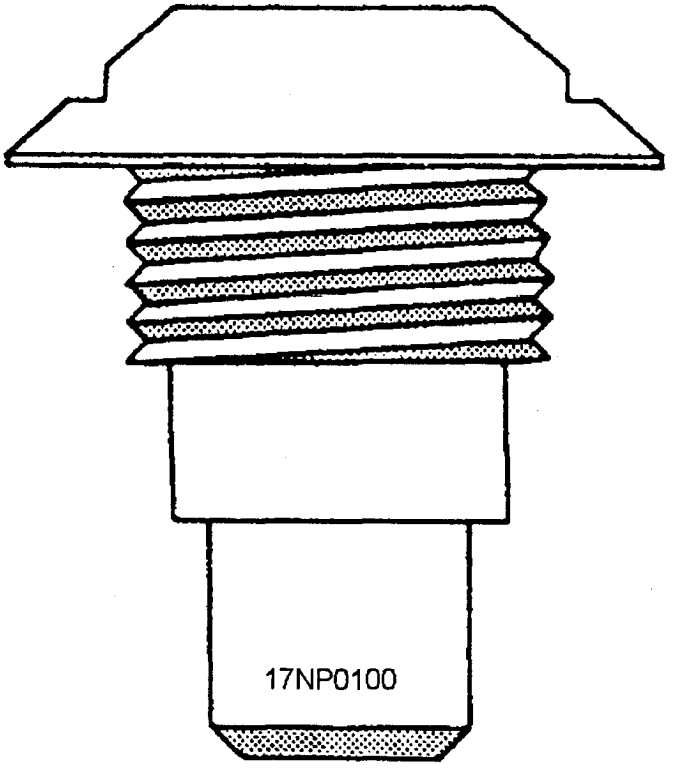


Figure 2-23.—Adapter booster BBU-15/B.

2.75-Inch FFAR and LSFFAR

The 2.75-inch airborne rocket (fig. 2-24) is an effective air-to-ground weapon against most targets. The FFAR is an air-to-air weapon. Fired in large numbers to produce a shotgun pattern, FFARs are carried and launched from 7- or 19-round launcher packages. These packages are described later in this chapter.

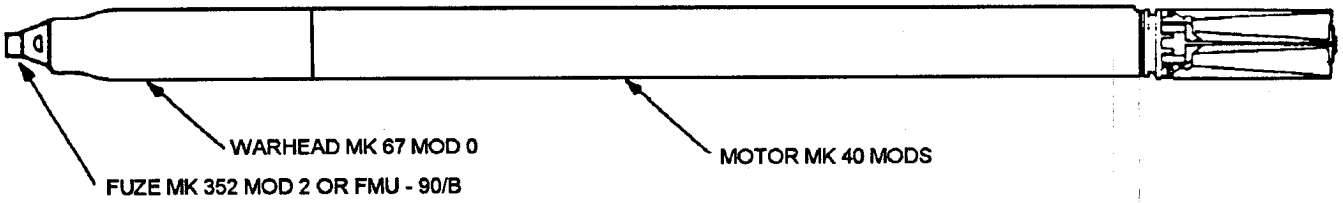
The LSFFAR is accurately and safely launched from low-speed aircraft and helicopters. Because of their spin feature, they cannot be ripple fired. LSFFARS are fired singly from 7- or 19-round launchers that have single-fire capability.

The 2.75-inch rockets are received through the supply system in three configurations as follows:

1. Complete rounds in 7- or 19-tube launchers, or in wooden boxes
2. Rocket motors in 7-tube launchers, and the fuze-warhead combination in separate shipping containers
3. Separate components in authorized shipping containers

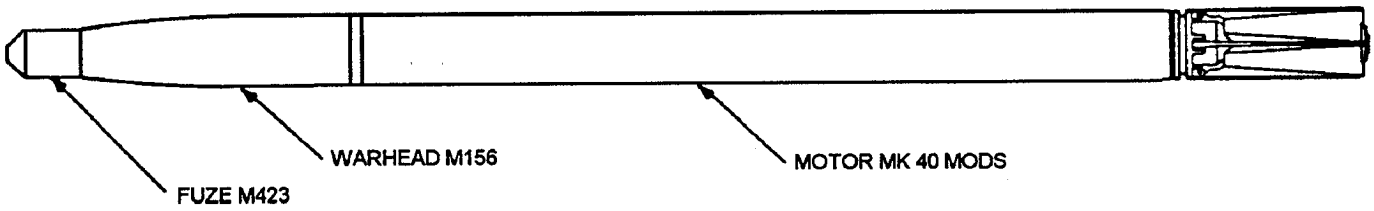
Squadron ordnancemen based ashore order and may assemble components for current operations. Aboard ship, weapons department ordnancemen assemble the components according to the ship's air and load plan. They deliver these assemblies to squadron ordnancemen for loading onto aircraft.

For detailed information, such as authorized assemblies, safety precautions, and restrictions, you should refer to *Airborne Rockets,* NAVAIR 11-85-5. You can find additional information in specific aircraft loading and tactical manuals.



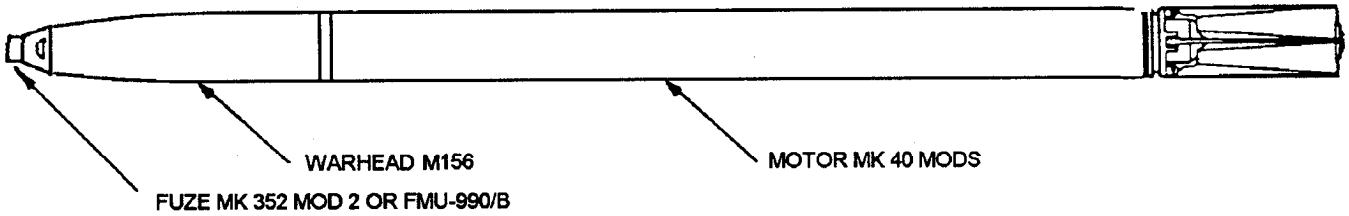
OVERALL LENGTH (IN.) - 52.69
NOMINAL WEIGHT (LB) - 17.62

2.75 - INCH LSFFAR SMOKE CONFIGURATION (MK 40 MOTOR, MK 67 WARHEAD, MK 352 MOD 2 OR FMU-90/B FUZE)



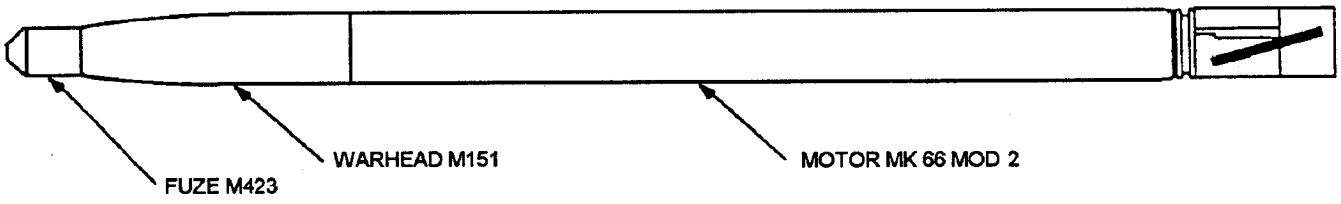
OVERALL LENGTH (IN.) - 53.43
NOMINAL WEIGHT (LB) - 22.27

2.75 - INCH LSFFAR SMOKE CONFIGURATION (MK 40 MOTOR, M156 WARHEAD, M423 FUZE)



OVERALL LENGTH (IN.) - 53.43
NOMINAL WEIGHT (LB) - 22.07

2.75 - INCH LSFFAR SMOKE CONFIGURATION (MK 40 MOTOR, M156 WARHEAD, MK 352 MOD 2 OR FMU-90/B FUZE)



OVERALL LENGTH (IN.) - 54.39
NOMINAL WEIGHT (LB) - 22.95

17NP0101

2.75 - INCH WAFFAR HE-FRAG CONFIGURATION (MK 66 MOD 2 MOTOR, M151 WARHEAD, M423 FUZE)

Figure 2-24.—2.75-inch FFAR/LSFFAR (typical configurations).

5.0-Inch FFAR

Like the 2.75-inch rocket, the 5.0-inch FFAR (fig. 2-25) can be assembled in various warhead and fuze combinations. The Mk 71 motor gives the additional advantage of one motor for all launch-speed applications.

The 5.0-inch rocket is carried and launched from multiple-round launchers. Because of their large size and weight, the number of rounds per launcher is reduced to four. The 5.0-inch rockets are received through the supply system in the following two configurations:

1. Rocket motors in a 4-round launcher and fuzes and warheads in separate shipping containers

NOTE: The Mk 191, Mk 193, and Model 113A fuzes are permanently installed in the warheads.

2. Separate components in separate shipping containers

REVIEW NUMBER 4

Q1. What is the usual configuration of the 2.75-inch airborne rocket ?

Q2. Aboard ship, who assembles rocket components for current operations?

AIRCRAFT ROCKET LAUNCHERS

LEARNING OBJECTIVE: *Recognize the shipping configuration for aircraft rocket launchers and identify common aircraft rocket launcher components.*

Aircraft rocket launchers (pods) carry and provide a platform to fire rockets. Launcher design permits multiple loading and launching of 2.75-inch and 5.0-inch rockets. Rocket pods let rocket motors (and, in some cases, completely assembled rounds) stay in the same container from their manufacture, through stowage, to their final firing.

Aircraft rocket launchers are classified as either 2.75-inch or 5.0-inch. They may be further classified as either reusable or nonreusable. Launcher tubes that are constructed of metal are considered reusable and are usually returned for reloading. Under certain conditions, they may be jettisoned at the pilot's discretion. Launcher tubes constructed of paper material are designed for onetime use only, and are jettisoned by the pilot after use.

The 2.75-inch rocket launchers currently in use are the LAU-61A/A, LAU-61B/A, LAU-61C/A, LAU-68B/A, and the LAU-68D/A. Characteristics and specifications for these launchers are listed in

REVIEW NUMBER 3 ANSWERS TO QUESTIONS Q1. THROUGH Q6.

A1. When classified by their mode of operation, fuzes are classified as impact firing, mechanical time, acceleration-deceleration, or proximity.

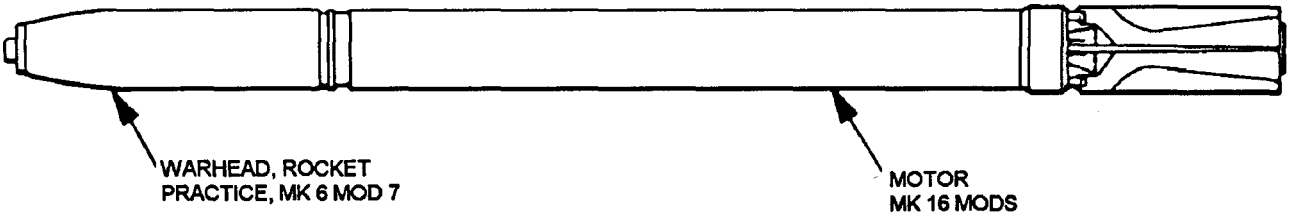
A2. Impact-firing fuzes function when the rocket strikes the target that offers enough resistance to cause actuation of the parts.

A3. The two types of impact firing fuzes are the nose detonating and base detonating types.

A4. Upon arming, the mechanical timer starts, and after a set time, the mechanical time fuze initiates the firing train.

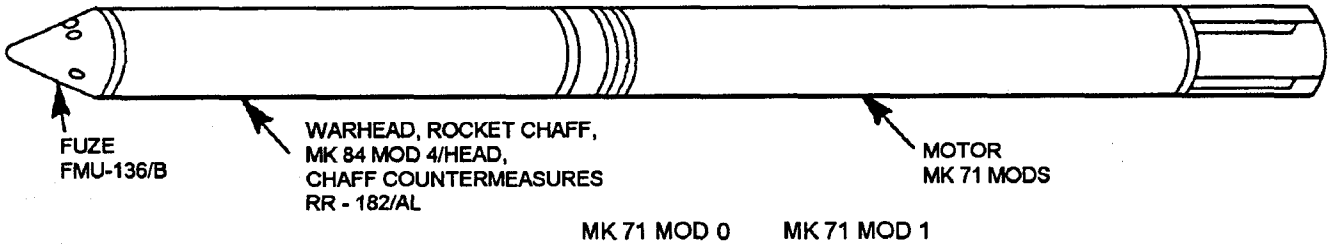
A5. In acceleration-deceleration fuzes, deceleration causes the fuze to function.

A6. Proximity fuzes sense, usually by electronic means, the presence and distance of a target.



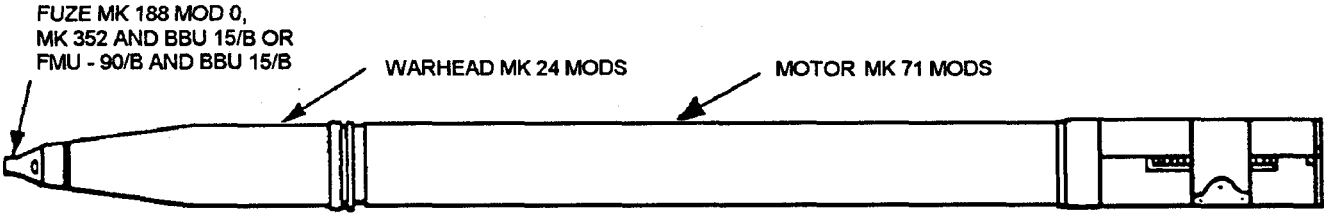
OVERALL LENGTH (IN.) - 93.76
NOMINAL WEIGHT (LB) - 112.3

5.0 - INCH FFAR PRACTIE CONFIGURATION (MK 16 MOTOR, MK 6 WARHEAD, NOSE PLUG)



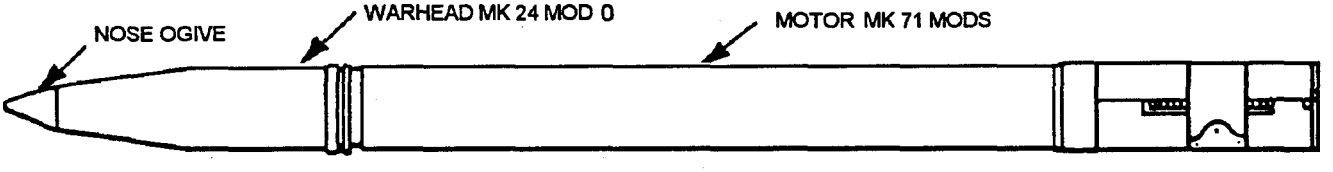
	MK 71 MOD 0	MK 71 MOD 1
OVERALL LENGTH (IN.) -	87.78	94.48
NOMINAL WEIGHT (LB) -	112.55	125.2

5.0 - INCH ROCKET GP CONFIGURATION (MK 71 MOTOR, MK 84 MOD 4 WARHEAD/RR-182/AL COUNTERMEASURERS HEAD, FMU - 136/B)



	MK 71 MOD 0	MK 71 MOD 1
OVERALL LENGTH (IN.) -	87.78	94.48
NOMINAL WEIGHT (LB) -	112.55	125.2

5.0 - INCH ROCKET GP CONFIGURATION (MK 71 MOTOR, MK 24 WARHEAD, MK 188 FUZE MK 352 WITH ADAPTER BOOSTER BBU 15/B OR FMU-90/B WITH ADAPTER BOOSTER BBU 15/B)



	MK 71 MOD 0	MK 71 MOD 1
OVERALL LENGTH (IN.) -	88.55	95.25
NOMINAL WEIGHT (LB) -	115.19	127.84

17NP0B11

5.0 - INCH ROCKET GP CONFIGURATION (MK 71 MOTOR, MK 24 WARHEAD, NOSE OGIVE)

Figure 2-25.—5.0-inch FFAR (typical configurations).

table 2-4. For detailed information about the LAU-61 and LAU-68 series launchers, refer to *2.75-inch Airborne Rocket Launchers, (LAU-61* and LAU-68 series), NAVAIR 11-75A-61.

Table 2-4.—2.75-Inch Rocket Launchers

LAUNCHER TYPE	NO. OF TUBES	TUBE MATERIAL	REUSABLE	METHOD OF FIRING
LAU-61A/A	19	Alum.	Yes	Ripple or Single
LAU-61B/A	19	Alum.	Yes	Ripple or Single
LAU-61C/A	19	Alum.	Yes	Ripple or Single
LAU-68B/A	7	Alum.	Yes	Ripple or Single
LAU-68D/A	7	Alum.	Yes	Ripple or Single

The 5.0-inch rocket launchers are the LAU-10B/A, LAU-10C/A, and the LAU-10D/A. Characteristics and specifications for these launchers are listed in table 2-5. For detailed information on the LAU-10 series launchers, you should refer to *5.0-inch Airborne Rocket Launchers* (LAU-10 series), NAVAIR 11-75A-63.

Table 2-5.—5.0-Inch Rocket Launchers

LAUNCHER TYPE	NO. OF TUBES	TUBE MATERIAL	REUSABLE	METHOD OF FIRING
LAU-10B/A	4	Alum.	Yes	Ripple or Single
LAU-10C/A	4	Alum.	Yes	Ripple or Single
LAU-10D/A	4	Alum.	Yes	Ripple or Single

SHIPPING CONFIGURATION

The rocket launcher shipping configuration shown in figure 2-26 is typical of all launcher shipping configuratioas, except for the RF barriers.

Center Section

The launcher center section is a cylindrical construction of 4, 7, or 19 tubes held together by a supporting framework, and it is covered with an aluminum skin. The center section houses or supports all other components of the launcher.

The center section for the LAU-10 (series) allows either 14-inch or 30-inch suspension. The center section for the LAU-61 and LAU-68 (series) provides for 14-inch suspension only.

Shipping Ends

The shipping ends are a multipurpose arrangement that consists of a shockpan assembly, a shockpan cover assembly, and/or locking ring assembly. An alternate hole and pin arrangement on the top and bottom is arranged so that the shockpans interlock when the launchers are stacked. The cover is equipped with a rubber seal ring that, when compressed by the locking ring assembly, forms a watertight closure over the end of the launcher.

RF Barriers

RF barriers consist of a molded, expanded, polystyrene bead base with an aluminum foil coating cemented to the outer surface. RF barriers are used on 2.75-inch pods to prevent the entry of electromagnetic radiation into the rocket igniter circuit. Equally important is the barrier on the aft end of the pod. It prevents exposure of the igniter lead contact. The LAU-61 and LAU-68 use the aft barrier only. The barriers remain installed for flight and are removed by impact or blast when the rocket is fired.

COMMON COMPONENTS

Rocket launcher packages have several components that are common to all or most launcher packages. Any notable differences are pointed out in the following discussion.

REVIEW NUMBER 4 ANSWERS TO QUESTIONS Q1. AND Q2.

A1. The 2.75-inch airborne rocket is used as an air-to-ground weapon against most targets.

A2. Aboard ship, weapons department ordnancemen assemble rocket components according to the ship's air and load plans, and deliver them to the squadron ordnancemen who load them onto the aircraft.

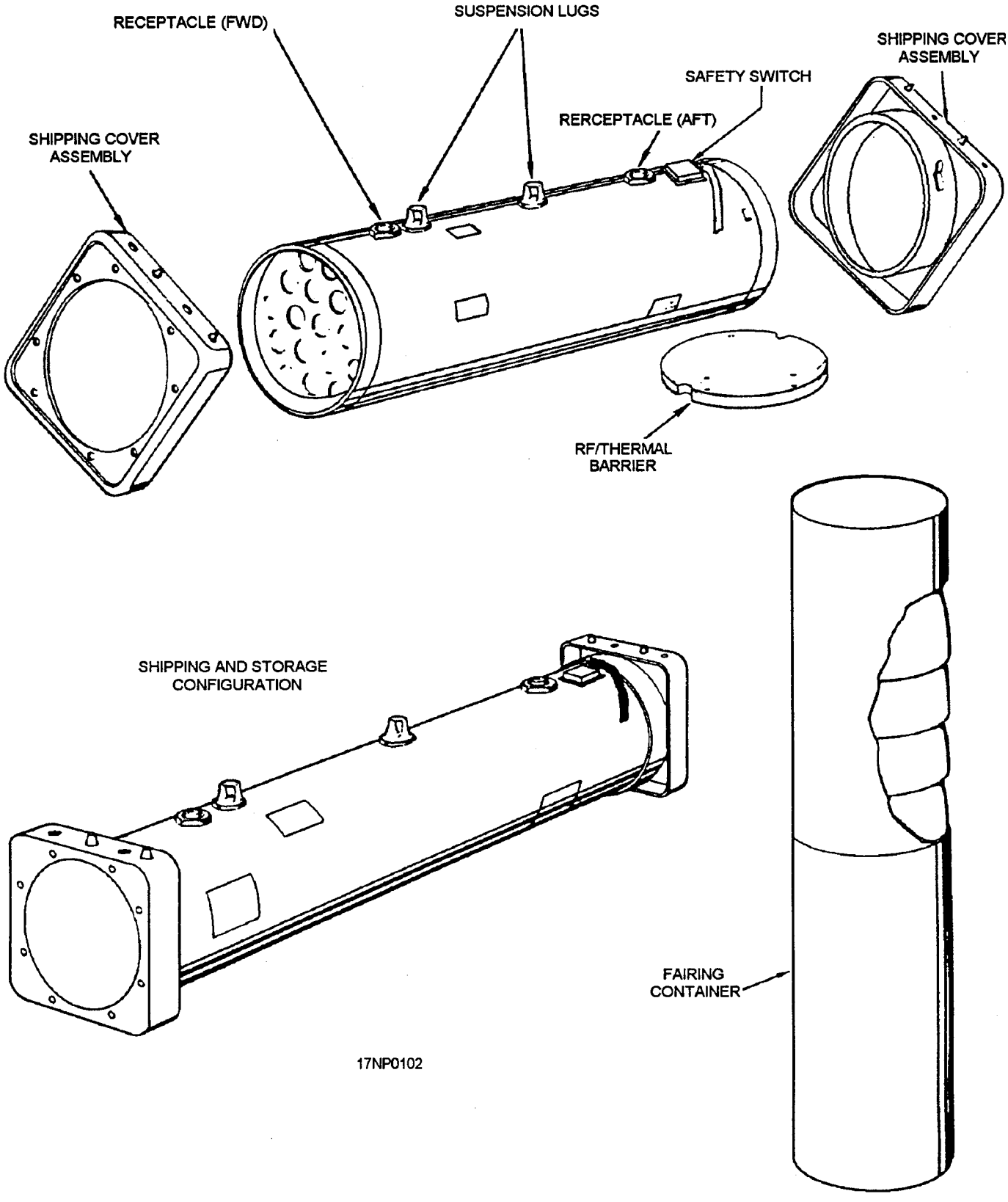


Figure 2-26.—Typical launcher shipping and storage configuration.

Fakings

Frangible fairings (fig. 2-27) are made of an impregnated molded fiber designed with a waffle- or grenade-type structure that shatters readily upon rocket impact or from a blast. The fairings fit flush with the outside surface of the center section and form an aerodynamically smooth joint. The forward fairing consists of a one-piece molded section that disintegrates on rocket impact. The tail fairing for the LAU-10 (series) (fig. 2-27, view A) is molded in two sections (nose and base), The rocket blast shatters the nose portion. The base section remains on the launcher and acts as a choke or funnel to direct debris away from the aircraft. The tail fairings for the LAU-61 and LAU-68 (series) are distinctively different in appearance (fig. 2-27, view B). They are made of aluminum and are open on both ends. They function in the same manner as the base section of the tail fairing for the LAU-10 (series).

Fairings are not shipped with the rocket launcher packages. They must be ordered separately and are received in sets packaged in cylindrical-shaped cardboard fairing containers (fig. 2-26).

Fairings are not used in all applications. You should review the specific aircraft tactical manual for any restrictions in their use.

Breaker Switch

A breaker switch is used on all rocket launchers. The breaker switch is a safe-arm device that prevents loaded rockets from firing. It is usually located on the top of the center section of the launcher between the aft end and the aft electrical receptacle. Figure 2-28 shows the various safe-arm devices currently in use.

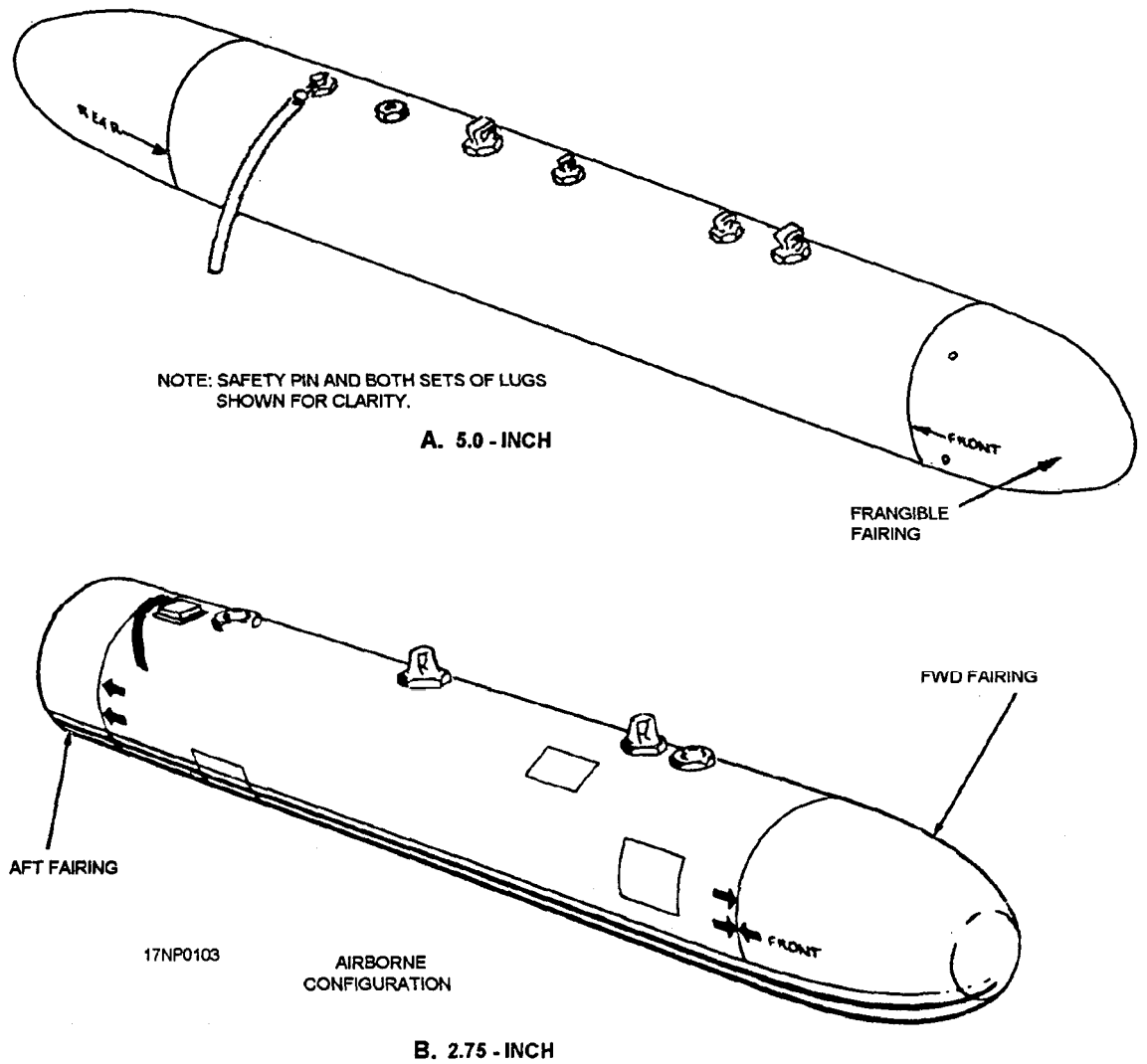


Figure 2-27.—Rocket launcher airborne configurations.

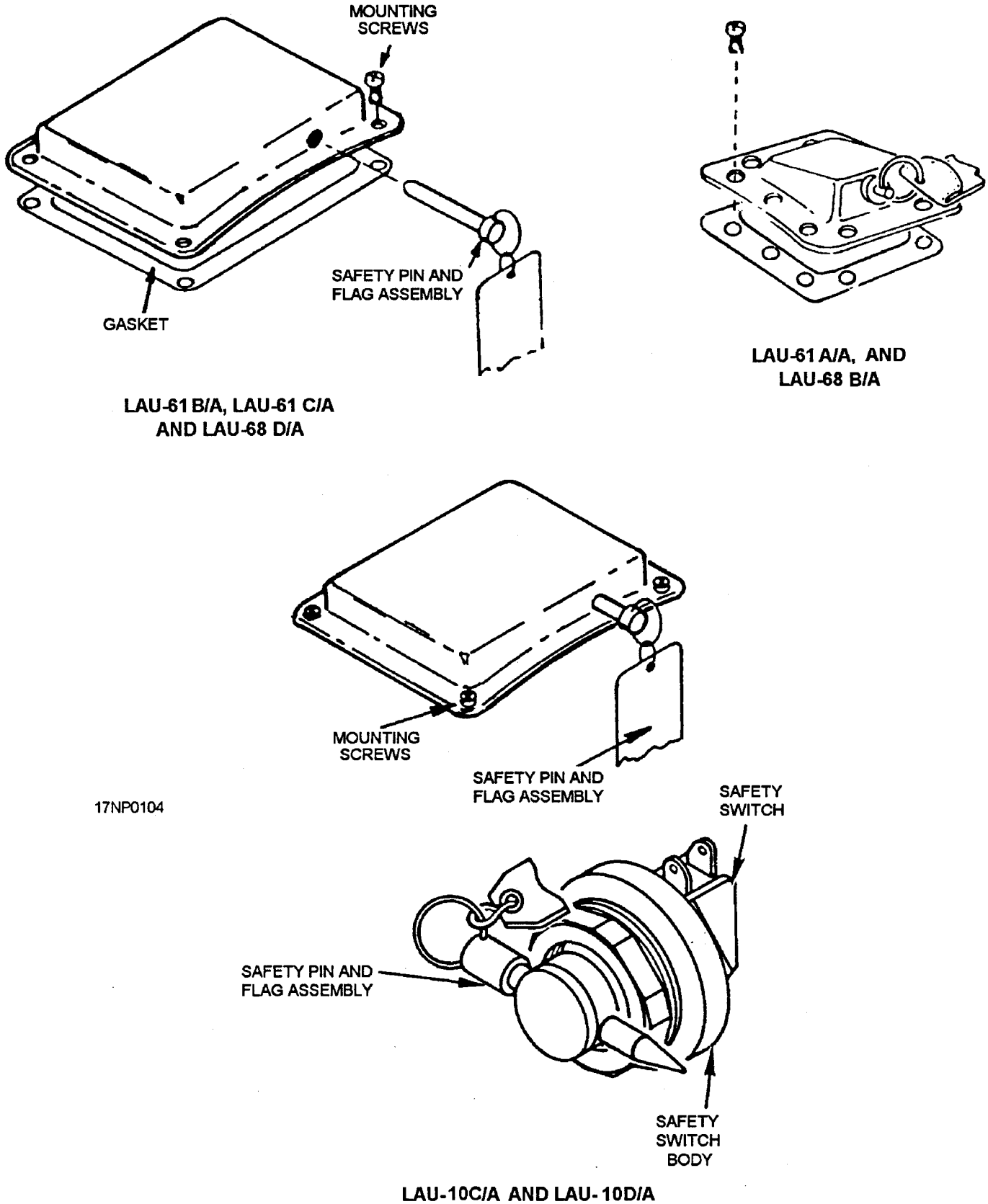


Figure 2-28.—Rocket launcher safe/arm devices.

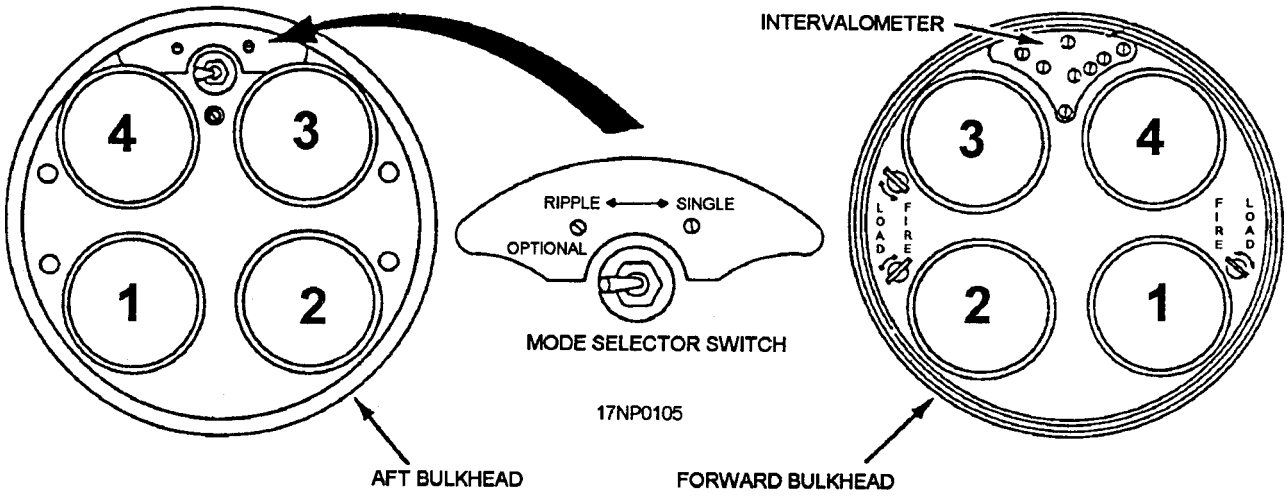


Figure 2-29.—Mode selector switch and intervalometer (5.0-inch launcher).

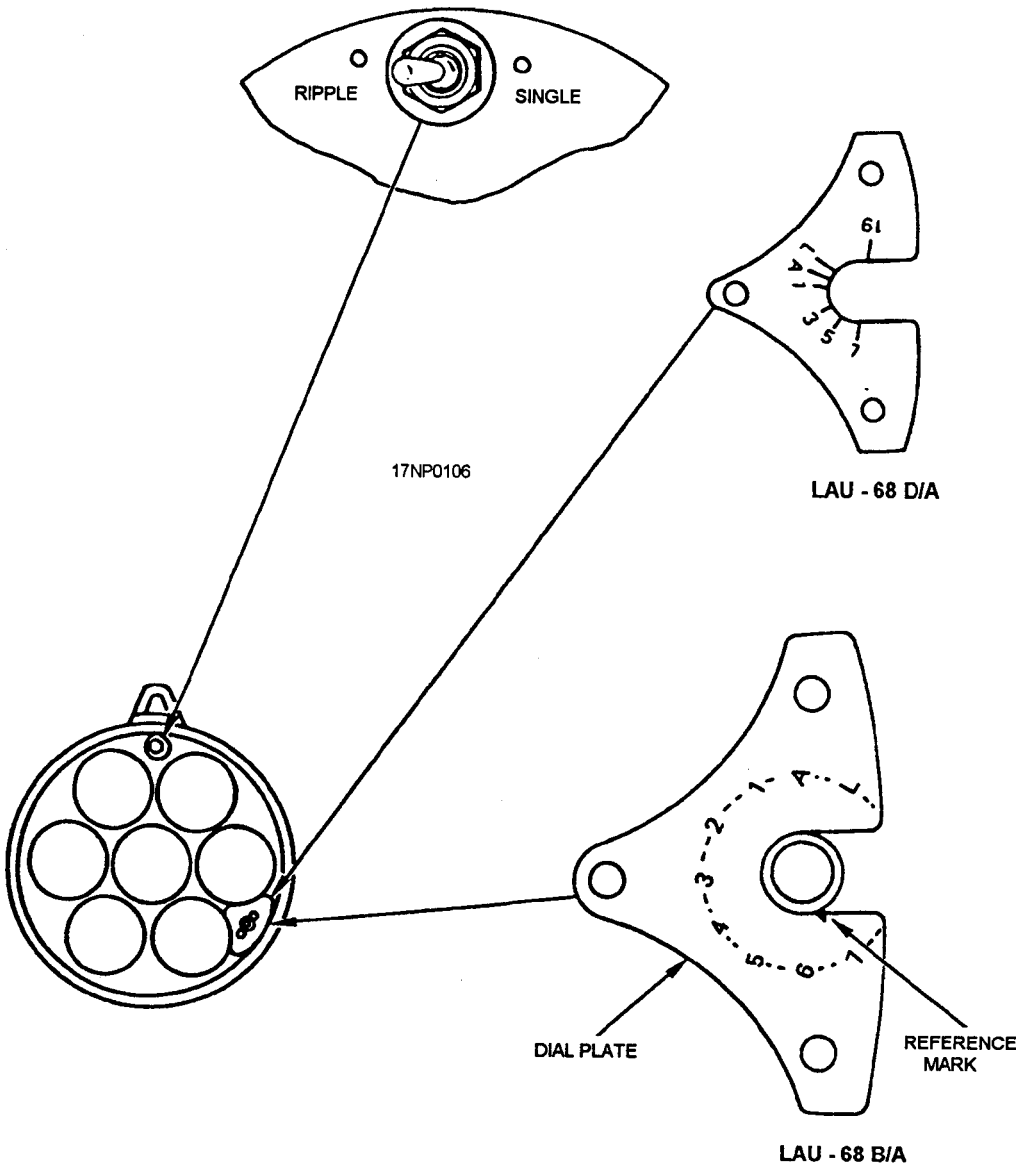


Figure 2-30.—Mode selector switch and intervalometer (LAU-68B/A and LAU-68D/A).

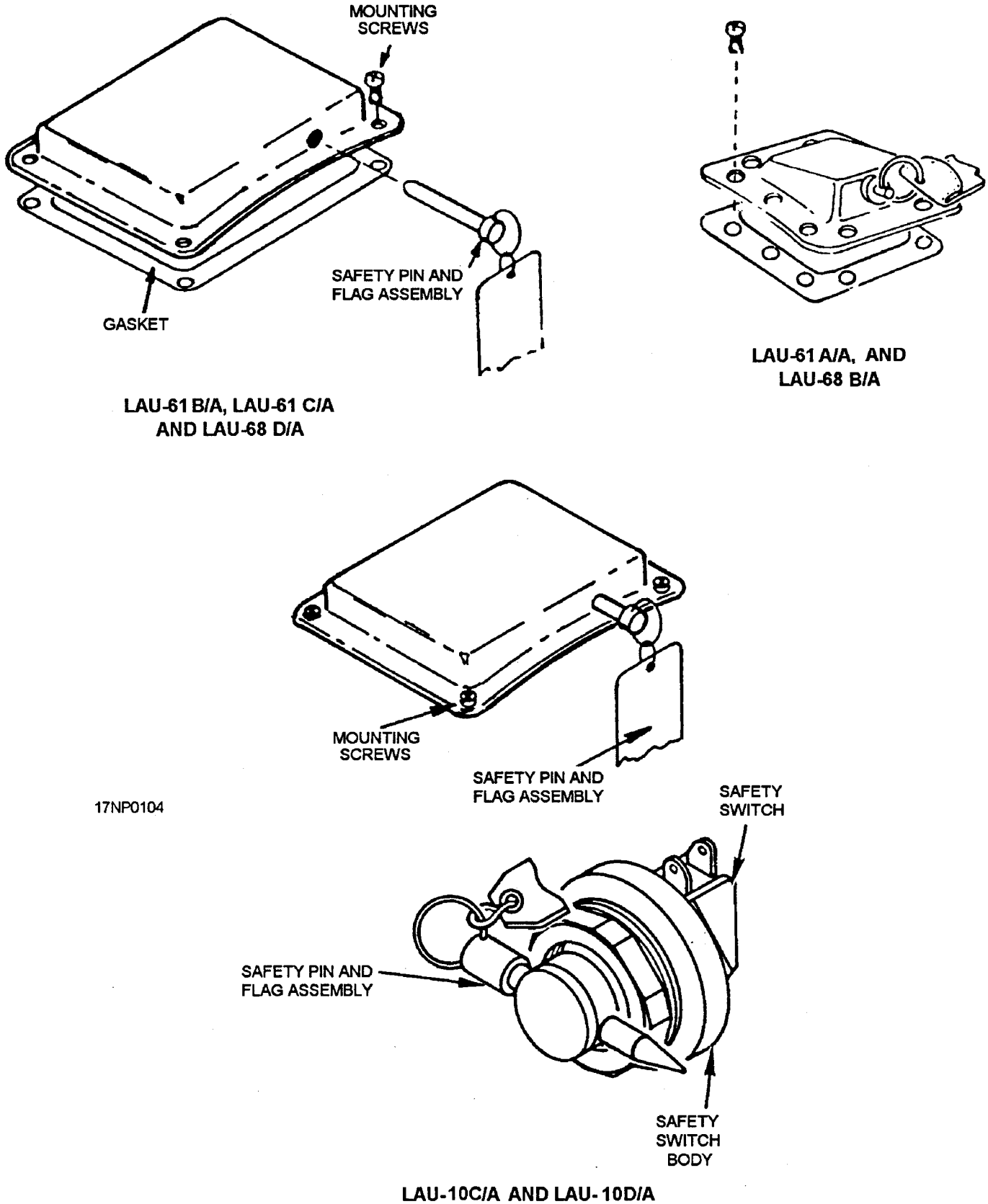


Figure 2-28.—Rocket launcher safe/arm devices.

With the detent pin installed in the breaker switch, the electrical system is grounded in the safe position, and the rockets won't fire. The detent pin has a REMOVE BEFORE FLIGHT red streamer attached. Pull the pin immediately before the aircraft takes off and install it immediately after the aircraft lands.

Install the detent pin in the breaker switch before loading the launcher with rocket motors. Keep the detent pin installed, except during actual flight, until the launcher is downloaded and/or verified as being empty.

Mode Selector Switch

The mode selector switch (figs. 2-29, 2-30, and 2-31) is used on all launchers. The switch is located in the aft bulkhead of the launcher. The switch permits preflight selection of either ripple or single firing of the rockets by controlling the functioning of the pod intervalometer.

Intervalometer

The intervalometer for the LAU-10 (series) pods is located in the forward bulkhead of the center section (fig. 2-29) and in the aft bulkhead for the LAU-61 and LAU-68 (series) (figs. 2-30 and 2.-31). Intervalometers, whether installed in 5.0-inch or 2.75-inch launchers, perform the same function.

If the mode selector switch is in the SINGLE fire position, the intervalometer fires one rocket on each

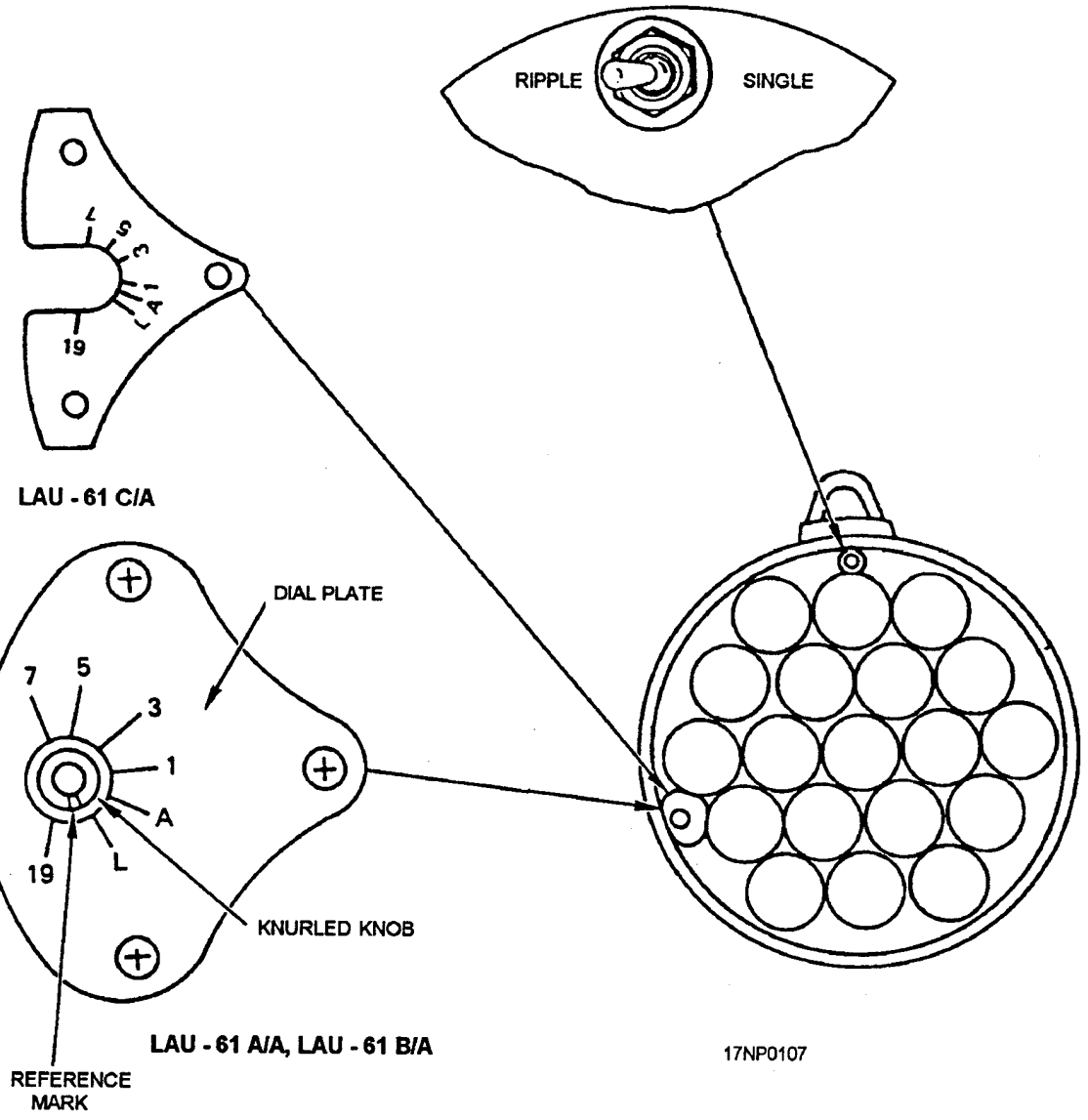


Figure 2-31.—Mode selector switch and intervalometer (LAU-61A/A, LAU-61B/A, and LAU-61C/A).

firing pulse. If the mode selector switch in the 19-shot pod is in the SINGLE fire position, the intervalometer fires the rockets in pairs. If the mode selector switch is in the RIPPLE fire position, the intervalometer converts the firing pulse into a ripple pulse and successively fires all rockets at 95-millisecond intervals. Ripple firing functions the same on all pods.

The intervalometer used with the 2.75-inch pod has a shaft that extends through the aft bulkhead of the launcher and a knurled knob with a reference (index) mark mounted on the shaft. Intervalometer switch positions are marked on the aft bulkhead of the center section. **The intervalometer should NOT be manually rotated through the numbered positions except when checking an empty pod.**

Intervalometers used in the LAU-10 (series) pods cannot be manually rotated When the intervalometer has made a complete four-round firing cycle, it automatically homes in on the original starting point (zero) and does not recycle without first de-energizing the circuit, and then re-energizing it.

5.0-INCH (SERIES) LAUNCHERS

The LAU-10 (series) launchers are reusable launchers intended for shipping (without warheads), stowing, and firing four 5.0-inch rockets. When loaded with four completely assembled rounds, the total weight varies with rocket configuration from 500 to 550 pounds.

The rockets are retained in the launcher tubes during shipping, handling, and flight by engagement of a spring-loaded detent pawl in the rocket detent groove (fig. 2-32). When the rocket is loaded and unloaded, a detent lift tool is used to raise and lower the detent pawl by rotating the detent lift handle, which is located at the forward end of the launcher. The detent also supports the firing pin. Each firing pin (fig. 2-32) is part of the detent assembly and is raised and lowered concurrent with the pawl. The firing pin extends into the tube and contacts the rocket tiring contact band, which is located aft of the rocket detent groove.

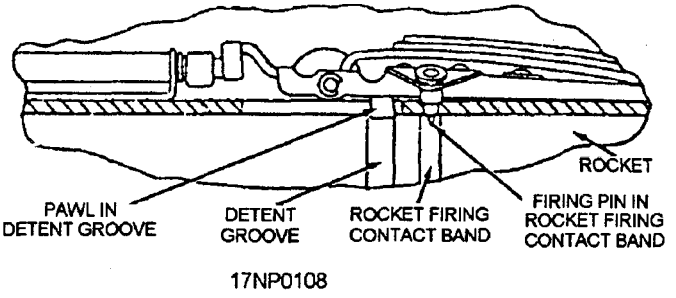


Figure 2-32.—LAU-10 (series) detent pin and firing pin assembly.

When the switch in the aircraft firing circuit is closed, electrical current flows from the aircraft firing circuit through the electrical receptacle, safety switch, mode selector switch, intervalometer, and the firing pin in the launcher to the contact band in the forward end of the motor, and through the lead wire to the squib in the igniter. The current entering the rocket squib heats the squib primer mixture, which, in turn, ignites the igniter charge.

Pressure within the igniter unseats a blowout plug, permitting the burning charge to ignite the propellant grain. The whole process of ignition requires about 0.005 second. Pressure of the hot propellant gases from the burning grain bursts the nozzle seal and provides the thrust to propel the rocket. Thrust overrides the detent spring, releasing the pawl from the rocket detent groove. The thrust then pushes the rocket out the forward end of the tube. The impact from the first rocket out shatters the forward fairing and the blast removes the tail fairing.

2.75-INCH (SERIES) LAUNCHERS

The 2.75-inch (series) launchers are intended for shipping (in some cases with warheads installed), stowing, and firing the 2.75-inch rockets. The weight of loaded launchers varies, depending upon the number of rockets installed and rocket configuration.

The rockets are retained in the launcher tubes during shipping, handling, and flight by engagement of a leaf-spring type of detent with integral blast paddles (fig. 2-33). During loading, the rocket motor depresses the detent until the detent snaps into the detent grooves located on the aft end of the motor. To remove rocket motors, use a rocket loading and release tool to depress the detent. A spring-loaded firing contact (fig. 2-34) is located in the end of each tube.

The principles of operation for the 2.75-inch launcher are basically the same as the 5.0-inch launcher. The 2.75-inch launcher can be loaded with less than 7 or 19 rockets when tactical requirements exist. However, you should refer to the specific tactical manual and aircraft loading manual. Also, since the rockets are fired in a definite sequence, the rockets must be loaded into the launcher tubes in the proper sequence. Airborne rocket loading procedures, including electrical test procedures, are covered later in this manual.

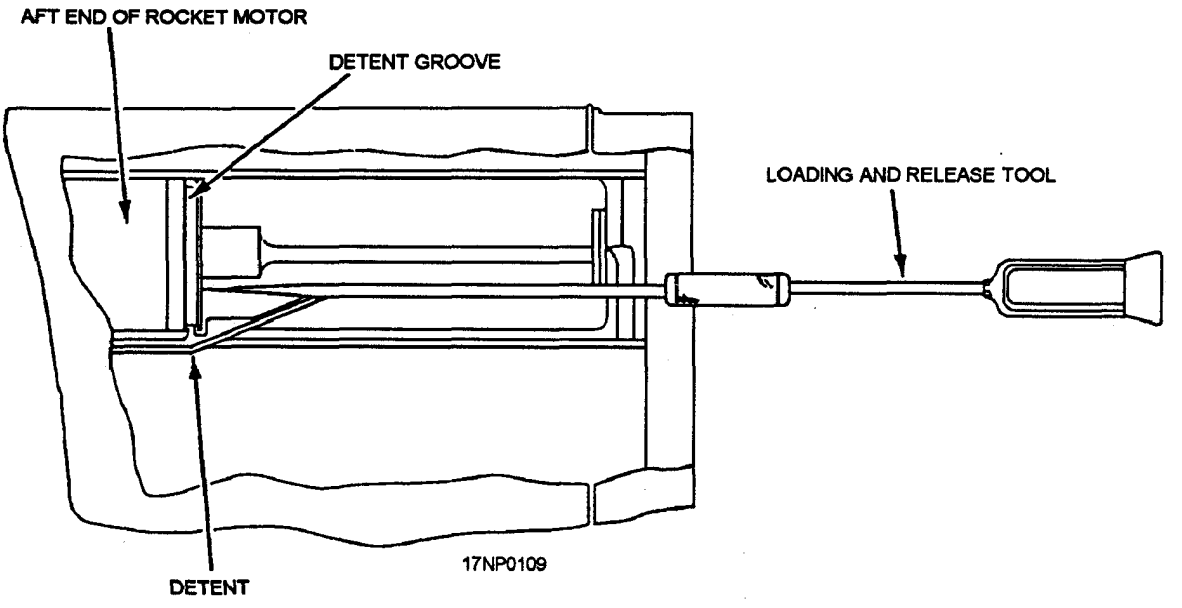


Figure 2-33.—Rocket launcher detent (2.75-inch).

REVIEW NUMBER 5

Q1. Name the section of the launcher that houses or supports all other components of the launcher.

Q2. RF barriers are used on 2.75-inch rocket pods to_____.

Q3. List the components that are common to rocket launcher packages.

Q4. What device, found on all rocket launchers, prevents loaded rockets from firing?

Q5. When is the detent pin in the rocket launcher safe/arm device removed?

Q6. What is the weight, depending on configuration, of a fully loaded LAU-10 rocket launcher?

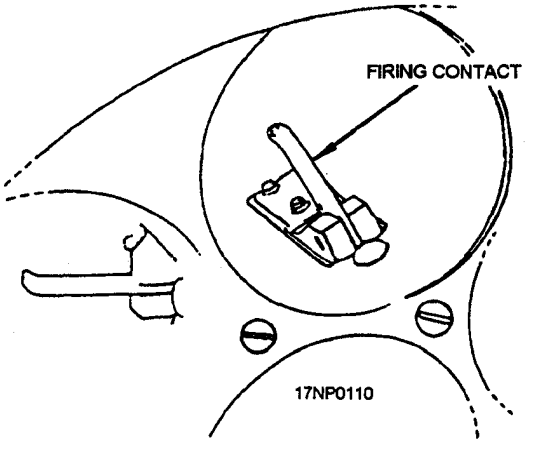


Figure 2-34.—Launcher firing contact assembly (2.75-inch launcher).

ROCKET SAFETY PRECAUTIONS

LEARNING OBJECTIVE: *Recognize the safety precautions to follow when working with aircraft rockets and rocket launchers.*

The aircraft rocket is no more dangerous than any other explosive weapon. It does have certain peculiar hazards. A completely assembled rocket, if accidentally fired, takes off under its own power in the direction it is pointed, and threatens everything in its path. When fired, an assembled rocket expels a blast of burning gas capable of injuring or killing anyone it strikes. Generally, a rocket motor without a head attached won't explode. It is a fire hazard since ballistite or cordite N (SPCG) ignites easily and burns readily. High-explosive heads, either fuzed or unfuzed, present the same risk as gun projectiles under the same conditions. Handle rockets, whether completely assembled or disassembled, with extreme care to avoid damage to parts.

Only personnel who are certified to handle rockets should be in the vicinity of assembly operations. When handling airborne rockets, rocket components, and launchers, follow all safety practices that apply to airborne armament and weapons. If practicable, all work should be performed from the side of the rocket launcher.

Rocket motors should be stowed in the same manner as smokeless powder. **Never allow matches and open flames in the stowage area. Smoking should NOT be permitted in the loading area within 200 feet of ammunition.** Do not stow rocket motors in

the same compartments with or near radio apparatus or antenna leads. Induced currents might ignite the motor. Do NOT fire rocket motors when the propellant temperature is outside the safe-firng temperature limits specified on the motor tube.

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

Stow high-explosive heads and fuzes (except fuzes that are permanently installed in the head) separately in the same manner as high-explosive projectiles. Ready-service stowage of assembled rockets is authorized for the 2.75-inch and 5.0-inch aircraft rockets according to NAVSEA OP 4 and NAVSEA OP 5.

A fuze is relatively sensitive and must be handled with care to avoid extreme shock that might cause damage. Conduct fuzing, unfuzing, assembly, or disassembly operations of all types of ammunition away from other explosives and vital installations. Only the minimum number of persons and rounds required should be in the vicinity. The ideal situation is to permit work on only one round at a time. This work should be done on a deck or at some other location remote from all magazines, ready stowage, explosive supplies, or vital installations.

Examination of the exterior of some fuzes will not show if they are armed. If, for any reason, you think a fuze might be armed, the fuze should be treated as an armed and sensitive fuze. You must NOT attempt to remove it from the rocket head. The complete fuzed round should be disposed of according to current directives. When available, explosive-ordnance-disposal (EOD) personnel should dispose of such rounds.

CAUTION

NEVER attempt to remove a base fuze from a rocket head.

You should NOT tamper with (or attempt to repair) any parts of the round. If the round is damaged or defective, remove the head from the motor and mark the defective part for return to the issuing agency. Disassembly or alteration of rocket components is NOT authorized except under specific instructions from Naval Air Systems Command.

Fuzes and/or warheads dropped 5 feet or more onto a hard surface and rockets that have been accidentally released from aircraft launchers upon aircraft landing must be disposed of according to current directives. If a loaded launcher is dropped, you should NOT use it until the launcher tubes, latching mechanisms, and rockets are inspected for damage.

Rocket launchers should NOT be suspended from a bomb rack that does not have independent ignition and

REVIEW NUMBER 5 ANSWERS TO QUESTIONS Q1. THROUGH Q6.

A1. The center section of the launcher that houses or supports all other components of the launcher.

A2. RF barriers are used on 2.75-inch rocket pods to prevent entry of electromagnetic radiation into the igniter circuit.

A3. The components that are common to rocket launcher packages are as follows: fairings, breaker switch, mode selector switch, and intervalometer.

A4. The breaker switch, found on all rocket launchers, prevents loaded rockets from firing.

A5. The detent pin in the rocket launcher safe/arm device is removed immediately before takeoff.

A6. The weight, depending on configuration, of a fully loaded LAU-10 rocket launcher is approximately 500 to 550 pounds.

jettisoning circuits. To prevent possible explosion, do NOT expose airborne rockets or loaded launchers to the 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 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.

Rockets should NOT be loaded or unloaded from launchers while on the flight deck. RF barriers should remain in place on the launcher while on the flight deck.

The detent pin must be in the breaker switch at all times. The only exceptions are when you are making certain electrical checks, or when the aircraft is ready for flight. Do NOT, under any circumstances, perform an electrical test with rockets in the launcher.

REVIEW NUMBER 6

Q1. If *you are working around rockets or loaded pods, the preferred position is* _____.

Q2. *Smoking is not permitted within what minimum range of rocket ammunition?*

Q3. *What is the maximum distance that a rocket motor can be dropped and still be used as a serviceable motor?*

Q4. *What minimum distance must be maintained between gas turbine exhaust paths and rockets?*

REVIEW NUMBER 6 ANSWERS TO QUESTIONS Q1. THROUGH Q4.

A1. If you are working around rockets or loaded pods, the preferred position is at the sides of the rocket or pod. Never work in front or behind them.

A2. Smoking is not permitted within 200 feet of rocket ammunition.

A3. A rocket motor can be dropped 2 feet and still be used as a serviceable motor.

A4. A minimum of 10 feet must be maintained between gas turbine exhaust paths and rockets.

CHAPTER 3

AIR-LAUNCHED GUIDED MISSILES AND GUIDED MISSILE LAUNCHERS

Guided missiles are self-propelled objects. After launching, they automatically alter their direction of flight in response to signals received from outside sources. They usually carry high-explosive charges and are equipped with a means to explode them at or near a target. The majority of guided missiles used in the Navy are essentially rockets that are maneuvered while in flight.

AIR-LAUNCHED GUIDED MISSILES

LEARNING OBJECTIVE: *Recognize air-launched guided missile classifications. Match missiles with their range and speed. Identify air-launched guided missiles and recognize the methods used to designate them. Identify missile components to include guidance and control, armament, and propulsion systems. Identify the guided missiles used in the Navy today.*

The purpose of a guided missile is to reach and destroy or damage its target. The type of target involved influences the characteristics of the missile; however, each missile meets the following basic requirements:

- It must have sufficient speed to intercept or catch its target.
- It must be maneuverable in flight to correct its flight path as required to intercept the target.
- It must be capable of inflicting a satisfactory degree of damage to the target on intercept.
- It must have an acceptable operating envelope (range/altitude) within which it is effective.
- It must be capable of launching when required and at a satisfactory rate.
- The missile and its components must be safe to handle, store, and use.

In general, a typical guided missile has a long, cylindrical shape, with an oval or a hemispherically shaped nose. It is fitted with a series of stabilizing or maneuvering fins, wings, or canards around its outer surface.

MISSILE CLASSIFICATION

Guided missiles are classified according to their range, speed, launch environment, mission, and vehicle type.

Range

Long-range guided missiles are usually capable of traveling a distance of at least 100 miles. Short-range guided missiles often do not exceed the range capabilities of long-range guns. The Navy has air-launched guided missiles that function within these ranges; they are medium-range or extended-range missiles.

Speed

The speed capability of guided missiles is expressed in Mach numbers. A Mach number is the ratio of the speed of an object to the speed of sound in the medium through which the object is moving. Under standard atmospheric conditions, sonic speed is about 766 miles per hour (Mach 1.0). Guided missiles are classified according to their speed as shown below:

- Subsonic—Up to Mach 0.8
- Transonic—Mach 0.8 to Mach 1.2
- Supersonic—Mach 1.2 to Mach 5.0
- Hypersonic—Above Mach 5.0

When considering the speed of an air-launched guided missile, the speed of the launching aircraft is added to the speed of the missile. For example, if a missile's speed is Mach 2.5 and the aircraft's speed, at the time of missile launch, is Mach 2.0, the missile's speed is Mach 4.5.

Types of Guided Missiles

Guided missiles are divided into two types—service missiles and nonservice missiles.

SERVICE MISSILES.— These missiles are generally referred to as tactical missiles. Service missiles are fully operational and fully explosive loaded rounds, designed for service use in time of war.

NONSERVICE MISSILES.— These include all types of missiles other than service or tactical. They are subdivided as captive air training missiles (CATMs), dummy air training missiles (DATMs), special air training missiles (NATMs), and practice guided weapons (PGWs).

Some practice and training missiles are used for actual launching. They contain live propulsion and guidance systems with inert loaded warheads. They are fitted with pyrotechnic fuze indicator signals and/or tracking flares that give a visual indication of missile/target impact. These missiles can also be fitted with a telemetry-type warhead, which transmits electronic signals to a monitoring station. The monitoring station displays the missile's in-flight performance and missile/target hit. Some types of exercise missiles contain explosive-destruct charges so the missiles destroy themselves in flight. These explosive-destruct charges, when installed, are used as a safety measure so the missile does not travel beyond the established target range.

The CATMs are used for pilot training in aerial target acquisition and aircraft controls/displays. They have both tactical and training components.

The DATMs are ground training missiles used to train ground personnel in missile assembly/disassembly, uploading/downloading, and handling procedures.

The NATMs are used for pilot training during fleet weapon training exercises.

The PGWs are used for stowage procedures and techniques. All components are completely inert.

Service missiles are fired as practice or training missiles when approved by proper authority. Normally, approval is restricted to missiles that are obsolete or to missiles that have exceeded their normal service life.

Guided missiles used in naval aviation include air-to-air and air-to-surface missiles. Air-to-air guided missiles are fired by one aircraft against another aircraft. Air-to-surface guided missiles are fired from an aircraft against a target on the land or water surface.

For further information on the classification of guided missiles, you should refer to *United States Navy Ammunition Historical and Functional Data,NAVSEA* SW010-AB-GTP-010, and *Identification of Ammunition,* NAVSEA SW010-AF-ORD-010.

MISSILE DESIGNATION

The Department of Defense established a missile and rocket designation sequence. The basic designation (table 3-1) of every guided missile are letters, which are in sequence. The sequence indicates the following:

1. The environment from which the vehicle is launched
2. The primary mission of the missile
3. The type of vehicle

Examples of guided missile designators common to the Aviation Ordnanceman are as follows:

Basic

Designator	Meaning
AGM	Air-launched, surface-attack, guided missile
AIM	Air-launched, intercept-aerial, guided missile
ATM	Air-launched, training guided missile
RIM	Ship-launched, intercept-aerial, guided missile

The basic designator is followed by a design number. In turn, the number may be followed by consecutive letters, which show a modification. For example, the designation of AGM-45C means the missile is an air-launched (A), surface-attack (G), missile (M), forty-fifth missile design (45), third modification (C).

In addition, most guided missiles are given popular names, such as Sparrow, Sidewinder, Harpoon, and Shrike. These names are retained regardless of subsequent modifications to the original missile.

MISSILE IDENTIFICATION

The external surfaces of all Navy guided missiles, except radome and antenna surfaces, are painted white. The color white has no identification color-coding significance when used on guided missiles.

There are three significant color codes used on guided missiles and their components-yellow, brown,

Table 3-1.—Guided Missile and Rocket Designations

FIRST LETTER DESIGNATING LAUNCH ENVIRONMENT	DESCRIPTION
A Air	Air launched.
B Multiple	Capable of being launched from more than one environment.
C Coffin	Stored horizontally or at less than a 45-degree angle in a protective enclosure and launched from the ground.
F Individual	Carried and launched by one man.
M Mobile	Launched from a ground vehicle or movable platform.
P Soft Pad	Partially or non-protected in storage and launched from the ground.
U Underwater	Launched from a submarine or other underwater device.
R Ship	Launched from a surface vessel, such as a ship or barge.
SECOND LETTER DESIGNATING MISSION SYMBOL	**DESCRIPTION**
D Decoy	Vehicles designed or modified to confuse, deceive, or divert enemy defenses by simulating an attack vehicle.
E Special Electronic	Vehicles designed or modified with electronics equipment or communications, countermeasures, and electronic relay missions.
G Surface Attack	Vehicles designed to destroy enemy land or sea targets.
I Intercept-Aerial	Vehicles designed to intercept aerial targets in defensive roles.
Q Drone	Vehicles designed for target reconnaissance or surveillance.
T Training	Vehicles designed to be modified for training purposes.
U Underwater Attack	Vehicles designed to destroy enemy submarines or other underwater targets or to detonate underwater.
W Weather	Vehicles designed to observe, record, or relay data pertaining to meteorological phenomena.
THIRD LETTER DESIGNATING VEHICLE TYPE SYMBOL	**DESCRIPTION**
M Guided Missile	An unmanned, self-propelled vehicle with remote or internal trajectory guidance.
R Rocket	A self-propelled vehicle whose flight trajectory cannot be altered after launch.
N Probe	A non-orbital, instrumented vehicle to monitor and transmit environmental information.
NOTE: The designations listed in the above table cover all the guided missiles and rockets used within the Department of Defense. Therefore, all designations listed may not be used by the Navy.	

and blue. These color codes indicate the explosive hazard in the missile component. If components are painted blue on a practice missile and have a yellow or brown band painted on them, the component has an explosive component that doesn't have a comparable part in a service missile.

Each component of the missile, besides being color coded, is identifiable by lettering stenciled on the exterior surface of the component. The lettering on a component gives information such as the Mark and Mod, type and weight of explosive filler, loading activity symbol and date of loading, temperature range restrictions, and unit serial number.

All missiles used in naval aviation are assigned missile serial numbers. These numbers are shipped with the missile's logbook. The missile serial number is normally the serial number of the leading component of the missile, such as the guidance and/or control components. The serial number is important because it is the number used to track the missile from assembly at a weapons station until it is fired or discontinued from service.

For further information concerning identification of guided missiles, refer to NAVSEA SW010-AF-ORD-010/NAVAIR 11-1-117, *Identification of Ammunition* (latest revision).

REVIEW NUMBER 1

Q1. The speed of a guided missile is given in terms of Mach numbers. If a guided missile is traveling at Mach 1, how fast is it going ?

Q2. A missile traveling at Mach 3 is traveling at speeds.

Q3. List the two types of guided missiles.

Q4. What two types of guided missiles are used in naval aviation?

Q5. The first letter of a missile designation describes the missile's_____.

Q6. Define the missile designation ATM.

Q7. Where would you find the serial number in an assembled missile ?

Q8. What do the color codes identify on guided missiles?

MISSILE COMPONENTS

Guided missiles are made up of a series of subassemblies (figs. 3-1 and 3-2). The various subassemblies form a major section of the overall missile to operate a missile system, such as guidance, control, armament (warhead and fuzing), and propulsion. The major sections are carefully joined and connected to each other. They form the complete missile assembly. The arrangement of major sections in the missile assembly varies, depending on the missile type.

The guidance section is the brain of the missile. It directs its maneuvers and causes the maneuvers to be executed by the control section. The armament section carries the explosive charge of the missile, and the fuzing and firing system by which the charge is exploded. The propulsion section provides the force that propels the missile.

Guidance and Control Section

The complete missile guidance system includes the electronic sensing systems that initiate the guidance

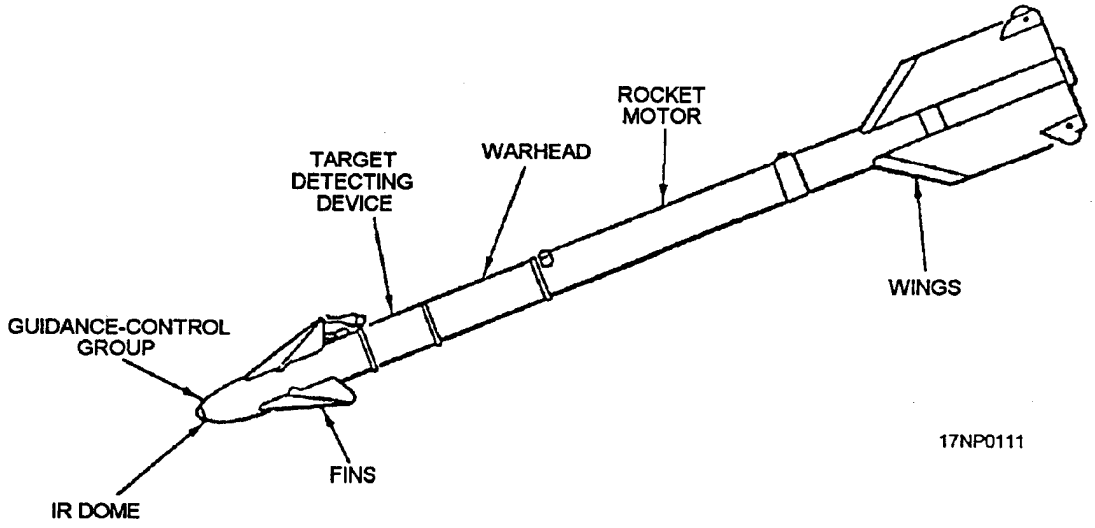


Figure 3-1.—Typical air-to-air guided missile.

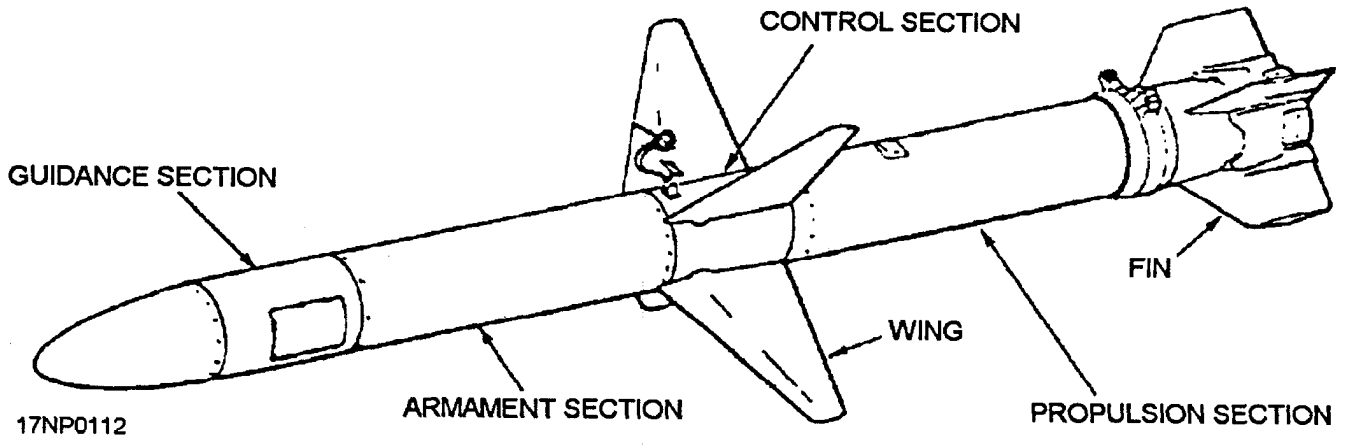


Figure 3-2.—Typical air-to-surface guided missile.

orders and the control system that carries them out. The elements for missile guidance and missile control can be housed in the same section of the missile, or they can be in separate sections.

There are a number of basic guidance systems used in guided missiles. Homing-type, air-launched, guided missiles are currently used. They use radar or infrared homing systems.

A homing guidance system is one in which the missile seeks out the target, guided by some physical indication from the target itself. Radar reflections or thermal characteristics of targets are possible physical influences on which homing systems are based. Homing systems are classified as active, semiactive, and passive.

ACTIVE.— In the active homing system, target illumination is supplied by a component carried in the missile, such as a radar transmitter. The radar signals (fig. 3-3) transmitted from the missile are reflected off the target back to the receiver in the missile. These reflected signals give the missile information such as the target's distance and speed. This information lets the guidance section compute the correct angle of attack to intercept the target. The missile's angle of attack is controlled by the control section that receives electronic commands from the guidance section. Mechanically manipulated wings, fins, or canard control surfaces are mounted externally on the body of the weapon. They are actuated by hydraulic, electric, or gas generator power, or combinations of these to alter the missile's course.

SEMIACTIVE.— In the semiactive homing system (fig. 3-4), the missile gets its target illumination from an external source, such as a transmitter carried in the launching aircraft. The receiver in the missile

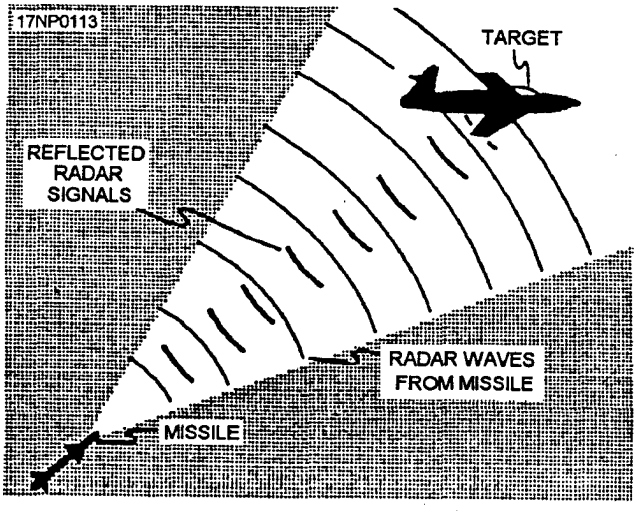


Figure 3-3.—Active homing system.

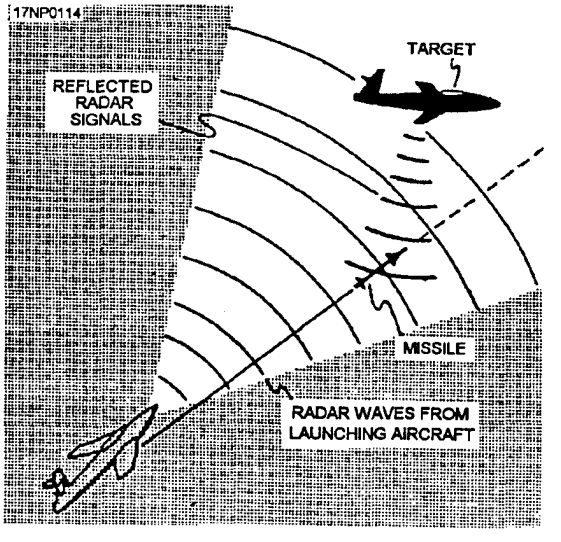


Figure 3-4.—Semiactive homing system.

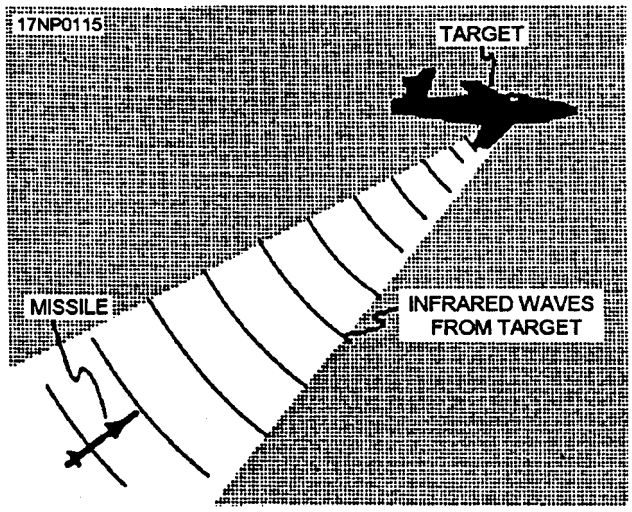


Figure 3-5.—Passive honing system.

receives the signals reflected off the target, computes the information, and sends electronic commands to the control section. The control section functions in the same manner as previously discussed.

PASSIVE.— In the passive homing system (fig. 3-5), the directing intelligence is received from the target. Examples of passive homing include homing on a source of infrared rays (such as the hot exhaust of jet aircraft) or radar signals (such as those transmitted by ground radar installations). Like active homing, passive homing is completely independent of the launching aircraft. The missile receiver receives signals generated by the target, and then the missile control section functions in the same manner as previously discussed.

Armament Section

The armament system contains the payload (explosives), fuzing, safety and arming (S&A) devices, and target-detecting devices (TDDs).

PAYLOAD.— The payload is the element or part of the missile that does what a particular missile is launched to do. The payload is usually considered the explosive charge, and is carried in the warhead of the missile. High-explosive warheads used in air-to-air guided missiles contain a rather small explosive charge, generally 10 to 18 pounds of H-6, HBX, or PBX high explosives. The payload contained in high-explosive warheads used in air-to-surface guided missiles varies widely, even within specific missile types, depending on the specific mission. Large payloads, ranging up to 450 pounds, are common. Comp B and H-6 are typical explosives used in a payload.

Most exercise warheads used with guided missiles are pyrotechnic signaling devices. They signal fuze functioning by a brilliant flash, by smoke, or both. Exercise warheads frequently contain high explosives, which vary from live fuzes and boosters to self-destruct charges that can contain as much as 5 pounds of high explosive.

FUZING.— The fuzing and firing system is normally located in or next to the missile's warhead section. It includes those devices and arrangements that cause the missile's payload to function in proper relation to the target. The system consists of a fuze, a safety and

REVIEW NUMBER 1 ANSWERS TO QUESTIONS Q1. THROUGH Q8.

A1. If a guided missile is traveling at Mach 1, it is traveling at approximately 766 miles per hour.

A2. A missile traveling at Mach 3 is traveling at supersonic speeds.

A3. The two types of guided missiles are service and nonservice guided missiles.

A4. The two types of guided missiles used in naval aviation are air-to-air and air-to-surface guided missiles.

A5. Th first letter of a missile designation describes the missile's launch environment.

A6. The missile designation ATM stands for an air-launched training guided missile.

A7. The serial number in an assembled missile is usually found on the leading component.

A8. The color codes on guided missiles identify the explosive hazard in the missile component.

arming (S&A) device, a target-detecting device (TDD), or a combination of these devices.

There are two general types of fuzes used in guided missiles—proximity fuzes and contact fuzes. Both fuzes are armed by acceleration forces upon missile launching. Arming is usually delayed until the fuze is subjected to a given level of accelerating force for a specified amount of time. In the contact fuze, the force of impact closes a firing switch within the fuze to complete the firing circuit, detonating the warhead. Where proximity fuzing is used, the firing action is very similar to the action of proximity fuzes used with bombs and rockets.

SAFETY AND ARMING (S&A) DEVICES.— S&A devices are electromechanical, explosive control devices. They maintain the explosive train of a fuzing system in a safe (unaligned) condition until certain requirements of acceleration are met after the missile is fired.

TARGET-DETECTING DEVICES (TDD).— TDDs are electronic detecting devices similar to the detecting systems in VT fuzes. They detect the presence of a target and determine the moment of firing. When subjected to the proper target influence, both as to magnitude and change rate, the device sends an electrical impulse to trigger the firing systems. The firing systems then act to fire an associated S&A device to initiate detonation of the warhead.

Air-to-air guided missiles are normally fuzed for a proximity burst by using a TDD with an S&A device. In some cases, a contact fuze maybe used as a backup. Air-to-surface guided missile fuzing consists of influence (proximity) and/or contact fuzes. Multifuzing is common in these missiles.

Propulsion Section

Guided missiles use some form of jet power for propulsion. There are two basic types of jet propulsion power plants used in missile propulsion systems-the atmospheric (air-breathing) jet and the thermal jet propulsion systems. The basic difference between the two systems is that the atmospheric jet engine depends on the atmosphere to supply the oxygen necessary to start and sustain burning of the fuel. The thermal jet engine operates independently of the atmosphere by starting and sustaining combustion with its own supply of oxygen contained within the missile.

ATMOSPHERIC JET PROPULSION SYSTEM.— There are three types of atmospheric jet propulsion systems-the turbojet, pulsejet, and ramjet engines. Of these three systems, only the turbojet engine is currently being used in Navy air-launched missiles. A typical turbojet engine includes an air intake, a mechanical compressor driven by a turbine, a combustion chamber, and an exhaust nozzle. The engine does not require boosting and can begin operation at zero acceleration.

THERMAL JET PROPULSION SYSTEM.— Thermal jets include solid propellant, liquid propellant, and combined propellant systems. As an AO, you come in contact with all three systems, The solid propellant and combined propellant systems are currently being used in some air-launched guided missiles.

The majority of air-launched guided missiles used by the Navy use the solid propellant rocket motor. They include the double-base and multibase smokeless powder propellants as well as the composite mixtures. Grain configurations vary with the different missiles. Power characteristics and temperature limitations of the individual rocket motors also vary.

In some guided missiles, different thrust requirements exist during the boost phase as compared to those of the sustaining phase. The dual thrust rocket motor (DTRM) is a combined system that contains both of these elements in one motor. The DTRM contains a single propellant grain made of two types of solid propellant—boost and sustaining. The grain is configured so the propellant meeting the requirements for the boost phase burns at a faster rate than the propellant for the sustaining phase. After the boost phase propellant burns itself out, the sustaining propellant sustains the motor in flight over the designed burning time (range of the missile).

REVIEW NUMBER 2

Q1. List the major sections of guided missiles.

Q2. What section is considered the brains of the missile ?

Q3. List the three types of homing systems.

Q4, If a missile gets its target illumination from the launching aircraft, what type of homing system does it have?

Q5, List the components of the armament section.

Q6. Describe the function of safety and arming (S&A) devices.

Q7. What are the two types of propulsion used with guided missiles ?

Q8. Describe the basic difference between the two types of propulsion.

	AIM-7F	AIM-7M
WEIGHT:	510.0	510.0
DIMENSIONS:		
LENGTH:	145.2 in.	144.0 in.
DIAMETER:	8.0 in.	8.0 in.
WING SPAN:	40.0 in.	40.0 in.
TAIL SPAN:	31.0 in.	31.6 in.
SUSPENSION PROVISIONS:	LAU-92	LAU-92

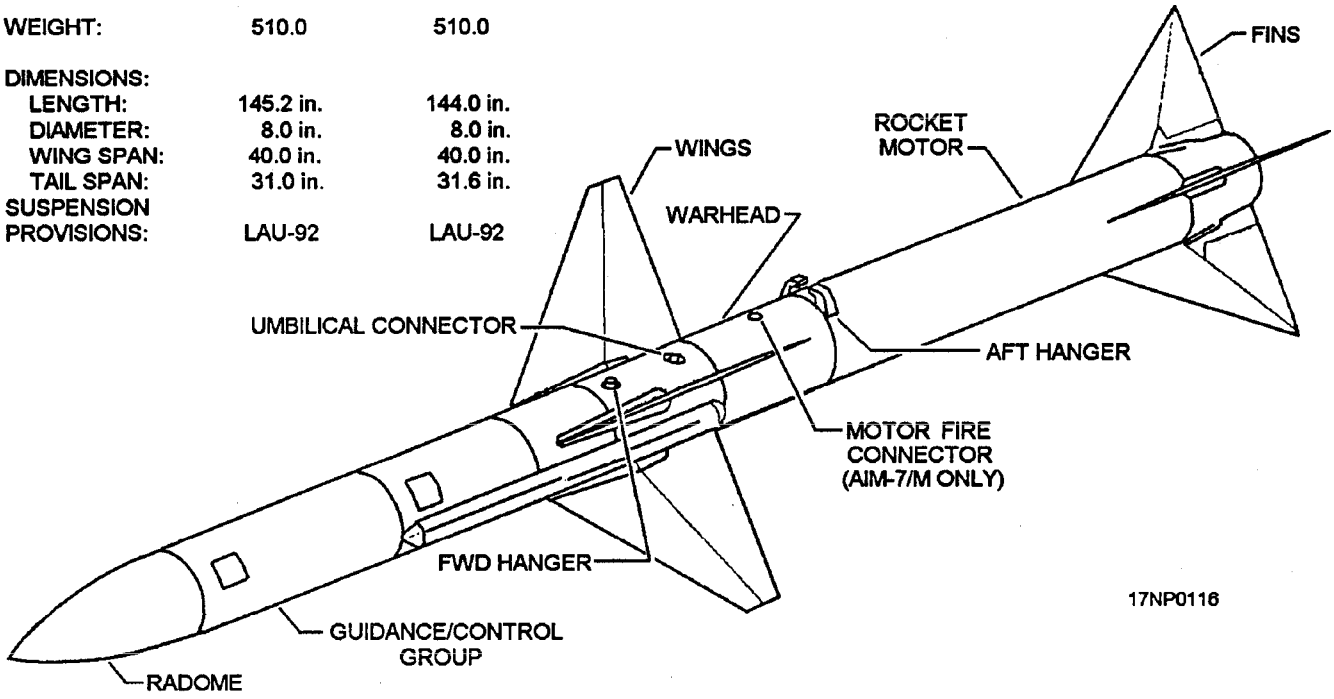


Figure 3-6.—AIM-7F/M Sparrow missile.

REVIEW NUMBER 2 ANSWERS TO QUESTIONS Q1. THROUGH Q8.

A1. *Guidance, control, armament, and propulsion are the major sections of guided missiles.*

A2. *The guidance section is considered the brains of the missile.*

A3. *The three types of homing systems are active, semiactive, and passive homing.*

A4. *If a missile gets its target illumination from the launching aircraft, it as semiactive homing.*

A5. *The armament section consists of the payload, fuzing, safety and arming (S&A) devices, and target-detecting devices (TDDs).*

A6. *Safety and arming devices maintain the explosive train of a fuzing system in a safe condition until the acceleration requirement is met after launch.*

A7. *The two types of propulsion used with guided missiles are atmospheric (air breathing) jet and thermal jet.*

A8. *The atmosphere jet depends on the atmosphere to supply the oxygen for proper fuel burning, and the thermal jet contains its own supply of oxygen and is independent from the atmosphere.*

SERVICE GUIDED MISSILES

Missiles have been operational for several years. Still, research on missiles continuously produces changes in the missile field. The missiles discussed in this manual are presently operational.

Sparrow III Guided Missile

The AIM-7F/M missile (fig. 3-6) is a supersonic, air-to-air DTRM, guided missile. It is designed to be rail or ejection launched from an interceptor aircraft. The missile's tactical mission is to intercept and destroy enemy aircraft in all-weather environments. It is designed to be launched from the F-14 and F/A-18 aircraft.

The AIM-7F/M missile is a semiactive missile. Missile guidance depends on RF energy radiated by the launching aircraft and reflected by the target. Excluding the radome, the missile body has four sectional tubular shells that house the major functional components. The four major functional components are the target seeker, flight control, warhead, and rocket motor. The overall length of the missile is approximately 142 inches with a diameter of 8 inches. It weighs approximately 510 pounds. The missile is issued to the fleet as an all-up-round (AUR). The only assembly required at fleet level is the installation of the wing and fin assemblies, which are shipped in separate shipping containers.

The radome is ceramic and forms the nose piece of the missile. It does not obstruct RF energy. It covers the RF head assembly of the target seeker and provides protection against environmental damage.

The target seeker receives and interprets the radar energy reflected from the target. Then it produces signals that are sent to the flight control section to direct the missile to intercept the target or come within lethal range of it.

The flight control consists of the autopilot and the hydraulic group. These function to provide control signals and mechanical energy to move the external control surfaces that guide the missile toward the point of intercept, and to stabilize the missile in pitch, yaw, and roll.

The warhead is located between the target seeker and flight control section. The warhead is explosive-loaded, and it contains the fuze, fuze booster charge, and the safety and arming (S&A) device. It is a continuous-rod type of warhead. At detonation, the rod sections expand into a continuous ring. Target kill is accomplished by collision of the continuous ring with the target. Detonation is triggered either by a fuze pulse from the target seeker at the nearest point of intercept or a fuze pulse from the flight control upon impact with the target,

The DTRM attaches to the aft end of the missile flight control section. It is equipped with a SAFE/ARM igniter assembly that is manually locked in either the SAFE or ARMED position. This switch can only be repositioned with an arming key. When in the SAFE position, the arming key cannot be removed. This switch prevents accidental firing of the motor. It should not be moved to the ARMED position until immediately before aircraft launch.

The control surfaces consist of four delta-shaped wing and fin assemblies. The wings and fins are designed for quick attachment and release without the use of tools. The wing assemblies attach to the flight control section, which controls their rotary motion to produce the desired pitch, yaw, and roll. The tail fin assemblies attach to fittings on the rear of the rocket motor and provide stability to the missile.

Another series of the Sparrow III guided missile is the RIM-7E and RIM-7H. These missiles are surface-to-air guided missiles. They are used in some ships in the ship's Basic Point Defense Surface Missile System (BPDSMS) and Improved Point Defense Surface Missile System (IPDSMS), respectively. As an Aviation Ordnanceman, your responsibility for these missiles is in the area of handling and stowage only.

For further information concerning the Sparrow III (series) missiles, refer to publication *organizational, Intermediate, and Depot Maintenance Instruction Manual with Illustrated Parts Breakdown,* NAVAIR 01-265GMAD-9-3 (series).

Harpoon Guided Missile

The Harpoon surface attack guided missile, AGM-84 series (AGM-84/C/D Tactical) air-launched

missile (fig. 3-7), is an all-weather antiship attack weapon. The SLAM tactical missile (fig. 3-7), AGM-84E, is a standoff land attack missile. The Harpoon can be delivered from the A-6, F/A-18, P-3, and S-3 aircraft. The SLAM primary launch platforms are the A-6E and F/A-18 aircraft. Both missiles are AURs and require no assembly other than installation of the wing and control fin assemblies. The missile consists of the guidance section, warhead section, sustainer section, boattail section, wings, and control fins. The missile is approximately 151 inches in length and weighs approximately 1,144 pounds.

The Harpoon missile has a low-level cruise trajectory with over-the-horizon range that makes it less susceptible to radar detection. It uses active guidance and has counter-countermeasure capability.

The guidance section contains the seeker, radar altimeter, midcourse guidance unit, and power supply. A radome on the front of the guidance section provides

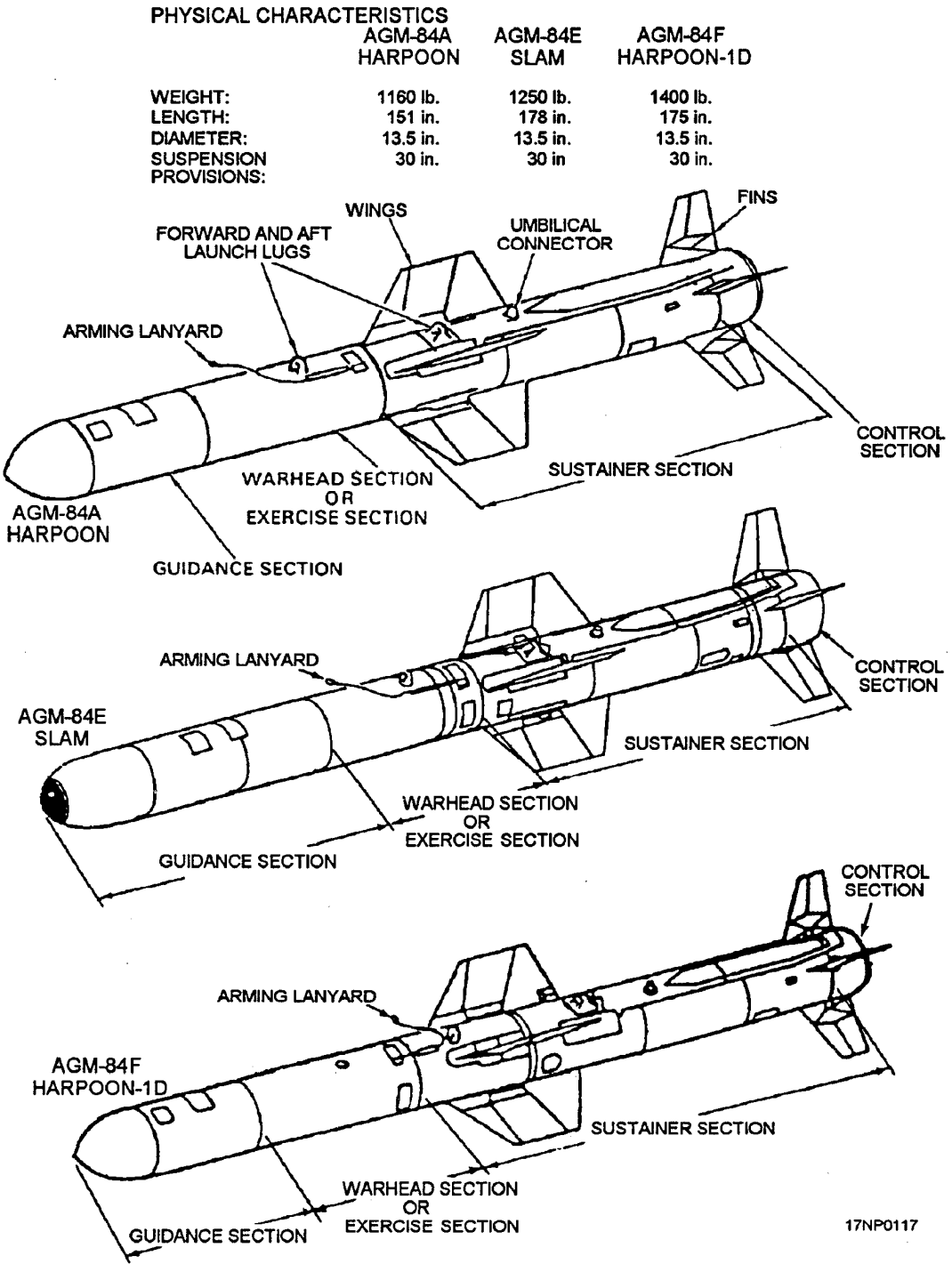


Figure 3-7.—AGM-84 series Harpoon/SLAM guided missile.

the required aerodynamic shield to protect the internal components of the seeker. During ground handling, the radome is protected by a radome protector cap.

The warhead section contains a penetration blast type of explosive, the guided missile fuze, fuze booster, and the pressure probe assembly. It also provides internal routing of the interconnecting cable from the guidance section to other parts of the missile.

The sustainer section contains the fuel tank and fuel supply system, missile battery, pyrotechnic relay panel, and the turbojet engine. Three BSU-4/B missile wings and one BSU-43/B missile wing are attached to the sustainer section by quick-attach, clevis-type fittings. These wings are attached to the missile at the organizational level. They provide the aerodynamic lift required to sustain missile flight. They are made of a framed aluminum honeycomb construction and are nonfolding.

The boattail section contains four control actuators, which control the control fins. Four identical nonfolding missile control fins (BSU-44/B) provide directional control of the missile's airframe proportional to the input signal received from the guidance section. The control fins are one-piece aluminum castings, and are attached to the control fin actuators by means of an integral torque-limiting, screw-type device.

For further information concerning the air-launched AGM-84 (series) Harpoon guided missiles, refer to the publications *Airborne Weapons Assembly,* NAVAIR 11-140-6.2-4, and *Airborne Weapons Assembly, AGM-84/E,* NAVAIR 11-140-6.2-5.

Sidewinder Guided Missile

The Sidewinder guided missiles, AIM-9 series (fig. 3-8), are supersonic, air-to-air weapons with passive infrared target detection, proportional navigation guidance, and torque-balance control systems. They are capable of being launched from the A-6, F-14, and F/A-18 aircraft. The AIM-9 series missiles are issued to the fleet as AURs. The components of the ATM-9L-1 are identical to the AIM-9L/M except that a training warhead is substituted for the tactical warhead in the ATM-9L-1. The AIM-9L/M missile is used strictly for tactical purposes. The ATM-9L-1 missile is used for pilot training in target acquisition and missile firing.

The Sidewinder guided missile is approximately 113 inches in length, 5 inches in diameter, weighs approximately 190 pounds, and consists of five major components. These components are the guidance and

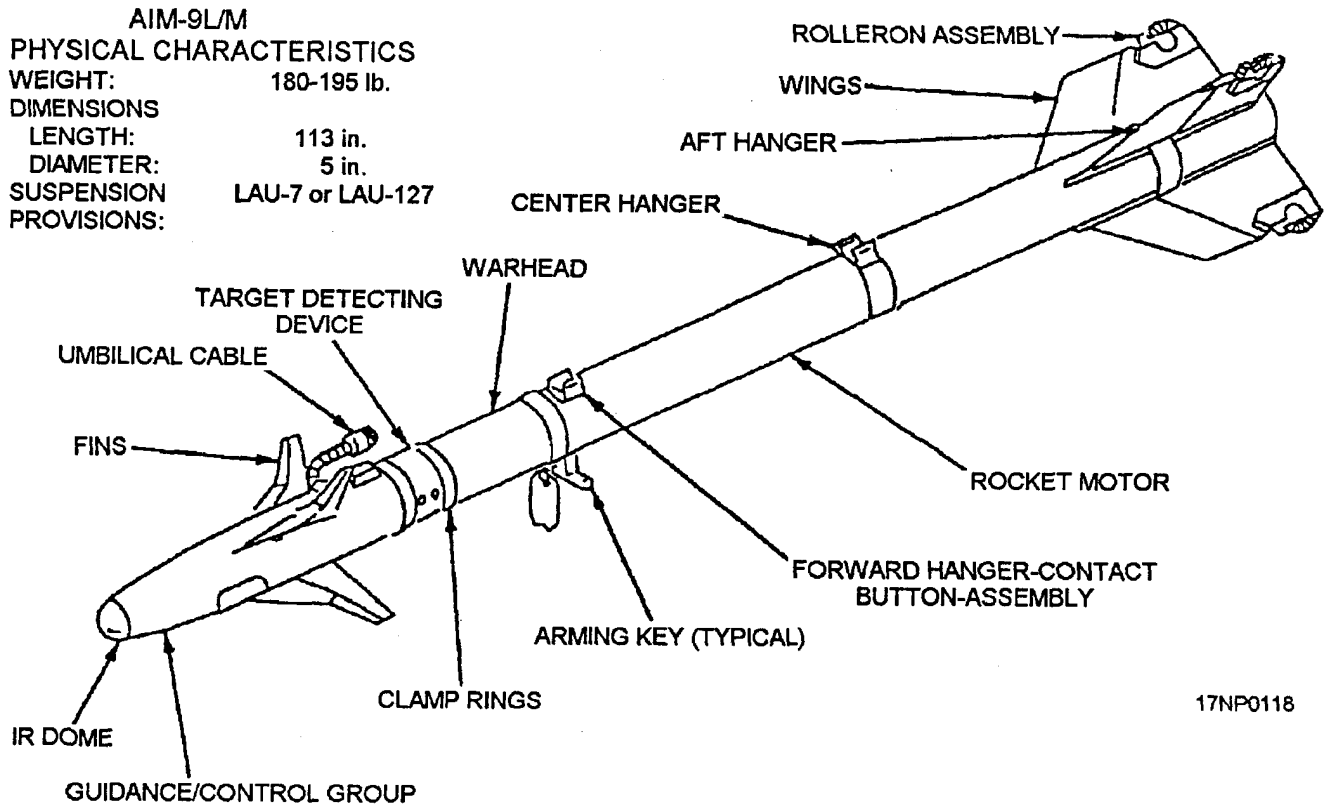


Figure 3-8.—AIM-9 series Sidewinders guided missile.

control section, the target detector section, the S&A device, the warhead section, and the rocket motor section (fig. 3-9).

The guidance and control section consists of the following three major assemblies:

1. An infrared seeker assembly, which is used for detecting the target.

2. An electronic assembly, which is used for converting detected target information to tracking and guidance command signals.

3. A gas servo assembly (which consists of a gas generator, manifold, pistons, rocker arms, electrical solenoids, and thermal battery), where the electrical guidance commands are converted to mechanical movement of the control fins.

Four BSU-32/B control fins are mounted on the guidance and control section to provide aerodynamic lift and course alterations to the missile during free flight. They are movable surfaces that are electrically controlled and pneumatically operated by the gas servo assembly, The missile's umbilical cable is also attached to the guidance and control section. A shorting cap/dust cover must be installed on the umbilical connector at all times when the missile is not electrically connected to the LAU-7 launcher. The umbilical cable provides the necessary path for the exchange of electronic signals between the missile and aircraft before missile launch. It also provides a connection to the launcher-mounted cooling gas supply, which prevents the electronic components of the guidance and control section from becoming overheated during operation before missile launch. The umbilical cable is sheared off at missile launch.

The target detector (TD) is a narrow-beam, active-optical, proximity fuze system. The purpose of the TD is to detect the presence of an air target within the burst range of the missile warhead and generate an electrical firing signal to the S&A device.

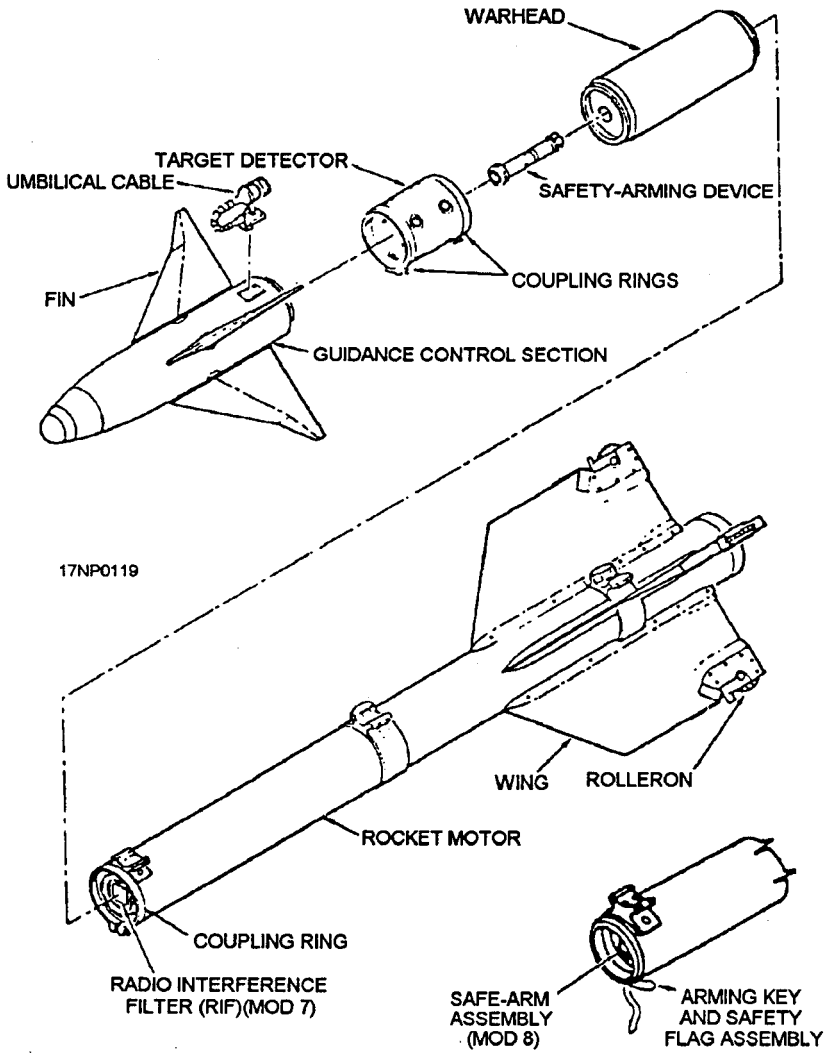


Figure 3-9.—AIM-9 series Sidewinders guided missile (exploded view).

The S&A device attaches to the target detector and is located between the TD section and the warhead section. The S&A device contains an interrupted firing train that is aligned by an acceleration arming device. It contains the necessary high explosives, switches, and circuits to initiate detonation of the warhead.

The WDU-17/B warhead (used in the AIM-9L configuration) is an annular blast fragmentation warhead that consists of a case assembly, two booster plates, an initiator, high explosive, and fragmentation rods. The explosive output from the S&A device is transferred through the initiator to the booster plates. The initiation is then transferred through the explosive-loaded channels of the booster plates to the booster pellets at each end of the warhead. Detonation of the booster pellets sets off the high explosive, causing warhead detonation.

The WDU-9A/B warhead (used in the ATM-9L-1 configuration) is mechanically interchangeable with the WDU-17/B tactical warhead The WDU-9A/B contains a smoke-flash mix with CH-6 booster to provide visual observation of the missile/target hit.

The Mk 36 Mod 7 rocket motor uses a single-grain propellant. A nonpropulsive head closure, located on the forward end of the motor tube, blows out if the motor is accidentally ignited without the warhead installed, making the motor nonpropulsive (a fire hazard vice a missile hazard). The Mk 36 Mod 8 rocket motor is basically identical to the Mod 7 motor except that the Mod 8 motor is equipped with a safe-arm ignition assembly. The purpose of this assembly is to prevent accidental or inadvertent rocket motor ignition. The safe-arm ignition assembly must be manually rotated to the armed position before flight. This is accomplished by the use of a hex-head T-handle.

Four Mk 1 Mod 0 or Mod 1 wings are attached to the aft end of the motor tube. They provide aerodynamic lift and stability during flight. Each wing has a rolleron assembly that provides pitch, yaw, and roll stabilization during free flight. When the missile is fired, the rolleron is uncaged by acceleration and is free to move through its longitudinal axis during flight. The rolleron wheel is designed so that the passing airstream causes it to spin at a very high speed, thus acting as a gyroscope, which helps to stabilize the missile and reduce roll during flight.

For further information about the AIM-9L/M and ATM-9L-1 Sidewinder guided missile, you should refer to the *Sidewinders Guided Missile AIM-9L and Training Missile,* NAVAIR 01-AIM9-2.

Advanced Medium Range Air-to-Air Missile (AMRAAM)

The AMRAAM is an all-weather missile (fig. 3-10). Aircraft currently scheduled to carry the missile are the

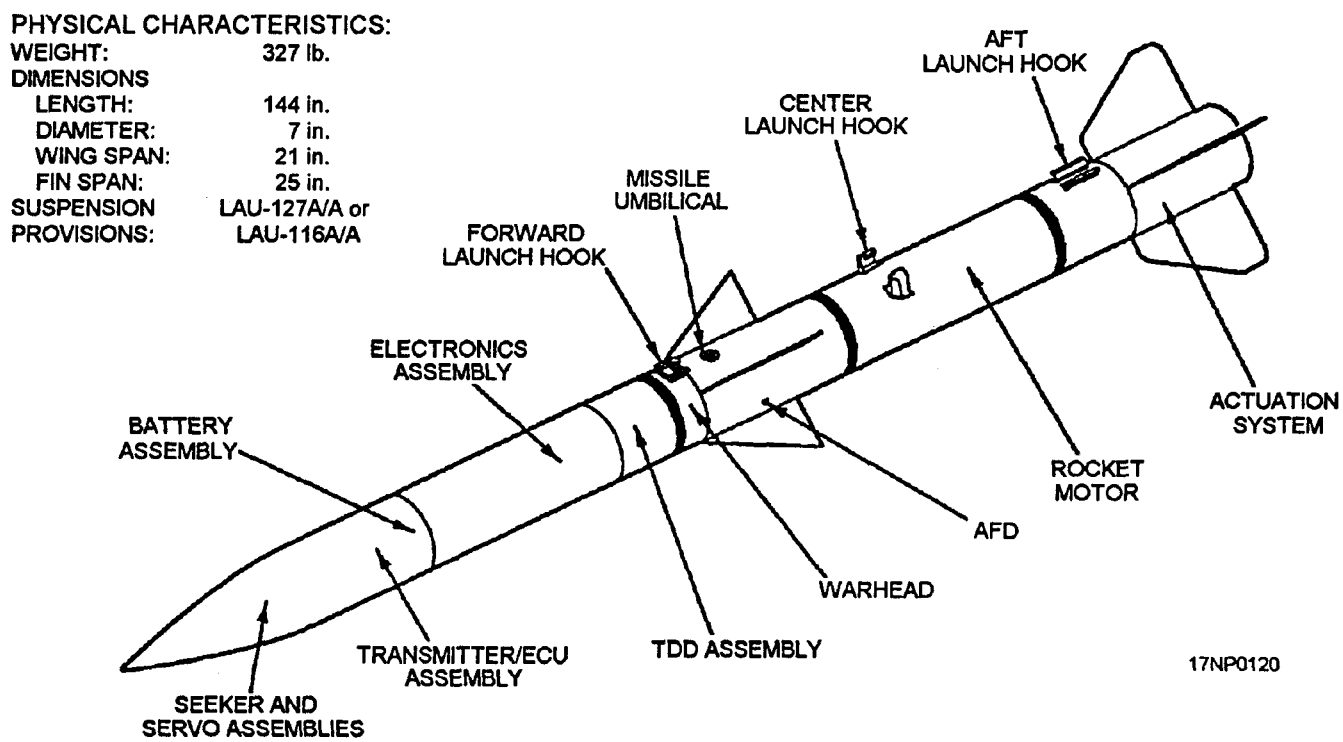


Figure 3-10.—AIM-120 AMRAAM guided missile

F-14 and F/A-18 aircraft. The AIM-120 is an AUR that consists of a guidance section, armament section, propulsion section, and control section.

The guidance section consist of a radome, seeker components, electronics unit, inertial reference unit, target detection device, batteries, power converter, and related harnesses and hardware.

The armament section includes a WDU-33/b fragmenting warhead, Mk-44 booster, and a FZU-49/B safe and arm fuze (SAF).

The propulsion section consists of a dual-thrust, solid-propellant, low-smoke, rocket motor, a blast tube and exit cone, and an arm/fire device (AFD).

The control section includes four independently controlled electromechanical actuators, four thermal batteries, a data link assembly, and associated hardware. The control surfaces are locked in position by gas pressure-operated mechanical locks during ground handling and captive carry. During launch, a pyrotechnic gas generator creates enough gas pressure to unlock the control surfaces.

REVIEW NUMBER 3

Q1. Within the radome of the Sparrow III missile, what feature receives and interprets the radar energy reflected from the target?

Q2. What part of the Sparrow III missile provides control signals and mechanical energy to move external control surfaces that guide the missile?

Q3. To what part of the Sparrow missile is the DRTM attached?

Q4. Name the aircraft from which the Harpoon guided missile is launched.

Q5. The Harpoon missile is less susceptible to radar detection because

Q6. List the sections of the Harpoon missile.

Q7. Sidewinder missiles are equipped with _____ target detection.

Q8. List the five mjor components of the Sidewinder missile.

Q9. By what means is the S&A device aligned?

Q10. What feature of the Sidewinder missile provides aerodynamic lift and stability during flight?

Phoenix Missile

The tactical AIM-54C Phoenix (fig. 3-11) is an air-launched, air-to-air guided missile that employs active, semiactive, and passive homing capabilities. The AIM-54C is used as a long-range, air-intercept missile launched from the F-14 aircraft. It is equipped with the AWG-9 Airborne Missile Control System

WEIGHT:	1000 lb.
DIMENSIONS:	
LENGTH:	156 in.
DIAMETER:	15 in.
FIN SPAN:	36 in.
SUSPENSION:	LAU-93

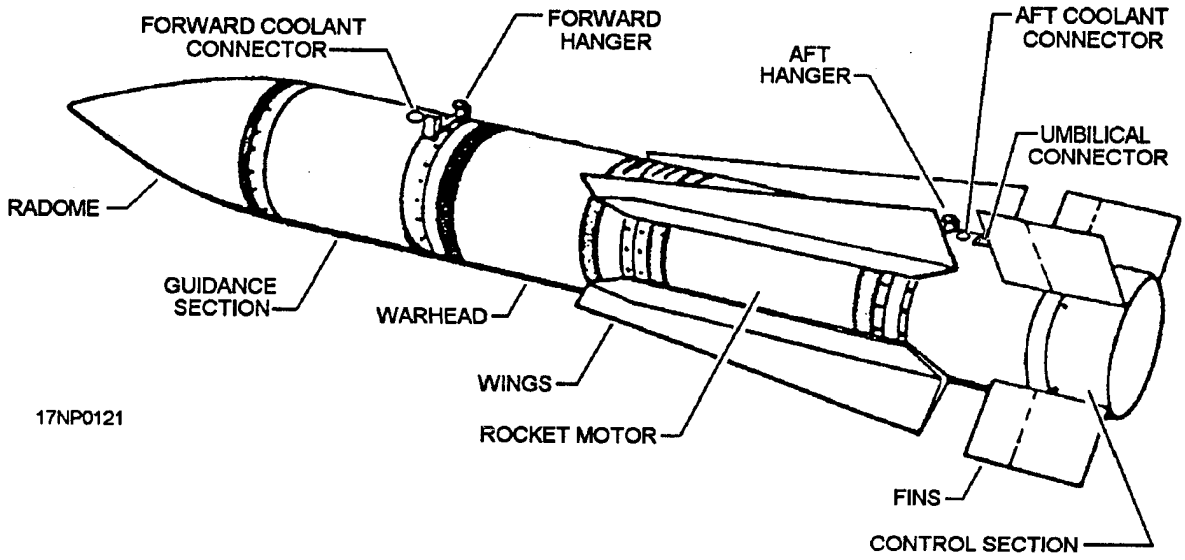


Figure 3-11.—AIM-54 Phoenix guided missile (typical).

(AMCS). The missile can be launched in multiple missile attacks, as required, against hostile forces. A maximum of six AIM-54C Phoenix missiles can be launched from a single aircraft, with simultaneous guidance against widely separated targets. In addition, the missile has dogfight, electronic counter-countermeasures (ECCM), and anticruise missile capabilities.

The physical description of the Phoenix missile is extremely brief because it is classified as Secret. The overall length of the missile is 13 feet with a diameter of 15 inches. It weighs approximately 1,020 pounds. The missile consists of the guidance section, the armament section, the propulsion section, and the control section. The missile is an AUR. The wings and fins can be mounted or removed to facilitate handling.

Maverick Missile

The tactical AGM-65E Maverick (fig. 3-12) is a laser-guided, rocket-propelled, air-to-ground missile. It is used against fortified ground installations, armored vehicles, and surface combatants. The Maverick missile is compatible with the A-4M, A-6E, and F/A-18 aircraft.

The AGM-65E missile has two major sections-the guidance and control section and the center/aft section. Four fixed wings are an integral part of the center/aft section, and four movable control surfaces (fins) are located at the aft section. These fins are installed or removed to aid in handling. The missile is issued to the fleet as an AUR. Installation of the fins is the only assembly required at the organizational maintenance level.

The AGM-65E missile system has all the laser missile features, including automatic terminal homing on laser energy reflected from the target, which is illuminated by a laser designator. The laser designator can be a ground device, either hand-held or tripod mounted It can also be a stabilized airborne device, mounted either on a separate aircraft or on the launching aircraft. Additionally, the warhead provides kinetic penetration into earth-barricaded or concrete fortifications and ships. The fuzing system allows a selectable detonation delay to optimize kill capability.

For further information on the AGM-65E Maverick, you should refer to *User-Guided Missile AGM-65E (Maverick),* NAVAIR 11-120-58.

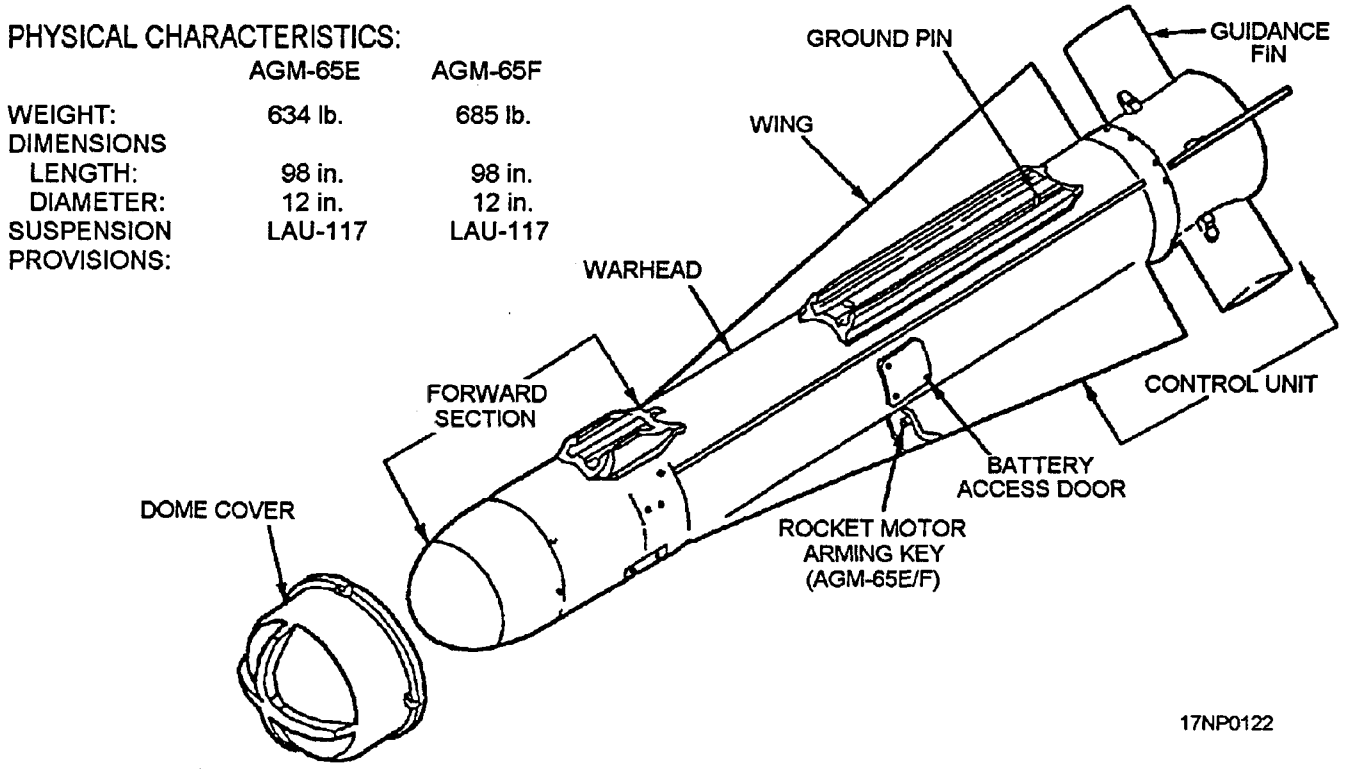


Figure 3-12.—AGM-65E Maverick missile.

HARM Missile

The AGM-88A high-speed antiradiation missile (HARM) (fig. 3-13) offers performance improvements over the existing Shrike and Standard ARM missiles when used for defense suppression and similar operations.

The HARM missile, in conjunction with the launching aircraft's avionics, detects, identifies, and locates enemy radars, displays threat information, and computes target parameters. The HARM missile is 10 inches in diameter, 194 inches long, and weighs 780 pounds. The missile operates in three basic modes: (1) self-protect (which attacks targets that pose immediate threat to the aircraft), (2) target of opportunity (which attacks discrete targets important to the tactical situation), and (3) prebrief (missile programmed to the vicinity of known or expected targets, and to attack when lock-on is achieved). Launch aircraft for the HARM are the A-6E, EA-6B, and F/A-18.

Penguin Missile

The AGM-119B (fig. 3-14) is a fire and forget, antisurface ship, all-up-round (AUR) missile. The missile uses inertial guidance and infrared (IR) homing. The AGM-119B is intended to be launched from the SH-60B LAMPS helicopter. It is the first helicopter-launched, air-surface, antiship missile system in the U.S. Navy inventory.

The missile launch assembly (MLA) contains the missile control system (MCS) and attaches to the wing pylon of the SH-60B LAMPS Mk III helicopter. It provides mechanical attachment points for the missile launch/release system (BRU-14 rack with two AERO-1A adapters, which provide a 30-inch suspension capability). The MLA, with BRU-14

REVIEW NUMBER 3 ANSWERS TO QUESTIONS Q1. THROUGH Q10.

A1. Within the radome of the Sparrow III missile, the target seeker receives and interprets the radar energy reflected from the target.

A2. The flight control section, which consists of the autopilot and hydraulic group, provides the Sparrow III missile with control signals and mechanical energy to move external control surfaces to guide the missile,

A3. The DRTM is attached to the aft end of the missile flight control section of the Sparrow missile.

A4. The Harpoon guided missile is launched from A-6, F/A-18, S3, and P-3 aircraft.

A5. The Harpoon missile is less susceptible to radar detection because of its low-level cruise trajectory with over-the-horizon range.

A6. The sections of the Harpoon missile include the guidance, warhead, sustainer and boattail sections.

A7. Sidewinder missiles are equipped with passive infrared target detection.

A8. The five major components of the Sidewinder missile include the guidance and control section, target detector section, S&A device, warhead section, and rocket motor section.

A9. The S&A device is aligned by an interrupted firing train that is aligned by an acceleration arming device.

A10. Four Mk 1 Mod 0 or Mod 1 wings attached to the aft end of the motor tube provide aerodynamic lift and stability to the Sidewinder missile during flight.

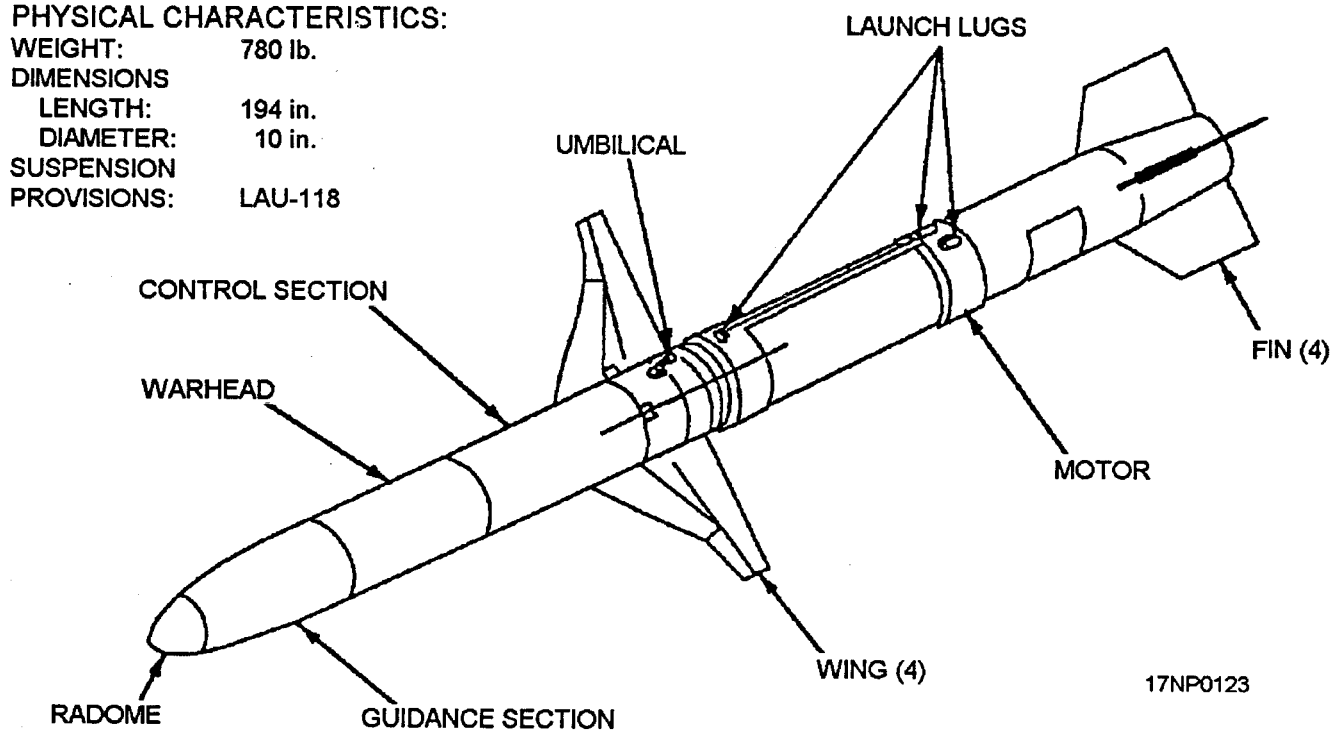


Figure 3-13.—AGM-88 HARM missile.

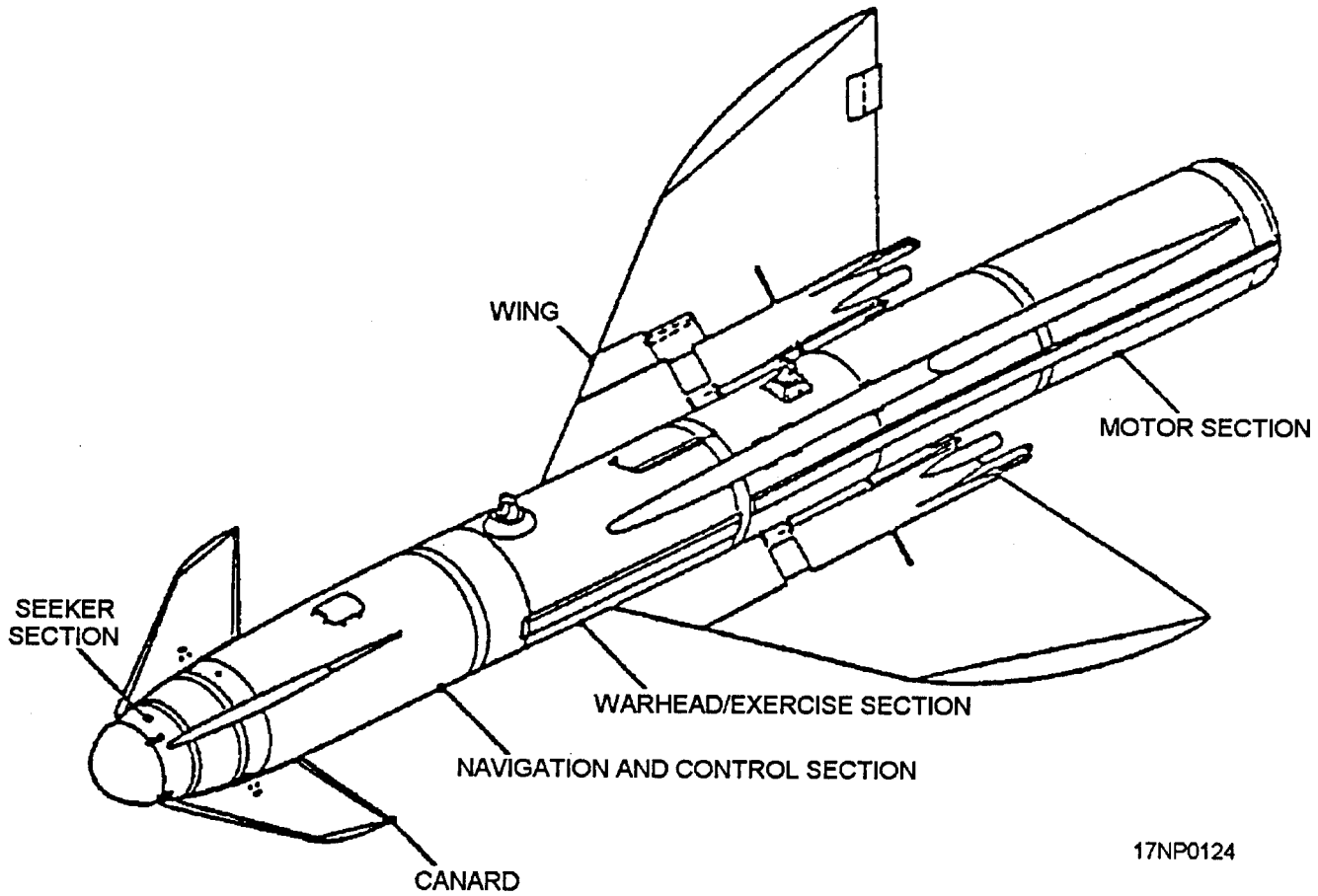


Figure 3-14.—AGM-119B Penguin missile.

attached, carries and launches the Penguin missile on command.

Sidearm Missile

The AGM-122A Sidearm missile (fig, 3-15) is a short-range, air-to-ground, antiradiation missile that is designed to detect, home on, and destroy or disable enemy radar.

The Sidearm missile borrows its technology and design from the Sidewinder missile, Currently the Sidearm missile can only be carried on the AH-1 helicopter, but it is being considered for use on other aircraft.

REVIEW NUMBER 4

Q1. List the homing capabilities incorporated into the Phoenix missile.

Q2. How many Phoenix missiles can be launched from a single aircraft?

Q3. List the sections of the Phoenix missile.

Q4. List the types of targets the Maverick missile is used against.

Q5. How does the laser guidance system work in the Maverick missile?

Q6. Name the three basic modes of HARM missile operation.

Walleye Guided Weapon

The Walleye guided weapon does not contain a propulsion system as do guided missiles. It is included in this chapter because it contains a guidance system, a control system, externally mounted control surfaces, and is listed in the Air Launched Guided Missiles and Components section of *Navy Ammunition Logistic Code TW010-AA-ORD-010,* NAVAIR 11-1-116A.

The Walleye guided weapon system (fig. 3-16) is designed to deliver a self-guided, high-explosive weapon from an attack aircraft to a surface target. The Walleye weapon is issued to the fleet as an AUR. The only assembly required at the organizational maintenance level is the installation of the wings and fins.

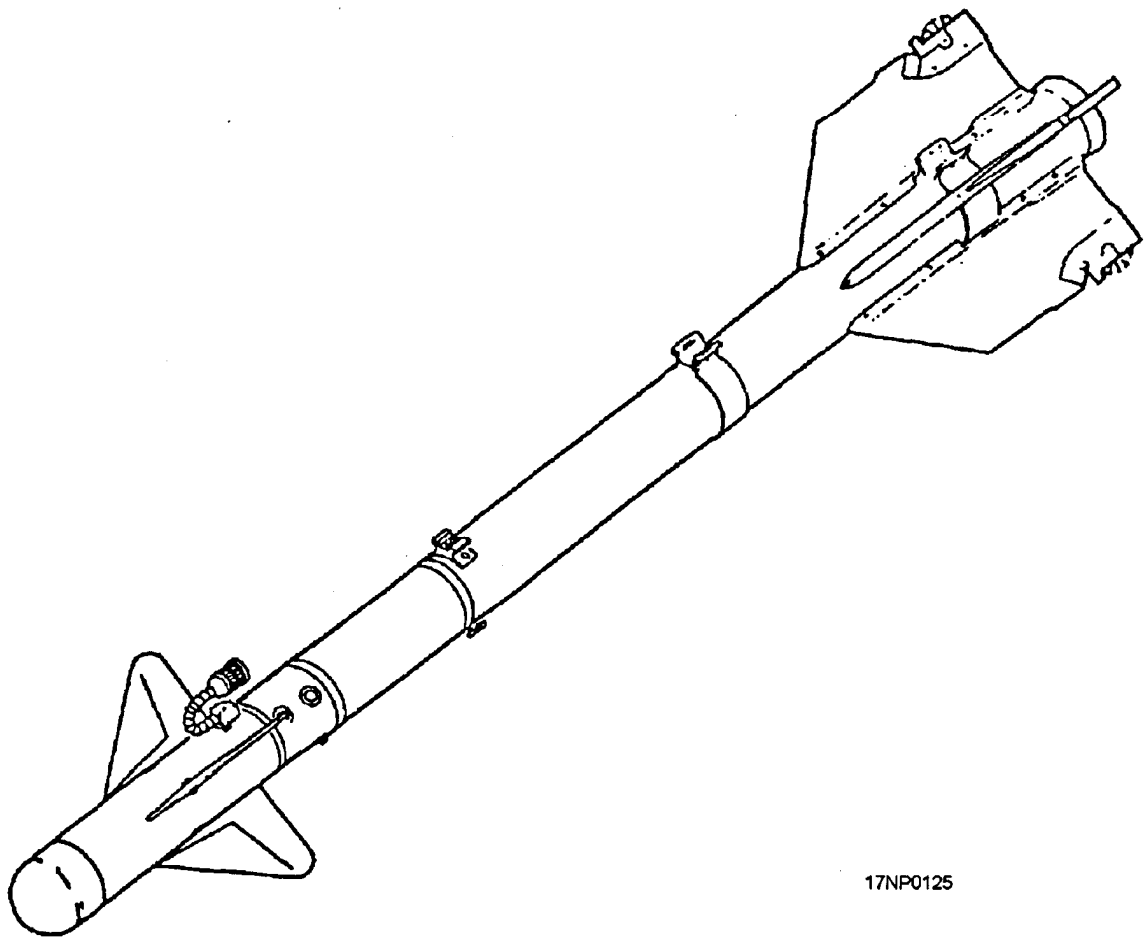


Figure 3-15.—AGM-122A Sidearm missile.

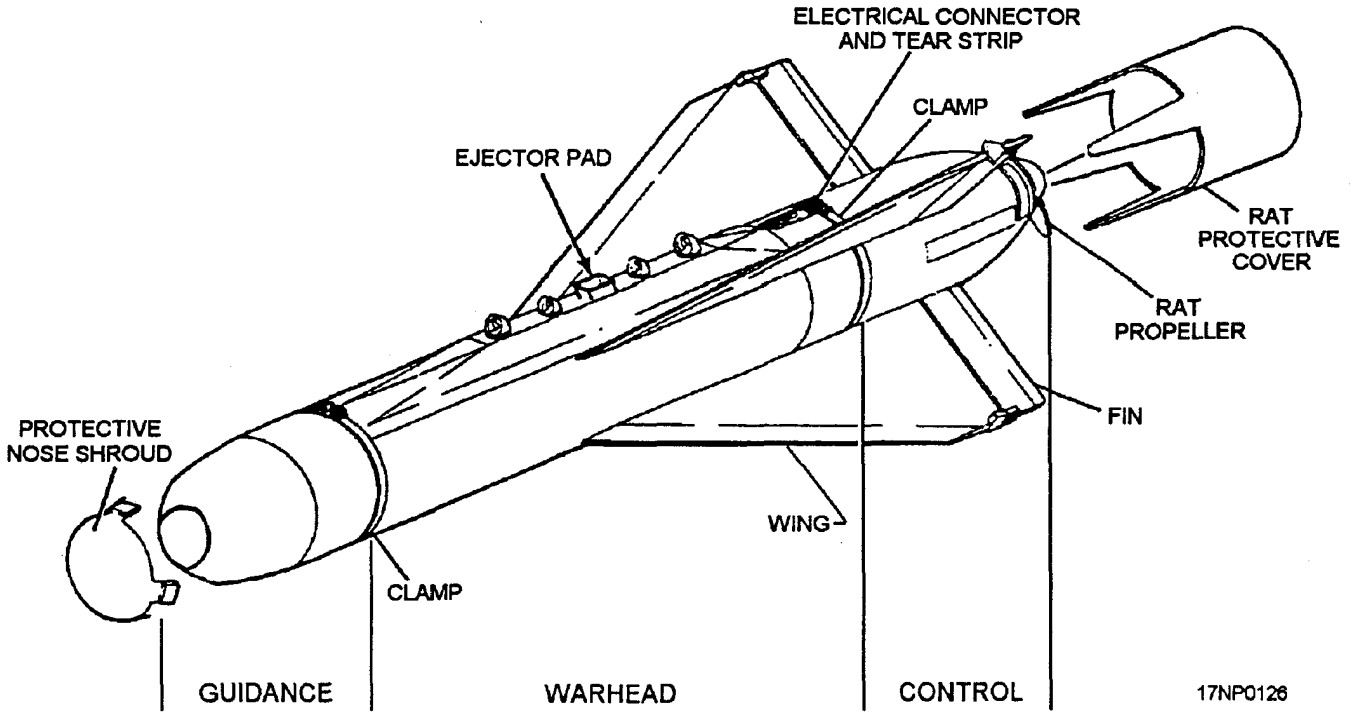


Figure 3-16.—Walleye guided weapon (typical).

The weapons are grouped into four basic series-Walleye I (small scale), Walleye I extended range data link (ERDL), Walleye II (large scale), and Walleye II ERDL. Note that the Walleye II and Walleye II ERDL weapons are larger in diameter and length and weigh more than the Walleye I weapon. The Walleye II ERDL weapon also has larger wings. A Walleye weapon representative of each basic series is discussed in this chapter.

WALLEYE I.— The Mk 21 Walleye I tactical weapon consists of a guidance section, a warhead section (including the fuze and fuze booster), a control section, four wings, and four fins. The weapon has provisions for 14- and 30-inch suspensions, and an ejector foot pad that is used to adapt the weapons to various types of aircraft bomb racks. The Walleye I (series) weapons are in the 1,000-pound class weapon category.

To form a typical attack situation, the weapon, pilot, and aircraft must perform as a complete weapons system. The weapon uses aircraft electrical power (via an umbilical cable that connects the weapon to the aircraft) from the time electrical power is applied to the aircraft until the aircraft reaches a speed of approximately 180 knots. The automatic power changeover circuit in the weapon then switches the weapon to ram air turbine (RAT) generator power.

Basically, the guidance section of the weapon and the aircraft system form a closed-circuit television system. A television camera mounted in the nose of the guidance section provides a picture of the area forward of the aircraft and displays this information on a television monitor located in the cockpit of the aircraft. Additional circuits provide a cross-hair grid on the pilot's television monitor, which is a pair of vertical and a pair of horizontal lines. This intersection of horizontal and vertical cross hairs (the square in the middle) defines the tracking area. By looking at the video scene displayed on the television, the pilot is able to boresight the weapon and aircraft to acquire the target, initiate lock-on, and confirm weapon tracking.

After boresighting the weapon, selecting the proper fuze option, and achieving satisfactory lock-on, the pilot initiates release and escapes the target area. The weapon continues to track the target until it reaches the point of impact.

The Walleye I Mk 27 practice weapon is identical to the Mk 21 weapon except for the warhead and control sections. The warhead is entirely inert, does not contain a fuze or fuze booster, and has ballast to maintain weapon CG (center of gravity) compatibility with the Mk 21 weapon. This weapon is used for captive-flight pilot training and for aircraft loading and ground handling training purposes.

For further information concerning the Walleye I guided weapon, you should refer to the *Walleye I Guided Weapon,* NAVAIR 01-15MGA-1.

WALLEYE I ERDL.— The Walleye I extended range data link (ERDL) guided weapon consists of the same basic items as the Walleye I. These weapons are designed to be used in conjunction with the AN/AWW-13 data pod. They permit target information to be transmitted between the weapon and data pod before and after release of the weapon.

WALLEYE II.— The Mk 5 tactical Walleye II guided weapon consists of a guidance section, a fairing assembly, a warhead section (including the fuze and fuze booster), a control section, four wings, four fin adapters, and four fins. The weapon has provisions for 30-inch suspension only, and is in the 2,000-pound class weapon category. The Walleye II (series) weapons are essentially the same as the Walleye I weapons except they are physically larger in size and have improved electronics. Functional operation of the weapon and delivery tactics are basically the same as Walleye I.

For further information concerning the Walleye II (series) weapons, you should refer to the *Guided Weapon (Walleye II),* NAVAIR 01-15MGB-2.2.

WALLEYE II ERDL.— The Walleye II extended range data link (ERDL) guided weapon Mk 23 Mods 0, 1, and 2 (frequency channels A, C, and E) consists of the same basic items as the Walleye II Mk 5 weapons. However, these assemblies include added data link functions and extended range capability. The addition of the larger wings enables the weapon to be launched with longer slant ranges to a target complex. The addition of the data-link pod (Guided Weapon Control-Monitor Set AN/AWW-9/13) and a joystick controller (guided weapon control group OK-293/AWW) on the aircraft allow the pilot to remotely steer the weapon to a specific target within the complex with pinpoint accuracy.

The Guided Weapon Control-Monitor Set AN/AWW-9/13, data-link pod (fig. 3-17), is the communications link between the pilot and the weapon. The pod is suspended from a standard Walleye-configured bomb rack. It can be jettisoned in an emergency. The pod contains the necessary electronics to allow the pilot to receive the transmitted video from the weapon and to transmit the command signals to the weapon. In addition, the pod contains a video tape recorder (VTR) that records the video transmitted by the weapon all the way to impact on the target. This allows low-cost weapon performance monitoring, which can be played back for mission evaluation or for training purposes.

The weapon system may be used in one- or two-aircraft operations. In a single aircraft operation, the aircraft carries both the weapon and the pod, and the aircraft performs both launch and control functions. In the two-aircraft operation, one aircraft carries the weapon and a second aircraft carries the pod. In this operation, both the launch aircraft and the pod aircraft receive a video picture of the target area from the weapon. After weapon launch, the pod aircraft monitors the flight of the weapon and can update the weapon aim point all the way to impact.

Tactically, the two-aircraft operation dominates because of the limited number of available pods. For example, a one-pod configured aircraft monitors the

REVIEW NUMBER 4 ANSWERS TO QUESTIONS Q1. THROUGH Q6.

A1. The Phoenix missile use active, semiactive, and passive homing.

A2. Six Phoenix missiles can be launched from a single aircraft.

A3. The Phoenix missile consists of the guidance, armament, propulsion, and control sections.

A4. The Maverick missile is used against fortified ground installations, armored vehicles, and surface combatants.

A5. The Maverick missile has automatic terminal homing on laser energy reflected from the target, which has been illuminated by a laser designator.

A6. The three basic modes of HARM missile operation are self-protect, target of opportunity, and prebrief

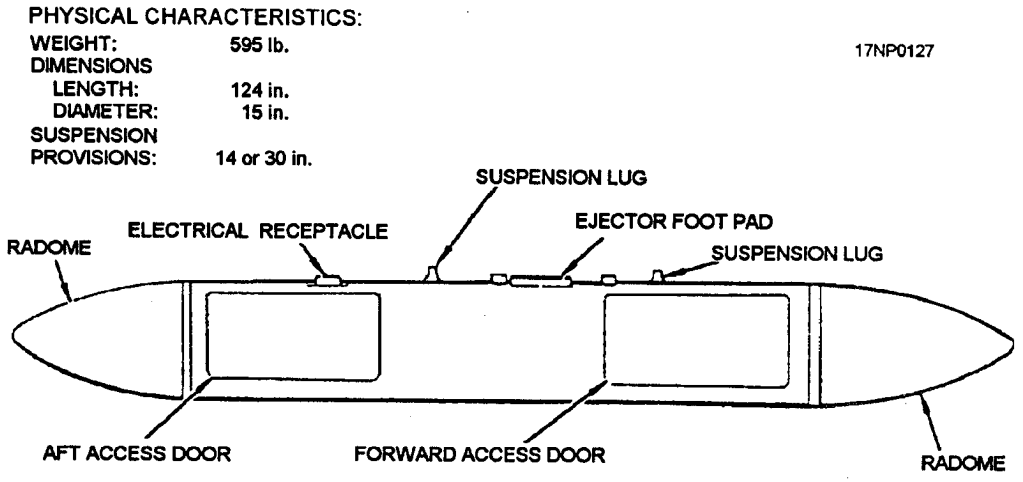


Figure 3-17.—AN/AWW-9/13 advanced data-link pod.

weapon control functions for several individual weapon launchings during one mission (not simultaneously). The three frequency channels (A, C, and E) are used to control the individual weapons launchings. The three channels prevent the control section of the weapon from responding to override (steering) commands from a pod that is not set to that weapon's specific frequency channel. Therefore, more than one weapon/pod operation can be conducted in the same area.

The Walleye II ERDL Mk 38 series (frequency channels A, C, and E) practice guided weapon is used for captive flight and data-link training for pilots of data link configured F/A-18 aircraft. The practice guided weapon contains the same data link components as the tactical Walleye I ERDL Mk 23 weapon except that the warhead in the Mk 38 is filled with inert material.

REVIEW NUMBER 5

Q1. Name the four basic series of Walleye guided weapon systems.

Q2. List the sections of the Walleye I tactical weapon.

Q3. When the Walleye I is used, how is a typical attack situation formed?

Q4. What type of suspension does the Walleye II have ?

Q5. What is the difference between the Walleye I and Walleye II weapons?

Q6. Name the functions the Walleye II ERDL have that the Walleye I and Walleye II don't have.

Q7. The data-link pod provides the _____.

Q8. What prevents the control section of one weapon from responding to commands not set to its channel?

GUIDED MISSILE LAUNCHERS

LEARNING OBJECTIVE: *Identify the purpose and recognize the use of guided missile launchers. Identify the components of the LAU-7/A (series) guided missile launcher.*

Guided missile launchers provide the mechanical and electrical means of suspending and air-launching a guided missile from an aircraft. Because the physical, mechanical, and functional requirements vary for each particular missile-to-aircraft configuration (table 3-2), a brief description of each type of missile launcher is discussed in the following paragraphs.

Table 3-2.—Missile Launcher Application

LAU-7/A	AIM-9 SIDEWINDER	RAIL	A-6, F-14, F/A-18
LAU-92	AIM-7 SPARROW	EJECTOR	F-14
LAU-93	AIM-54A/C PHOENIX	EJECTOR	F-14
LAU-132	AIM-54C PHOENIX	EJECTOR	F-14D
LAU-115/A	AIM-7 SPARROW	RAIL	F/A-18
LAU-115A/A	AIM-120 AMRAAM	RAIL	F/A-18
LAU-116/A	AIM-7 SPARROW	EJECTOR	F/A-18
LAU-116A/A	AIM-120 AMRAAM	EJECTOR	F/A-18
LAU-117/A(V)2/A	AGM-65 MAVERICK	RAIL	A-16, F/A-18
LAU-118/A	AGM-88 HARM	RAIL	A-6, EA-6B, F/A-18
LAU-127	AIM-120 AMRAAM AIM-9 SIDEWINDER	RAIL	F/A-18

LAU-7/A (SERIES) GUIDED MISSILE LAUNCHER

The LAU-7/A (series) guided missile launcher (fig, 3-18) is a reusable launcher that provides a complete launching system for use with the AIM-9 Sidewinder (series) missiles. The launcher (fig. 3-18) has four major assemblies—the housing assembly, nitrogen receiver assembly, mechanism assembly, and power supply.

Housing Assembly

The housing assembly is the main structural member of the launcher. It is an extruded, machined aluminum member that provides structural rigidity to the launcher and includes provisions for mounting all other assemblies. It also includes provisions for mounting the launcher to the aircraft.

Nitrogen Receiver Assembly

The nitrogen receiver assembly stores the high-pressure nitrogen (3,200 psig) used to cool the missile's IR detector in the guidance system. Two nitrogen receiver assemblies are available for use with the launcher. One is a cylindrical fiber glass container with a corrosion-resistant metal liner, and the other is a plain cylindrical steel container. The receiver mounts in the aft section of the housing assembly and screws into the aft end of the mechanism assembly. All receivers contain a charging valve (for refilling), relief valve, and a pressure indicator mounted in the aft end of the cylinder. The pressure indicator is color coded to ensure correct readings as follows:

- Red 0 to 2.2 psi
- Yellow 2.2 to 2.8 psi
- Green 2.8 to 3.5 psi
- White 3.5 to 5 psi

All readings listed must be multiplied by 1,000 psi.

Mechanism Assembly

The mechanism assembly is an electromechanical device that holds the missile for takeoffs and landings and releases the missile for launching. It mounts in the center of the housing assembly forward of the receiver assembly. The subassemblies of the mechanism assembly are discussed in the following paragraphs.

ELECTRICAL HARNESS ASSEMBLY.— The electrical harness assembly consists of the appropriate connectors and wiring to interconnect between the aircraft power and firing circuits and the launcher. Also,

REVIEW NUMBER 5 ANSWERS TO QUESTIONS Q1. THROUGH Q8.

A1. The four basic series of Walleye guided weapon systems are the Walleye I, Walleye I EDRL, Walleye II, and Walleye II ERDL.

A2. The sections of the Walleye I tactical weapon include the guidance section, warhead section, control section, four wings, and four fins.

A3. When the Walleye I is used, a typical attack situation is formed by the weapon, pilot, and aircraft performing as a complete weapons system

A4. The Walleye II has a 30-inch suspension.

AS. The Walleye I and Walleye II weapons are basically the same; however, the Walleye II is physically larger and has improved electronics.

A6. The Walleye II ERDL has added data link functions and extended range capability.

A7. The data-link pod provides the communications link between the pilot and weapon.

A8. Three frequency channels (A, C, and E) prevent the control section of one weapon from responding to commands not set to its channel.

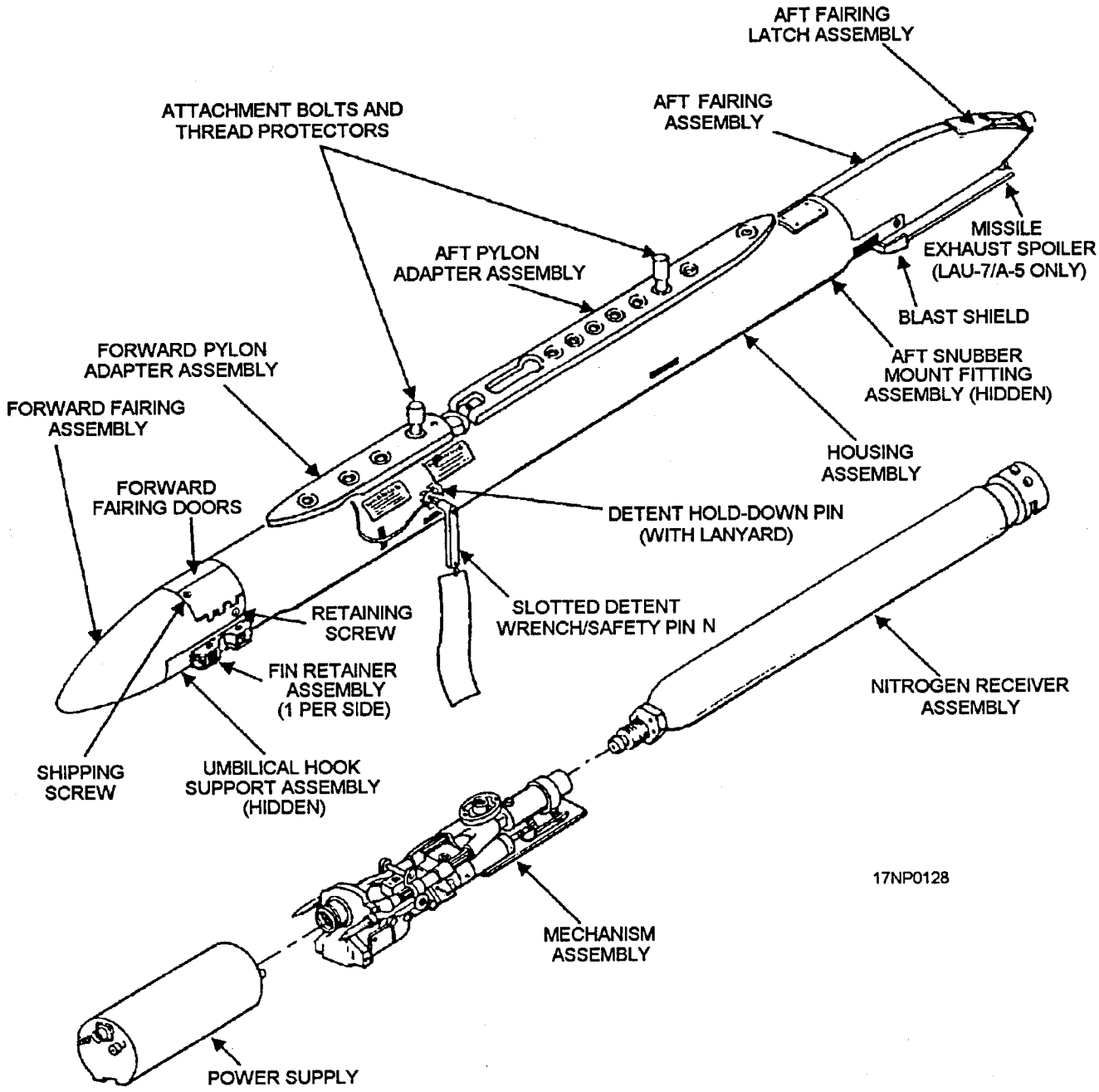


Figure 3-18.—LAU-7/A (series) guided missile launcher.

the nitrogen system supply tube is routed through the electrical wiring harness to the power supply.

DETENT, DETENT LOCK, DETENT-LOCK SOLENOID, AND SNUBBERS.— The detent, detent lock, detent-lock solenoid, and forward snubbers (fig. 3-19) make up an electromechanical system that restricts longitudinal and lateral motion of the mounted missile. This system prevents accidental launch or release during catapult takeoff or arrested landings. A slotted detent wrench/safety pin is installed through the mechanism assembly to prevent movement of the aft detent and to safe the launcher firing circuits. It is also used to raise the aft detent lug sufficiently to clear the missile hanger during loading. The slotted detent wrench/safety pin is removed before flight. When the detent is down (normal), the striker points make contact with the buttons (contacts) on the forward hanger of the missile. The forward striker point does not have a function for the missile; the aft striker point makes contact between the missile and the firing safety switch.

NITROGEN CONTROLVALVE.— The nitrogen control valve is a solenoid-operated shutoff valve that controls the flow of nitrogen from the receiver assembly to the missile. Operation of the control valve is controlled from the cockpit by the pilot.

Power Supply

One power supply is available for use in the launcher. Power supply PP-2581/A is a single-phase power supply. It is a self-contained unit with connectors on each end. The aft connector links the power supply and the mechanism assembly. The forward connector provides the connection to the missile's umbilical cable.

Forward Fairing Assembly

The forward fairing assembly is an aluminum casting that mounts to the forward end of the outer housing to provide an aerodynamic nose to the front of the launcher. It has two doors that are spring-loaded to open. These doors provide access to the umbilical hook support assembly.

Umbilical Hook Support Assembly

The umbilical hook support assembly mounts to the forward housing rails and, during missile loading, is connected to the missile umbilical shear block. At missile launch, the mechanism snaps up, retracting the sheared end of the umbilical cable into the launcher to prevent interference with the missile hangers.

Fin Retainer Assemblies

Two fin retainer assemblies are mounted to the forward end of the housing assembly beneath the forward fairing assembly. The fin retainer is a small, U-shaped bracket that contains two spring retainers that

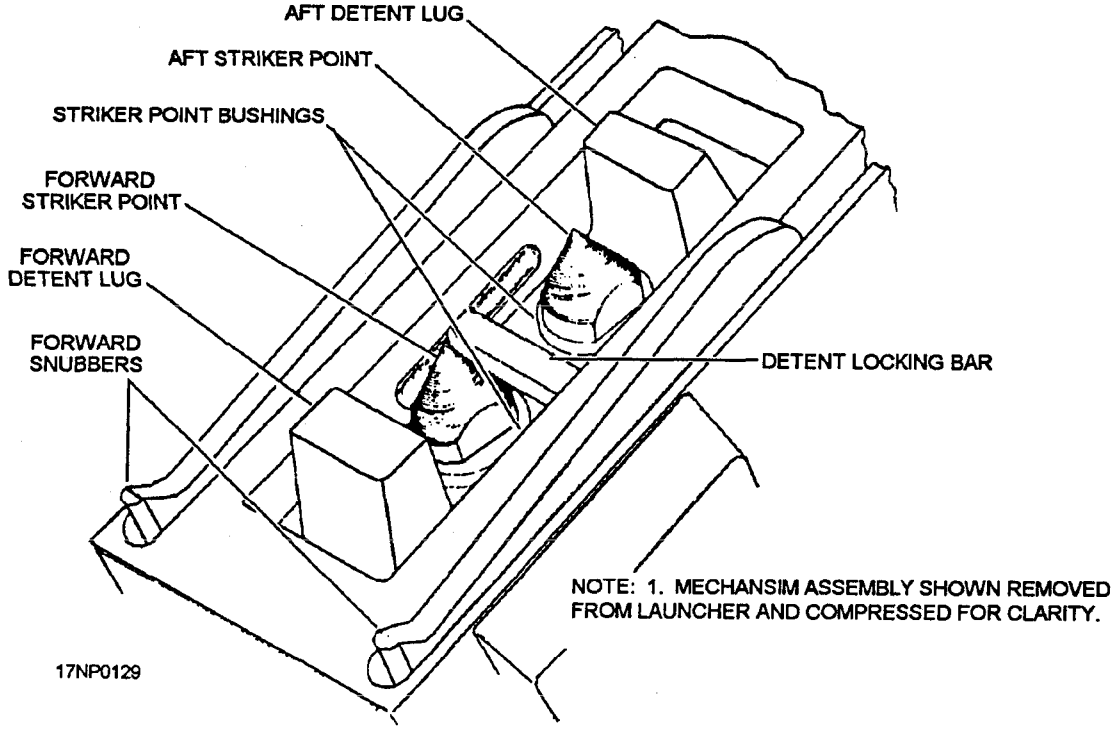


Figure 3-19.—Mechanism assembly detent and snubbers.

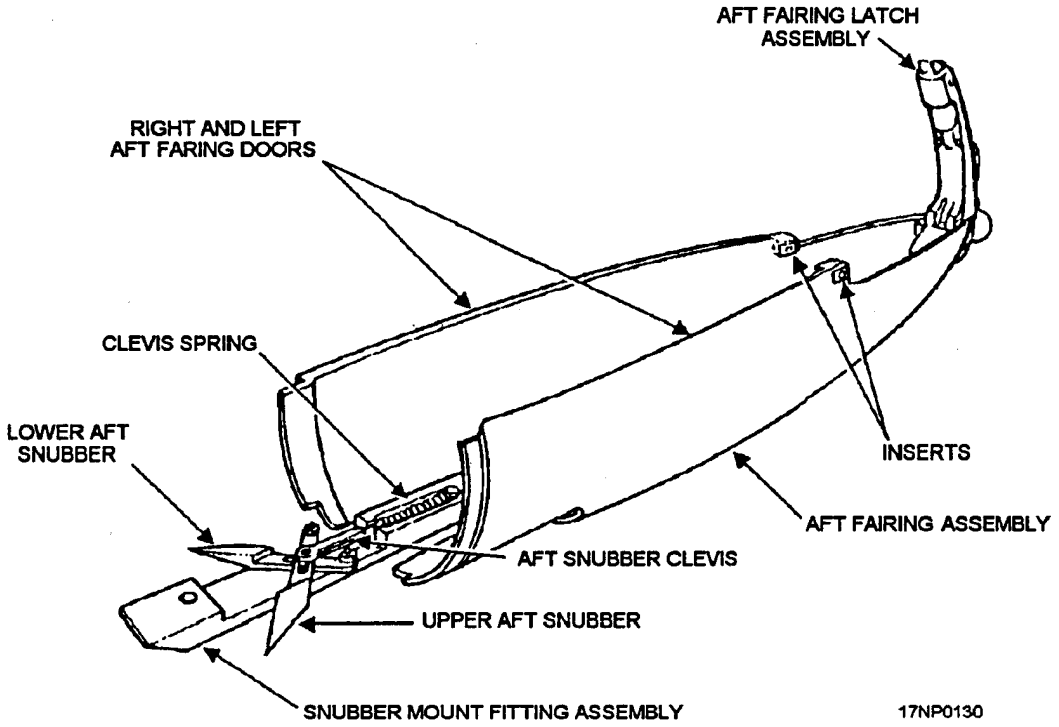


Figure 3-20.—Aft snubber mount fitting assembly, aft fairing assembly, and aft fairway latch assembly.

snap over the missile fins to prevent movement during captive flight.

Snubber Mount Fitting Assembly, Aft Fairing Latch Assembly, and Aft Fairing Assembly

The aft snubber mount fitting assembly, aft snubber assembly, and aft fairing latch (fig. 3-20) are assembled together as a group and mounted to the aft end of the housing assembly. When the aft fairing latch assembly (fig. 3-21) is in the open position you can access the nitrogen receiver. It also releases the aft snubbers to allow missile loading. When in the closed position, it allows the snubbers to spring over the aft missile hanger, locking it in place.

For further information on the LAU-7/A (series) guided missile launcher, refer to *Guided Missile Launcher LAU-7/A,* NAVAIR 11-75A-54.

REVIEW NUMBER 6

Q1. What missile launcher is used to carry and launch the Sidewinder missile?

Q2. List the four major assemblies of the LAU-7/A launcher.

Q3. What is the purpose of the nitrogen receiver assembly ?

Q4. What is the purpose of the detent, detent lock, detent-lock solenoid, and snubber sub-assemblies of the mechanism assembly?

Q5. What is provided by the LAU-7/A guided missile launcher?

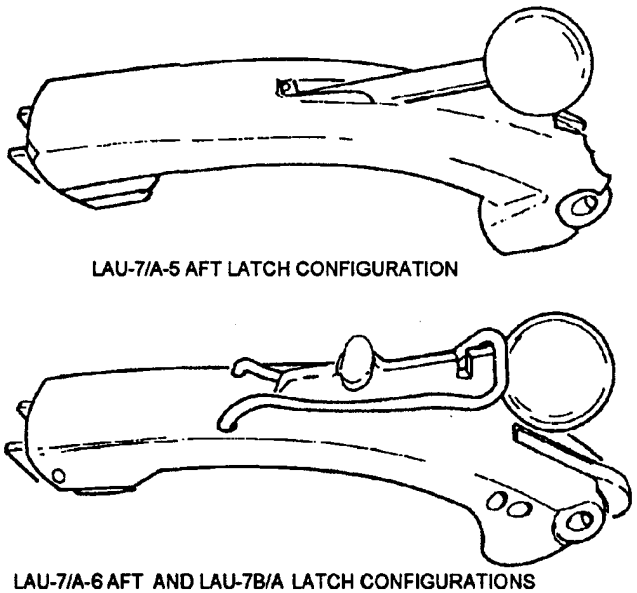


Figure 3-21.—Aft fairing latch assembly.

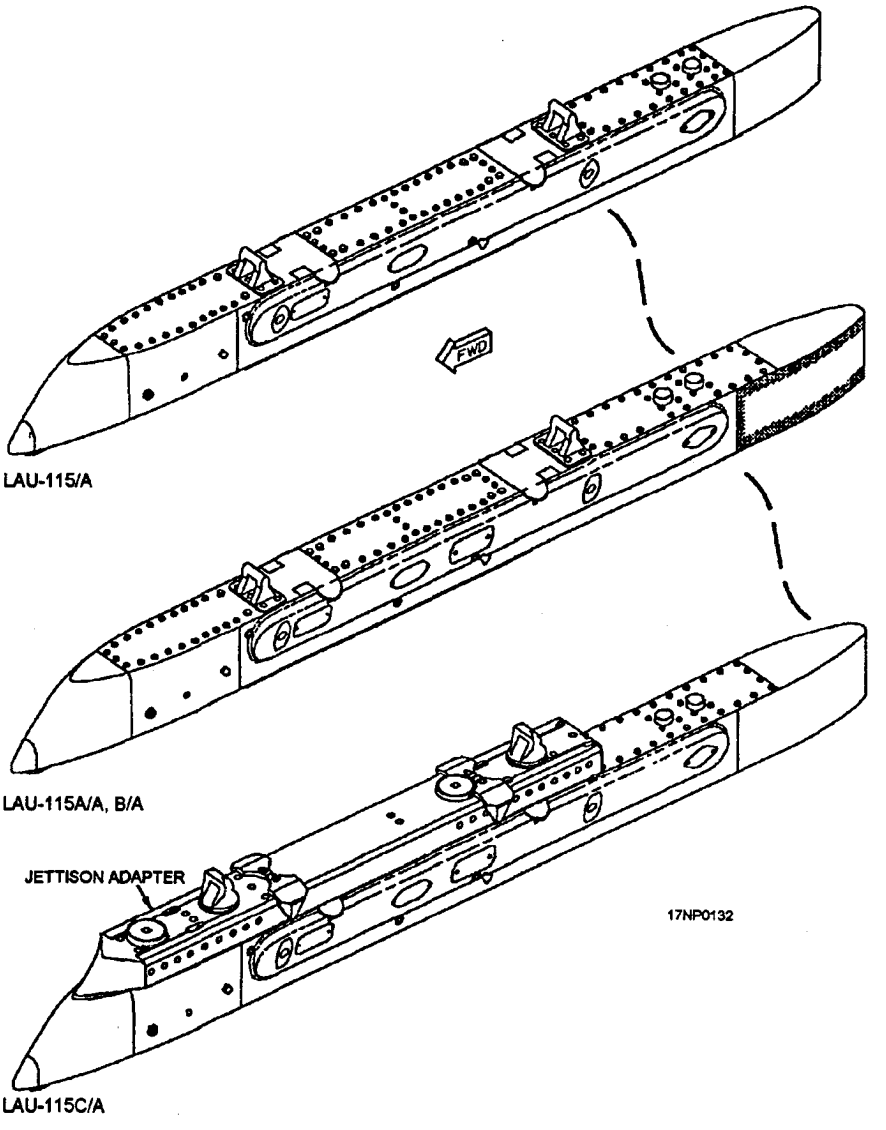


Figure 3-22.—LAU-115A/A, LAU-115B/A, and LAU-115C/A guided missile launchers.

REVIEW NUMBER 6 ANSWERS TO QUESTIONS Q1. THROUGH Q5.

A1. The LAU-7/A missile launcher is used to carry and launch the Sidewinder missile.

A2. The four major assemblies of the LAU-7/A launcher include the housing, nitrogen receiver, mechanism, and power supply assemblies.

A3. The nitrogen receiver assembly is used to store high-pressure nitrogen (3,200 psig) that is used to cool missile IR detector guidance systems.

A4. The detent, detent lock, detent-lock solenoid, and snubber subassemblies of the mechanism assembly are an electromechanical system that restricts longitudinal and lateral movement of mounted missiles. This prevents accidental launch or release during catapult takeoffs or arrested landings.

A5. The LAU-7/A guided missile launcher provides a complete system that lets the pilot monitor the condition of the missile during flight, control mode of operation of the missile guidance system, and initiate arming and launch sequence.

Table 3.3.—LAU-115 Technical Characteristics

LAU-115/A	LAU-115A/A	LAU-115B/A	LAU-115C/A
Weight: 52 pounds Height: 7 inches Width: 7 inches Length: 78 inches	Weight: 59 pounds Height: 7 inches Width: 7 inches Length: 82 inches	Weight: 59 pounds Height: 7 inches Width: 7 inches Length: 82 inches	Weight: 120 pounds Height: 10 inches Width: 7 inches Length: 82 inches

LAU-115 SERIES GUIDED MISSILE LAUNCHER

The LAU-115 series guided missile launcher (fig. 3-22) is a reusable launcher. It completes the F/A-18 aircraft suspension and launching system for the AIM-7 Sparrow missile. The technical characteristics can be found in table 3-3. The forward internal grooves of the rail provide a guide and support for the forward missile mounting button. The external rail flanges are a guide for the aft missile suspension lugs during firing. The aft section of the rail consists of a removable fitting that provides mounting for the aft missile suspension lugs.

The latch mechanism is composed of a detent cam and keeper. The detent cam is spring-loaded down and acts as a stop during missile loading. The cam mechanism is constructed so the force created by the missile motor during normal missile firing overcomes the detent cam spring tension. This action lets the missile button push the detent cam up, actuating the missile-gone switch.

An electrically operated solenoid is used to assure that the missile is retained during sudden deceleration, such as an arrested landing. The keeper portion of the latch mechanism is spring-loaded to the down position and retains the missile during all periods of aircraft acceleration. The keeper mechanism has an indicator. When the keeper is in the down or latched position, the indicator is flush with the launcher skin. If, during missile loading, the missile button is not in its maximum forward position, the indicator extends beyond the upper launcher mold line. This indicates that the missile is not properly latched in place. During loading, the missile button can slide past the keeper, stopping when contact is made with the detent cam.

During the unloading of a missile, the indicator bell crank is supported in the launcher structure. It is manually operated by using a 3/8-inch square drive tool. The square drive end of the bell crank is accessible from the side of the launcher. The launchers are suspended from BRU-32 bomb racks in the outboard pylons. Two LAU-7/A launchers can be attached for suspension of the AIM-9 missiles. For ground safety, an actuator-operated safety device prevents inadvertent loss of the AIM-7 missile.

LAU-116/A GUIDED MISSILE LAUNCHER

The LAU-116/A guided missile launcher (fig. 3-23) is a reusable launcher of the F/A-18 aircraft suspension

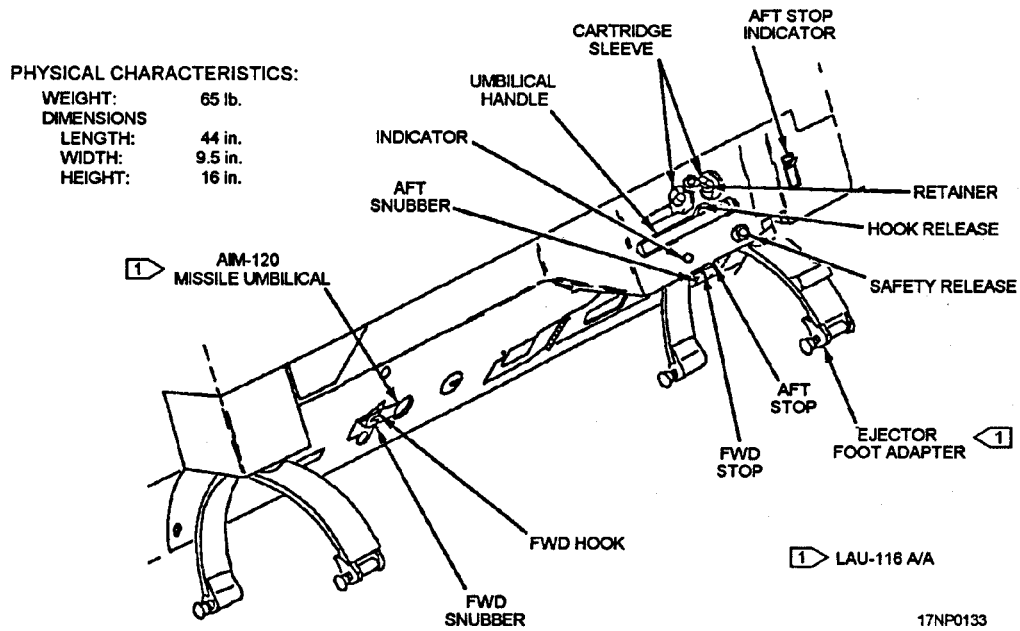


Figure 3-23.—LAU-116/A guided missile launcher.

and launching system for the AIM-7 Sparrow missile. The launchers are mounted internally in the fuselage structure. They are self-contained, gas-operated mechanisms, capable of suspending and ejecting the AIM-7 Sparrow missile. Ejection force is supplied by two CCU-45 impulse cartridges ignited by an electrical impulse applied by the missile firing switch. The rapidly expanding gases actuate the ejector pistons and release the missile from the launcher. Power is applied to the missile guidance control system through the umbilical plug. An actuator-operated safety device prevents inadvertent firing of launcher cartridges.

LAU-117/A GUIDED MISSILE LAUNCHER

The LAU-117/A guided missile launcher (fig. 3-24) is a reusable launcher that completes the F/A-18 aircraft suspension and launching system for the Maverick, AGM-65, air-to-ground missile. The mechanical structure of the launcher is built around a box-section channel or rail, which supports the missile. The missile hooks contact the rail surfaces or tracks, which are hard, anodized metal treated with a dry lubricant. Two lug fittings and lugs provide mechanical interface with the bomb rack. The two lug fittings provide smooth surfaces for the bomb rack sway braces. The missile restraint device is recessed into the rail channel between the lug fittings. A stop on one side of the rail track engages the missile aft hook to prevent damage to the umbilical connector during loading. The rear of the rail channel provides mounting for the launcher electronic assembly and the umbilical engaging assembly. The launcher electronic assembly houses all electronic circuitry. Fairings at the front of the rail, the front of the front lug fitting, and the rear of the launcher electronic assembly provide aerodynamic surfaces. Special brackets and bushings are provided for the Navy's single hoist ordnance loading system. The launcher can be suspended from the BRU-32 bomb rack on the inboard and outboard pylons. An electrically operated safety device prevents inadvertent loss of the missile.

LAU-118/A GUIDED MISSILE LAUNCHER

The LAU-118/A guided missile launcher (fig. 3-25) is a reusable launcher that completes the F/A-18 and EA6B aircraft suspension and launching system for the HARM, AGM-88, air-to-ground guided missile. The launcher consists of the launcher housing, forward and aft fairing assemblies, forward and aft launcher tracks, suspension lugs, insert plugs, and internal electrical components. The launcher is a structurally modified Aero 5B-1. The LAU-118/A is suspended from the BRU-32 bomb rack (Aero 7 on A-6 aircraft) on the inboard and outboard pylons. An electrically operated retention mechanism prevents inadvertent loss of the missile.

LAU-92/A GUIDED MISSILE LAUNCHER

The LAU-92/A guided missile launcher (fig. 3-26) carries and launches the AIM-7 (series) Sparrow guided missile on the F- 14 aircraft. The launcher is installed in semisubmerged fuselage stations 3, 4, 5, and 6. It is

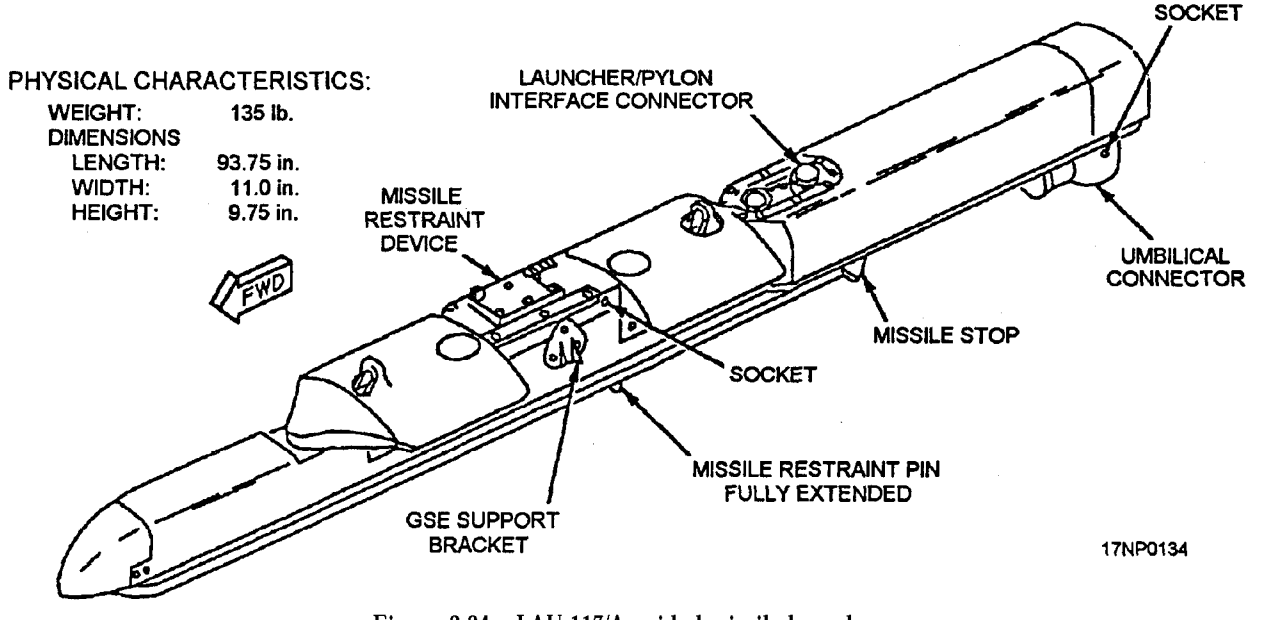


Figure 3-24.—LAU-117/A guided missile launcher.

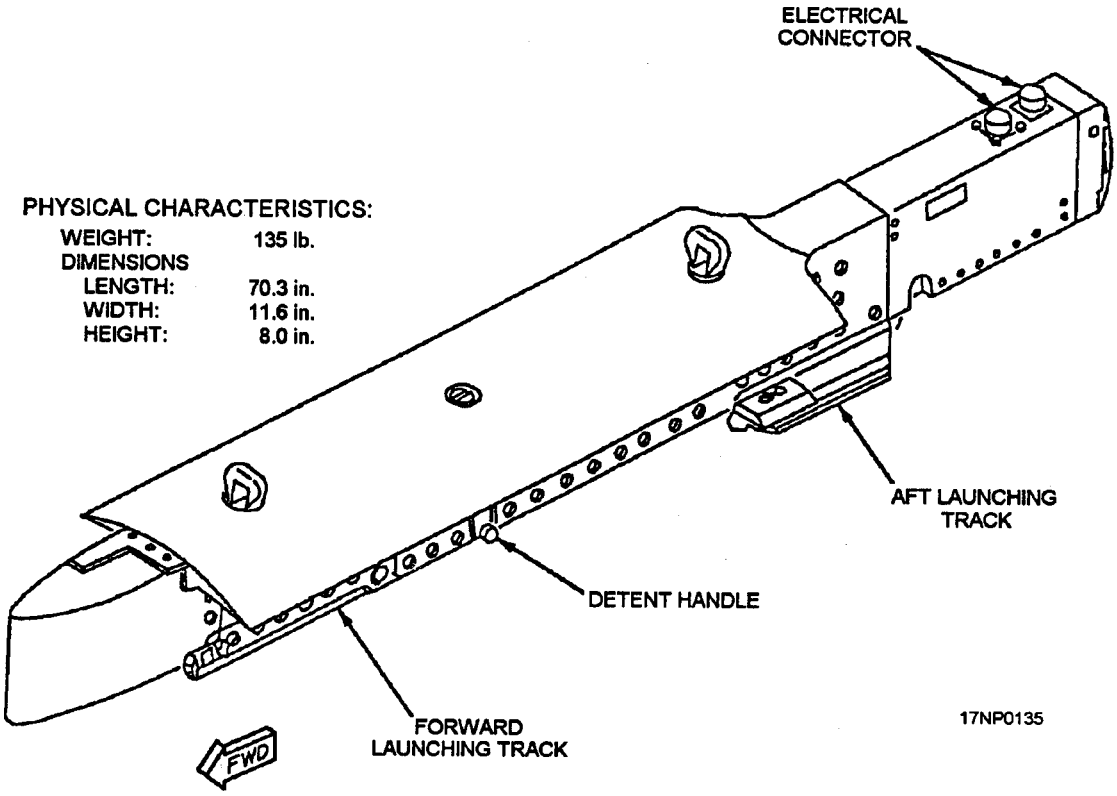


Figure 3-25.—LAU-118 guided missile launcher.

retained on the weapons rail by means of four hooks, which are operated by a latch mechanism. The launcher can also be installed on the wing-mounted, multipurpose pylon by using an LAU-92/A adapter. The launcher components are accessible by means of a door in the adapter.

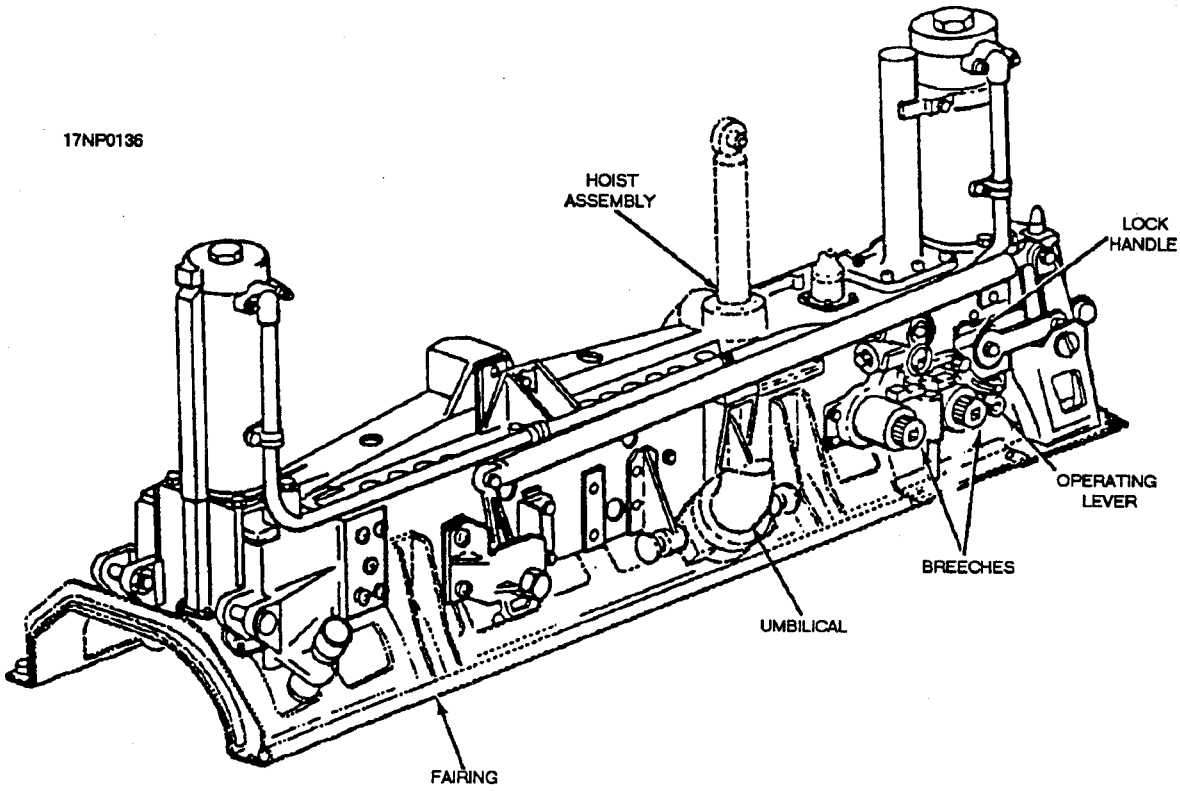


Figure 3-26.—LAU-92/A guided missile launcher.

LAU-93/A GUIDED MISSILE LAUNCHER

The LAU-93/A guided missile launcher (fig. 3-27) carries and launches the AIM-54 Phoenix missile, and is installed on the weapons rail of the F-14 aircraft. The launcher provides electrical and coolant connections between the weapons rail and the missile. The mechanical components of the launcher consist of a gas-operated, hook-opening linkage and two ejectors, a ground safety lock and positive launch pin, coolant, and electrical umbilicals. The launcher can also be installed on the wing-mounted, multipurpose pylon by using an LAU-93/A adapter.

ADU-299/E MISSILE LAUNCHER ADAPTER

The ADU-299/E missile launcher adapter (fig. 3-28) is attached to the parent rack of wing stations 1, 2,4, and 5 on A-6 aircraft. The adapter is used to adapt the LAU-7 missile launcher to the parent rack providing Sidewinder missile capabilities for A-6 aircraft. Mechanical attachment of the adapter to the ejector rack is provided by two suspension lugs on 30-inch centers. Mechanical attachment of the adapter to the LAU-7 launcher is provided by two swivel nuts positioned on 30-inch centers to mate with the launcher bolts. When the launcher and adapters are electrically connected and mechanically mated, electrical power is supplied by an adapter harness from the wing pylon to the aft end of the adapter.

LAU-127 GUIDED MISSILE LAUNCHER

The LAU-127 guided missile launcher (fig. 3-29) is designed to carry and launch the AIM-120 series AMRAAM missile. The LAU-127 will also be capable of launching the AIM-9 series sidewinder missile.

LAU-132 GUIDED MISSILE LAUNCHER

The LAU-132 guided missile launcher is similar in appearance and operation to the LAU-93 launcher. The LAU-132 was developed for carriage and launch of the AIM-54C Phoenix missile on the F-14D aircraft.

REVIEW NUMBER 7

Q1. What missile launcher is used to carry an AIM-7 Sparrow missile on the outboard pylon of an F/A-18 aircraft?

Q2. What guided missile launcher completes the F/A-18 aircraft suspension and launching system for the Maverick missile?

Q3. What missile is compatible with the LAU-118/A guided missile launcher?

Q4. What missile launcher is used to carry and launch the AIM-54 Phoenix missile on the F-14 aircraft?

Q5. What missile adapter is used to hang the LAU-7/A missile launcher on station 1 of an A-6 aircraft?

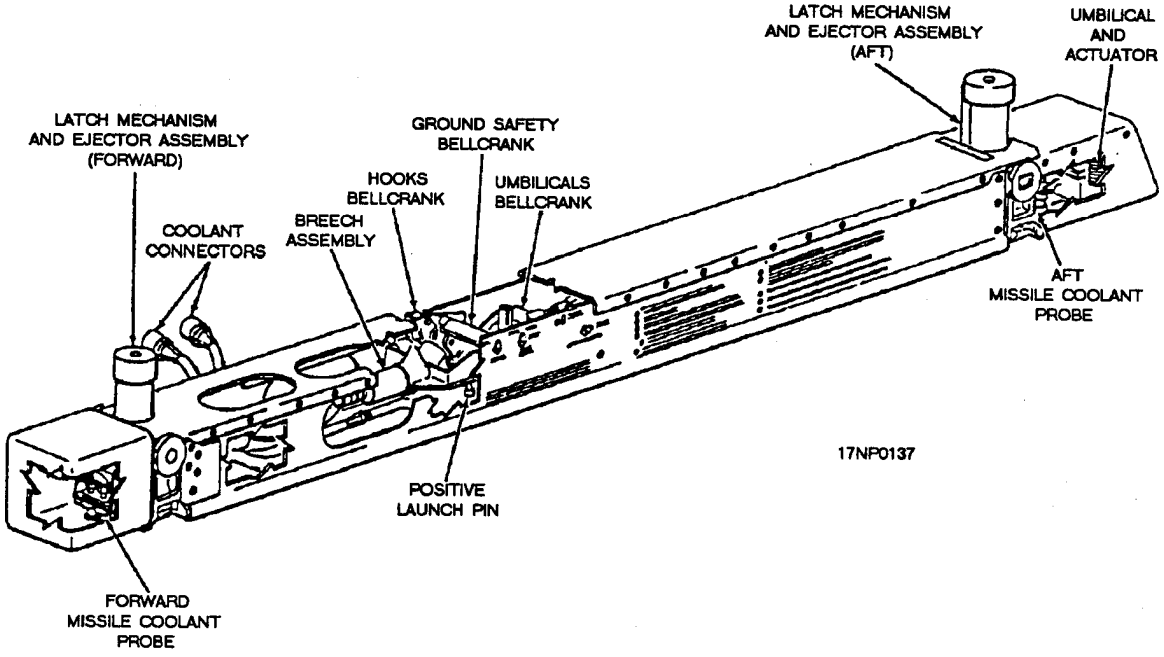


Figure 3-27.—LAU-93/A guided missile launcher.

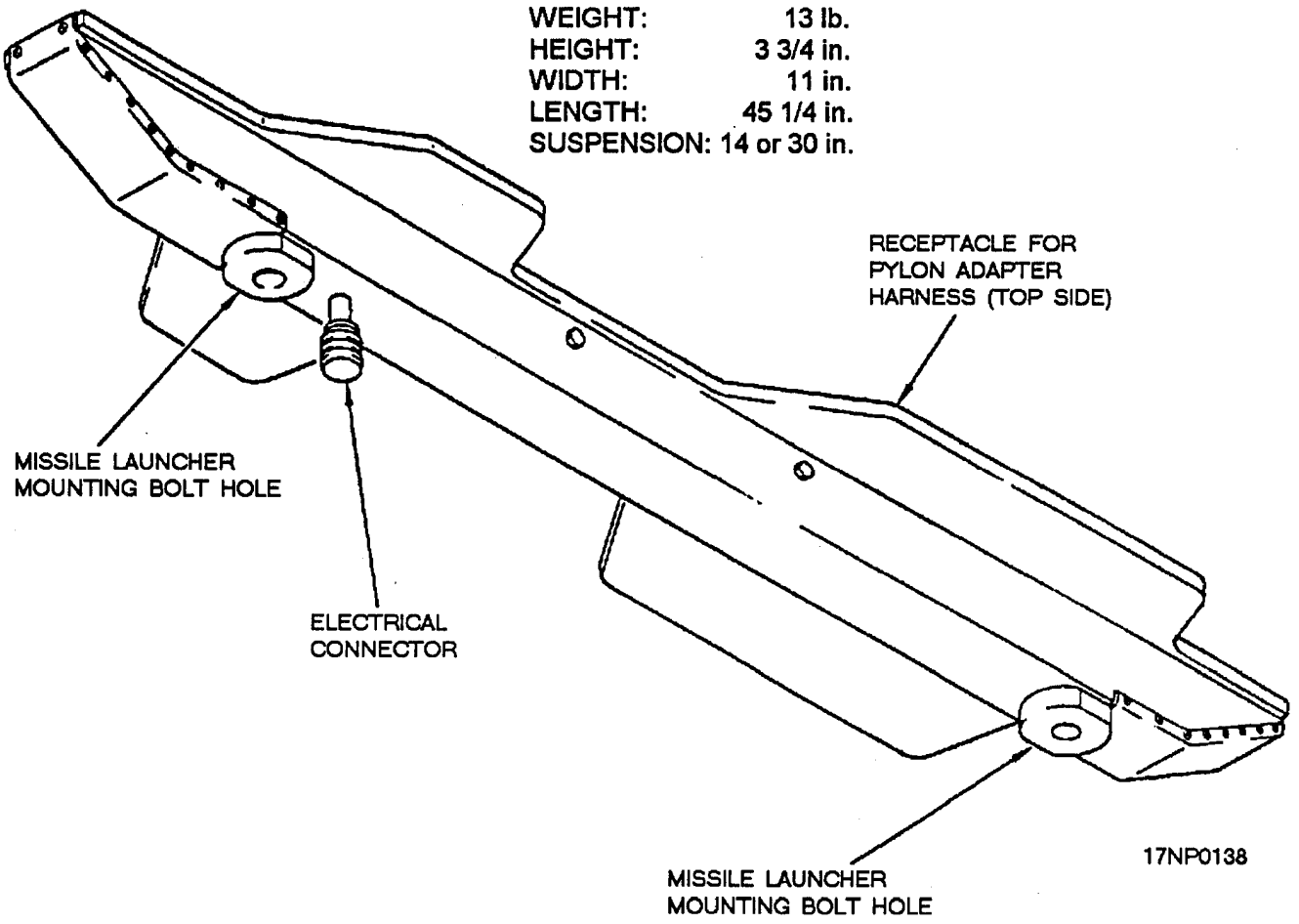


Figure 3-28.—ADU-299/E missile launcher adapter.

GUIDED MISSILE HANDLING

LEARNING OBJECTIVE: *Identify the methods used in guided missile handling afloat and ashore.*

The establishment of the all-up-round (AUR) concept simplified the handling of guided missiles at the user level. The AUR concept has improved the reliability, availability, and logistics support of current guided missiles used by fleet activities.

NAD/NWS/MMMUs

The service life of an AUR missile begins at a naval ammunition depot (NAD) or a naval weapons station (NWS). The NAD or NWS receives the individual components of a missile from the manufacturer. The NAD or NWS assembles the components to make up a complete round, performing the required operational checks and tests. The AUR is then packed into a missile container and is stored as RFI (ready for issue). The missile logbook is also packed inside the missile container. The missile logbook is compiled from the operational records that are received with each component. This logbook remains with the missile until the missile is either expended (fired) or disassembled.

Mobile missile maintenance units (MMMUs) are assigned to areas close to overseas operating forces. Generally, they are located at a naval air station (NAS) or a naval magazine station (NAVMAGSTA). The purpose of MMMUs is to upgrade missiles from a non-RFI (not ready for issue) status to an RFI status. This prevents the time-consuming and costly procedure of shipping non-RFI missiles from overseas operating areas back to the United States for component replacement or scheduled checks and tests, This quick turnaround time increases missile availability to deployed operating units in the fleet.

AFLOAT

Under the AUR concept, missiles are received aboard ship in containers completely assembled except for the wings and fins. Depending upon the particular missile and the type of container involved, the wings and fins may or may not be shipped in the same container as

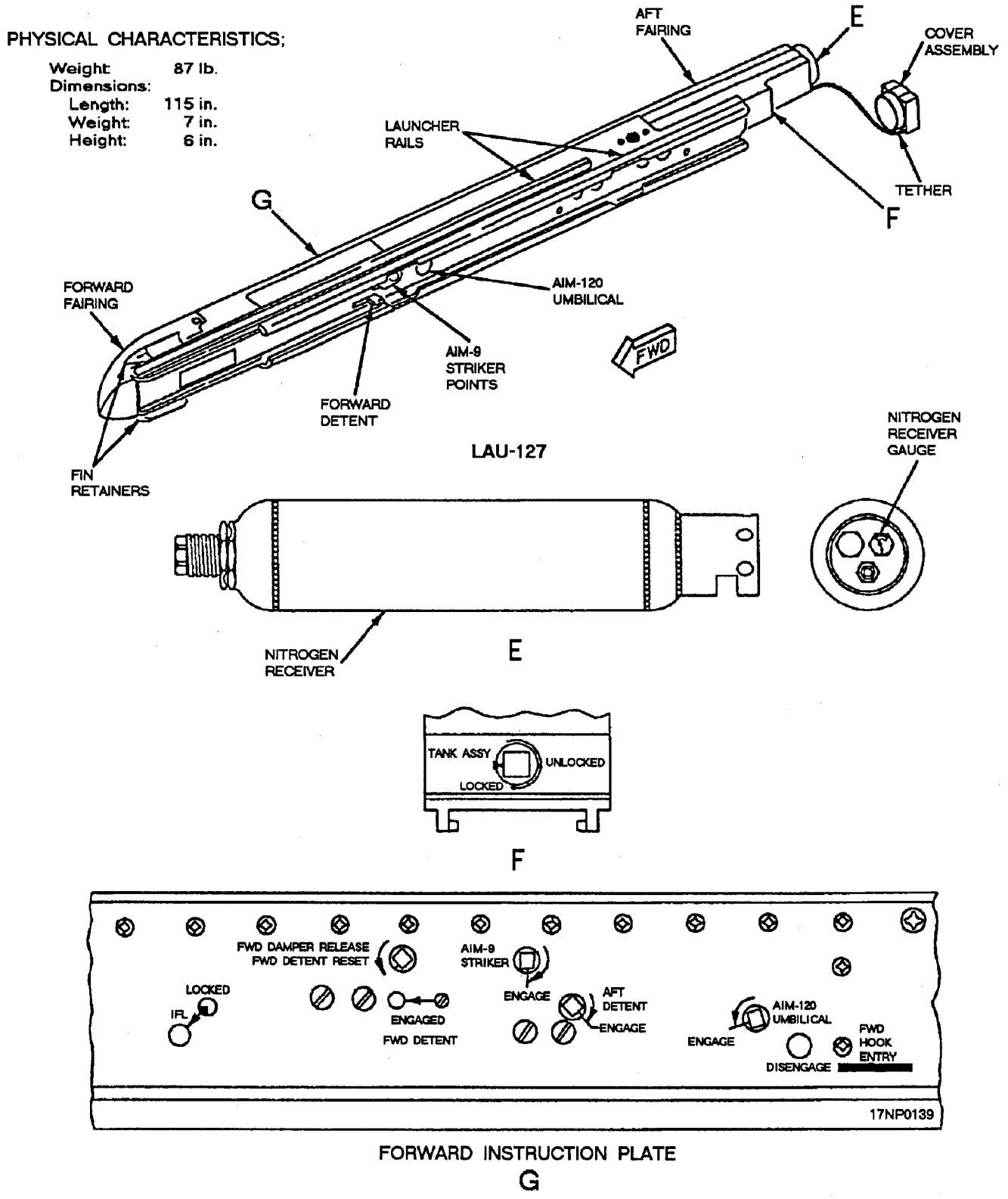


Figure 3-29.—LAU-127 guided missile launcher.

fins may or may not be shipped in the same container as the missile. In most cases, the wings and fins are shipped in separate containers that contain either one complete set of wings and fins (4 wings and 4 fins) or two sets of wings and fins (8 wings and 8 fins).

When containerized missiles, wings, and fins are received aboard ship, the containers are inspected for any obvious damage. When the inspection reveals a damaged container, it must be sent to the decanning area to be opened for inspection of the missile or wings and

fins. When a container, missile, or wings and fins do not meet the inspection criteria listed in the appropriate technical manual, they must be tagged non-RFI and kept separate from RFI material for later turn-in. Missiles, wings, and fins can be either deep stowed in magazines still in their sealed containers, or they can be decanned, inspected, and stowed in stanchions located in ready-service magazines or missile magazines. Missiles that are deep stowed in their sealed containers can be off-loaded as RFI. However, when the seal has been broken and/or the missiles, wings, or fins removed from the container, the missiles, wings, and fins must be tagged non-RFI and off-loaded to the appropriate NAD, NWS, or MMMU.

When missiles are decanned for ready service, the missile logbooks are removed from the empty containers and turned into the aviation ordnance control station (AOCS), where they are kept on file until the missile is fired (expended) or off-loaded. When the missile is fired, the missile logbook is mailed to the appropriate NAD or NWS. When the missile is to be off-loaded, the logbook must be placed in the missile container.

ASHORE

Guided missile handling functions for naval air stations or shore-based squadrons are the same as shipboard functions except for the obvious difference in working environments. Space limitations are not as critical ashore and allow for an increase in handling capability.

Other details of missile handling, such as MOAT (missile on aircraft test), supply procedures, missiles firing reports, quality deficiency reports, and loading procedures, are discussed in the appropriate chapters throughout this manual.

REVIEW NUMBER 8

Q1. What concept simplified the handling of guided missiles at the user level?

Q2. The responsibility for assembling individual missile components into complete RFI missiles rests with _____.

Q3. What is the purpose of a mobile missile maintenance unit (MMMU)?

SAFETY PRECAUTIONS

LEARNING OBJECTIVE: *Recognize the safety precautions to follow when working with guided missiles.*

Safety precautions have been established for each particular type of missile. All missile handling must be carried out according to the approved local safety regulations of the ship, depot, or wherever the work is being done. All of the safety precautions cannot be discussed in this chapter. However, some of the general safety precautions are as follows:

- Observe detailed precautions. Follow specific instructions for each type of guided missile. You will find the specific instructions in the manual issued for each particular type of aircraft.

- Keep work areas clear of obstructions, loose cables, hoses, and any unneeded equipment during missile assembly and testing. Permit only assigned personnel engaged in the work in the area or vicinity of the missile.

- Use only the authorized handling equipment with any missile, or any missile section, component, or related parts, including shipping crates and containers.

- Make sure that all electrical equipment used in missile handling operations is adequately shielded and grounded. Also, avoid injury from sharp edges often present on nose assemblies, wings, and fins. After assembly, cover all sharp edges with protective covers.

- Use tools specified in the missile manual when uncrating missile components and for assembling missiles. Do not force any unit. If it does not fit or function properly, determine the cause and correct it before proceeding.

- Before connecting igniters in missile motors, check the firing leads for stray or induced voltages and for static charges.

- Before handling any piece of ordnance material, inspect the safety device to be sure that it is in a SAFE position. If not, the unit must be made safe by experienced personnel before further work is performed.

- The wing servo units in many missiles are supplied with primary power by means of an accumulator charged from gas bottles (or cylinders) containing compressed air or nitrogen; both of which contain pressure. Use extreme caution when charging

accumulators and when handling the gas bottles or containers in which the gases are stowed.

- When testing for leaks in a gas container, use soapy water.

- When cleaning hydraulic units, use only the cleaning solvents or other materials specified in the particular missile publication.

- Keep your hands and other parts of your body clear of exhaust vents when working with test equipment that uses high pneumatic pressure.

- When any hydraulic unit is disassembled for inspection or repair, make sure that the workbench is thoroughly cleaned of dirt and metal filings.

- Missile ordnance materials, including rocket motors, igniters, fuzes, warheads, and in some cases boosters or auxiliary rockets, are potentially dangerous. Handle each unit according to the specific procedures authorized in the appropriate publication,

- Load forward-firing ordnance in authorized loading areas only, with aircraft facing uninhabited areas.

- When leading/handling forward-firing ordnance, you should avoid working in front or behind the ordnance.

REVIEW NUMBER 9

Q1. What *solution is used to leak test gas containers?*

Q2. When handling forward-firing ordnance, what is the desired place you should work?

REVIEW NUMBER 7 ANSWERS TO QUESTIONS Q1. THROUGH Q5.

A1. The LAU-115/A series guidied missile launcher is used to carry an AIM-7 Sparrow missile on the outboard pylon of an F/A-18 aircraft.

A2. The LAU-117/A guided missile launcher completes the F/A-18 aircraft suspension and launching system for the Maverick missile.

A3. The AGM-88 HARM missile is compatible with the LAU-118/A guided missile launcher.

A4. The LAU-93/A missile launcher is used to carry and launch the AIM-54 Phoenix missile on the F-14 aircraft.

AS. The ADU-299E missile adapter is used to hang a LAU-7/A missile launcher on stations 1, 2, 4, and 5 of an A-6 aircraft.

REVIEW NUMBER 8 ANSWERS TO QUESTIONS Q1. THROUGH Q3.

A1. The handling of guided missiles at the user level was simplified by the introduction of the all-up-round (AUR) concept.

A2. The responsibility for assembling individual missile components into complete RFI missiles rests with naval ammunition depot (NAD) or naval weapons station (NWS).

A3. The purpose of a mobile missile maintenance unit (MMMU) is to upgrade missiles from a non-RFI to an RFI status.

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REVIEW NUMBER 9 ANSWERS TO QUESTIONS Q1. AND Q2.

A1. A soapy water solution is used to leak test gas containers?

A2. When handling forward-firing ordnance, you should work on the sides. Work in the front or rear of the ordnance should be kept to a minimum.

CHAPTER 4

PYROTECHNICS

Pyrotechnics are fireworks adapted to military use. The word *pyrotechny* means *the art of fire.* Therefore, pyrotechnics are items that produce their effect by burning, and are consumed in the process. Pyrotechnics, as used in the military, are items that produce a bright light for illumination or colored lights or smoke for signaling.

All Navy pyrotechnic devices contain combustible chemicals. When ignited, these chemicals generate a flame, flash, infrared radiation, smoke, sound display, or combinations of these effects for many purposes. Some of these effects are visual and audible signaling, area and target illumination, reference point marking, indication of practice weapon impact or fuze action, tracking, decoying, simulating, and smoke-screen generation.

Dye-marking devices are pyrotechnics and screening devices, even though their display is not the product of combustion. They are classed as pyrotechnic or screening devices because their end purposes are quite similar to those of the true pyrotechnic. Dye-marking devices are used to establish reference points on the surface of the water. In some cases, the dye is spread on the surface by explosive means.

Pyrotechnics generally function by means of an ignition train, similar to the explosive train of high-explosive ammunition.

For further information on pyrotechnics, you should refer to *Pyrotechnic, Screening, Marking, and Countermeasure Devices,* NAVSEA SW050-AB-MMA-010/NAVAIR 11-15-7.

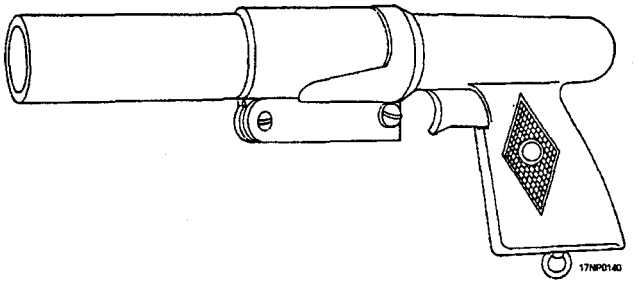

Figure 4-1.—Pyrotechnic pistol, Mk 1 Mod 0.

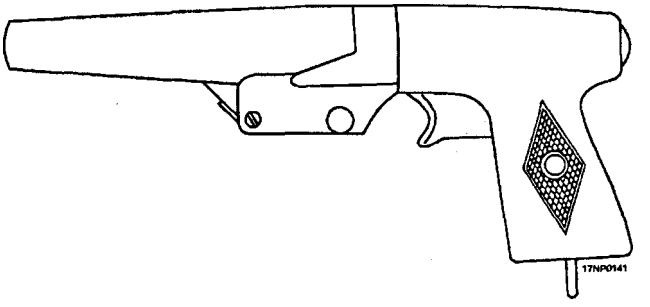

Figure 4-2.—Pyrotechnic pistol, Mk 5.

HAND-MANIPULATED SIGNALING DEVICES

LEARNING OBJECTIVE: *Identify the purpose and use of hand-manipulated signaling devices.*

Hand-manipulated devices are used for various signaling purposes, such as identification, recognition, warning, and distress.

PYROTECHNIC PISTOLS

Pyrotechnic pistols, Mk 1 Mod 0 (fig. 4-l), Mk 5 (fig. 4-2), and AN/M8 (fig. 4-3) are breechloaded, double-action, single-shot devices. The barrel is hinged to the frame and held in position by a breechblock or latch pin. All are fired by pulling a pistol type trigger.

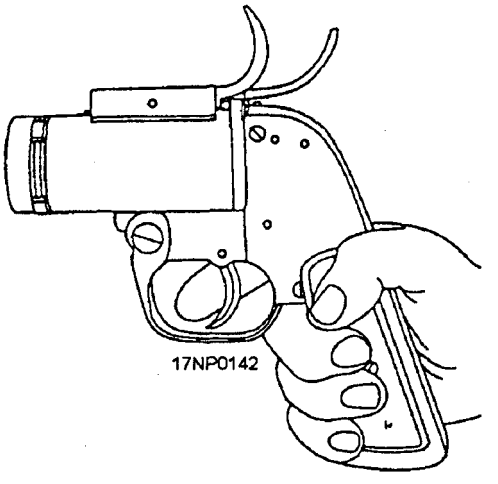

Figure 4-3.—Pyrotechnic pistol, AN/M8.

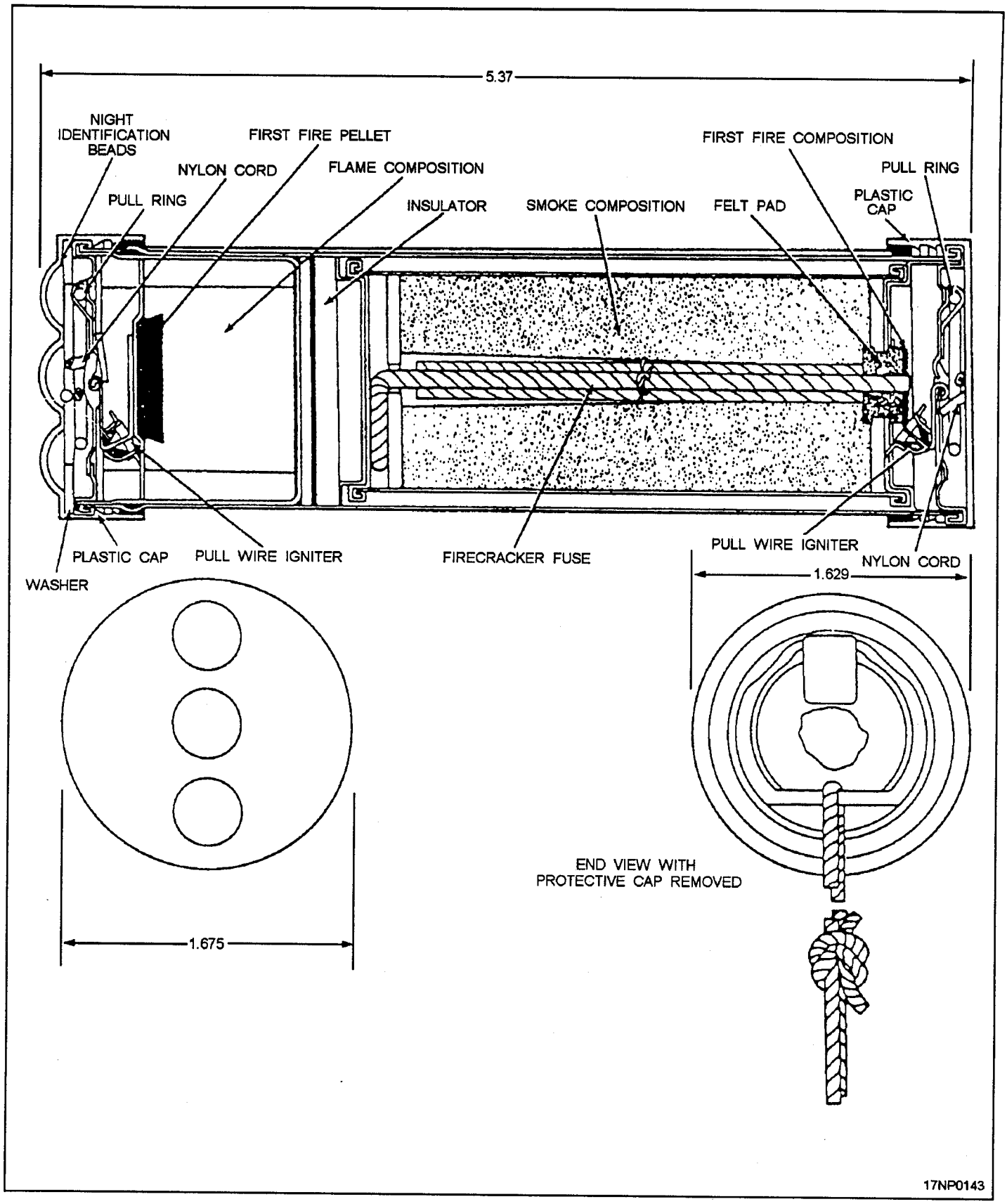

Figure 4-4.—Mk 13 Mod 0 marine smoke and illumination signal.

Table 4-1.—Pyrotechnic Pistols and Devices Launched

ITEM	DEVICES LAUNCHED
Mk 1 Mod 0 Pyrotechnic Pistol	Mk 2 Marine Smoke Signal
	Mk 1 Marine Illumination Signal
Mk 5 Pyrotechnic Pistol	Mk 2 Marine Illumination Signal
AN/M8 Pyrotechnic Pistol	Mk 1 Marine Illumination Signal
	Mk 2 Marine Smoke Signal
	Mk 50 Decoy Flare
	M11 Aircraft Signal

These devices are capable of firing various types of marine signaling devices. Refer to table 4-1.

MK 13 MOD 0 MARINE SMOKE AND ILLUMINATION SIGNAL

The Mk 13 Mod 0 (fig. 4-4) is used as a day or night signal by personnel on land or sea. Because of its small size and weight (6.4 ounces), it can be carried in life vests or flight suit pockets and on life rafts. 'This signal is especially adapted for use by aircrew personnel downed at sea.

The Mk 13 Mod 0 signal is a metal cylinder approximately 5 inches long and slightly more than 1.5 inches in diameter. It emits orange smoke for day use and red flame for night use. Burning time for each end is about 20 seconds. The protective plastic cap on the flame (night) end is molded so there are three prominent protrusions or beads across the face. You can identify this end by the sense of touch. The face of the cap at the smoke (day) end is smooth. A label on the outer surface around the whole body of the signal further identifies the smoke (day) and flame (night) ends. This label has instructions for its use.

To use the signal, remove the plastic cap from the end of the signal. Flip the pull ring over the signal rim and push downward to break the seal. After the seal is broken, NEVER point the signal toward your face or body. Then, ignite the signal with a quick pull on the ring. Hold the signal firmly at arm's length and at a 45-degree angle to prevent burns from hot drippings. If you only use one end, douse the signal in water to cool it. Save the other end for later use.

MK 79 MOD 0 ILLUMINATION SIGNAL KIT

The Mk 79 Mod 0 signal kit (fig. 4-5) consists of a Mk 31 Mod 0 signal projector, a plastic bandoleer that holds seven Mk 80 Mod 0 signals, and an instruction sheet.

The kit is used by downed aircrew personnel as a distress signaling device. Because it is small and lightweight, personnel can carry it in pockets of flight suits or in life rafts. The projector aims and fires the signals. Each signal contains a single red star. On activation, this star is propelled upward to a height of between 250 and 650 feet. The star burns for a minimum of 4 1/2 seconds.

To operate the device, you cock the projector firing pin by moving the trigger screw to the bottom of the vertical slot, and slip it to the right so that it catches at the top of the angular slot. After cocking the firing pin, remove a signal from the bandoleer and mate the projector with the signal. Now, rotate the projector clockwise until the signal is seated. Hold the projector overhead, pointed at a slight angle away from your body. While firmly gripping the projector, fire the signal by slipping the trigger screw to the left, out of the safety slot and into the firing slot.

NOTE: This first step is very important because the signal is threaded and screwed into the end of the projector. If you don't cock the projector before screwing in the signal, the firing pin could be forced into the primer of the signal, possibly firing the signal prematurely.

REVIEW NUMBER 1

Q1. Navy pyrotechnic devices contain what type of material ?

Q2. Why are dye-marking devices classified as pyrotechnic devices?

Q3. When used during the day, what color smoke is emitted from the Mk 13 Mod 0 marine smoke and illumination signal?

Q4. What is the burning time for each end of the Mk 13 Mod 0 signal?

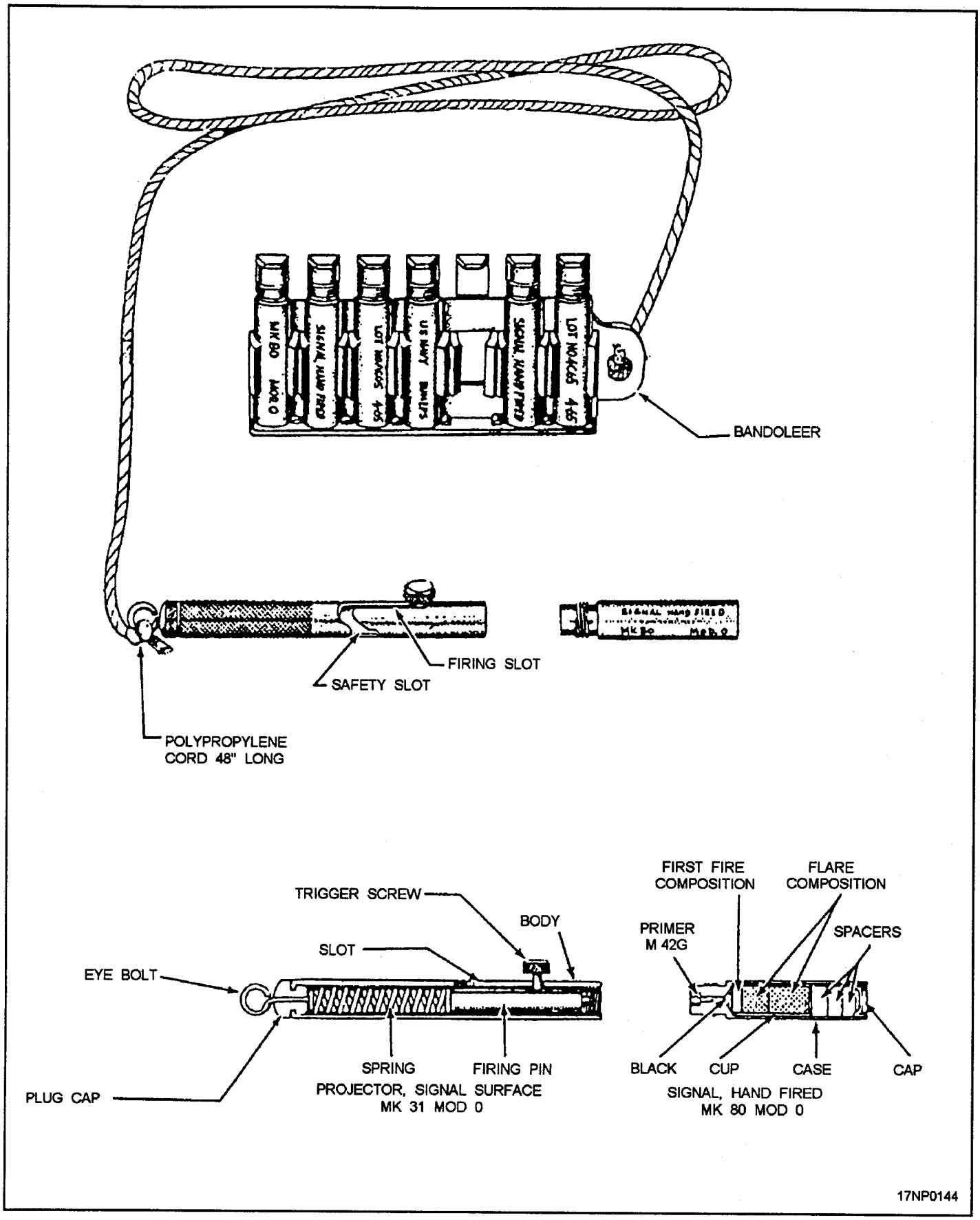

Figure 4-5.—Mk 79 Mod 0 illumination signal kit.

Q5. You can identify the night end of the Mk 13 Mod 0 signal by the _____ .

Q6. List the components of the Mk 79 Mod 0 illumination signal kit.

Q7. When you activate the Mk 79 Mod 0 signal kit, the star is propelled upward to a height of _____ .

Q8. What is the burn time of the Mk 79 Mod 0 star?

AREA AND TARGET ILLUMINATING DEVICES

LEARNING OBJECTIVE: *Identify the purpose and use of area and target illuminating devices to include components and operation.*

The illuminating devices discussed in this chapter are designed to be launched or dropped from aircraft. Aircraft flares are used to illuminate large areas for bombardment, reconnaissance, emergency aircraft landing, or any other purpose where a high-intensity light is required.

MK 45 MOD 0 AIRCRAFT PARACHUTE FLARE

The aircraft-launched Mk 45 Mod 0 aircraft parachute flare (fig. 4-6) is used for night illumination of surface areas in search-and-attack operations. It replaces the Mk 24 Mods aircraft parachute flare.

The Mk 45 Mod 0 aircraft parachute flare is as an AUR, complete with the candle, parachute assembly, and fuze. All components are encased in a cylindrical aluminum body approximately 36 inches long (including the fuze assembly) and 4.9 inches in diameter.

The Mk 364 Mod 0 fuze is shipped installed in the flare. Its sole purpose is to control the altitude of flare ejection in relation to launch altitude. It does not directly control candle ignition. The fuze has 15 functional settings and 1 SAFE setting. The functional settings are at 1,000-foot intervals from 1,000 to 14,000 feet, except that 1 minimum setting of 500 feet is provided. The fuze-setting mechanism consists of a single yellow dial indicator you can easily turn by hand—clockwise for setting and counterclockwise for safing. A spring-loaded detent holds the dial indicator at a selected setting or at SAFE, and prevents accidental changing of the setting by vibration forces.

The Mk 45 Mod 0 flare is launched from an available external launching system, such as bomb racks. The launching system provides a 14-inch suspension, or the flare is launched from an aircraft by hand. It is usually dispenser launched. A drogue tray

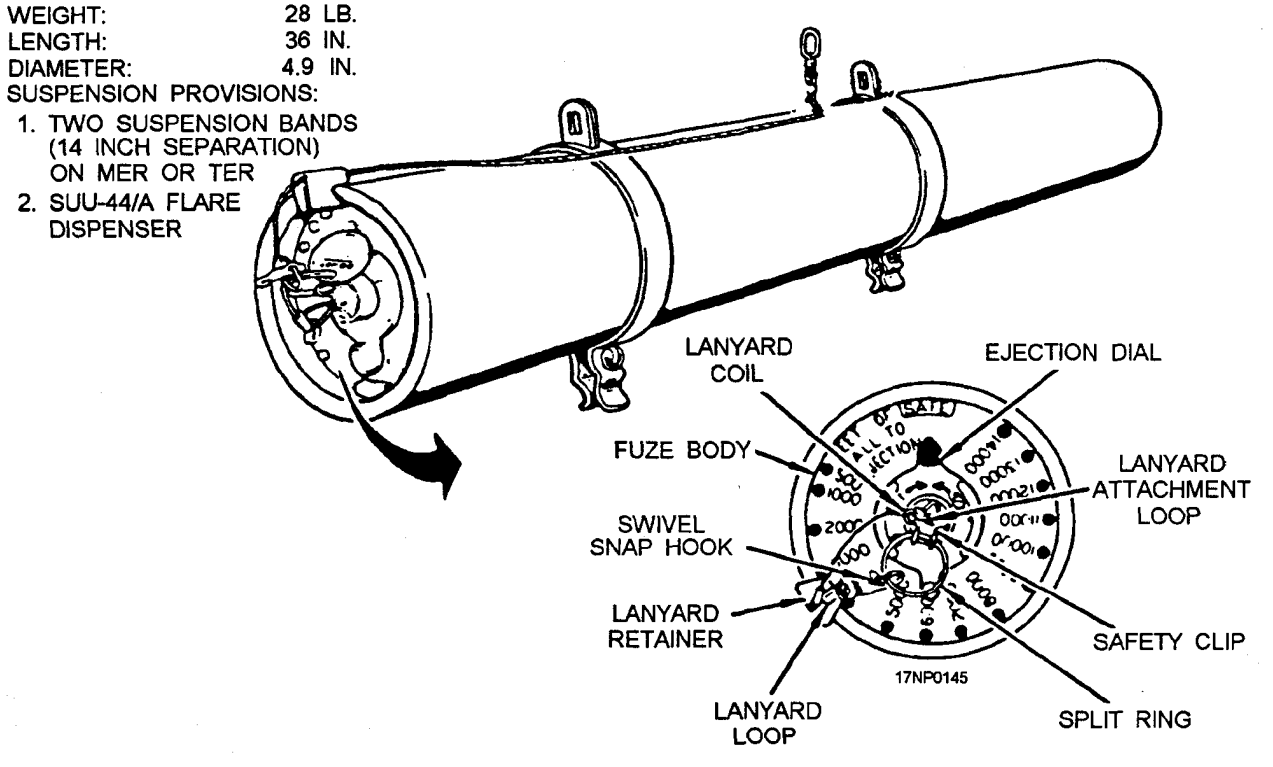

Figure 4-6.—Mk 45 Mod 0 aircraft parachute flare.

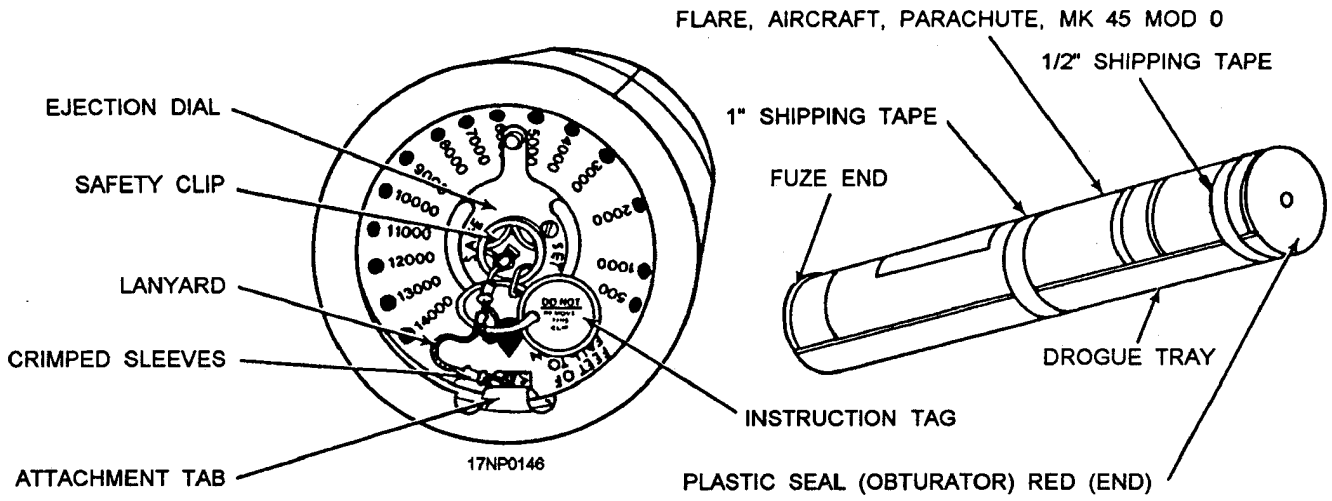

Figure 4-7.—Mk 45 Mod 0 aircraft parachute flare with drogue tray.

(fig. 4-7) is used to dispenser launch the flare. Normally, the drogue tray is configured to the flare at the time of manufacture. The drogue tray is a quarter-round, lightweight, aluminum channel with perpendicular ends. The fuze end has an attachment tab and a circular opening to allow for flare fuze setting. It is attached to the safety clip by a lanyard. The opposite end is solid and has a red plastic seal that acts as a pressure seal for dispenser ejection cartridge gases. Flares and trays are loaded into the dispenser as a unit.

Regardless of launch method, the flare is initiated by exerting pull on the lanyard. When the lanyard is pulled, it snaps the safety clip from its position over the toggle. A force of 18 to 35 pounds pulls the internal disconnect completely out of the fuze mechanism, allowing the spring-loaded striker to strike the primer. The primer ignites a fixed, 2-second delay element and drives the plunger into the ejection time-delay fuze at a point determined by the selected setting. After 2 seconds, the delay element ignites black powder in the plunger. Ignition is transferred through a perforation in the plunger to the time-delay fuze. After the preset delay, the fuze ignites the expellant. The expellant forces off the aluminum end cap and expels the candle and the parachute assembly from the flare case with considerable force.

REVIEW NUMBER 1 ANSWERS TO QUESTION Q1. THROUGH Q8.

A1. Navy pyrotechnic devices contain combustible chemicals.

A2. Dye-marking devices are classified as pyrotechnic devices because they are used for about the same purpose as the true pyrotechnic.

A3. Orange smoke is emitted from the Mk 13 Mod 0 marine smoke and illumination marker when it is used during the day.

A4. The burning time for each end of the Mk 13 Mod 0 signal is 20 seconds.

A5. You can identify the night end of the Mk 13 Mod 0 signal by the three prominent beads across its face.

A6. The components of the Mk 79 Mod 0 illumination signal kit include the Mk 31 Mod 0 signal projector, a plastic bandoleer, and an instruction sheet.

A7. When you activate the Mk 79 Mod 0 signal kit, the star is propelled upward to a height of 250 to 650 feet.

A8. The burn time of the Mk 79 Mod 0 star is a minimum of 4 1/2 seconds.

Upon opening, the main parachute pulls on the cables of the suspension/ignition system. The shorter cable pulls the release pin from the igniter assembly, cocking and releasing the firing pin so that it strikes the primer. The primer ignites an ignition pellet, which, in turn ignites the magnesium candle. The burning candle is then suspended on the fully deployed main parachute. When the candle approaches the end of its burning time, its heat activates the explosive bolt. (Ten of the eighteen shroud lines are attached to the explosive bolt.) Release of these shroud lines causes the parachute to collapse and flutter to the ground.

LUU-2B/B AIRCRAFT PARACHUTE FLARE

The LUU-2B/B flare is the same size as the Mk 45 flare. It is 36 inches long, 4.9 inches in diameter, and weighs about 30 pounds. The flare is supplied only as an AUR, and it is shipped assembled with drogue trays for dispenser launch. The flare is hand launched, or configured for launching from IMER or ITER aircraft bomb racks. It replaces the Mk 24 Mods and Mk 45 Mods aircraft parachute flares.

Components

The LUU-2B/B flare (fig. 4-8) has four major components:

WEIGHT:	30 LB.	CANDLEPOWER 2,000,000 LUU-2B/B 1,600,000 LUU-2A/B
LENGTH:	36 IN.	
DIAMETER:	4.9 IN.	
SUSPENSION PROVISIONS:	14 IN.	

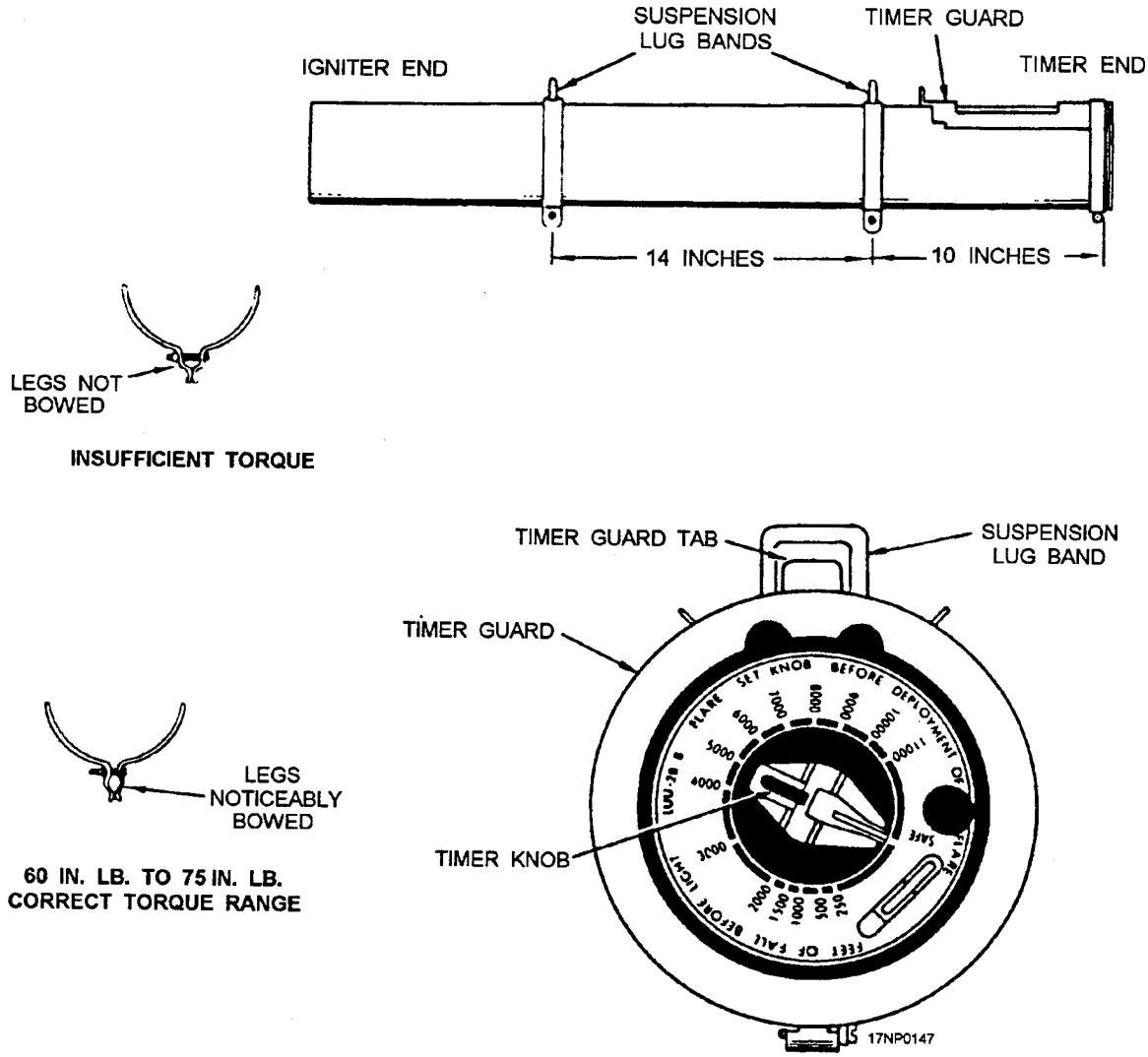

Figure 4-8.—LUU-2B/B aircraft parachute flare.

1. The mechanical timer assembly
2. The parachute suspension system
3. The out-of-line igniter
4. The case assembly with the tamped candle

The mechanical timer assembly consists of a mechanical timer and related hardware in a Lexan plastic housing. The nonexplosive mechanical timer functions like the explosive Mk 364 fuze on the Mk 45 flare. The mechanical timer is a three-gear timer, powered by a torsional mainspring. A phosphorescent plastic decal with calibrated markings from 250 to 11,000 feet of fall is located on the face of the timer cover. A white, plastic, dial timer knob is used to set the desired drop distance. Settings of 150,500, and 1,000 to 11,000 feet can be selected. A safe setting is also provided.

An 18-foot diameter cruciform-shaped canopy parachute suspension system is used for good stability. The riser cables connect the parachute to a bulkhead. The bulkhead separates the parachute compartment from the remainder of the flare assembly. One cable is attached to an explosive bolt for parachute dump at candle burnout, just like the Mk 45 flare.

In the ignition system, a lanyard is attached to one of the parachute riser cables. This lanyard is threaded through the bulkhead and past the candle in an internal raceway along the side of the aluminum case. This leads to the ignition assembly in the ignition housing near the candle's face. The lanyard is attached to a triggering mechanism, which consists of the out-of-line igniter (OLI-2/A). Upon ignition, the firing pin initiates the pyrotechnic firing train.

The aluminum case assembly contains a tamp-cast illuminating candle that consists of a composition of magnesium, sodium nitrate, and a polymer binder. The flare is designed so the outer aluminum case is partially consumed during candle burning.

Operation

A lanyard is attached to the timer knob on the flare timer during flare uploading procedures. The lanyard is also connected to the flare drogue tray or bomb rack, depending on the launch configuration. At launch, the timer knob is pulled out of the timer (requires approximately 30 pounds of force) by the lanyard, starting the clock mechanism. After the preset time (drop distance) ends, the three locking pawls in the timer assembly release, retracting and releasing the timer assembly. A spring, located between the timer assembly and the packaged parachute, expels the timer assembly, which, in turn, initiates removal of the parachute from the flare case. When the cord breaks, it separates the timer assembly from the parachute. As the parachute system deploys and its main cables are pulled taut, the ignition lanyard is pulled to activate the ignition system. The ignition lanyard must exert a pull force in excess of 90 pounds to pull the slider assembly in line. This, in turn, releases the firing pin against the primer. The primer ignites a propellant wafer that produces sufficient heat for candle ignition. Pressure buildup during candle ignition blows off the igniter housing, and the candle power reaches a nominal value. Just before candle burnout, the explosive bolt functions to release one of the suspension cables, causing the parachute to dump.

The LUU-2B/B flare has several advantages over the Mk 24 and Mk 45 flares. The most important advantage is that the candle is not ejected from the case on the LUU-2B/B. Only the parachute is removed from the case. This is accomplished by a mechanical timer instead of an explosive fuze, as is done in the Mk 24 and Mk 45. Therefore, if the timer knob should be accidentally pulled during handling when the timer is not on the SAFE setting, the timer and release mechanisms can be forcibly hand-held onto the flare housing to prevent ejection of the timer and release mechanisms. When the timer completes its cycle, the timer mechanism can be taped on the flare housing and marked for disposal. If the timer is ejected from the flare and a portion of the parachute comes out of the housing, the parachute can be stuffed back into the housing, taped, and marked for disposal.

Another advantage of the LUU-2 B/B flare is the increased pull force on the parachute lanyard to initiate the ignition sequence. If the parachute should accidentally deploy on the flight deck/line, the opening shock from deck winds or jet blast is not sufficient to ignite the candle.

REVIEW NUMBER 2

Q1. What is the length and diameter of the Mk 45 Mod 0 aircraft parachute flare ?

Q2. What fuze is used with the Mk 45 Mod 0 flare?

Q3. What are the settings of the Mk 45 Mod 0 flare?

Q4. List the component that holds the dial indicator at a selected setting or at SAFE.

Q5. What amount of force needs to be exerted to pull the internal disconnect completely out of the fuze mechanism ?

Q6. What is the approximate weight of the LUU-2B/B aircraft parachute flare?

Q7. The components of the LUU-2B/B flare are _____.

Q8. What is the minimum drop distance setting of the LUU-2B/B flare?

Q9. What is the diameter of the parachute suspension system?

Q10. At launch, the timer knob is pulled off of the timer by what amount of force on the lanyard?

Q11. Using the LUU-2B/B flare instead of the Mk 45 Mod 0 flare is more advantageous because the LUU-2B/B flare candle _____.

AIRCRAFT-LAUNCHED SMOKE AND FLAME MARKING DEVICES

LEARNING OBJECTIVE: *Identify the physical and functional description of aircraft-launched smoke and flame marking devices. Recognize the methods used to launch them.*

Smoke and flame marking devices are pyrotechnic devices dropped on the ground or on the water's surface to emit smoke and/or flame. Reference points established by these devices serve a variety of purposes. They can be used to determine wind direction and approximate velocity, mark the location on the surface for emergency night landings, establish an initial contact point for continued search for a submarine, or locate target areas in antisubmarine warfare.

MK 25 MODS 2 AND 3 MARINE LOCATION MARKER

The Mk 25 Mods 2 and 3 (fig. 4-9) marine location markers are launched from aircraft or surface craft. They are launched from aircraft to provide day or night reference points for marking the course of enemy submarines in antisubmarine warfare operations. They are suitable for any type of sea-surface reference-point marking that calls for both smoke and flame for a period of 10 to 20 minutes. Mods 2 and 3 function identically. The only significant difference is that Mod 2 contains two seawater-activated batteries and two related squibs while Mod 3 contains a single battery and squib.

Physical Description

The Mk 25 marker consists of a cylindrical outer tube about 18.5 inches long and 2.9 inches in diameter. A valve assembly is fitted into the projecting chimney at the marker's nose end. The smoke and flame are emitted from this opening. At the opposite end is a

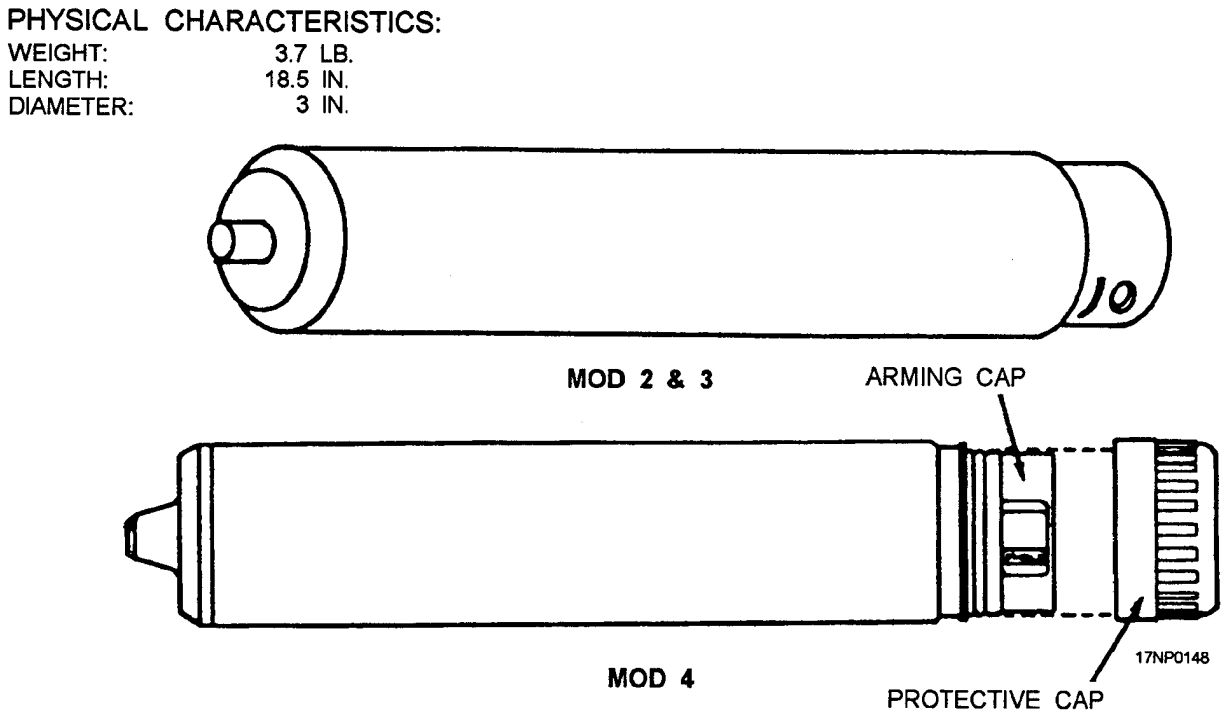

Figure 4-9.—Mk 25 marine location marker.

heavier aluminum base assembly to which the outer tube is crimped. The heavy base end causes the marker to float in the water with the chimney out of the water and the base in the water.

Within the base assembly is a Mk 72 Mod 0 seawater-activated battery (two batteries in the Mod 2). The battery is shielded from water contact by two plugs fitted into 1/2-inch holes on two opposite sides of the base assembly. A rigid cover (arming plate), held in place by a retainer ring, is recessed into the base end. An arrow in the center of the arming plate indicates its safe or armed position. The words SAFE and ARMED are stamped into the base rim. Also, a machined notch in the rim at the armed position helps during night use. When the arming plate is in the safe position, it physically blocks the base plugs internally to prevent them from being accidentally pushed in. When in the armed position, the arming plate no longer blocks the base plugs, allowing them to be pushed in at the appropriate time. A black rubber G-ring circles the base assembly approximately 1/4 inch from the crimp, which holds the outer case.

Functional Description

To activate the seawater battery, the base plugs are pushed in before the marker is actually launched. The marker is ignited by an electric squib, and power is supplied by the seawater-activated battery (two batteries and two squibs in Mod 2). When the marker enters the water, seawater enters the battery cavity and serves as an electrolyte, causing the battery to produce a current that activates the squib. The squib ignites the starter mix, which, in turn, ignites the red phosphorous pyrotechnic composition. Gas buildup forces the valve assembly from the chimney in the nose, and yellow flame and white smoke are emitted. Burning time averages 13.5 to 18.5 minutes. Although this marker is normally used in seawater, it can be used in inland bodies of fresh water by using table salt and following the procedures outlined in *Pyrotechnic, Screening, Marking, and Countermeasure Devices,* NAVSEA SW050-AB-MMA-010/NAVAIR 11-15-7.

REVIEW NUMBER 2 ANSWERS TO QUESTIONS Q1. THROUGH Q11.

A1. The Mk 45 Mod 0 aircraft parachute flare is 36 inches long and approximately 4.9 inches in diameter.

A2. The Mk 364 Mod 0 fuze is used with the Mk 45 Mod 0 flare.

A3. The Mk 45 Mod 0 flare has 15 functional settings, from 1,000 to 14,000 feet in 1,000-foot increments. There is one minimum setting of 500 feet.

A4. A spring-loaded detent holds the dial indicator at a selected setting or at SAFE.

A5. The Mk 45 Mod 0 flare is initiated by exerting a force of 18 to 35 pounds to pull the internal disconnect completely out of the fuze mechanism.

A6. The LUU-2B/B aircraft parachute flare weighs about 30 pounds.

A7. The components of the LUU-2B/B flare are the mechanical timer assembly, the out-of-line igniter, the parachute suspension system and the case assembly with tamped candle.

A8. The minimum drop distance setting of the LUU-2B/B flare is 150 feet.

A9. The diameter of the parachute suspension system is 18 feet.

A10. At launch, the timer knob is pulled off of the timer by approximately 30 pounds of force on the lanyard.

A11. Using the LUU-2B/B flare instead of the Mk 45 Mod 0 flare is more advantageous because the LUU-2B/B flare candle is not ejected from the case of the LUU-2B/B.

Launching Methods

Currently, there are two methods of launching the Mk 25 marker—by hand or by sonobuoy launcher. To launch by hand, rotate the base arming plate clockwise to the armed position. Push the base plugs into the battery cavity, located in the marker base, and throw the marker into the water. It functions as previously discussed.

If the base plugs (one or both) of a marker are disturbed so the watertight integrity of the battery cavity is compromised and the marker is not launched immediately, a marine marker adapter kit (Mk 34 Mod 0) must be installed. The Mk 34 Mod 0 adapter kit is also used when the marker is launched from sonobuoy launchers. The adapter kit fits over the base end of the marker, and, when properly installed, seals the battery cavity. The adapter kit is installed by rotating the marker base arming plate to the armed position and pushing the base plugs into the battery cavity. Remove the black G-ring and install the adapter kit around the marker base so the seal plugs on the leaf-spring ends cover the holes into the battery cavity. Insert the U-pin to hold the adapter in place. To hand-launch a marker with a Mk 34 adapter kit installed, remove the U-pin and the adapter and throw the marker into the water.

Before launching the Mk 25 marker from sonobuoy launchers, you should install a Mk 34 adapter kit (fig. 4-10) on the marker. The adapter kit provides a safe environment for the marker until the last possible moment before launch. Because of the physical difference in size between the Mk 25 marker and the sonobuoy launch tubes, a sonobuoy launch container (SLC) and spacer assembly (fig. 4-10) is used to launch the Mk 25 marker from a sonobuoy launcher.

The Mk 25 marker, with the Mk 34 adapter kit installed, is installed into the cavity half of the split foam spacer assembly section with the U-pin of the Mk 34 adapter in the UP position. Then, remove the U-pin and place the other half of the split foam spacer assembly section over the marker, which completely encloses the marker. The foam spacer assembly containing the marker is then installed into the SLC against the obturator. Foam pads are installed, and the end cap is locked into slots in the SLC, retaining the assembly

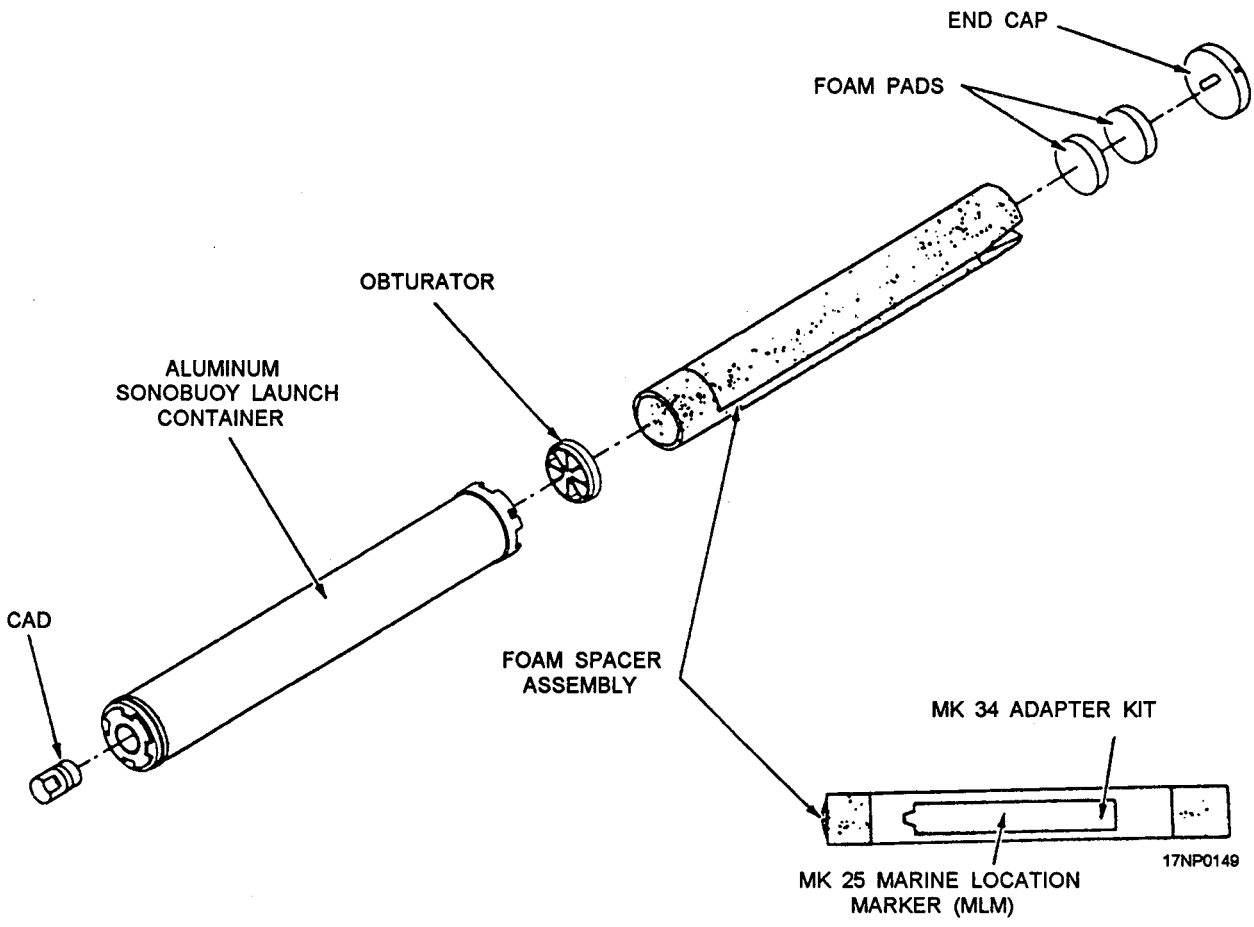

Figure 4-10.—Spacer assembly and sonobuoy launch container.

inside the SLC. A JAU-1/B cartridge is installed in the SLC, and the loaded SLC is installed in the sonobuoy launcher aboard the aircraft.

To launch the Mk 25 marker, the JAU-1/B cartridge is initiated through the aircraft circuitry. It develops sufficient gas pressure inside the SLC to force off the SLC end cap and expel the foam spacer assembly containing the Mk 25 marker. Once out of the SLC, the split foam spacer assembly is separated by the airstream, freeing the marker. The airstream then separates the Mk 34 adapter kit from the marker, allowing them to fall to the water as separate units. Upon entry into the water, the marker functions as previously discussed.

MK 58 MOD 1 MARINE LOCATION MARKER

The Mk 58 Mod 1 marine location marker (fig. 4-11) is designed for day or night use in any condition calling for long-burning, smoke and flame reference-point marking on the ocean's surface. In addition to being used for antisubmarine warfare, it is used for search-and-rescue operations, man-overboard markings, and as a target for practice bombing at sea. The marker produces a yellow flame and white smoke for a minimum of 40 minutes and a maximum of 60 minutes. It is visible for at least 3 miles under normal operating conditions.

Physical Description

The Mk 58 Mod 1 marine location marker consists of a cylindrical tin can approximately 21.78 inches long and 5.03 inches in diameter. The can contains two pyrotechnic candles of a red phosphorus composition. The ignition end of the marker has three holes-two for smoke and flame emission and one for water to enter the Mk 72 Mod 1 seawater-activated battery. Adhesive foil disks hermetically seal the two emission holes. A reinforced adhesive foil strip with a rectangular pull ring hermetically seals the battery cavity hole. The adhesive foil seals are protected during handling and shipping by a replaceable polyethylene protective cover.

Launching Methods

The Mk 58 Mod 1 marker maybe hand launched, externally launched from suitable aircraft bomb racks by using breakaway suspension bands, or launched from sonobuoy launchers by using a sonobuoy launcher container (SLC) and the appropriate foam spacer. No matter how the marker is launched, the protective cover, the pull ring, and reinforced adhesive foil strip over the battery's cavity are removed.

When launching the marker from a sonobuoy launcher, you remove the protective cover and pull ring and reinforced adhesive foil strip. Then, load the marker onto the bomb rack. After securing the marker

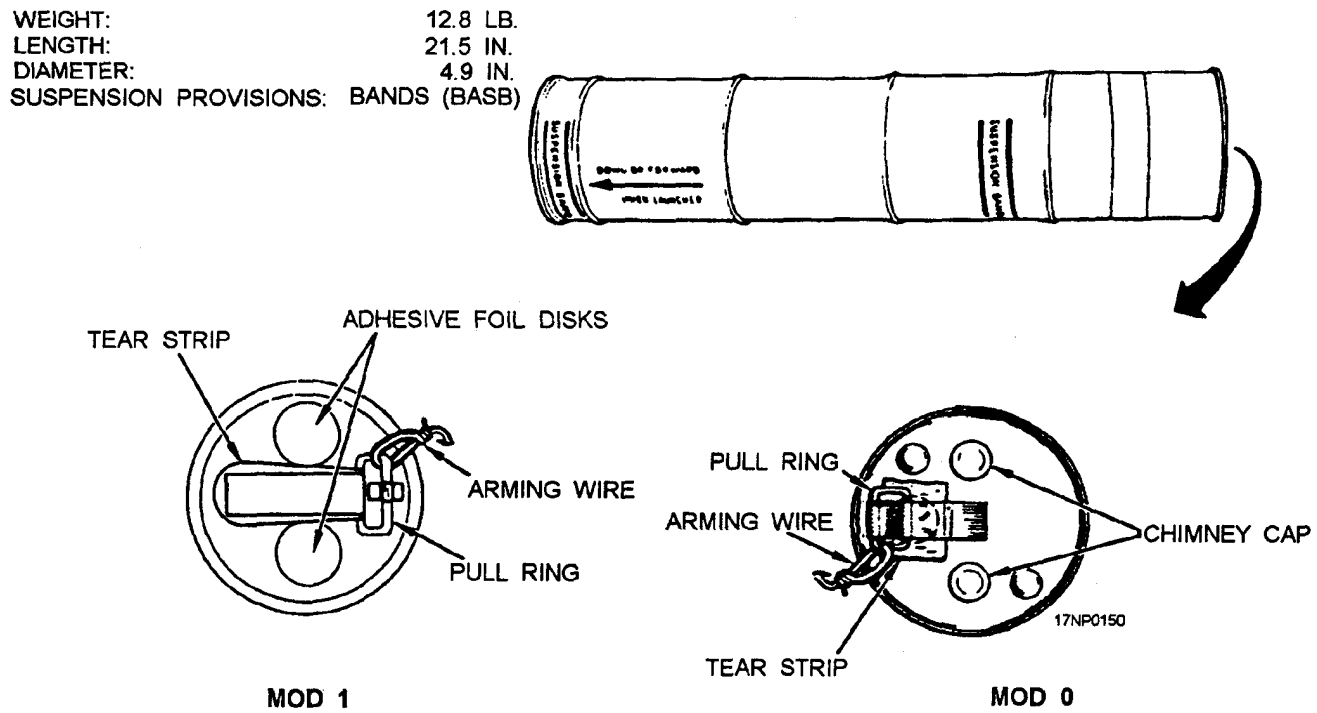

Figure 4-11.—Mk 58 Mod 0/1 marine location marker.

to the bomb rack, attach the pull ring to an arming wire, which is attached to the bomb rack. When the marker is released from the bomb rack, the arming wire retains the pull ring and removes the foil strip covering the battery's cavity. When submerged, the Mk 72 Mod 1 battery is activated by seawater. Current from the battery initiates a Mk 13 electric squib, which ignites the starter composition of the first pyrotechnic candle. The composition ignites the starter pellet, which, in turn, ignites the first candle. When the first candle is nearly burned out, its heat ignites the transfer time fuze which carries ignition to the second candle starter composition. This starter composition initiates the second pyrotechnic candle.

REVIEW NUMBER 3

Q1. What is the burn time of the Mk 25 Mods 2 and 3 marine location markers?

Q2. The Mk 25 Mods 2 and 3 marine location markers function in the same way. Describe the difference between them.

Q3. What is the purpose of the heavy aluminum base assembly crimped to the outer tube?

Q4. List the methods used to launch the Mk 25 and Mods marine location markers.

Q5. What adapter kit is used when the Mk 25 and Mods marine location markers are launched from sonobuoy launchers?

Q6. List the uses of the Mk 58 Mod 1 marine location marker.

Q7. The Mk 58 Mod 1 marker produces a yellow flame and white smoke for what length of time?

Q8. Under normal conditions, the flame and/or smoke of the Mk 58 Mod 1 marker is visible for _____.

Q9. List the methods used to launch the Mk 58 Mod 1 marine marker

Q10. What seawater-activated battery is used with the Mk 58 Mod 1 marker?

DECOYING DEVICES

LEARNING OBJECTIVE: *Identify the purpose and use of decoy devices.*

Decoy flares are dispensed from launching mechanisms on aircraft. They are fired during evasion tactics when threatened by enemy heat-seeking missiles.

The Mk 46 Mods 1, 1A, and 1C decoy flares are loaded into and launched from either the AN/ALE-39 dispensing set or the AN/ALE-37A chaff dispenser. The decoy flare (fig. 4-12) consists of a cylindrical aluminum case about 5.8 inches long and 1.42 inches in diameter. The base end of the flare is flanged to a maximum diameter of 1.495 inches to fit the counterbore in the chamber of the dispenser. The end

	CHAFF PACKAGE	MJU-8/B MJU-8A/B	MJU-22/B	SM-875/ALE
LENGTH:	5.8 IN.	5.8 IN.	10.55 IN.	3.828 IN.
DIAMETER:	1.4 IN.	1.4 IN.	1.4 IN.	1.4 IN.

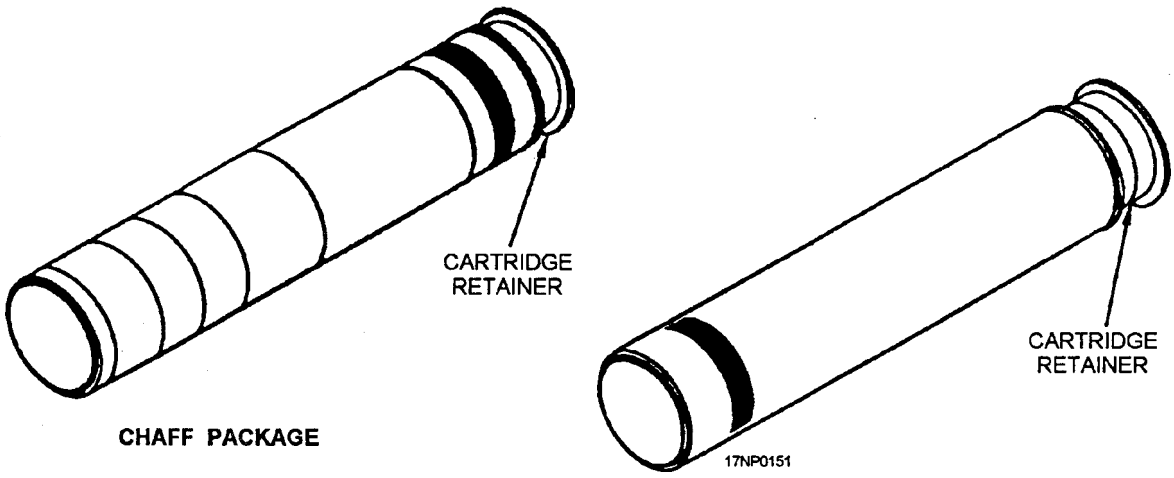

Figure 4-12.—Mk 46 Mod 1, MJU-8/B, A/B, MJU-22/B, SM 875/ALE and chaff package.

of the flare case opposite the flanged base is closed with an aluminum closure disk.

When properly installed in the chamber of a dispenser, the cartridge retainer fits snugly over and around the firing end of a corresponding Mk 131 impulse cartridge. When the cartridge is fired, gas pressure causes the hammer to move into the adapter, locking the adapter and the piston together. Gases from the fired cartridge expand to exert a pushing force against the piston. This removes the closure disk and ejects the flare grain. As the piston strikes the piston stop, the adapter to which the pull wire is firmly attached separates from the igniter cup. Then, the adapter travels with the flare grain. This action causes the igniter to move over the friction material on the crinkled end of the pull wire, igniting the ignition composition. Flame flashes through the longitudinal hole in the flare grain and ignites the first-fire composition in both the longitudinal hole and the cross hole. The first-fire composition ignites the flare grain on all surfaces.

The flare is rendered safe during normal handling operations by the segmented adapter. If the closure disk is accidentally displaced, the entire grain and the igniter assembly slips out of the flare case without igniting. The device arms only after an impulse cartridge is fired and bends the sharpened edges of the adapter so it is locked to the piston.

PRACTICE BOMB SIGNAL CARTRIDGES

LEARNING OBJECTIVE: *Identify the purpose and use of practice bomb signal cartridges.*

Practice bomb signal cartridges are used for day and night operations and as a visual indication of bomb

REVIEW NUMBER 3 ANSWERS TO QUESTIONS Q1. THROUGH Q10.

A1. The burn time of the Mk 25 Mods 2 and 3 marine location markers is between 10 and 20 minutes.

A2. The Mk 25 Mods 2 and 3 marine location markers function in the same way, Mod 2 contains two saltwater-activated batteries and two related squibs. Mod 3 contains one battery and one squib.

A3. The heavy aluminum base assembly crimped to the outer tube sits in the water and causes the candle to sit out of the water.

A4. The Mk 25 and Mods marine location marker is launched by hand or by sonobuoy launcher.

A5. The Mk 34 adapter kit is used when the Mk 25 and Mods marine location marker is launched from sonobuoy launchers.

A6. The Mk 58 Mod 1 marine location marker is used for antisubmarine warfare, search-and-rescue operations, man-overboard markings, and as a target for practice bombing at sea.

A7. The Mk 58 Mod 1 marker produces a yellow flame and white smoke for 40 to 60 minutes.

A8. Under normal conditions, the flame and/or smoke of the Mk 58 Mod 1 marker is visible for 3 miles.

A9. The Mk 58 Mod 1 marine marker is hand launched, externally launched from aircraft bomb racks, or launched from sonobuoy launchers.

A10. The Mk 72 Mod 1 seawater-activated battery is used with the Mk 58 Mod 1 marker.

impact and fuze function. Three types of signal cartridges are discussed in this section.

Mk 4 Mod 3 signal cartridge. The Mk 4 Mod 3 practice bomb signal cartridge (fig. 4-13) consists of an aluminum case. The rim end has a percussion primer, and the opposite end is sealed with an aluminum disk. The cartridge produces a flash of light and a white smoke puff. The Mk 4 Mod 3 is primarily used for night operations.

CXU-3/B and CXU-3A/B signal cartridges. The CXU-3/B and CXU-3A/B practice bomb signal cartridges (fig. 4-14) consists of a cylindrical aluminum case. The case is closed on one end with a percussion primer, and the opposite end is closed with a crimped-in-place aluminum cover (cap). The cartridge produces a dense, white smoke display for day missions.

CXU-4/B spotting charge. The CXU-4/B spotting charge (fig. 4-15) is a fire-free signal used with practice bomb BDU 45/B to provide a daytime visual indication of bomb impact point and fuse function.

REVIEW NUMBER 4

Q1. Describe the primary purpose of decoy flares.

Q2. What means are used to launch the Mk 46 Mods 1, 1A, and 1C decoy flares?

Q3. What cartridge is used to fire a decoy flare from a chaff dispenser?

Q4. What practice bomb signal cartridge is used primarily for night operations?

Q5. What practice bomb signal produces white smoke for day missions?

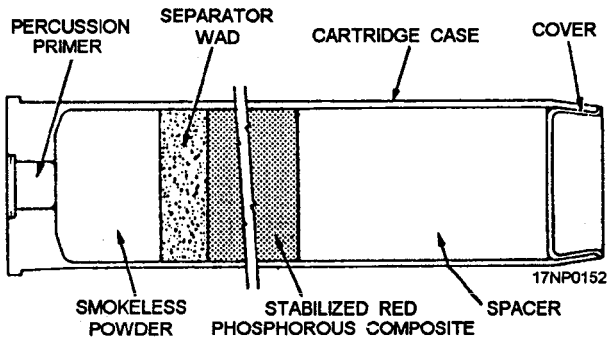

Figure 4-13.—Practice bomb signal cartridge.

LENGTH:
MK 4 MOD 3: 5 IN.
CXU-3/B AND 3A/B: 6 IN.
DIAMETER: 0.85 IN.

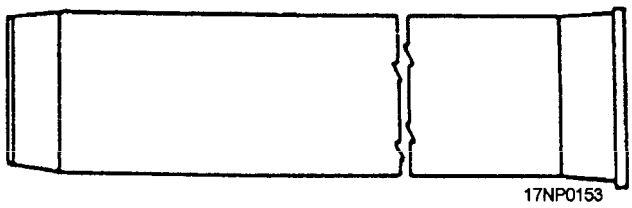

Figure 4-14.—Mk 4 Mod 3, CXU-3/B, and CXU-3A/B practice bomb signal cartridge.

HANDLING AND SAFETY PRECAUTIONS

LEARNING OBJECTIVE: *Recognize the safety precautions to follow when working with pyrotechnics.*

Pyrotechnic ammunition is one of the most widely used types of ammunition in naval aviation. Pyrotechnics of one type or another are carried in almost every Navy aircraft, including unarmed transport and training aircraft.

All pyrotechnic and screening devices, while designed and tested to be safe under normal conditions, are subject to accidental ignition. A general rule for the handling of pyrotechnic devices is as follows:

You should be constantly aware that pyrotechnics contain chemical components that are intended to burn with intense heat, and you should act accordingly.

LENGTH: 2.85 IN.
DIAMETER: 2 IN.

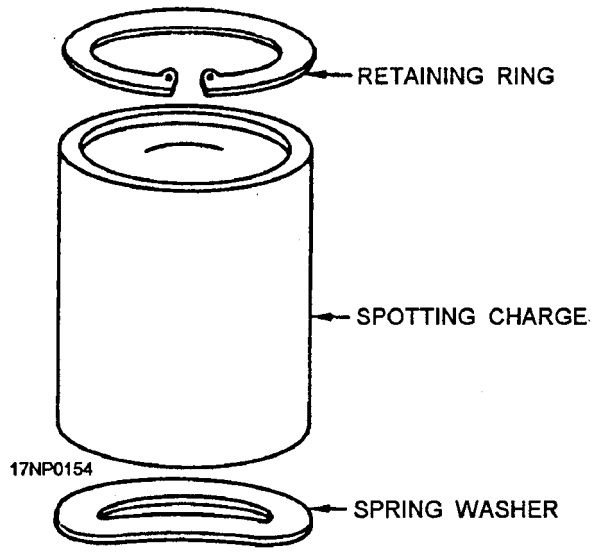

Figure 4-15.—CXU-4/B spotting charge.

Pyrotechnic and screening devices are normally equipped with some type of safety pin, lock, or tape that is designed to prevent accidental activation of the initiation mechanism. Do **NOT** tamper with such equipment. Do **NOT** strike, bend, or otherwise remove the safety equipment until just before the device is launched Any devices that show signs of damage to the safety features are considered unserviceable; carefully put them to one side and promptly dispose of them according to current directives.

If a pyrotechnic device should accidentally ignite, it will result in a fire hazard. In a confined area, the gases generated by this combustion could present a serious toxic hazard. Signaling charges that contain propellant charges, designed to propel the pyrotechnic candle into the air, create an extremely dangerous missile hazard.

Pyrotechnic compositions characteristically contain their own oxidants; therefore, they do not depend on atmospheric oxygen for combustion. For this reason, exclusion of air, by whatever means, from a pyrotechnic fire is usually ineffective. Many pyrotechnic mixtures, particularly illuminating flare compositions, burn with intense heat (up to 4,500°F). Normally, extinguishers are not useful in this kind of fire. Carbon dioxide extinguishers, in addition to being ineffective, are potential sources of danger because they tend to produce oxygen, which supports the combustion. Foam-type extinguishers are equally ineffective because they work on the exclusion-of-air principle.

Water, in flooding quantities and at low pressure, should be used to cool the surrounding area and to prevent the spread of the fire. Properly controlled and directed, water is the best fire-extinguishing agent for aircraft parachute flares burning in the open.

Pyrotechnic hazards are frequently increased by such factors as age, improper storage conditions, rough handling, moisture penetration, excessive temperatures, damage to shipping containers, and other mishaps that causes the devices to become unserviceable. In most cases, immediate danger does not exist. Unserviceable pyrotechnic and screening devices on ships at sea are put to one side for normal return to an appropriate shore station for disposition according to the instructions and regulations contained in NAVSEA OP 5, volume 1.

Conditions may develop that demand emergency disposal of potentially hazardous devices. In such cases, disposition is the responsibility of the commanding officer. Under **NO** circumstances, other than an extreme emergency, should ammunition, explosives, or other related hazardous materials be dumped at sea by a Navy vessel, aircraft, or activity without prior approval of the CNO. If, in the commanding officer's best judgement, immediate disposition is necessary to protect lives and property, the commanding officer should order such disposition by the most appropriate means available. In all cases, the commanding officer must notify Naval Sea Systems Command, at the earliest practical time, of the facts and circumstances.

REVIEW NUMBER 5

Q1. Pyrotechnics are dangerous to handle because they are composed of _____.

Q2. Combustion requires oxygen. By what method is oxygen supplied to pyrotechnic devices?

Q3. What means should you use if there is a fire involving parachute flares?

REVIEW NUMBER 4 ANSWERS TO QUESTIONS Q1. THROUGH Q5.

A1. The purpose of decoy flares is to provide evasion tactics for naval aircraft when they are threatened by enemy heat-seeking missiles.

A2. Mk 46 (Mods) decoy flares are launched from either the AN/ALE-39 dispenser set or the AN/ALE-37A chaff dispenser.

A3. The Mk 131 impulse cartridge is used to fire a decoy flare from a chaff dispenser.

A4. The Mk 4 Mod 3 signal cartridge is used primarily for practice bomb night operations.

AS. The CXU-3A/B signal cartridge is used for practice bomb day missions.

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REVIEW NUMBER 5 ANSWERS TO QUESTIONS Q1. THROUGH Q3.

A1. Pyrotechnics are dangerous to handle because they are composed of chemicals that are intended to burn with intense heat.

A2. Combustion requires oxygen. Generally pyrotechnic devices contain their own oxygen supply; they don't depend on the atmosphere for it.

A3. If there is a fire involving parachute flares, water, in flooding quantities and at low pressure should be used.

CHAPTER 5

AIR-LAID MINES AND TORPEDOES

Since World War II, the U.S. Navy has developed sophisticated air-launched torpedoes and air-laid mines. These weapons incorporate components so sensitive that their operation is classified information. Therefore, the information in this TRAMAN on air-launched torpedoes and air-laid mines is limited. You will be referred to publications containing detailed information for the weapons discussed throughout the chapter.

MK 46 AND MK 50 TORPEDOES

LEARNING OBJECTIVE: *Identify the purpose and use of the Mk 46 and Mk 50 torpedoes. Recognize the torpedo configurations to include warshot and exercise and aircraft-launched torpedoes. Identify Otto Fuel II.*

The Mk 46 and Mods torpedo (fig.5-1) is the primary weapon used in antisubmarine warefare (ASW).

MK 46 TORPEDO CONFIGURATIONS

The Mk 46 Mods torpedo can be assembled into one warshot (tactical) and three REXTORP

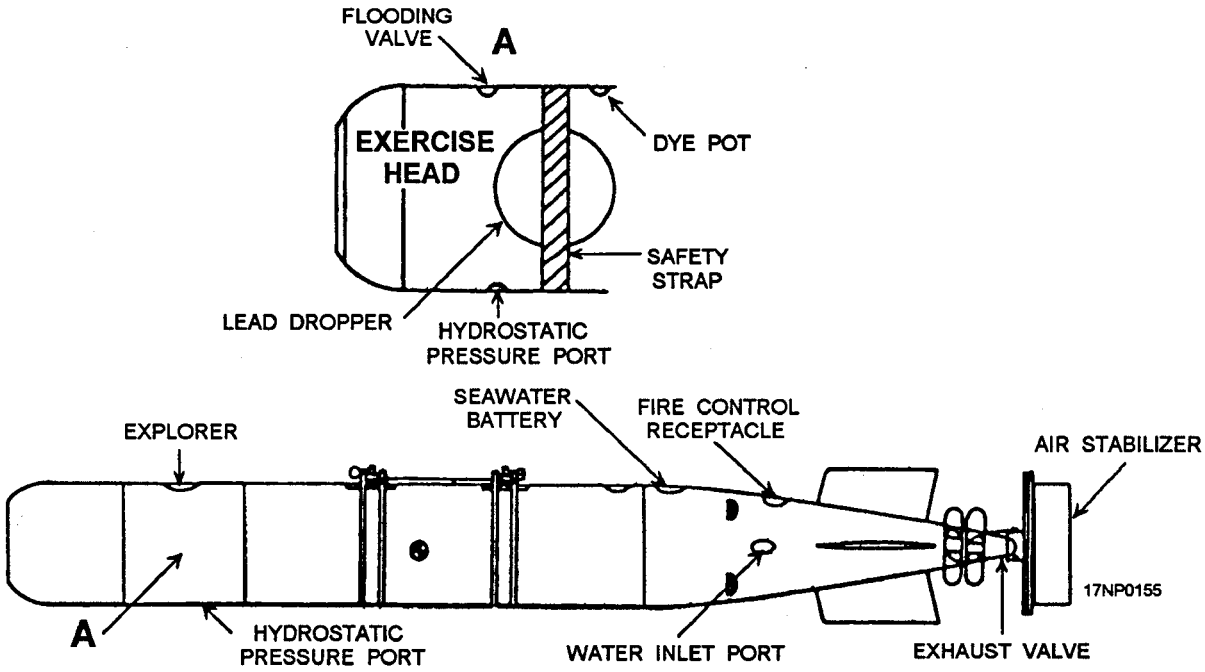


Figure 5-1.—Mk 46 torpedo.

(recoverable exercise torpedo) configurations (fig. 5-2).

Mk 46 Warshot Configuration

The warshot configuration of the Mk 46 and Mods torpedo consists of a nose section, warhead control group, long fuel tank, and afterbody. A tactical warhead (contains explosives) is used in the warshot configuration.

Mk 46 Exercise Configuration

There are three versions of exercise torpedoes available for aircraft launching: (1) a torpedo with a short exercise head, extender section, and a short fuel tank; (2) a torpedo with a long exercise head and a short fuel tank; or (3) a torpedo with a long exercise head, instrumentation for tracking on 3D ranges, and a short fuel tank. All three configurations use Mk 85 and Mods exercise heads.

For detailed information concerning the component configuration of the Mk 46 and Mods torpedo, you should refer to *Mk 46 Torpedo/Mk 46 REXTORP Flight Accessories (Description, Operation, Installation, Removal, and Trajectory Data),* NAVSEA SW512-AO-ASY-010.

Mk 50 Torpedo

The Mk 50 (fig. 5-3) is a lightweight, high-speed, antisubmarine torpedo that is compatible with all airborne ASW platforms. It has improved design features to ensure greater reliability and increased capabilities over previous torpedoes. The three major sections of the torpedo are nose, head, and afterbody. The nose contains the transmitter and receiver. The afterbody provides propulsion and control. The exercise head provides buoyancy for the torpedo. The warshot head contains an explosive charge. The exercise torpedo is identified by an orange nose and afterbody with a 6-inch blue strip around the circumference of the ballast assembly. For further information on the torpedoes, you should refer to *United States Ammunition Historical and Functional Data,* NAVSEA SW010-AB-GTP-010.

AIRCRAFT-LAUNCHED TORPEDO CONFIGURATIONS

To air-launch torpedoes, you will use launch accessory equipment. This equipment includes suspension bands to attach the torpedo to the aircraft and torpedo air stabilizers to ensure a predictable air trajectory and water entry. Torpedoes are configured and issued to the fleet depending on tactical or training requirements. As an Aviation Ordnanceman (AO), you are not responsible for the assembly of the torpedo at the organizational level. However, you are responsible for the installation of launch accessory equipment.

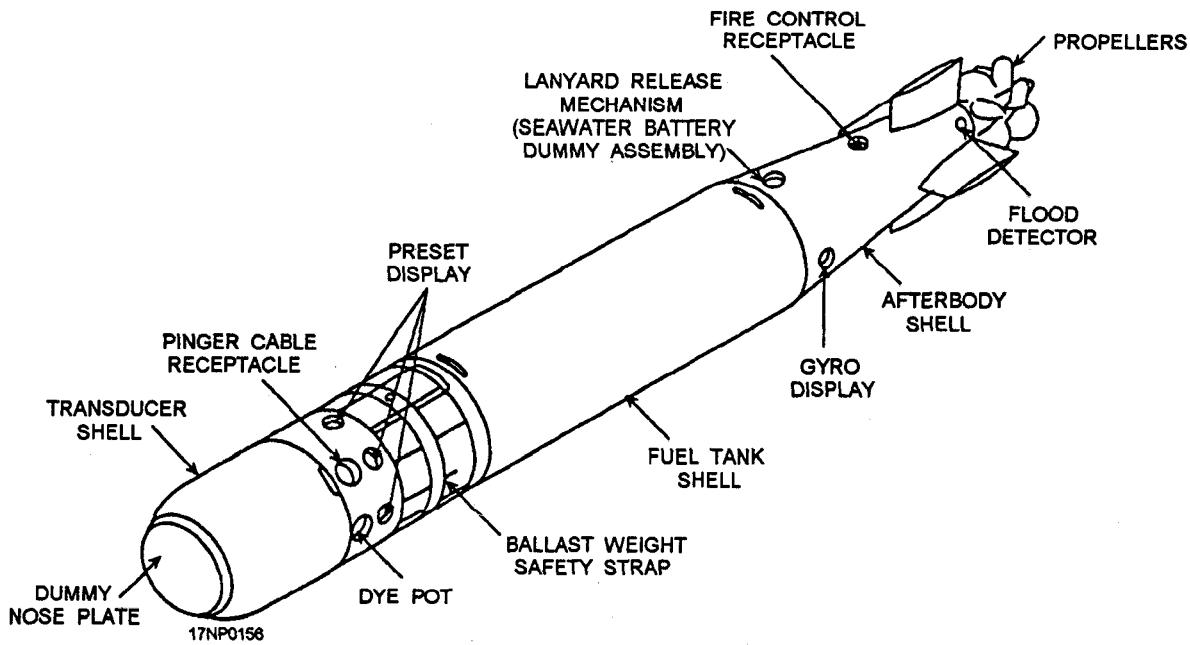


Figure 5-2.—Mk 46 recoverable exercise torpedo (REXTORP).

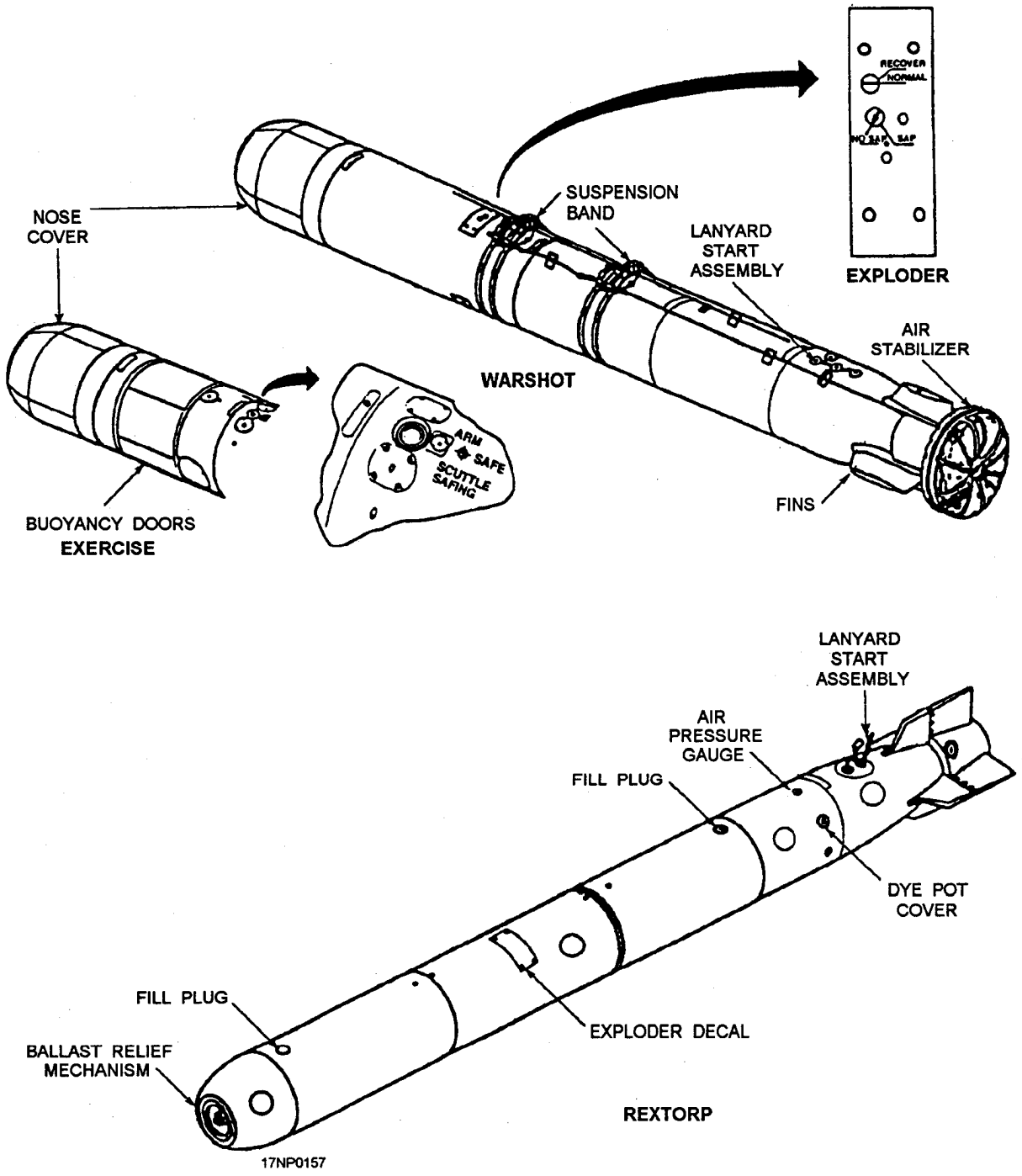


Figure 5-3.—Mk 50 torpedo configurations.

The physical characteristics, such as weight, length, etc., of the Mk 46 torpedo vary. These characteristics depend on the configuration of the torpedo itself (warshot or exercise) and the configuration of the attached launch accessories. The Mk 46 torpedo is configured with aircraft-launch accessories for either helicopter or fixed-wing aircraft launching.

The basic items of accessory equipment used in launching torpedoes from fixed-wing aircraft and helicopters are the torpedo air stabilizer and suspension band assembly. The torpedo air stabilizer ensures a predictable air trajectory and water entry without torpedo structural damage. The air stabilizer reduces the descent speed of the torpedo relative to the speed of the launching aircraft. A static line or release lanyard deploys the parachute when the torpedo is dropped from the aircraft. The deployed parachute stabilizes the torpedo during descent to the water, slows the descent speed to an acceptable velocity for water entry, and assures the proper water entry angle. The

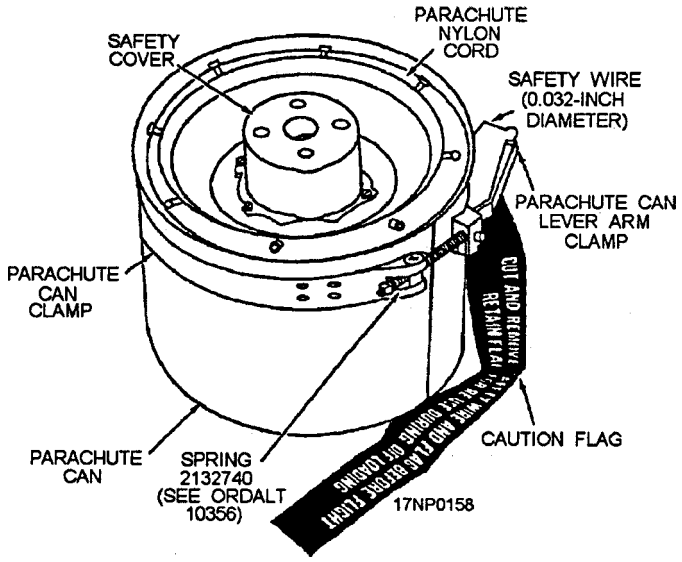


Figure 5-4.—Mk 28 Mod 2 torpedo air stabilizer.

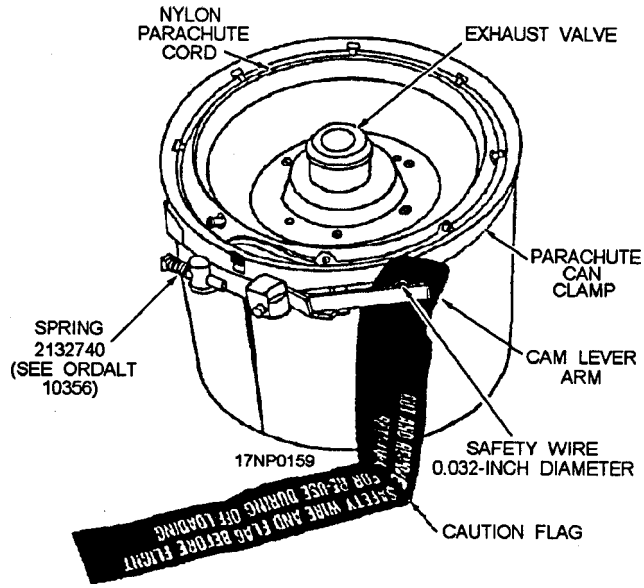


Figure 5-5.—Mk 28 Mod 3 torpedo air stabilizer.

Mk 28 Mod 2 (fig. 5-4) or the Mk 28 Mod 3 (fig. 5-5) air stabilizers are used on torpedoes configured for fixed-wing aircraft. The Mk 31 Mod 0 (fig. 5-6) or the Mk 31 Mod 1 (fig. 5-7) air stabilizers are used on torpedoes configured for helicopters.

Mk 78 Mod 0 or Mod 1 suspension bands (fig. 5-8) are used in pairs to suspend the torpedo from the bomb racks or shackles of the launching aircraft. The bands wrap around the torpedo and are secured by tension bolts. After the bands are installed, the torpedo is loaded aboard by engaging the suspension band lugs in the bomb racks or on the bomb shackles of the aircraft. The torpedo is loaded internally for fixed-wing aircraft launch and externally for helicopter launch. When the bomb rack/shackle hooks are released, the torpedo drops. Release wires unlatch the suspension bands, allowing them to break away from the torpedo as it is launched from the aircraft.

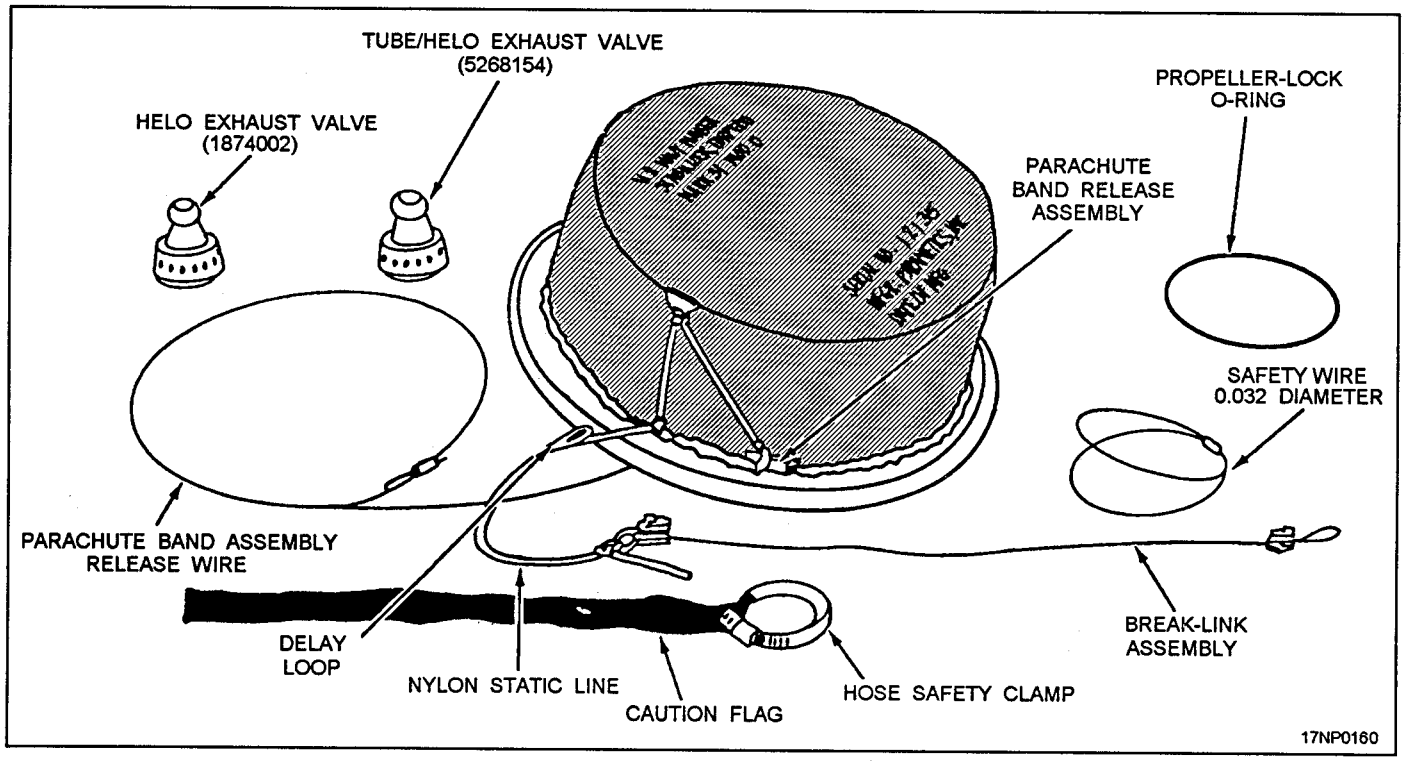


Figure 5-6.—Mk 31 Mod 0 torpedo air stabilizer.

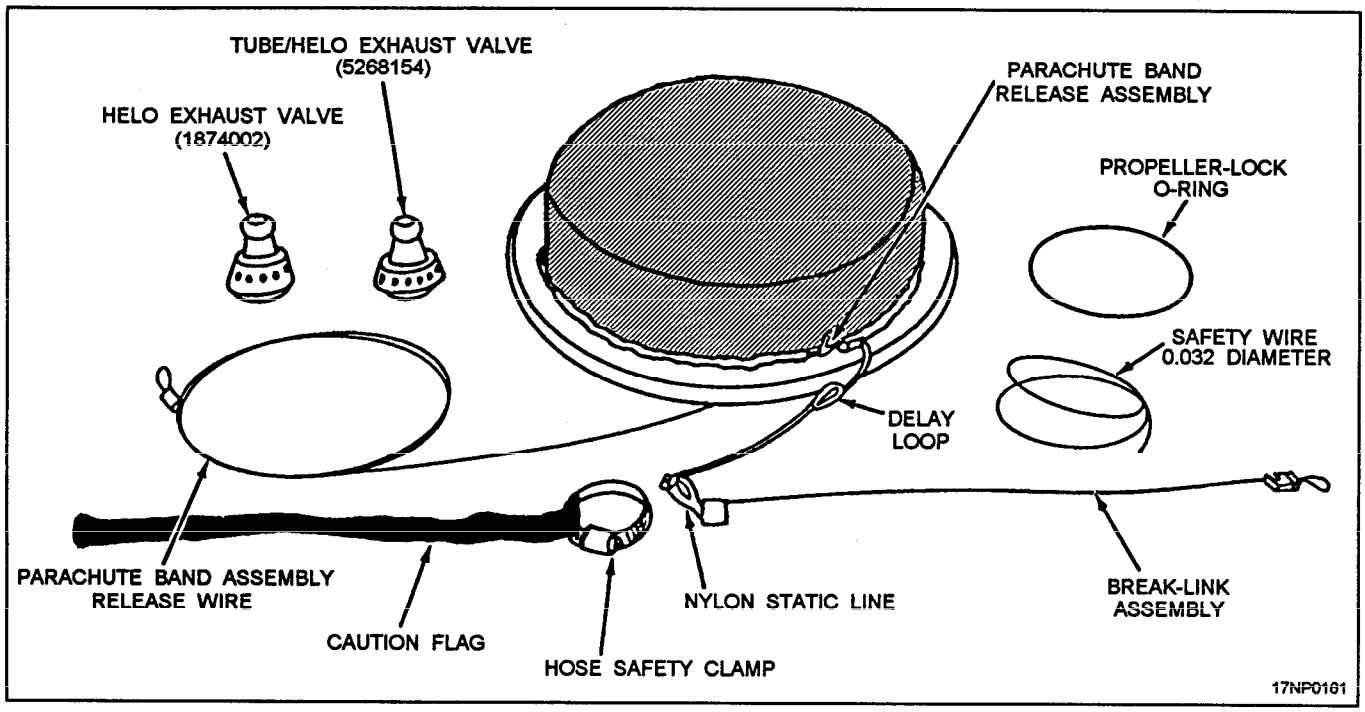


Figure 5-7.—Mk 31 Mod 1 torpedo air stabilizer.

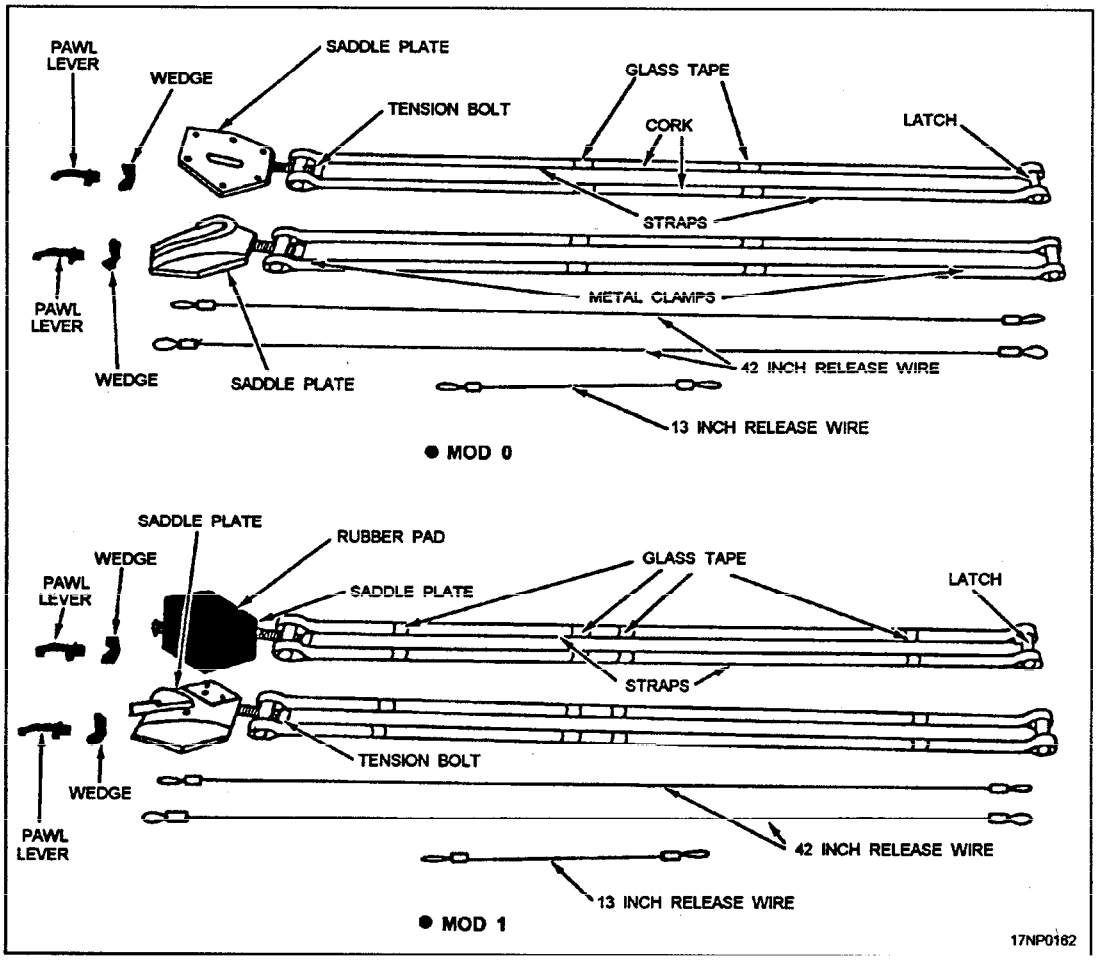


Figure 5-8.—Mk 78 Mod 0 and Mod 1 suspension band assemblies.

For detailed information concerning aircraft launch accessories, you should refer to the *U.S. Navy Aircraft Torpedoes Accessories and Trajectory Data and Quality Assurance Test and Inspection Plan for Installation of Torpedo Mk 46 Launch Accessories,* NAVSEA SW512-AO-ASY-010.

OTTO FUEL II

Otto Fuel II is the propellant for the propulsion system of the Mk 46 (all Mods) torpedo. Otto Fuel II is first sprayed under pressure into a combustion chamber where it is ignited. The exhaust gases from the burning fuel are used to drive the torpedo engine. The major advantage of this system is the short turnaround time required for exercise weapons.

Otto Fuel II is a stable, liquid monopropellant composed of a nitrate ester in solution with a desensitizing agent and a stabilizer. It is a bright red, free-flowing, oily liquid that is heavier than water. (NOTE: When in a thin layer, such as a spill, stain, or leak, Otto Fuel II is a yellow-orange color.) Otto Fuel II is noncorrosive. It has an extremely low vapor pressure, minimizing explosive and toxic hazards. Otto Fuel II can detonate, but the conditions and stimulus required are so extreme that it is considered a nonexplosive. The propellant has a high flash point and other safety characteristics. It is classified as a low fire hazard material.

The ingredient of medical concern in Otto Fuel II is the nitrated ester. Nitrated esters are known for their acute effects on the human body. Symptoms of exposure to Otto Fuel II include the following:

- Headache
- Dizziness
- Drop in blood pressure
- Nasal congestion

NOTE: Depending upon the sensitivity of the individual, a temporary symptom-free tolerance may develop during the remainder of the working period. After exposure to a vapor-free environment, the first contact with Otto Fuel II vapor often causes these symptoms to recur.

A stowage space is specifically designated for each type of torpedo stowed aboard a combat ship. When handling Otto Fuel II, at least two crew members should handle the fuel. All personnel must know the general characteristics of Otto Fuel II, the safety precautions for handling the fuel, and protective equipment required. To avoid hazardous situations when handling Otto Fuel II, personnel should be well trained and supervised. For further information concerning Otto Fuel II, you should refer to *Otto Fuel II Safety, Storage, and Handling Instructions,* NAVSEA S6340-AA-MMA-010.

REVIEW NUMBER 1

Q1. What is the primary weapon used for antisubmarine warfare?

Q2. List the Mk 46 configurations.

Q3. When the Mk 46 is used in the exercise configuration, what exercise head is used?

Q4. After launch, what equipment stabilizes the torpedo during its descent into the water?

Q5. List the air stabilizers used for (a) fixed-wing and (b) rotary-wing aircraft.

Q6. Torpedoes are suspended from bomb racks or shackles by Mk 73 Mod 0 or Mod 1 suspension bands. How do the suspension bands release when the torpedo is launched?

Q7. What propellant is used in the propulsion system of the Mk 46 torpedo ?

Q8. Because Otto Fuel II has a high flash point, low vapor pressure, and is noncorrosive, it is classified as _____.

Q9. List the symptoms you might exhibit if you were exposed to Otto Fuel II.

Q10. For safety reasons, how many crew members should be present when handling Otto Fuel II?

AIRCRAFT-LAID MINES

LEARNING OBJECTIVE: *Identify aircraft-laid mines and recognize their classifications. Describe aircraft-laid mine components and identify operational aircraft mines.*

Naval mines are used in offensive or defensive mining operations. The primary objective is to effectively defend or control vital straits, port approaches, convoy anchorages, and seaward coastal barriers.

Aircraft mine delivery is the principal method of making large scale mining attacks on enemy coastal and port areas. Aircraft-laid mines are usually carried and dropped in the same way as bombs, but they have

different ballistic flight paths. Air-laid mines usually require parachutes that are released from the mine on water entry.

CLASSIFICATIONS

Mines are classified by intended use, method of delivery, position assumed when laid, method of actuation, or weight. Mines classified by their intended use are further classified as service, exercise (recoverable), and training mines. Service mines are fully explosive-loaded mines assembled with service components for use in wartime. Exercise (recoverable) and training mines are inert loaded to service weight. They have many uses, such as assembly and laying in fleet exercises. After exercise completion, they are recovered, analyzed, and overhauled for reuse. When assembled, exercise and/or training mines may contain minor explosive components.

Mines classified by method of delivery are submarine-laid, surface-laid, or air-laid. The classification depends on the laying vehicle.

Mines classified by the position they take in the water after being laid are moored or bottom mines. Bottom mines rest on the bottom of the sea. Their effective depth is controlled by the amount of charge they contain relative to the depth of the area in which they are planted. Their design includes sufficient negative buoyancy to provide good stability on the bottom of the sea.

Moored mines are buoyant mines. They are connected by cable to an anchor resting on the bottom (fig. 5-9). There are two important considerations in laying moored mines-stability and moored depth. Mine stability is achieved by an anchor with sufficient negative buoyancy to retain the mine in its position (without moving) on the bottom of the sea.

Mines are classified by the methods used to activate them. Methods of activation are contact and influence, or a combination of both methods. Influence-actuated mines are the only mines used tactically in an air-laid operation. Influence-actuated mines are further classified as magnetic, acoustic, or pressure mines.

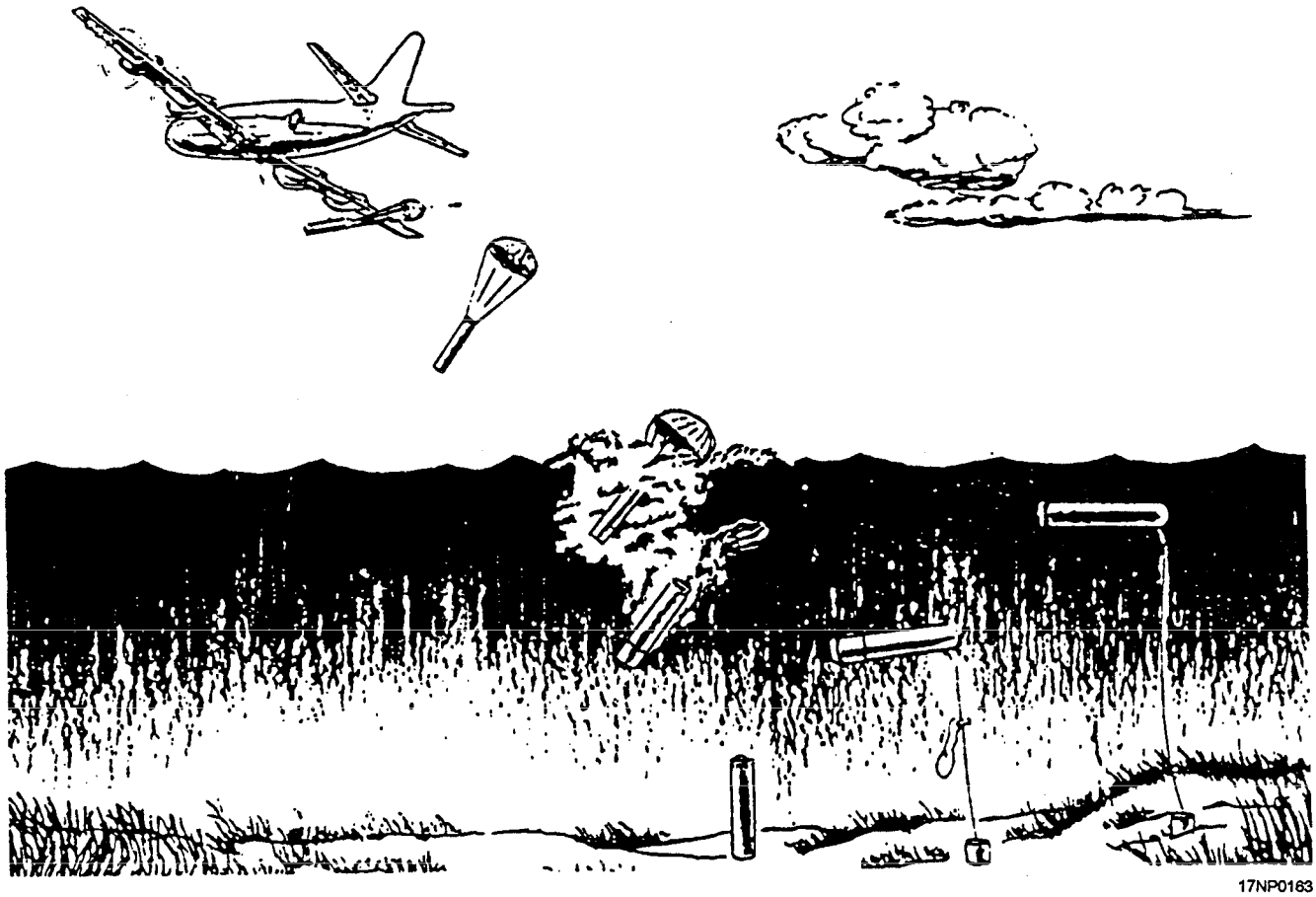


Figure 5-9.—Aerial mine delivery sequence of moored mines.

These classifications are generally combined to describe a given mine; for example, an air-laid, pressure-fired, bottom mine or an air-laid, magnetic-fired, moored mine. Table 5-1 provides a list of the air-laid mines currently in use.

Table 5-1.—Air-laid Mines Currently in Use

MINE DESIGNATION	WEIGHT CLASS	TYPES OF ACTUATION	POSITION IN WATER	RETARDED
Mk 55	1000 lb	Influence	Bottom	Parachute
Mk 60	2400 lb	Influence	Bottom	Parachute
Mk 62	500 lb	Influence	Bottom	Fin
Mk 63	1000 lb	Influence	Bottom	Parachute
Mk 64	2000 lb	Influence	Bottom	Parachute
Mk 65	2000 lb	Influence	Bottom	Parachute

REVIEW NUMBER 2

Q1. Mines classified by their intended use are classified as _____ .

Q2. What mines are fully loaded with explosives and designated for use in wartime?

Q3. What mines are classified by the position they take in the water after being laid?

Q4. The effective depth of a bottom mine is controlled by_____.

Q5. Moored mines are stabilized by what means?

Q6. List the classifications of influence-actuated mines.

MINE COMPONENTS

The components used in a mine vary, depending on the type of mine and its specific use. In addition to the mine case and explosive system, mine components provide mine arming, target sensing, actuation, laying control, countermeasure resistance, firing power, and sterilization. Exercise components are used in exercise (recoverable) mines.

REVIEW NUMBER 1 ANSWERS TO QUESTIONS Q1. THROUGH Q10.

A1. The Mk 46 torpedo is the primary weapon used for antisubmarine warfare.

A2. The Mk 46 configurations include warshot and exercise.

A3. When the Mk 46 is used in the exercise configuration, the Mk 85 and Mods exercise head is used.

A4. After launch, the air stabilizer stabilizes the torpedo during its descent into the water.

A5. Fixed-wing aircraft use Mk 28 Mod 2 or Mod 3 air stabilizers, and rotary-wing aircraft use Mk 31 Mod 1 air stabilizers.

A6. Torpedoes are suspended from bomb racks or shackles by Mk 73 Mod 0 or Mod 1 suspension bands. As torpedoes are launched from the aircraft, release wires unlatch the suspension bands, letting them break away from the aircraft.

A7. Otto Fuel II is the propellant used in the propulsion system of the Mk 46 torpedo.

A8. Because Otto Fuel II has a high flash point, low vapor pressure, and is noncorrosive, it is classified as a low fire hazard material.

A9. If you were exposed to Otto Fuel II, you might exhibit the following symptoms: headache, dizziness, blood pressure drop, and/or nasal congestion.

A10. For safety reasons, at least two crew members should be present when handling Otto Fuel II.

Mine Case

The mine case is the main element of the mine. It contains or carries all other components. The mine case is normally made of sheet steel, but aluminum, spun glass, or various plastics are used in some types of mine cases. The case is watertight and strong to resist water pressure. Mine case openings are carefully sealed with suitable gaskets.

Explosive Components

The explosive system of a mine includes the main charge, the booster, the initiating system, and auxiliary explosive devices.

MAIN CHARGE.— The main charge is the mine's payload. It is a high explosive cast directly into the mine case, or into an explosive section attached to the mine case when the mine is assembled. The amount of explosives used in air-laid mines ranges from 160 pounds to 1,300 pounds. Types of explosives used include Comp B, TNT, H6, or HBX mixtures. The HBX mixtures are commonly used explosives.

BOOSTER.— The booster varies from a few ounces to several pounds of explosive. Generally, the smaller boosters contain tetryl, and the larger boosters contain granular grade A TNT. The intermediate size booster contains Comp B. In some cases, the booster consists of a subbooster. The booster is housed in either a brass, terneplate, plastic, or fiber container. When assembled in the mine case, the booster is in intimate contact with the main charge explosive,

INITIATING SYSTEM.— An electric primer in an explosive fitting is used to set off a flash detonator. This initiates the leads to the booster or subbooster, causing the mine to detonate. Explosive fittings may contain a primer or a detonator, depending on their design function.

AUXILIARY EXPLOSIVE DEVICES.— Auxiliary devices are usually small explosives that blow or open a hole in the mine case to sink it. A small explosive device, such as the explosive driver, is used during the mine planting or operating sequence. For example, it is used to close or open electrical switches, unlock mechanical linkages, open gas bottles, and jam cables from further payout. Other types of auxiliary explosive devices are used to cut cables and to release pyrotechnic signals from exercise and training mines.

Arming Components

An arming device (fig. 5-10) is a combination of a hydrostatic switch piston and an explosive aligning piston. They are internally mounted in a single

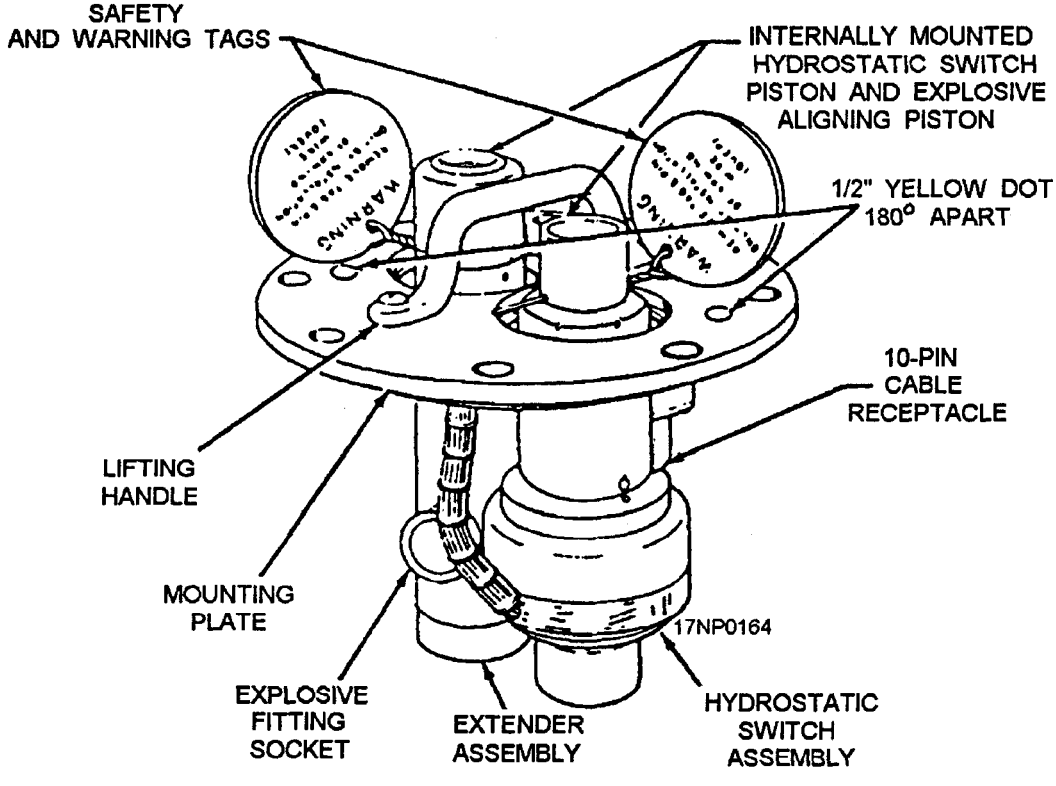


Figure 5-10.—Arming device.

assembly. The hydrostatic piston acts to open and close electrical switches. The explosive piston aligns the explosive train when the hydrostatic piston and the explosive piston are forced in by water pressure after the mine is laid. These pistons are held in the retracted or safe position by safety pins during ground handling. The safety pins are replaced by arming wire assemblies after the mines are loaded aboard the aircraft.

After planting, a clock-delay mechanism prevents firing until the mine has been submerged for a predetermined period of time, A switch in the detonator circuit of the mine controls the firing mechanism. This switch remains open until the clock-delay device has run its predetermined time. This time could vary from 8 minutes to 10 days, depending upon the type of clock installed. Sometimes another clock is also used to sterilize the mine after a preselected period of armed life.

Firing Components

Firing components include elements that detect the target, analyze target information, and act to fire the mine. In simple systems, these functions are done by a single device, However, in most systems, these functions are performed by two or more components.

The types of firing mechanisms used in mines vary widely in appearance and configuration. In older mines, the firing mechanism might be a circuit arrangement. In newer mines, the firing mechanism might be a color-coded rectangular box.

Since influence-actuated mechanisms are the only type of firing mechanisms currently used in aircraft mines, they are discussed in the following paragraphs. Influence-actuated firing mechanisms may be subdivided into three general categories-acoustic, pressure, and magnetic.

ACOUSTIC.— An acoustic mine is fired by the initiation of an enclosed microphone. The microphone picks up the sound waves generated by a nearby ship's rotating screws or other operating machinery. These mines are equipped with an anticountermine device that prevents detonation of the mine from explosions set off during minesweeping operations.

PRESSURE.— The pressure mine firing mechanism is actuated by a decrease in water pressure immediately surrounding the mine. Normally, this occurs only when a large ship passes over it. The pressure mine firing mechanism is used in conjunction with a magnetic-influence mechanism. The combination of these two mechanisms makes effective minesweeping operations nearly impossible.

MAGNETIC TYPE.— Magnetic mines are induction mines actuated by changes in the earth's magnetic field. Their actuation depends primarily on the rate at which the field changes rather than the amount of change. A change in the magnetic field induces an electromagnetic field in the winding of a coil. This electromagnetic field and the resulting current are proportional to the rate of change of the magnetic field. When the magnetic field increases to a predetermined level, a relay actuates and closes the firing circuit.

Parachute Packs

Some mines laid from aircraft use parachutes to prevent them from building up too much speed before

REVIEW NUMBER 2 ANSWERS TO QUESTIONS Q1. THROUGH Q6.

A1. Mines classified by their intended use are classified as service, exercise (recoverable), and training mines.

A2. Service mines are fully loaded with explosives and designated for use in wartime.

A3. Moored or bottom mines are classified by the position they take in the water after being laid.

A4. The effective depth of a bottom mine is controlled by the amount of charge contained in the mine relative to the depth to which the mine is planted.

A5. Moored mines are stabilized by a cable connected to an anchor resting on the ocean floor.

A6. Influence-actuated mines are classified as magnetic, acoustic, and pressure.

entering the water. The parachute reduces the impact velocity and protects the mine components from damage. The use of parachute packs permits the mines to be released from an aircraft at high altitudes, which may be required when ports or sea passages are heavily armed.

The parachute pack currently used is the delayed-opening type. In this type of parachute pack, a control mechanism is used to open the parachute at some point in the air trajectory of the mine. A typical delayed-opening parachute pack contains a drogue-type parachute, release gear, and a control device. The parachute release gear consists of a metal ring that attaches the parachute to the mine during air travel. It is released from the mine upon water impact by inertia weights, wipe-off plates, or hydrostatic mechanisms. The control device opens the parachute during the mine's descent. It is usually controlled by an adjustable fixed-delay device. Since the parachute is deployed by firing an explosive fitting, parachute pack control devices contain explosive components.

REVIEW NUMBER 3

Q1. What element of a mine carries all other components?

Q2. List the explosive components of a mine.

Q3. What amount of explosives are used in air-laid mines ?

Q4. After a mine is planted, what device prevents the mine from firing until it has been submerged for a predetermined time?

Q5. What is the range of the delay time in planted air-laid mines?

Q6. List the influence-actuated firing mechanisms.

Q7. What type of mine is detonated by the sound waves generated by nearby ships' rotating screws?

Q8. What force actuates the pressure mine?

Q9. What actuates the magnetic type of mine ?

OPERATIONAL AIRCRAFT MINES

Air-laid mines currently in operational use are discussed briefly in the following paragraphs.

Mk 55 Mine

The Mk 55 service mine and the Mk 55 exercise mine (fig. 5-11) are air-laid bottom mines. Each mine is fitted with a nose fairing and box fins for drop stability. Each is suspended from the aircraft by two

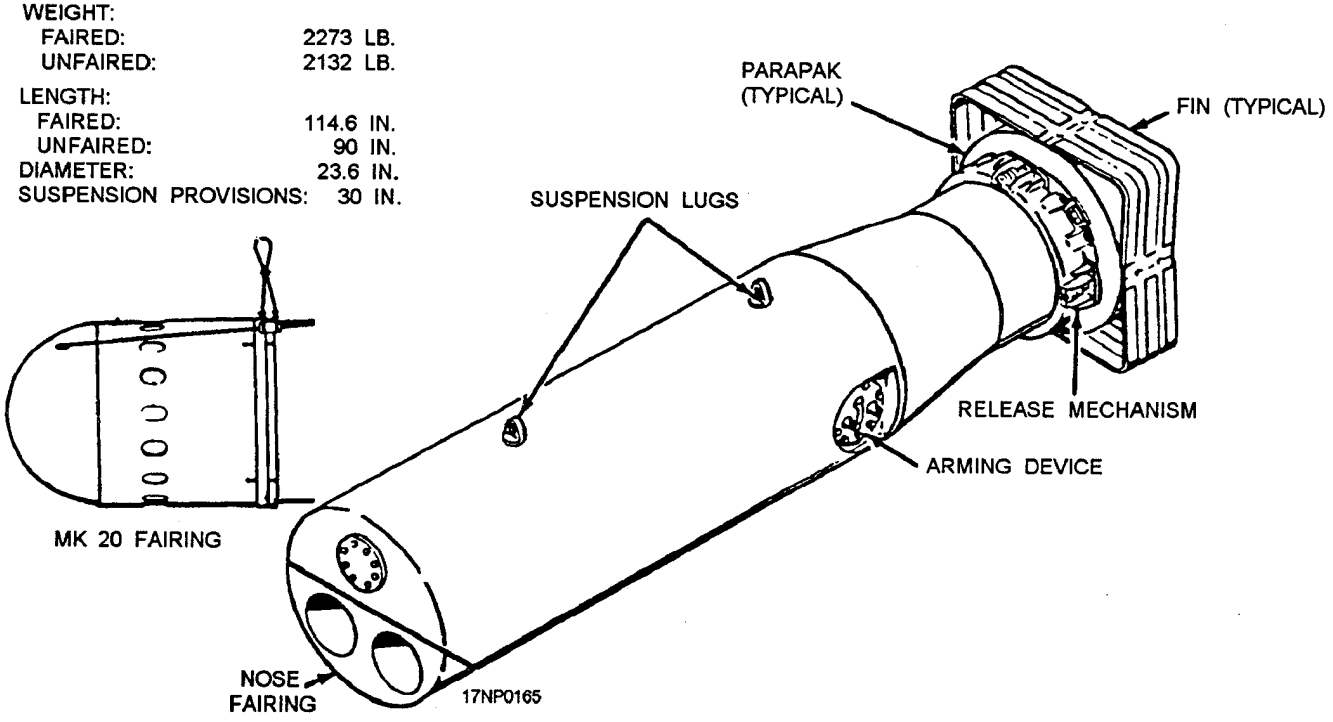


Figure 5-11.—Mk 55 service and Mk 55 exercise mine.

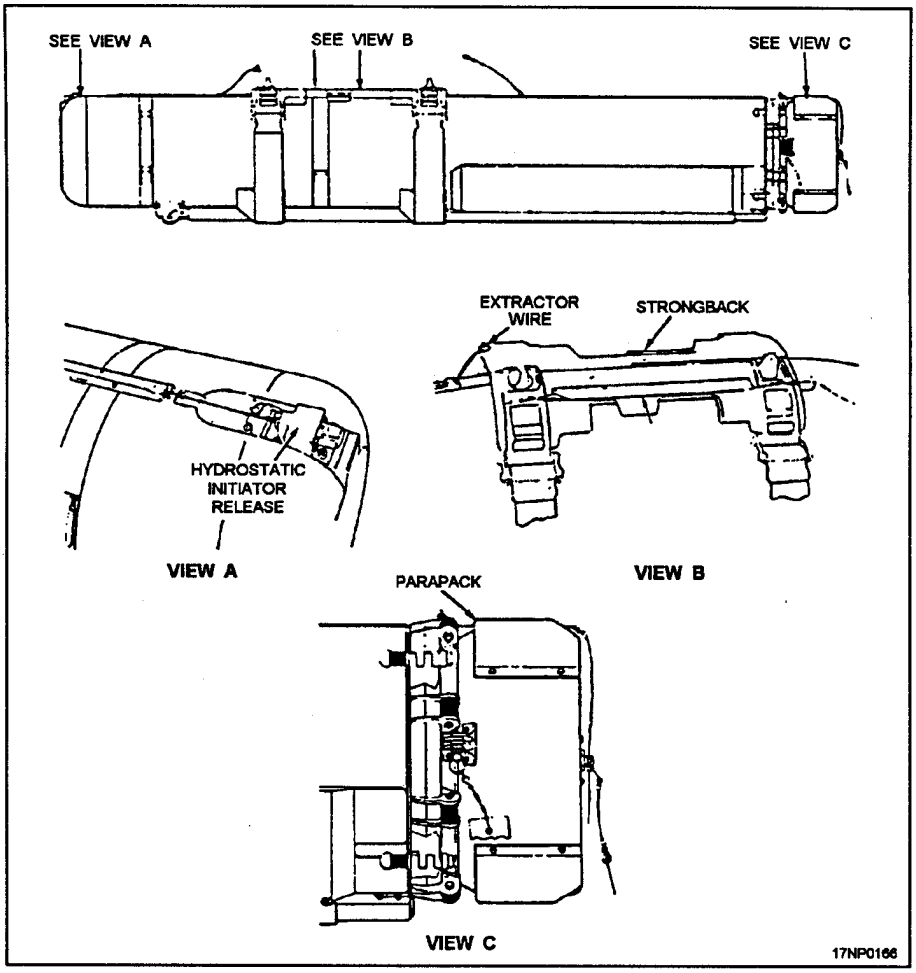


Figure 5-12.—Mk 60 captor mine.

REVIEW NUMBER 3 ANSWERS TO QUESTIONS Q1. THROUGH Q9.

A1. The mine case contains or carries all other components.

A2. The explosive components of a mine include the main charge, booster, initiating system, and auxiliary explosive devices.

A3. Between 160 and 1,300 pounds of explosives are used in air-laid mines.

A4. After a mine is planted, a clock-delay mechanism prevents the mine from firing until it has been submerged for a predetermined time.

A5. The range of the delay time in planted air-laid mines is from 8 minutes to 10 days.

A6. Influence-actuated firing mechanisms include acoustic, pressure, and magnetic.

A7. Acoustic mines are detonated by the sound waves generated by nearby ships' rotating screws.

A8. A decrease in the water pressure immediately surrounding the mine actuates the pressure mine.

A9. A change in the earth's magnetic field actuates the magnetic type of mine.

suspension lugs spaced 30 inches apart. Both mines use a parapak designed to slow descent and reduce impact when the mine enters the water. A control unit, activated by a single arming wire, opens the parapak. Each mine is equipped with an arming device and a double arming wire used on the extender and hydrostatic switch. The Mk 55 mine is equipped with a firing system that is responsive, either singly or in combination, to the acoustic, magnetic, and/or pressure influence of a passing ship. The Mk 55 exercise mine is an inert service mine equipped with exercise components.

Mk 60 Captor Mine

The Mk 60 captor mine (fig. 5-12) is an air-laid antisubmarine mine. This mine, when triggered by the influence of a submarine, launches a homing torpedo. A strongback assembly is used to attach the mine to aircraft bomb racks. Two Mk 3 suspension lugs threaded into the strongback provide a 30-inch suspension. The mine uses a parachute pack to slow descent and reduce impact when the mine enters the water. An explosive fitting actuated by a single arming wire opens the parachute. After entering the water, the parachute pack and strongback separate from the mine, and the stabilizer deploys. The mine is armed by a hydrostatic initiator, which is held in the safe position by a single arming wire. The Mk 60 configuration requires arming wire installation prior to aircraft loading.

Mk 62,63, and 64 Quickstrike Mines

The Mk 62, 63, and 64 (fig. 5-13) mines are air-laid, all modular, influence-actuated bottom mines. They are used against submarines and surface targets. The mines are upgraded by installation of the Mk 130 conversion kit, Mk 130 battery, and flight gear.

Mk 65 Quickstrike Mine

The Mk 65 quickstrike mine (fig. 5-14) is a 2,000 pound, air-laid, all modular, influence-actuated, bottom mine. The Mk 65 is used against submarines and surface targets. The Mk 65 consists of a Mk 65 mine case, a Mk 45 safety device arming group with a Mk 2 arming device, a Mk 57 target detecting device and a Mk 7 tail assembly.

REVIEW NUMBER 4

Q1. What components are used on the Mk 55 mine for drop stability?

Q2. What is the suspension of the Mk 55 mine?

Q3. What suspension is used with the Mk 60 mine ?

Q4. In what mine should you install the arming wire before the aircraft is loaded?

SAFETY PRECAUTIONS

LEARNING OBJECTIVE: *Recognize the safety precautions for handling mines and torpedoes.*

Handling mines is a specialized job. If you aren't qualified, don't disassemble the mines or their components. You should follow the same safety precautions for mines as you follow when handling bombs.

To conform with safety and ammunition stowage requirements, mines are normally received aboard ship in assembly configurations C or D. Aviation Ordnancemen are not required to assemble mines, but they are required to be qualified and certified in mine handling and aircraft loading procedures.

A Mobile Mine Assembly Group (MOMAG), composed of personnel from the Mineman rate, is responsible for the proper assembly of all mines. It is the responsibility of the mine planting activity to notify the MOMAGs of scheduled mine operations and the exact dates their assistance will be required.

When a mine is jettisoned safe, the wires remain in the clock starter and booster extender. This prevents them from operating after the mine submerges. However, when the mine strikes the water, the arming wires may pull free. Hydrostatic pressure or countermining shock can cause the wires to shear. Also, after a mine is submerged for a long period, the wires can corrode and break. No mine is jettisoned safe in water that is less than 800 feet (243.8 meters) deep with positive assurance that it isn't a hazard. Depths greater than 800 feet will crush or flood the mine case, making the mine inoperative.

When handling mines during preflight operations, follow the same general handling techniques you use for bombs or torpedoes.

REVIEW NUMBER 5

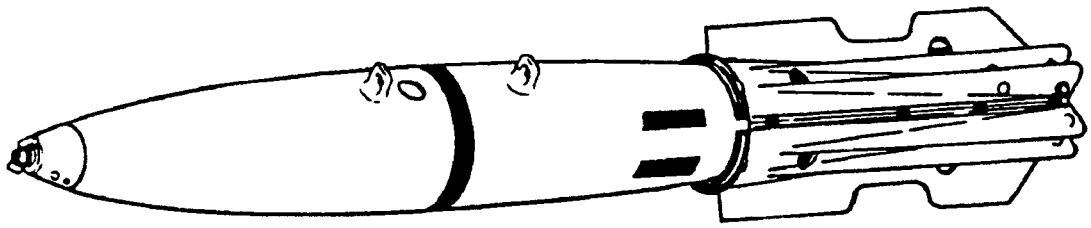
Q1. In what configuration are mines normally received aboard ship?

Q2. The assembly of mines is the responsibility of _____.

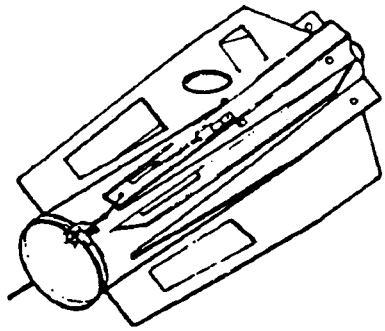
Q3. To what minimum depth must a mine be jettisoned to be considered jettison safe and not constitute a hazard?

PHYSICAL CHARACTERISTICS:

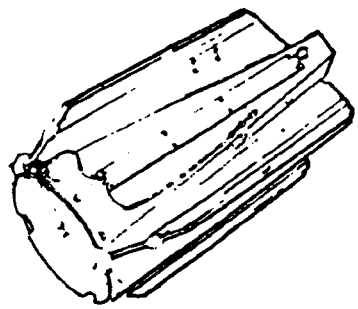
	MK 62 MINE	MK 63 MINE	MK 64 MINE
MK 15	565 LBS.	N/A	N/A
BSU-86	571 LBS.	N/A	N/A
MAU-91	N/A	1105 LBS.	N/A
MK 11	N/A	N/A	1990 LBS.
MK 12	N/A	1016 LBS.	N/A
DIMENSIONS:			
DIAMETER:	11 IN.	14 IN.	18 IN.
SUSPENSION PROVISIONS:	14 IN.	14 IN.	30 IN.



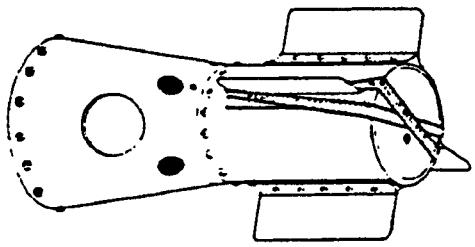
MK 62 MINE (TYPICAL) W/MK 15 FIN ASSEMBLY



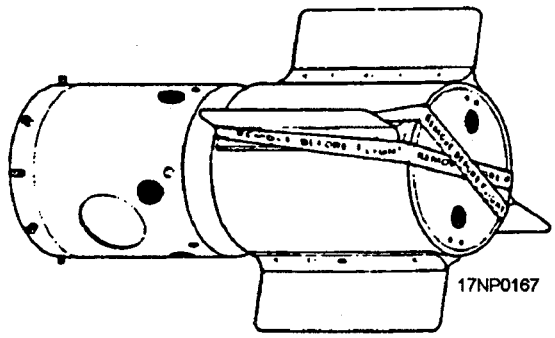
BSU-86 FIN ASSEMBLY
MK 62 MINE



MAU-91 FIN ASSEMBLY
MK 63 MINE



MK 11 TAIL SECTION
MK 64 MINE



MK 12 TAIL SECTION
MK 63 MINE

Figure 5-13.—Mk 62, 63, and 64 quickstrike mines.

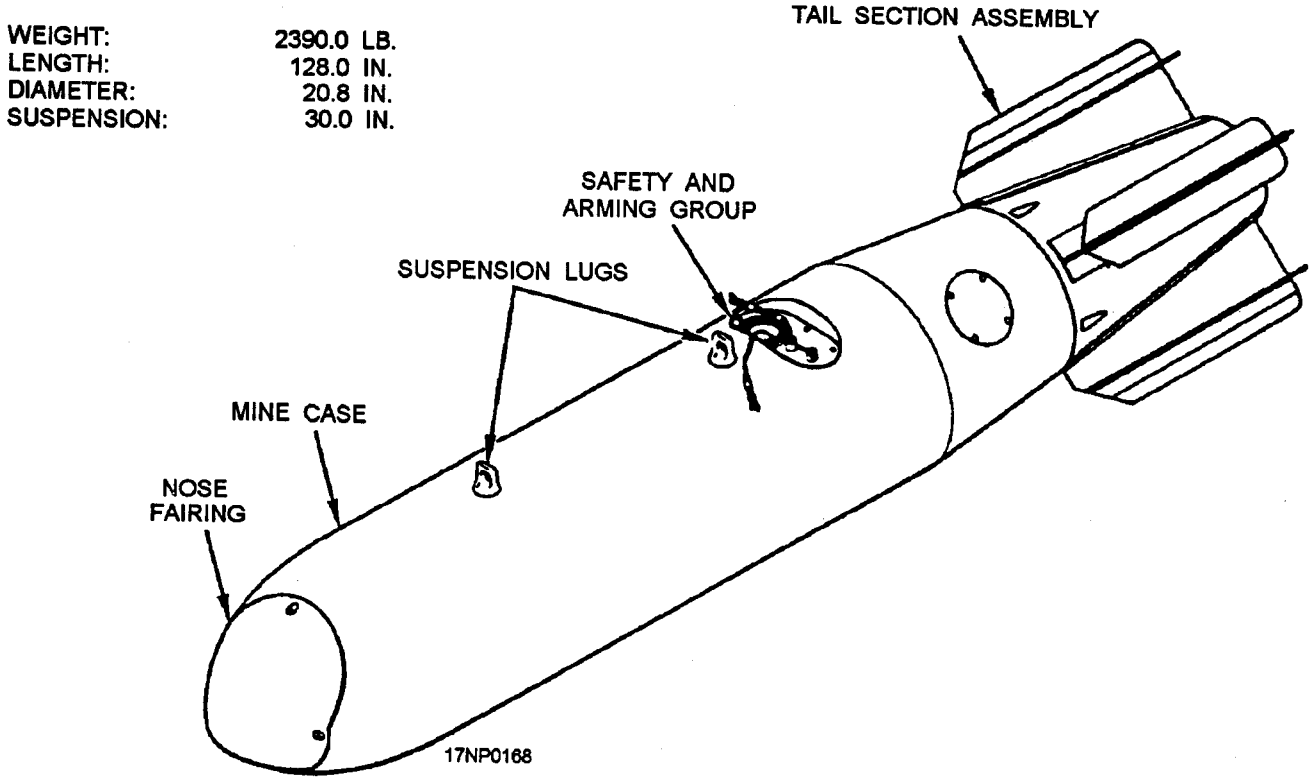


Figure 5-14.—Mk 65 quickstrike mine.

REVIEW NUMBER 4 ANSWERS TO QUESTIONS Q1. THROUGH Q4.

A1. A nose fairing and box fins are used on the Mk 55 mine for drop stability.

A2. The Mk 55 mine is equipped with suspension lugs 30 inches apart.

A3. The Mk 60 mine is equipped with two Mk 3 suspension lugs.

A4. You should install the arming wire in the Mk 60 mine before the aircraft is loaded.

REVIEW NUMBER 5 ANSWERS TO QUESTIONS Q1. THROUGH Q3.

A1. Normally, mines are received aboard ship in configurations C and D.

A2. The assembly of mines is the responsibility of a mobile mine assembly group (MOMAG).

A3. A mine must be jettisoned to a minimum depth of 800 feet (243.8 meters) to be considered jettison safe and not constitute a hazard.

CHAPTER 6

M61A1 GUN INSTALLATION

Gun systems installed in high-speed aircraft must meet demanding performance requirements and provide firepower. The General Electric M61A1 20-mm automatic gun system, installed in the F-14 and F/A-18 aircraft, meets these requirements.

The M61A1 (fig. 6-1) is a six-barrel, rotary-action, automatic gun based on the machine-gun design of Richard J. Gatling. The gun consists of a revolving cluster of barrels. Each barrel is fired once per revolution. The M61A1 automatic gun is hydraulically driven, electrically controlled, and can fire M50-series ammunition at 4,000 to 7,200 rounds per minute. As installed in Navy aircraft, the gun has a pilot selectable firing rate of either 4,000 (GUN LOW) or 6,000 (GUN HIGH) rounds per minute. It is designed for either air-to-ground or air-to-air gunnery missions.

Ammunition is supplied to the M61A1 gun by an ammunition handling and storage system that functions within a specific aircraft. The system uses an endless conveyor that transports 20-mm ammunition from the ammunition drum to the gun. The conveyor then returns the expended cases and unfired rounds to the ammunition drum.

Although the physical location of components varies between different aircraft gun installations, the function and description of the components are essentially the same.

M61A1 AUTOMATIC GUN

LEARNING OBJECTIVE: *Identify the components of the M61A1 automatic gun and recognize the operating principles.*

The primary parts of the gun are the barrels, housing assembly, and rotor assembly. Look at table 6-1 for M61A1 gun characteristics. The following paragraphs

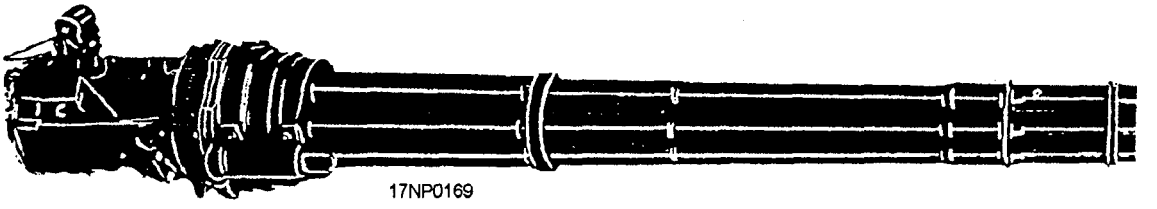


Figure 6-1.—M61A1 automatic gun.

Table 6-1.—M61A1 Characteristics

GUN	
Rotation	Counterclockwise viewed from breech end
Drive	External Electric Motor or Hydraulic Unit
Caliber	20mm
Length Overall	Approximately 72 inches
Weight	283 pounds
Solenoid Operating Voltage	28 Vdc
Solenoid Resistance	1 ohm
Firing Voltage	250-400 Vdc
BARRELS	
Number of Barrels	6
Length	60 inches
Number of Lands	9
Twist	Right-hand gain twist
RATE OF FIRE	4000 to 6000 spm
AMMUNITION	20MM Electric Primed
M51 Type (Except chrome plated)	20MM Dummy Cartridge
M53	Armor Piercing Incendiary (API)
M54	High Pressure Test Cartridge (HPT)
M55A1	Government Standard 20MM Cartridge
M55A2	20MM Target Practice Ball Cartridge (TP)
M56A3	High Explosive Incendiary (HEI)

contain a description of each gun component and an explanation of how each component works. Figure 6-2 shows an exploded view of the gun components, and figure 6-3 shows the gun component locations. As each component is discussed, you should look at these figures.

GUN COMPONENTS

The primary parts of the gun are described in the following paragraphs.

Muzzle clamp assembly. The muzzle clamp assembly is positioned at the outer end of the barrels. It restrains individual barrel movement during firing. It is positioned against the flange on the barrels and secured by the pressure of the self-locking nut assembly against the opposite side of the shoulders.

Mid-barrel clamp assembly. The mid-barrel clamp assembly is positioned near the center of the barrels. The clamp tabs are engaged in the slots of the stop shoulders on the barrels. Secure the clamp in this position by rotating the locating disk to the locked position. The direction of rotation of the gun and barrel hue prevents the clamp from unlocking. Insert a cotter pin through the locking disk and clamp plate as an additional safety measure.

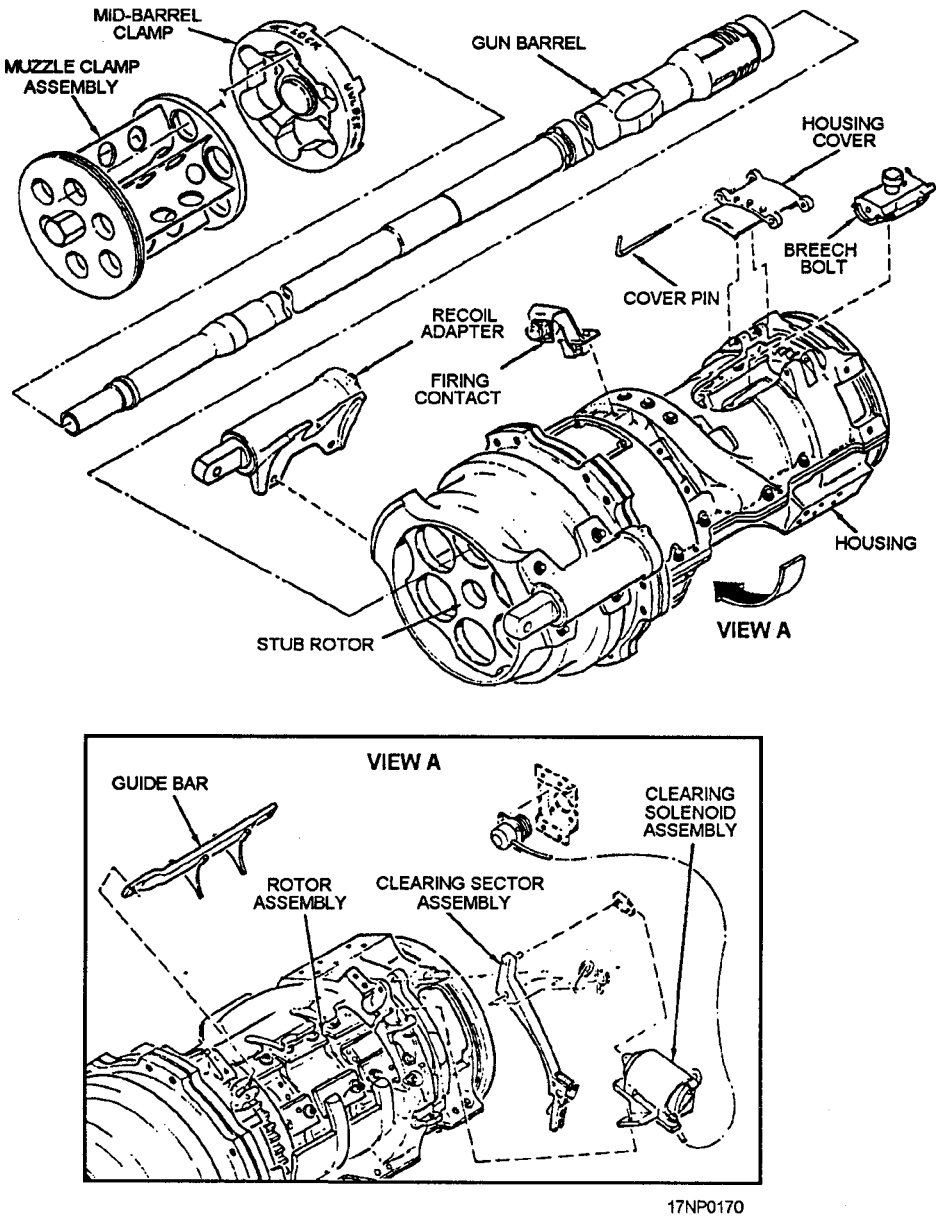


Figure 6-2.—Gun components (exploded view).

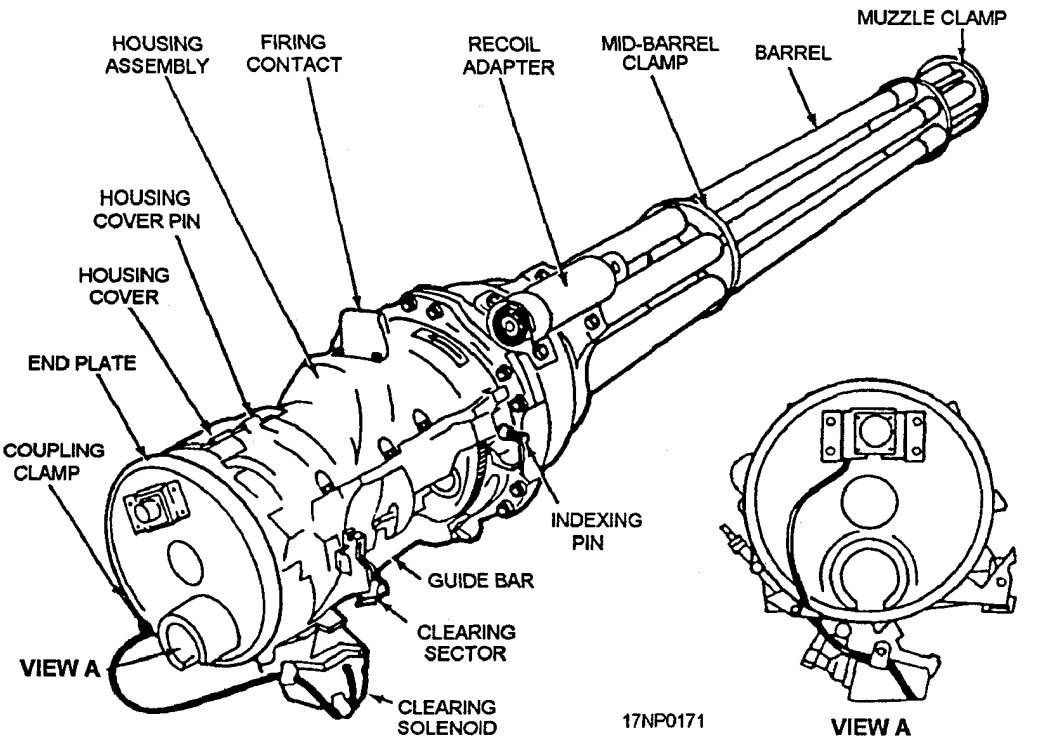


Figure 6-3.—Gun component locations.

Barrels. The M61A1 automatic gun has six rifled barrels. They are supported by the stub rotor attached to the rotor body. The three rows of interrupted locking lugs on the barrel engage similar interrupted locking lugs in the rotor to secure the barrel. There are three knurled bands near the center of the barrels. These bands give you a gripping surface for easy installation and removal of the barrels from the rotor.

Recoil adapters. The recoil adapters are mounted on the bearing retainer and provide the front mounting for the gun. There are alternate locations for the recoil adapters with respect to the gun's axis. These locations are possible because the bearing retainers can be mounted to the housing in increments of 60 degrees. The adapters reduce the amount of recoil and counter-recoil forces transmitted to the supporting structure when the weapon is fired.

Firing contact assembly. The firing contact assembly is mounted to the housing so that the connector is outside the housing, and the spring-loaded cam is inside the assembly. The contact assembly provides the necessary path for the current to enter the housing and reach the breech-bolt assembly. This path goes through the connector to the conductor, to the insulated insert in the contact cam assembly, and then to the breech-bolt assembly.

Clearing solenoid assembly. The clearing solenoid assembly is mounted near the back of the gun housing. It is linked to and controls the movement of the clearing sector assembly.

Clearing sector assembly. The clearing sector assembly is linked to and controlled by the clearing solenoid assembly. When the solenoid is activated, the sector arm diverts the bolt assemblies into the clearing cam path.

Guide bar. The guide bar is located on the gun housing. It guides the rounds into and out of the extractor lip that is located on each of the six breech-bolt assemblies.

Breech-bolt assembly. The breech-bolt assembly picks up a round as it enters the gun, transports it to the firing chamber, locks it into the firing position, transmits the firing voltage to the primer of the round, and returns the empty case to the guide bar, where it is cammed out of the gun. An extractor lip on the front of each bolt assembly engages the rim of a round throughout these actions.

There are six breech-bolt assemblies in the gun. Guide slots or grooves on the side of the bolt body permit it to slide on the rotor tracks. The bolt roller shaft determines the position of the bolt as it follows the main cam path or the clearing cam path in the housing.

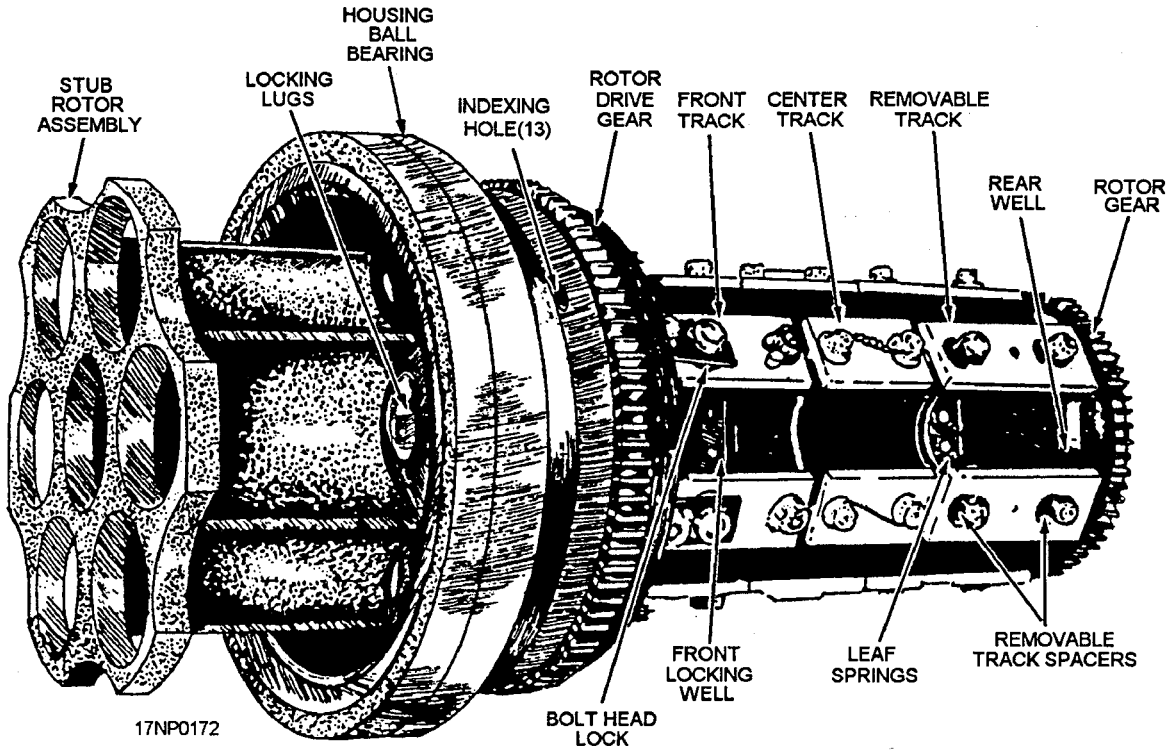


Figure 6-4.—Rotor assembly.

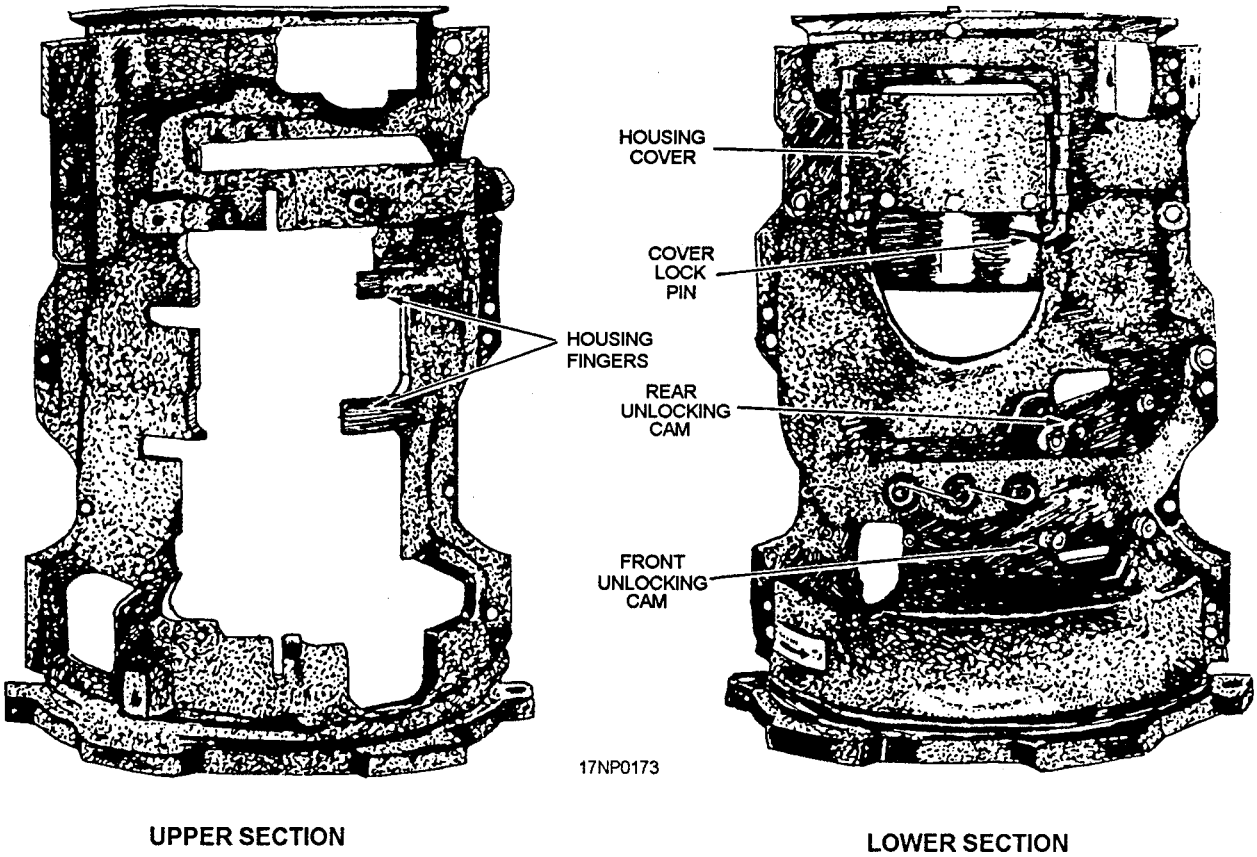


Figure 6-5.—Rear housing assembly and related parts (external view).

Rotor assembly. The rotor assembly (fig. 6-4) is a major unit of the M61A1 gun. The front section or stub rotor supports the six barrels. The main body of the rotor assembly contains the rotor tracks, rotor drive gear, and the locking lugs to lock the barrels in place.

The rotor tracks support the breech-bolt assemblies and provide a guide for the forward and backward movement of the bolt. There are six sets of rotor tracks attached to the ribs along the rotor body. Each set contains a front, center, and rear removable track. The removable track lets you install or remove a bolt assembly for servicing or replacement. The necessary front support for the rotor assembly consists of a double row of ball bearings. The rear is supported by needle bearings located inside the rotor body. The end plate provides the inner race for the needle bearings, and it also provides for the gun's rear support.

Rear housing assembly and associated parts. The rear housing assembly (figs. 6-5 and 6-6) is a major unit of the gun. It consists of an upper section and a lower section assembled as one unit. The rear housing assembly provides the main cam path that controls the movement of the breech-bolt assemblies. The elliptical (oval) shape of the main cam path causes the forward and backward movement of the bolt assemblies. The clearing-cam path is circular and located at the rear of the housing. It provides a path for the bolt assemblies during the gun's clearing cycle. The housing cover,

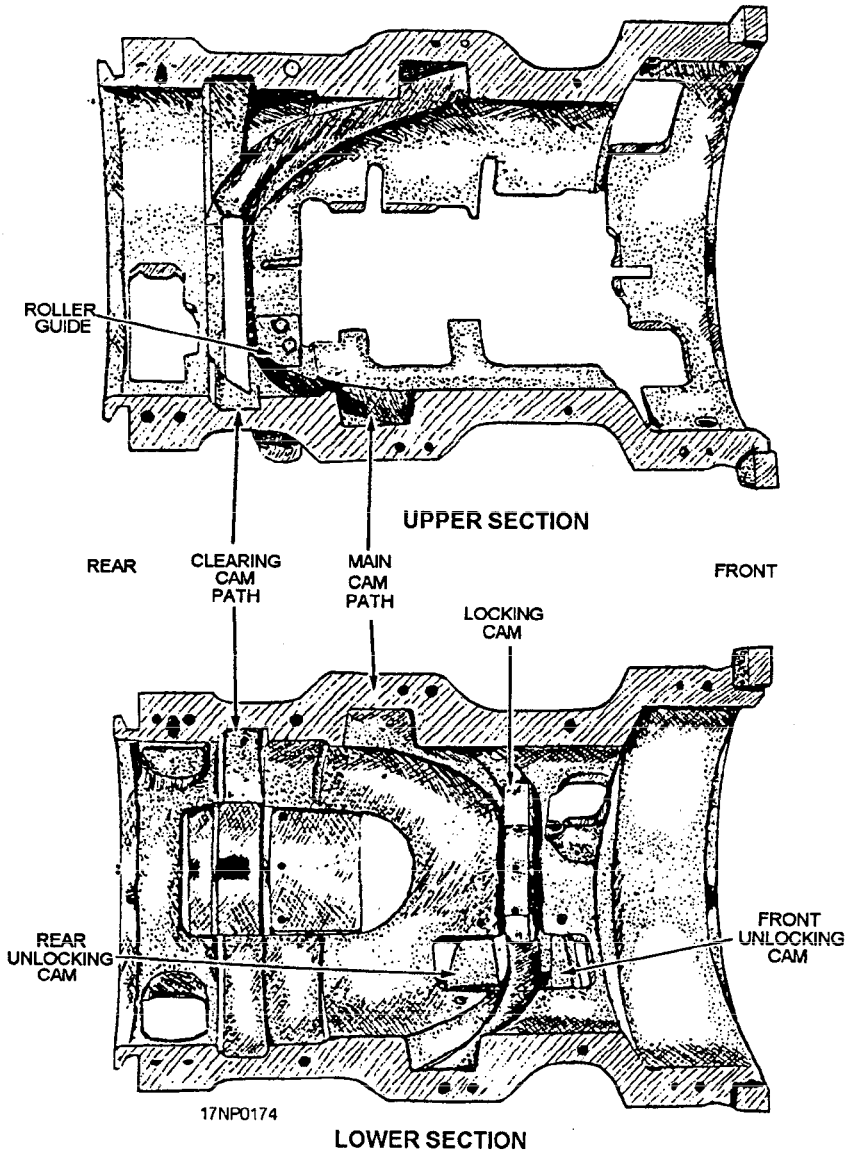


Figure 6-6.—Rear housing assembly and related parts (internal view).

when in the closed position, forms a part of the clearing cam path. You may remove the housing cover to install or remove the bolt assembly.

The locking and unlocking cams are part of the housing assembly. The gun indexing pin (timing pin) is located on the housing (fig. 6-3). It is used to time the gun when it is mated with the ammunition handling system, or when you perform loading/unloading procedures.

Lubricator assembly. A lubricator assembly (fig. 6-7) is attached externally to the gun housing assembly. It is used to lubricate the bolt assemblies during gun operation. During gun acceleration/deceleration and when the gun is firing, an inertia-actuated pump located within the lubricator assembly pumps the lubricant (DOD-L-85336) through a metal tube to the gun housing assembly. You can refill the lubricator assembly when performing normal maintenance procedures.

REVIEW NUMBER 1

Q1. List the naval aircraft that carry the M61A1 20-mm automatic gun.

Q2. When installed in naval aircraft, the M61A1 gun has a pilot selectable firing rate of _____.

Q3. List the primary parts of the M61A1 gun.

Q4. What is the purpose of the muzzle clamp assembly?

Q5. The M61A1 gun has six rifled barrels that are secured to the rotor by _____ .

Q6. What component has front mounting points so the gun can be mounted in the aircraft?

Q7. The rounds are guided into and out of the extractor lip of the breech-bolt assemblies by _____.

Q8. List the parts contained in the main body of the rotor assembly.

Q9. What assembly provides the main cam path that controls the movement of the breech-bolt assemblies?

Q10. What lubricant should you use for the M61A1 gun?

M61A1 GUN PRINCIPLES OF OPERATION

The operation of the M61A1 gun is divided into two distinct cycles—the firing cycle and the clearing cycle.

Firing Cycle

The firing cycle begins when power is applied to the firing contact assembly and the gun drive unit simultaneously.

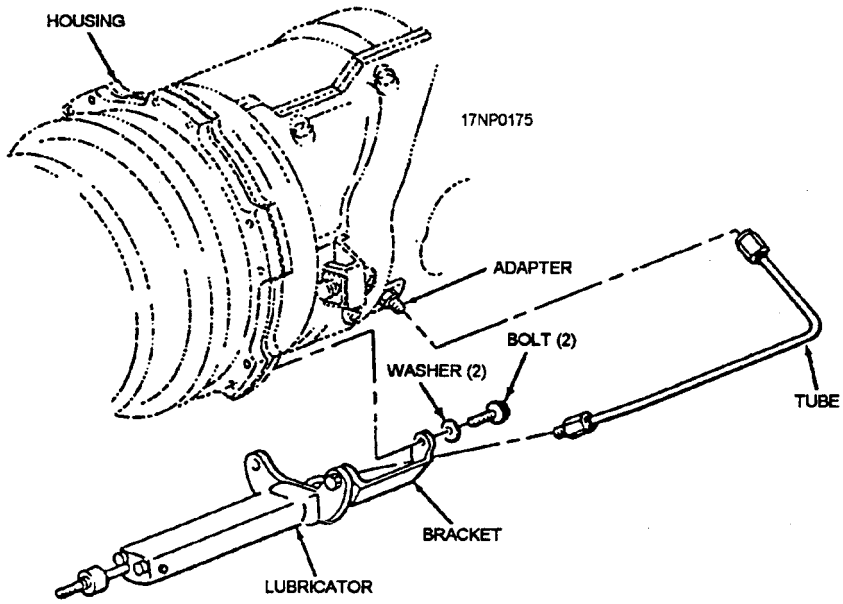


Figure 6-7.—Lubricator assembly installation (F-14).

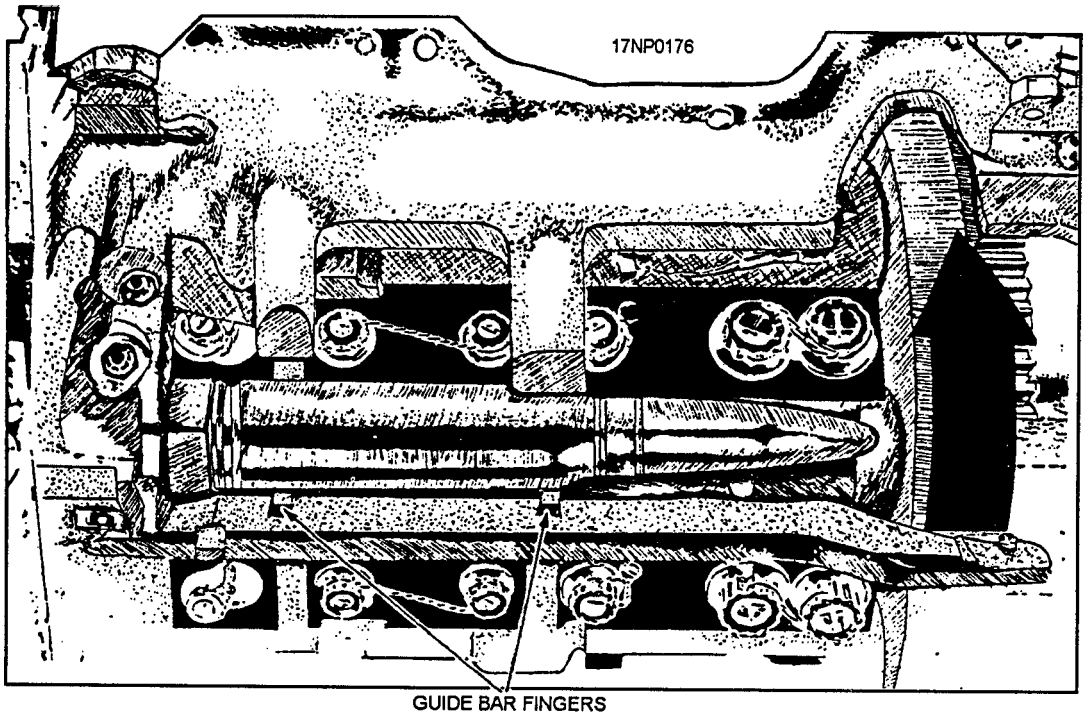


Figure 6-8.—Round guided into breech-bolt assembly.

If you look at the rotor from the rear, you see that it revolves in a counterclockwise direction. The ammunition is received from an external source. It is guided into the extractor lip on a breech-bolt assembly by the guide bar fingers (fig. 6-8), The bolt roller shaft follows the main cam path and moves the bolt assembly forward along the rotor tracks, cambering the round.

As the breech-bolt assembly enters the front dwell area of the main cam path, the locking cam forces the bolt shaft down, locking the bolt in the front locking well of the rotor (fig. 6-9). The insulated portion of the contact cam in the firing contact assembly depresses the firing pin cam in the breech-bolt assembly. This moves the firing pin forward against the primer of the round.

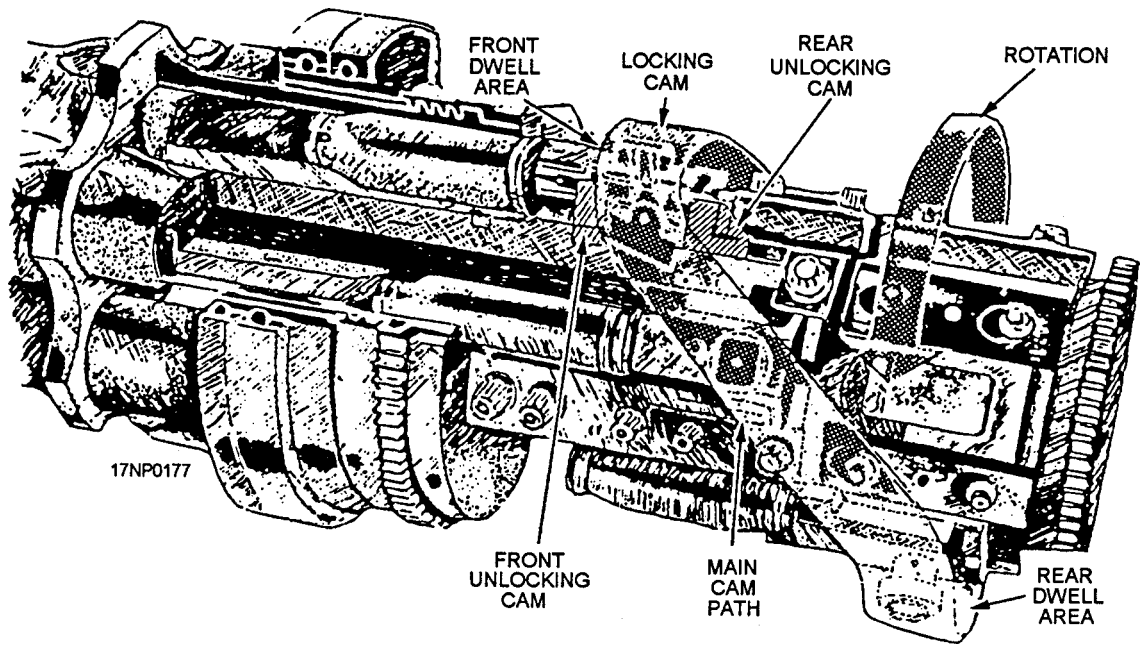


Figure 6-9.—Breech-bolt assembly in firing cycle.

The conductor portion of the contact cam makes contact with the firing pin cam, which allows a firing voltage to pass through the firing pin to fire the round.

The breech-bolt assembly remains locked throughout the locking cam period until the projectile leaves the barrel. After the projectile leaves the barrel, the barrel pressure is reduced. The unlocking cam lifts the bolt shaft, retracts the bolt locking block, and unlocks the bolt.

The main cam path guides the breech-bolt assembly rearward The empty case is removed from the chamber by the extractor lip of the bolt assembly. Then, the bolt assembly travels back along the rotor tracks until the guide bar removes the empty case from the bolt extractor lip and ejects it from the gun (fig. 6-10). To complete the cycle, the bolt assembly travels along the rear cam dwell area and into position to receive the next round.

The breech-bolt assembly has now completed a full firing cycle through the elliptical-shaped main cam path. It has performed seven actions or operations in the following sequence:

1. Feed
2. Chamber
3. Lock
4. Fire
5. Unlock
6. Extract
7. Eject

All six breech-bolt assemblies repeat this firing cycle until the clearing solenoid is actuated, and the gun starts the clearing cycle.

Clearing Cycle

The clearing cycle starts when the clearing solenoid is energized. The clearing solenoid depresses the

REVIEW NUMBER 1 ANSWERS TO QUESTIONS Q1. THROUGH Q10.

A1. The naval aircraft that carry the M61A1 20-mm automatic gun are the F-14 and F/A-18.

A2. When installed in naval aircraft, the M61A1 gun has a pilot selectable firing rate of 4,000 rounds per minute (GUN LOW) and 6,000 rounds per minute (GUN HIGH).

A3. The primary parts of the M61A1 gun are the barrels, housing assembly, and rotor assembly.

A4. The muzzle clamp assembly restrains individual barrel movement during firing.

A5. The M61A1 gun has six rifled barrels that are secured to the rotor by three rows of interrupted locking lugs.

A6. The recoil adapters have front mounting points so the gun can be mounted in the aircraft.

A7. The rounds are guided into and out of the extractor lip of the breech-bolt assemblies by the guide bar.

A8. The rotor tracks, rotor drive gear, and the locking lugs to lock the barrels in place are contained in the main body of the rotor assembly.

A9. The rear housing assembly and associated parts provide the main cam path that controls the movement of the breech-bolt assemblies.

A10. You should use DOD-L85336 lubricant for the M61A1 gun.

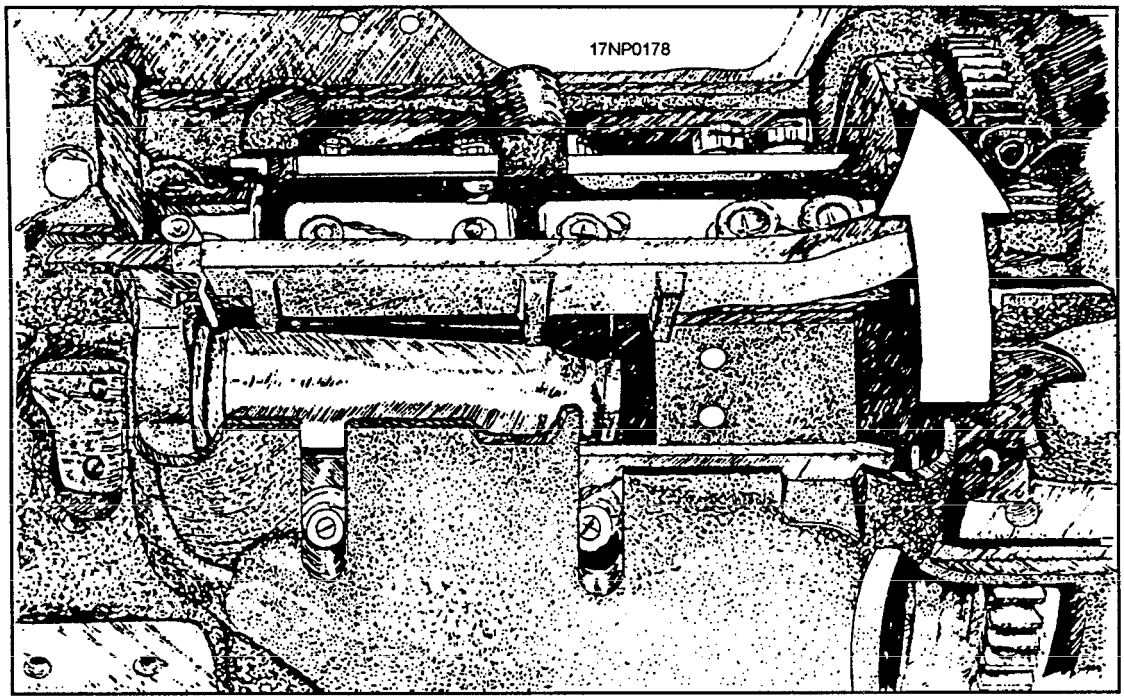


Figure 6-10.—Ejection of empty case.

clearing sector arm to the gun housing. This places the clearing sector arm in a ready position. The first bolt assembly that passes the sector arm triggers the actuating pin that lets the sector arm continue to the clearing mode position. This diverts the succeeding bolt assemblies into the clearing cam path (fig. 6-11).

As the breech-bolt assembly picks up a round at the guide bar, the clearing sector arm depresses the bolt roller shaft. This locks the bolt assembly in the rear locking well of the rotor. While locked in this position, the bolt assembly cannot follow the main cam path, so it follows the clearing cam path. The clearing cam path isn't as deep as the main cam path, and it keeps the bolt roller shaft depressed. This firmly locks the bolt assembly in the rear of the rotor body.

The M61A1 gun continues to receive rounds during the clearing cycle. However, because each bolt assembly remains positioned at the back of the rotor during rotation, the guide bar cam fingers eject all unfired rounds. When the clearing solenoid is

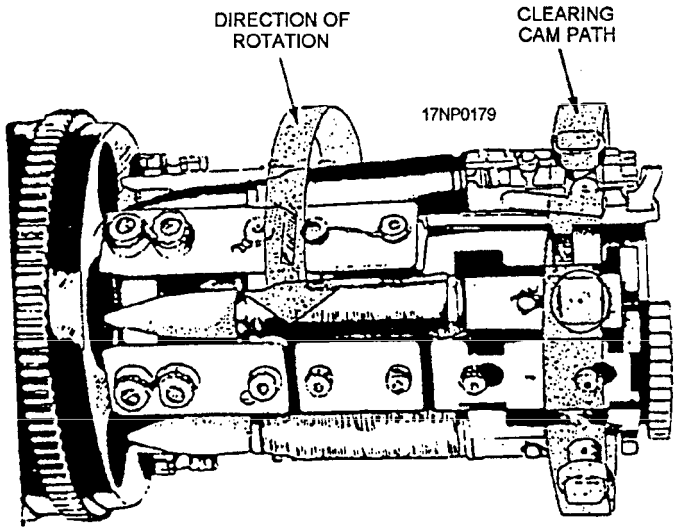


Figure 6-11.—Breech-bolt assembly in clearing cycle.

deactivated, the clearing sector arm pivots out of the main cam path. This allows the leaf springs in the rear locking well to force the bolt locking block upward. The bolt roller shaft follows the main cam path that permits the gun to be fired.

If necessary, you may clear the gun manually. To do this, manually pivot the clearing sector cam into the main cam path while turning the rotor by hand.

For further information on the M61A1 automatic gun, you should refer to the *M61A1 Automatic Gun,* NAVAIR 11-95M61A1-1. NAVAIR 11-95M61A1-1 provides intermediate-level maintenance procedures and includes associated special support equipment.

REVIEW NUMBER 2

Q1. Name the two cycles of the M61A1 gun.

Q2. When does the firing cycle begin in the M61A1 gun?

Q3. After the projectile leaves the barrel, what component removes the empty case from the chamber?

Q4. The main cam path is_____shaped.

Q5. List, in sequence, the six operations the breech-bolt assembly performs during a full firing cycle.

Q6. At what point does the clearing cycle start?

Q7. The M61A1 gun continues to receive rounds during the clearing cycle. What component ejects all unfired rounds ?

AMMUNITION HANDLING AND GUN DRIVE SYSTEMS

LEARNING OBJECTIVE: *Identify the ammunition handling and gun drive systems of the M61A1 automatic gun. Describe the principles of operation of each system and identify the interrelationship of the various systems.*

The ammunition and gun drive subsystems are discussed in the following paragraphs.

DRUM UNIT ASSEMBLY

Live ammunition and expended cases are stowed in the drum unit assembly. This assembly has four major parts-drum unit, entrance cover, exit cover, and scoop disk, Refer to figure 6-12 as you read about these parts.

Drum Unit. The drum unit is a cylindrical structure that consists of an outer drum and an inner drum helix, The live ammunition rounds and expended cases are stored radially around the longitudinal axis of the outer drum with their bases in an outward direction. The rounds are suspended by their bases in partitions. These partitions are mounted lengthwise with respect to the inner surface of the outer drum. With the outer drum mounted stationary to the aircraft's structure, the rounds are moved along the length of the partitions by the rotation of the double-lead helix (inner drum), It's easy to understand this movement if you think of the inner drum helix as the threads on a screw. The projectile end of the casing protrudes into the threads. As the inner drum helix is rotated, it produces a screwing-type motion, causing the rounds to slide along the partitions from one end to the other end of the outer drum.

Entrance Cover. The entrance cover is stationary mounted to the entrance end of the outer drum. The entrance cover contains a retainer gear and 252 steel ball bearings that support the scoop disks and the inner drum helix. The retainer partitions are mounted to the retainer gear that controls the position of the rounds as they are passed from the entrance cover to the scoop disk. A spring-loaded timing pin on the entrance cover is used to index the drum for installation of the entrance unit.

Exit Cover. The exit cover is stationary mounted to the exit end of the outer drum. The exit cover is constructed like the entrance cover. It controls the position of the rounds as they pass from the scoop disk to the exit cover. A spring-loaded timing pin on the exit cover is used to index the drum for installation of the exit unit.

Scoop Disk. A scoop disk is mounted on each end of the inner drum helix. Each scoop disk has two sets of sprocket spur gears located 180 degrees apart. These spur gears mesh with the retainer gear in the entrance/exit covers that provide rotating support for the inner drum helix. The sprockets attached to the spur gear transfer rounds from the entrance cover retainer partitions to the drum partitions, and from the drum partitions to the retainer partitions in the exit cover.

EXIT UNIT

The exit unit is attached over an opening in the exit cover and geared to the exit cover retainer gear. The exit unit contains two gear-driven sprocket assemblies. The sprocket assemblies remove live rounds or expended cases from the retainer partitions in the exit cover and place them in the conveyor elements. Before you install

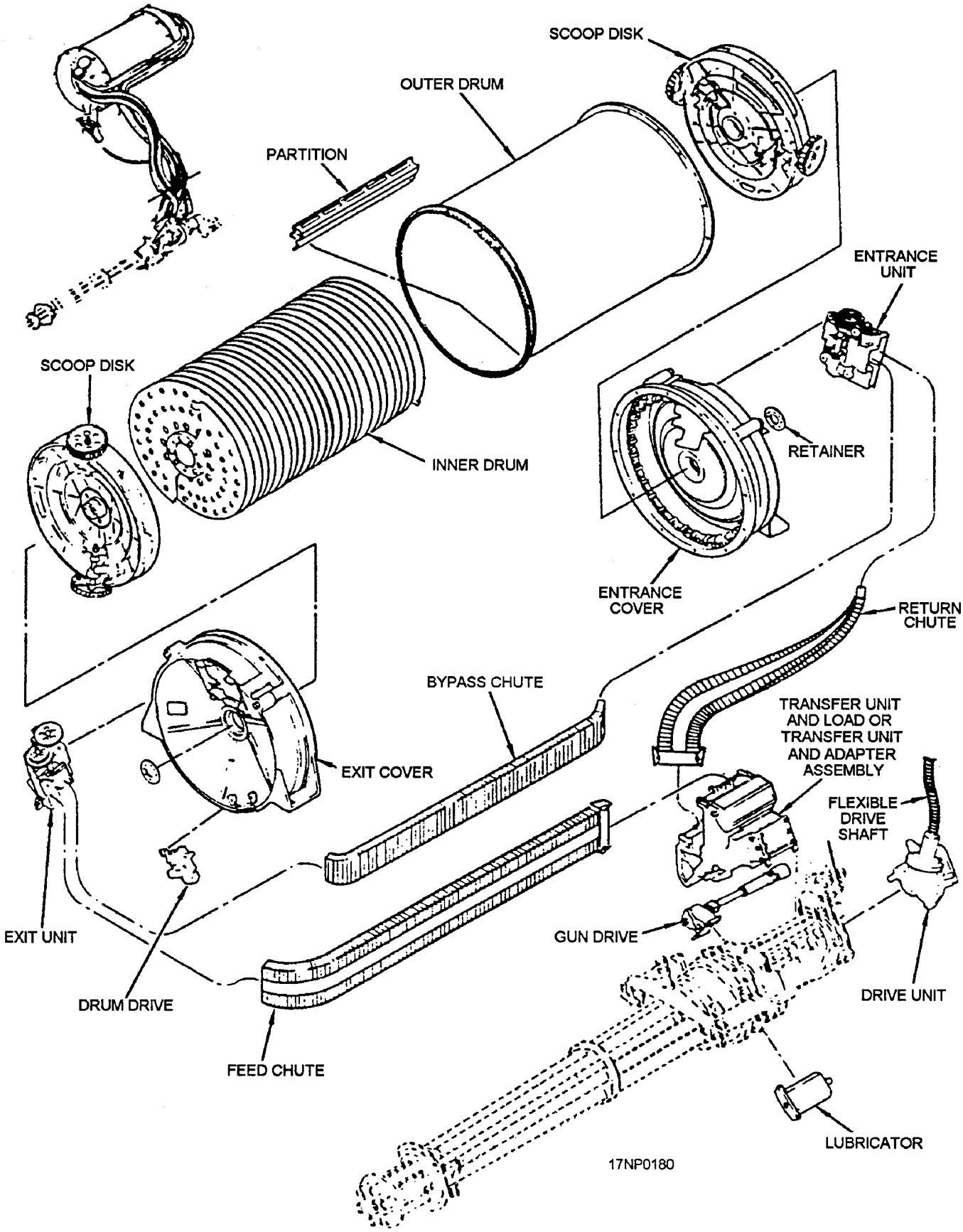


Figure 6-12.—Ammunition handling component (exploded view).

the exit unit to the exit cover, press and hold the exit unit timing pin and the exit cover timing pin to make sure there is proper gear alignment between the two components. Once the exit unit is properly attached to the exit cover, make sure that the spring-loaded timing pins release.

The exit unit also contains a last-round switch that is electrically connected to the gun control firing circuits. The switch is actuated by the projectiles of the 20-mm rounds. The switch prevents expended rounds (empty cases) from being fed into the gun and jamming it, Before the gun will fire, the ammunition must be cycled through the ammunition drum until the first round actuates the last-round switch. When there is no more ammunition present or when expended rounds are present, the last-round switch is released. This automatically initiates the gun clearing cycle and terminates gun firing. Before the gun can be fired again, live ammunition must be manually positioned by the ground loading crew to actuate the last-round switch.

ENTRANCE UNIT

The entrance unit is attached over the opening in the entrance cover and geared to the entrance cover retainer gear. The entrance unit contains three gear-driven sprocket assemblies. The sprocket assemblies remove live rounds or expended cases from the conveyor elements and place them in the entrance cover retainer partitions. Before installation, press the spring-loaded timing pin and align the scoop sprocket stud pin with the entrance unit timing mark. With the entrance unit properly timed and aligned, you must press the entrance cover timing pin and align the timing mark on the scoop disk with the timing mark on the entrance cover. You need to properly time and align both the entrance unit and the entrance cover to ensure proper gear alignment between the two components. Once the entrance unit is attached to the entrance cover, you should make sure that the spring-loaded timing pins release.

TRANSFER UNIT AND ADAPTER ASSEMBLY

The transfer unit and adapter assembly are actually two separate components bolted together to form one unit. They are never separated at the organizational maintenance level. The function of each component is discussed in the following paragraphs.

Transfer Unit

The transfer unit is gear-driven by the gun and attached to the M61A1 gun housing by quick-release pins to make maintenance easier. The gear-driven sprocket assemblies and guides maintain positive control of the rounds and conveyor elements passing through the transfer unit. The transfer unit removes the rounds from the conveyor and places them into the extractor lip of the gun breech bolts. The transfer unit also receives expended cases and unfired rounds from the gun breech bolts and places them in the conveyor elements. When you install the transfer unit and the adapter assembly as a single unit, press and hold the timing pin on the transfer unit and the gun housing.

REVIEW NUMBER 2 ANSWERS TO QUESTIONS Q1. THROUGH Q7.

A1. The two cycles of the M61A1 gun are the firing cycle and the clearing cycle.

A2. The firing cycle begins in the M61A1 gun when power is applied to the firing contact assembly.

A3. after the projectile leaves the barrel, the extractor lip of the breech-bolt assembly removes the empty case from the chamber.

A4. The main cam path is elliptical shaped.

A5. The six operations the breech-bolt assembly performs during a full firing cycle are feed, chamber lock and fire, unlock, extract, and eject.

A6. The clearing cycle starts when the clearing solenoid is energized.

A7. The M61A1 gun continues to receive rounds during the clearing cycle. The guide bar cam fingers eject all unfired rounds.

Once the transfer unit/adapter assembly is properly attached, you must make sure that the spring-loaded timing pins release.

Adapter Assembly

The adapter assembly bolts directly to the transfer unit. During downloading and loading operations, the adapter assembly interfaces with the linkless ammunition loading system (LALS).

REVIEW NUMBER 3

Q1. List the major parts of the drum unit assembly.

Q2. What component of the drum assembly looks like the threads of a screw?

Q3. What is the purpose of the retainer gear and steel ball bearings contained in the entrance cover?

Q4. What component should you use to index the drum for installation of the exit unit?

Q5. What is the purpose of the two sets of sprocket spur gears located on the scoop disk?

Q6. What switch in the exit unit prevents expended rounds from being fed into the gun and jamming it?

Q7. What is the purpose of the sprocket assemblies in the entrance unit?

Q8. What part of the transfer unit and adapter assembly interfaces with the linkless ammunition loading system (LALS) ?

CHUTE ASSEMBLIES

The chute assemblies are interlocking segments. They provide a flexible path through which the conveyor elements transport live rounds and expended cases around an aircraft structure. The bypass chute provides a path from the entrance unit to the exit unit, through which the conveyor elements pass. The feed chute provides a path from the exit unit to the adapter assembly, through which the conveyor transports live rounds or unexpended cases. The return chute provides a path from the transfer unit to the entrance unit, through which the conveyor transports expended cases or unfired rounds.

The construction of the chute assemblies lets the conveyor elements pass through in only one direction. If the system is rotated in the wrong direction, the element tabs will jam in the chute segments and damage the system. The chute ends are color-coded red and green to key the right connection to other components. Additionally, each end is clearly marked with a metal labeling plate. This identifies the component to which a particular chute end must be connected. The ends of the chutes are equipped with quick-release latches for ease of removal and installation.

CONVEYOR ASSEMBLY

The conveyor assembly consists of individual conveyor elements shaped to cradle a 20-mm case. The elements are joined together by removable hinge pins to form an endless conveyor assembly. (See figure 6-13.) During system operation, the conveyor receives rounds of ammunition from the exit unit and delivers them through the feed chute to the transfer unit. The conveyor also receives expended cases and unfired rounds from the transfer unit and transports them through the return chute to the entrance unit. After receipt by the entrance unit, the expended cases and unfired rounds are removed from the conveyor elements and stored in the ammunition drum. The empty conveyor passes from the entrance unit to the exit unit through the bypass chute. Positive control of the conveyor elements is maintained by tabs on the conveyor elements, which engage guides in the chutes, exit unit, entrance unit, adapter assembly, and transfer unit. The total number

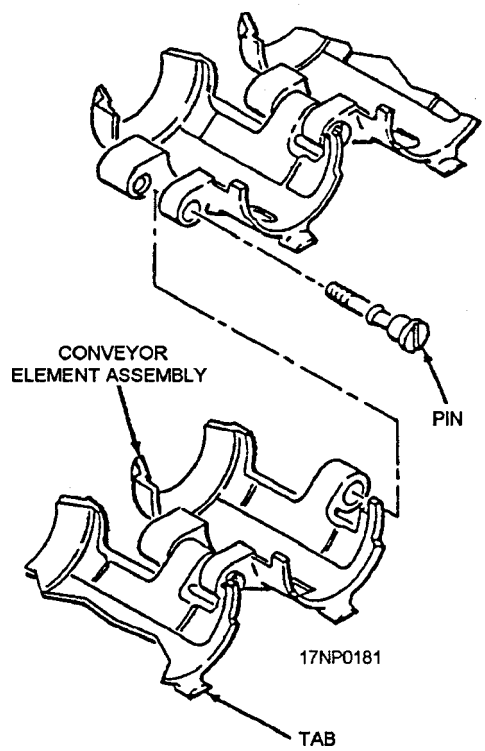


Figure 6-13.—Typical conveyor element assembly.

of elements required for a system varies according to aircraft application.

GUN DRIVE AND DRUM DRIVE SYSTEMS

The M61A1 gun and the ammunition handling system is simultaneously driven by a hydraulic drive unit run by the aircraft's hydraulic system. The hydraulic pressure is supplied through a hydraulic fluid manifold electrically controlled by a dual-rate solenoid valve. This solenoid valve is controlled from the cockpit through the gun control unit (GCU), which results in the gun firing at 6,000 (GUN HIGH) or 4,000 (GUN LOW) rounds per minute. Attached to the hydraulic drive unit is a mechanical drive unit that consists of a gear train with one input shaft (from the hydraulic drive unit) and, depending upon the type of aircraft, one or two output shafts.

F-14 aircraft. The F-14 aircraft uses a mechanical drive unit with two output shafts. The mechanical drive unit causes a telescoping shaft to drive the gun and the drum unit assembly.

F/A-18 aircraft. The F/A-18 aircraft uses a mechanical drive unit with one output shaft. Because the ammunition drum is near the mechanical drive unit, a gear on the output shaft of the mechanical drive unit meshes directly with the drum drive. A two-piece telescoping shaft transmits power from the same output shaft of the mechanical drive unit to the gun drive. This, in turn, drives the gun rotor.

Both aircraft have provisions to manually rotate the gun system by using a manual hand crank, During ground maintenance, the gun system may be rotated hydraulically. This is done by actuating a manual control on the hydraulic drive unit when the aircraft's hydraulic system is operating.

GUN GAS PURGE SYSTEM

The M61A1 gun is internally mounted in the aircraft's fuselage. When the gun is fired, the temperature of the gun barrels increases rapidly, and the gun compartment is filled with gun gas from the fired rounds. If the barrels are not properly cooled, the rounds may cook-off due to excessive barrel temperatures. Gun

REVIEW NUMBER 3 ANSWERS TO QUESTIONS Q1. THROUGH Q8.

A1. The major parts of the drum unit assembly are the drum unit, entrance cover, exit cover, and scoop disk.

A2. The inner drum helix of the drum assembly looks like the threads of a screw and produces a screwing-type motion, causing rounds to slide along partitions from one end to the other end of the outer drum.

A3. The purpose of the retainer gear and steel ball bearings contained in the entrance cover is to support the scoop disks and the inner drum helix.

A4. A spring-loaded timing pin on the entrance cover is used to index the drum for installation of the exit unit.

A5. The two sets of sprocket spur gears located on the scoop disk mesh with the retainer gear in the entrance and exit covers that provide rotating support for the inner drum helix.

A6. The last round switch in the exit unit prevents expended rounds from being fed into the gun and jamming it.

A7. The sprocket assemblies in the entrance unit remove live rounds or expended cases from the conveyor elements and place them in the entrance cover retainer partitions.

A8. The adapter assembly of the transfer unit and adapter assembly interfaces with the linkless ammunition loading system (LALS).

gas, when confined to an enclosed area such as a gun compartment, is highly explosive. The gun gas purge system cools the barrels and purges gas from the compartment during gun firing operations.

The gun gas purge system in the F-14 aircraft uses cold air from the refrigeration system to cool and purge residual gun gases from the ammunition drum and gun compartment. The subsystem, activated when gun firing is initiated, remains active for a 30-second period after gun firing to ensure that all gases are cooled and purged.

The F/A-18 gun gas purge system uses engine bleed air and has an additional gas control provided by a hydraulically actuated ram-air scavenge door that opens automatically during gun-firing operations. The gun gasses are vented through louvers in the lower mold line of the aircraft fuselage.

REVIEW NUMBER 4

Q1. What chute provides a path from the exit unit to the adapter assembly?

Q2. What chute provides a path from the transfer unit to the entrance unit of the drum?

Q3. What is the purpose of the gun gas purge system?

Q4. Describe the difference between the gun gas purge systems of the F-14 aircraft and the F/A-18 aircraft.

M61A1 GUN SYSTEM INSTALLATIONS

LEARNING OBJECTIVE: *Identify M61A1 gun system installations to include those used on the F/A-18 and F-14 aircraft.*

M61A1 gun and ammunition handling system installations have the same basic components. However, some components are peculiar to specific aircraft. These differences are discussed in the following paragraphs.

F/A-18 GUN SYSTEM INSTALLATION

The F/A-18 M61A1 gun system (fig. 6-14) is internally mounted in the nose of the aircraft on the center line. The fired projectiles exit the aircraft through the gun blast diffuser assembly, located just forward of the cockpit windscreen. Depending upon the mission

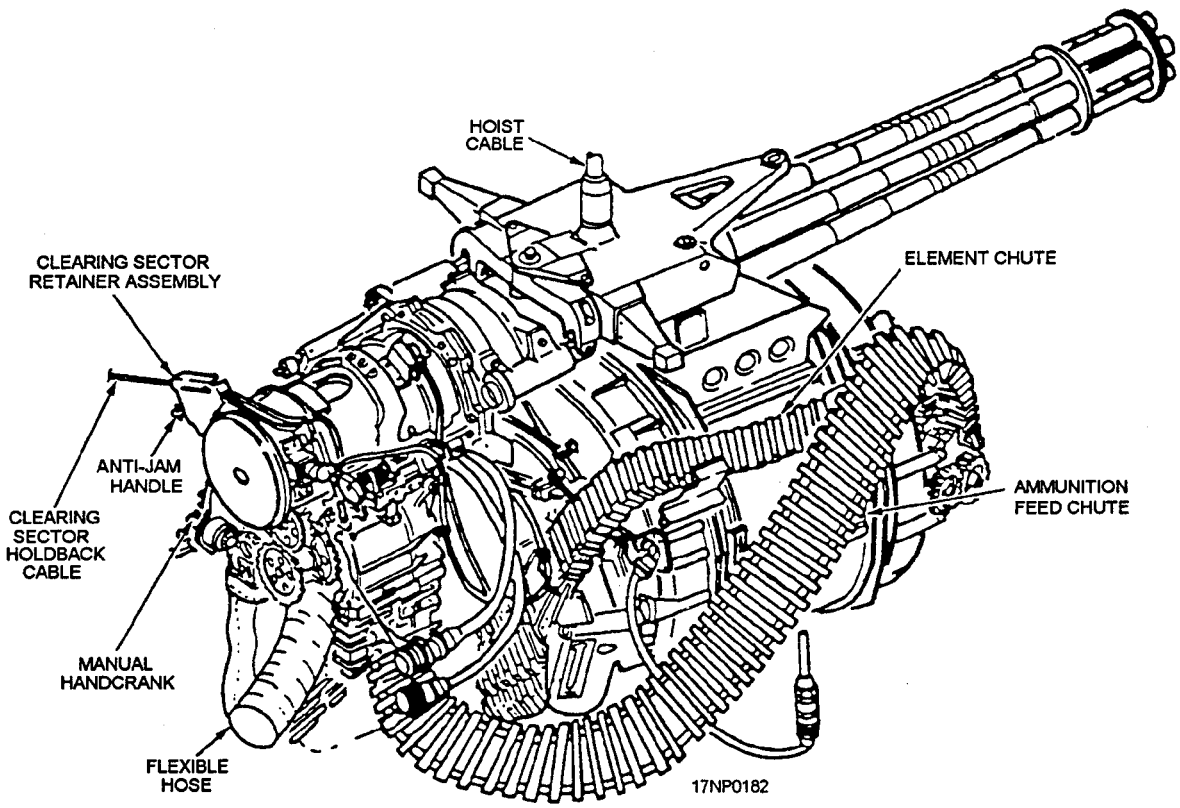


Figure 6-14.—F/A-18 M61A1 gun installation.

objective, the gun can be operated in the air-to-ground (A/G) or air-to-air (A/A) computer mode. There are two A/G modes-continuously computed impact point (CCIP) and manual (MAN). There are three A/A modes-director, disturbed, and cage. The pilot can select any one of the A/G or A/A modes while in flight.

The ammunition handling system holds a maximum of 578 rounds of ammunition. A rounds limiter, located in the gun compartment, can be preset to limit the total number of rounds the pilot can fire. The rounds limiter is used during training missions, and permits two or three gunnery missions from one gun load-out.

> For example, the rounds limiter is set at 200 rounds by ground maintenance personnel. When the pilot has fired 200 rounds, the gun's electrical system automatically initiates the gun clearing cycle. This prevents further firing until the rounds limiter is manually reset by ground maintenance personnel.

While in flight, the pilot has the option of selecting unrestricted firing or presetting the number of rounds per burst. If the pilot selects unrestricted firing, the gun fires continuously as long as the trigger is depressed and ammunition is available.

> For example, if the pilot presets 50 rounds, the gun fires a burst of 50 rounds each time the trigger is pulled and released. A display panel in the cockpit continuously indicates the number of rounds remaining.

The clearing sector retainer assembly (fig. 6-14) is used to manually clear the gun. When the manual clearing handle is in the cleared position, a wire rope assembly depresses the gun clearing sector assembly against the gun housing. This directs the breech-bolt assemblies into the clearing cam path when the gun is manually rotated. The manual clearing handle is held in the clearing position by a locking tab. For safety reasons, the manual clearing handle should remain in the cleared position until you are actually performing gun-arming procedures. When the gun access door is closed, you can determine the position of the manual clearing handle by the position of the indicator located on the door. If the indicator is flush with the door surface, the manual clearing handle is in the firing position. If the indicator protrudes from the door surface, the manual clearing handle is in the cleared position.

The entire gun system is handled as a single palletized unit. This includes the M61A1 gun, drum unit assembly, ammunition chutes, element chutes, and hydraulic motor. The system bolts directly to the aircraft structure with four bolts, and does not require any other boresighting or alignment. Other than minor adjustments in the aircraft, all maintenance is performed at the intermediate-maintenance level. The system is removed from the aircraft as a unit by using gun-handling adapters, a weapon skid or trailer, and an Aero 14C bomb-hoisting unit. The bomb-hoisting unit is used to raise or lower the gun system as it is being removed or installed. A gun system hoist adapter, designed to support the hoist boom, is attached to the aircraft during the raising or lowering operation. A gun-handling adapter, attached to a weapons skid or trailer, supports the gun system after it is removed from the aircraft.

For further information concerning the F/A- 18 M61A1 gun installation, you should refer to Description *and Principles of Operation,* A1-F18AA-750-100; *Testing and Troubleshooting,* A1-F18AA-750-200; *Maintenance,* A1-F18AA-750-300; and *System Schematics,* A1-F18AA-750-500.

REVIEW NUMBER 4 ANSWERS TO QUESTIONS Q1. THROUGH Q4.

A1. The feed chute provides a path from the exit unit to the adapter assembly.

A2. The return chute provides a path from the transfer unit to the entrance unit of the drum.

A3. The gun gas purge system cools the barrels and purges gas from the gun compartment during gun-firing operations.

A4. The gun gas purge systems of F/A-18 aircraft use engine bleed air and have additional gas control provided by a hydraulically actuated, ram-air scavenge door that opens automatically during gun-firing operation. This is not present in the F-14 aircraft.

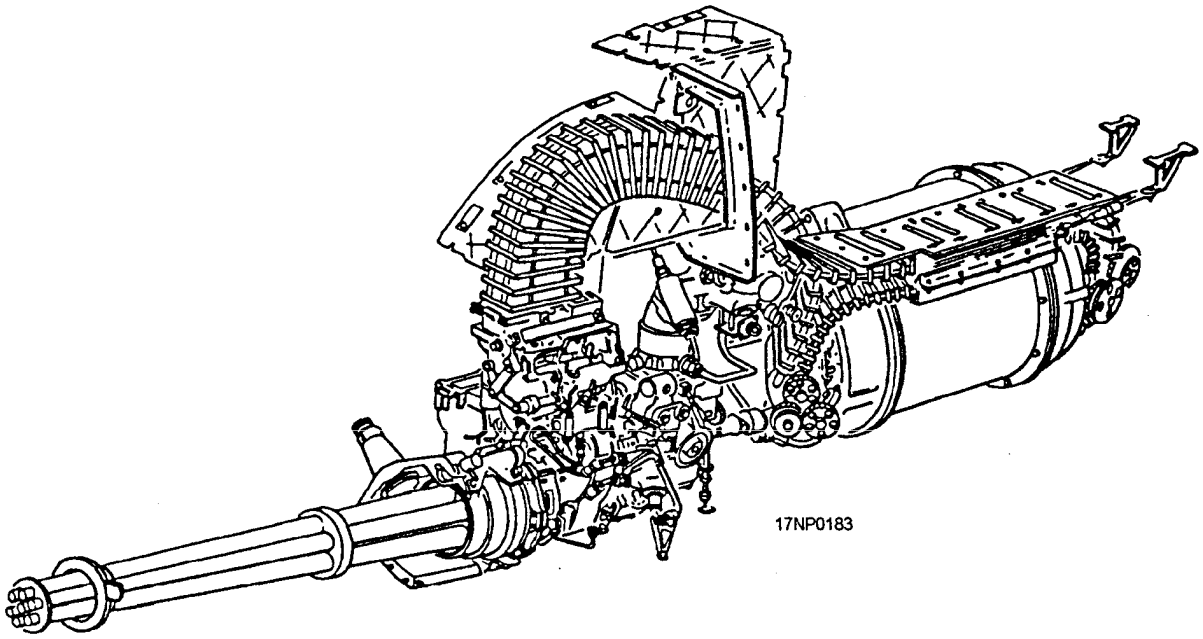


Figure 6-15.—F-14 M61A1 gun installation.

F-14 GUN SYSTEM INSTALLATION

The F-14 M61A1 gun system (fig. 6-15) is mounted in the forward fuselage on the left side of the aircraft. Depending upon the mission objective, this gun system can be operated in an A/G mode, A/A mode, or an air combat maneuver (ACM) encounter mode. The computer pilot attack mode (ACM encounter mode) operates in conjunction with the weapon control system, computer signal data converter (CSDC), and the vertical display indicator system to display target data. The manual attack mode is normally used in the A/G mode. It is also used as the primary backup for the ACM encounter mode in case of system malfunction.

The M61A1 gun system accommodates a maximum of 676 rounds of 20-mm ammunition. There are 576 rounds in the drum and a total of 100 rounds in the chutes, transfer adapter assembly, and gun. The system can be set by ground maintenance personnel for unrestricted firing, or for rounds limit of 50, 100, or 200 rounds per burst. The HOOK/GUN panel contains a gun-rounds counter that gives a digital readout countdown of the rounds remaining in the gun system.

The clearing sector holdback assembly and safety pin (fig. 6-16) is used to clear the gun manually. With the clearing sector holdback assembly installed, the breech-bolt assemblies are diverted to the clearing cam path. Keep the clearing sector holdback assembly and safety pin installed until just before aircraft flight.

REVIEW NUMBER 5

Q1. In F/A-18 aircraft, fired projectiles exit the aircraft through the gun blast diffuser assembly that is located _____ .

Q2. What maximum number of rounds does the M61A1 gun system hold when used on the F/A-18 aircraft?

Q3. What component, located in the gun compartment, can be preset to limit the total number of rounds the pilot can fire?

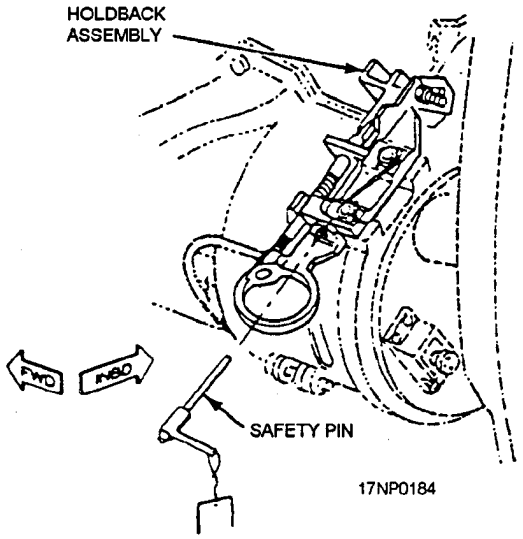


Figure 6-16.—F-14 clearing sector holdback assembly and safety pin.

Q4. When used on F-14 aircraft, where is the M61A1 gun system mounted?

Q5. What is the maximum capacity of the gun system when used on the F-14 aircraft?

MAINTENANCE AND TESTING

LEARNING OBJECTIVE: *Identify maintenance and testing procedures at the organizational and intermediate levels.*

The maintenance and testing responsibilities of an M61A1 gun installation are distributed evenly between the organizational and intermediate levels of maintenance. The basic responsibilities of these two levels of maintenance are discussed in the following paragraphs.

ORGANIZATIONAL MAINTENANCE

Organizational maintenance includes servicing (loading and unloading), preflight, postflight, minor periodic maintenance, malfunction troubleshooting, and removal and installation of components on the aircraft. Also, maintenance of the aircraft system and controls must be included in the AO's organizational responsibilities.

The gun firing record or log is kept at this level. The cumulative total of rounds fired is the basis for most of the maintenance. The number of rounds fired per firing flight is obtained from a counter located within the aircraft. For record accuracy, each time the gun installation is loaded, the counter must be reset (usually to zero) according to the instructions applicable to the aircraft. The two primary tasks that depend upon the round interval (rounds fired) are (1) torquing the two forward front track bolts (30,000 rounds), and (2) changing the breech-bolt assemblies (15,000 rounds).

Organizational responsibilities are not included in NAVAIR 11-95M61A1-1 or the NAVAIR 11-95M6IA1-2. Organizational responsibilities are outlined in MRCs, aircraft MIMs, and aircraft loading manuals.

If a component is being removed for sudden stoppage (jam) maintenance, be careful and take extra precautions. Loose propellant powder from ruptured cartridge cases may be scattered about the gun compartment. This creates an extremely hazardous situation. The loose powder must be removed in a RADHAZ-free environment before you begin to remove a component.

INTERMEDIATE MAINTENANCE

Intermediate maintenance responsibilities are tasks associated with repair or replacement of unserviceable or damaged assemblies, components, or parts of the gun installation that do not require the special maintenance facilities of an overhaul depot. When a gun reaches a round interval of 120,000 rounds fired or requires major repair or alteration, it is sent to a depot-level maintenance activity. The ammunition handling and gun drive system maintenance procedures are identical at both the intermediate- and depot-maintenance levels (with one exception, the depot level removes bearings); therefore, such maintenance is generally performed at the intermediate level. Intermediate maintenance may be divided into two categories—scheduled and unscheduled.

Scheduled maintenance includes inspecting, disassembling, replacing parts, lubricating, assembling, and functionally checking components based on the round interval specified in technical manuals. Scheduled gun maintenance begins at 15,000 rounds and proceeds through various interval states for different parts replacement up to the 120,000-round overhaul interval. Scheduled maintenance for the handling and drive system is set at an interval of 30,000 rounds.

REVIEW NUMBER 6

Q1. The breech bolts are changed out when what number of rounds have been fired from the M61A1 gun system?

Q2. What is the overhaul interval for the M61A1 gun ?

Q3. At what interval should scheduled maintenance for the handling and drive system be done?

SAFETY PRECAUTIONS

LEARNING OBJECTIVE: *Identify safety precautions to follow when working with the M61A1 gun.*

The weapons systems described in this chapter are safe systems. Live rounds are isolated from the firing circuits except when the gun system is deliberately being fired. The gun system is RADHAZ safe and completely shielded from radiation fields. The gun is charged and cleared in flight, so the aircraft can takeoff and land without live rounds in the firing position. Although the sole purpose of all ordnance is to destroy

an enemy, the equipment cannot identify friend from foe. Therefore, all safety precautions must be followed at all times.

The following general safety precautions are not related to any specific equipment or procedure. These precautions are recommended safety precautions that all personnel should follow when operating and maintaining equipment.

All persons who supervise or perform work in connection with ammunition handling should be familiar with the *United States Ordnance Safety Precautions,* NAVSEA OP 3347.

- When test firing is conducted using live ammunition, observe all existing range regulations.

- Before undertaking any operation for which a checkoff list exists, the checkoff list is read so all personnel know what to do.

- When provided, always use safety devices to prevent accidents. Keep safety devices in good operating order at all times.

- Do not make changes, modifications, or additions to a weapons system without prior approval and authorization from the appropriate authority.

- A hazardous condition exists if a gun malfunction occurs and there is anything in line with the gun muzzle. Observe area clearance requirements during maintenance periods.

- Electrically primed ammunition can be fired by percussion. NEVER cycle live ammunition through a gun for testing purposes.

- The explosive elements in electric primers are highly sensitive to static electricity. Make sure the primer button does not come into contact with the human body.

- Observe fire regulations and maintain good ventilation when using cleaning solvents and other volatile maintenance materials.

- Before performing maintenance actions involving pneumatic or hydraulic pressurized components, ensure that all pressure is removed and the component is in the safest possible condition.

REVIEW NUMBER 7

Q1. If a checkoff list is to be used during an operation, what action must take place first?

Q2. To prevent explosive primers on gun ammunition from being exposed to static electricity, what action should be taken?

Q3. When does a hazardous condition exist?

REVIEW NUMBER 5 ANSWERS TO QUESTIONS Q1. THROUGH Q5.

A1 In F/A-18 aircraft, fired projectiles exit the aircraft through the gun blast diffuser assembly that is located just forward of the cockpit windscreen.

A2. When used on the F/A-18 aircraft, the gun system holds a maximum of 578 rounds.

A3. A rounds limiter, located in the gun compartment, can be preset to limit the total number of rounds the pilot can fire.

A4. When used on F-14 aircraft, the M61A1 gun system is mounted in the forward fuselage on the left side of the aircraft.

A5. The maximum capacity of the gun system used on the F-14 aircraft is 676 rounds; 576 rounds in the drum and 100 rounds in the chute.

REVIEW NUMBER 6 ANSWERS TO QUESTIONS Q1. THROUGH Q3.

A1. The breech bolts are changed out when 15,000 rounds have been fired from the M61A1 gun system.

A2. The overhaul interval for the M61A1 gun is 120,000 rounds.

A3. Scheduled maintenance for the handling and drive system of the LALS should be done when the gun has fired 30,000 rounds.

REVIEW NUMBER 7 ANSWERS TO QUESTIONS Q1. THROUGH Q3.

A1. If a checkoff list is to be used during an operation, it must be read to all personnel who will take part in the operation.

A2. To prevent explosive primers on gun ammunition from being exposed to static electricity, make sure that the primer button of the ammunition doesn't come into contact with the human body.

A3. A hazardous condition exists if a gun malfunctions and there is anything in line with the gun muzzle.

CHAPTER 7

AMMUNITION LOADING

Aircraft gun ammunition is developed for specific types of aircraft-mounted guns. The M61A1/A2 uses M50 series 20-mm ammunition. The M50 series consists of various types of cartridges developed for specific applications, including test cartridges, dummy cartridges, target practice, target practice tracer, armor piercing incendiary, high-explosive incendiary, and semi-armor piercing, high-explosive incendiary. Blank and dummy rounds are also used for practice and maintenance.

The M50 series 20-mm ammunition is loaded into the M61A1 gun through the linkless ammunition loading system (LALS). The LALS transports rounds from the transporter to the aircraft system, and simultaneously transports spent cases and cleared rounds from the aircraft system to the transporter.

AIRCRAFT GUN AMMUNITION

LEARNING OBJECTIVE: *Recognize the 20-mm M50 aircraft gun ammunition configuration. Identify M50 20-mm gun cartridges and recognize their uses.*

M50 configuration ammunition (fig. 7-1) for the M61A1 Navy aircraft gun is issued in the form of cartridges (rounds). A complete service cartridge assembly consists of a cartridge case, electric primer, propellant, projectile, and fuze. All service cartridges have matched ballistics and are electrically primed.

CLASSIFICATION

The M50 configuration ammunition currently issued is classified as follows:

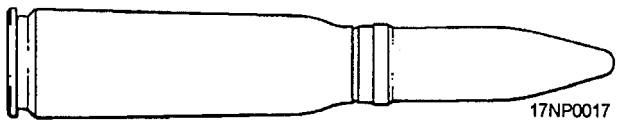


Figure 7-1.—M50 configuration cartridge.

1. Dummy Cartridge M51A1B1, M51A2 (steel), or M254 (plastic)
2. High-Pressure Test Cartridge, M54A1 (HPT,)
3. Target Practice Cartridge, M55A2 (TP)
4. High-Explosive Incendiary Cartridge, M56A3 (HEI)
5. Target Practice-Tracer Cartridge, M220 (TP-T)
6. High-Explosive Incendiary-Tracer Cartridge, M242 (HEI-T)

CARTRIDGE COMPONENTS, GENERAL DESCRIPTION

The cartridge components for M50-configured ammunition as used in a complete round are discussed in the following paragraphs.

Cartridge Case

The M103 (brass) and the M103B1 (steel) cartridge cases (fig. 7-2) are marked longitudinally. The caliber/case designation is on the first line. The manufacturer symbol, interfix number, lot serial number, and year of manufacture are on the second line. The M103 case is loaded for use with all service

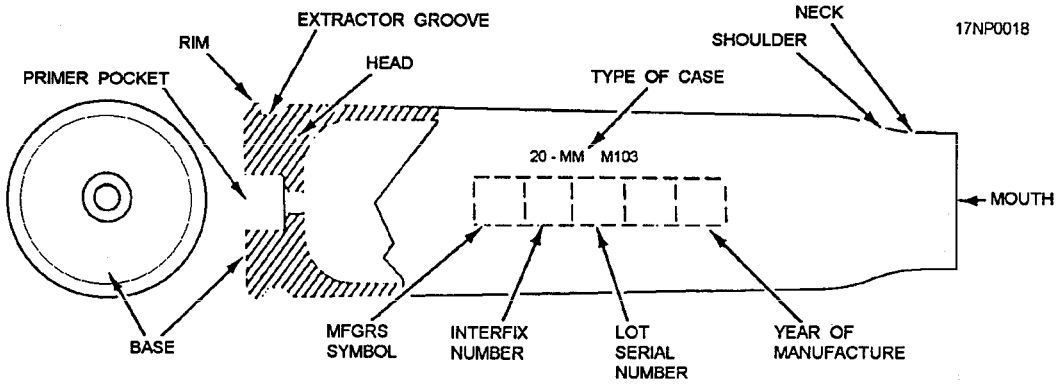


Figure 7-2.—M103 (brass) and M103B1 (steel) cartridge cases.

ammunition, and the M103B1 is used with the M51A1B1/M51A2 dummy cartridges.

Propellant

All M50-configured cartridges are loaded with (double-base) ball spherical propellant.

M52A3B1 Electric Primer

The electric primer is used in all current M50 configurations. It consists of an open-ended brass cup that contains a brass button insulated from the cup by a plastic liner. The firing pin of the gun contacts this button. The ignition charge (a conductive explosive mixture) is in contact with the other side of the button, and is retained by a paper disk and a metal support cup. The electrically initiated primer ignites the propellant charge.

NOTE: The primer explosive element is sensitive to electromagnetic and electrostatic energy.

Projectiles

All projectiles, except the HPT, have essentially the same external configuration. The rotating band is a copper alloy swaged into a circumferential groove near the aft end of the steel body.

Fuze M505A3 Point-Detonating (PD)

The PD fuze (fig. 7-3) consists of a body assembly, a rotor assembly, and a booster assembly. The fuze has a delayed arming distance of 20 to 35 feet after it leaves the muzzle of the gun. Before firing the HEI projectile, the rotor and the firing pin are locked in position by the rotor safety spring. (The rotor contains the detonator, which is out of line with the firing pin.) Centrifugal force causes the spring to open, allowing the rotor to move in-line with the firing pin. The fuze functions when the nose of the fuze is crushed against the target, forcing the firing pin against the detonator. The detonator, in turn, initiates the booster. The booster detonates and initiates the projectile's explosive charge.

Tracer

A tracer mix is direct-loaded into a cavity machined in the base of the TP-T and HEI-T projectiles. It is used in assembling the M220 and M242 cartridges,

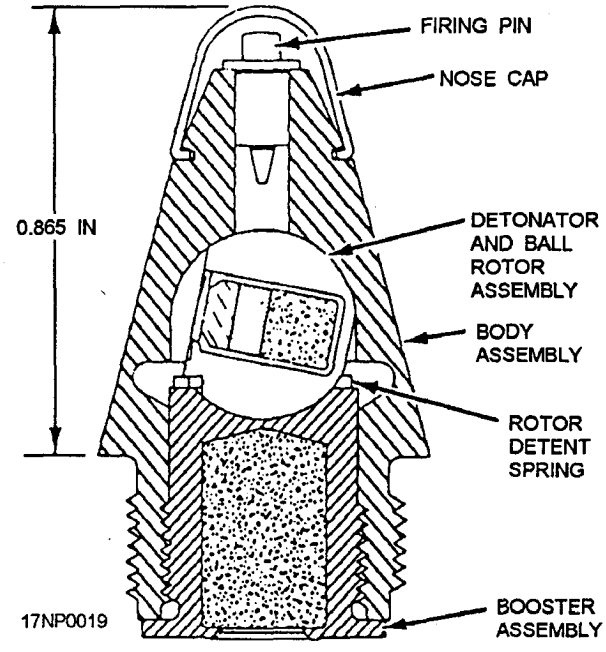


Figure 7-3.—M505A3 point-detonating fuze (unarmed).

respectively. The tracer is ignited by the heat and pressure of the propelling charge. The tracer is visible for about 1,280 yards of projectile flight.

M51A1B1/M51A2 DUMMY CARTRIDGES

Dummy cartridges are completely inert assemblies. They are used for drill and testing the feeder assembly of a weapon. The dummy cartridge is assembled with the M51A1B1/M51A2 projectile and M103B1 cartridge case to simulate the service cartridge. The two cartridges are the same except for a change to the annulus/primer pocket. The cartridge contains approximately 635 grains of inert material. This material produces an average overall weight equal to that of the other M50-configured ammunition.

M254 DUMMY CARTRIDGE

The M254 cartridge is made of plastic. It is an alternate to the M51A1B1/M51A2 steel dummy cartridge. You can tell the difference between the M254 and live ammunition by its appearance and by the feel of its nylon composition. M50 configuration characteristics are shown in table 7-1.

Table 7-1.—M50 Configuration Ammunition Characteristics

Cartridge		Approximate Unit Weight (grains)				Total wt. (grains) (approx.)	Remarks
Designation	Type	M103 case	M52A3B1 Electric primer	Propellant	Projectile		
M51A1B1/ M51A2	Dummy	1,775	None	635 (inert)	1,520	3,850 (min)	M103A1 Steel case
M54A1	HPT	1,855	22	590	1,965	4,392	
M55A2	TP	1,855	22	590	1,521	3,935	
M56A3	HEI	1,855	22	590	1,565	3,965	M505A3 fuze required
M220	TP-T	1,855	22	590	1,470	3,935	
M242	HEI-T	1,855	22	590	1,535	3,865	M505A3 fuze required
M254	Dummy	n/a	None	None	n/a	4,005	Plastic

M54A1 HIGH-PRESSURE TEST CARTRIDGE

The M544A1 cartridge is used only for proof firing of the gun at the place of manufacture. The projectile is made from a solid steel bar. It has a standard rotating band. The M103 or M103B1 cartridge case is used with the M52A3B1 electric primer.

M55A2 TARGET PRACTICE CARTRIDGE

The M55A2 cartridge has no explosive filler in the projectile. The solid nose is made of aluminum alloy. The projectile shape and ballistic properties are similar to those of the other M50-configured ammunition. The cartridge is used for practice firing, boresighting weapons, and testing new guns. The M103 cartridge case and M52A3B1 electric primer make up this cartridge.

M56A3 HIGH-EXPLOSIVE INCENDIARY CARTRIDGE

The M56A3 or M56A4 projectile is used in the M56A3 cartridge. The projectile is loaded with an incendiary and explosive composition, giving the combined effect of the blast of a high-explosive charge plus a fire-starting ability.

Both the M56A3 and M56A4 are loaded with aluminized composition A-4. The major difference between the projectiles is their construction, The M56A3 has a baseplate to prevent ignition of the HEI charge by the propellant. The M56A4 does not have the baseplate, and it has approximately 10 more grains of A-4. Both cartridges use the M103 case, M52A3B1 electric primer, and the M505A3 PD fuze.

M220 TARGET PRACTICE-TRACER CARTRIDGE

The M221 projectile is used with the M220 cartridge. The M221 projectile is similar to the M55A2 projectile, except it incorporates a tracer in the base of the projectile.

M242 HIGH-EXPLOSIVE INCENDIARY-TRACER CARTRIDGE

The M242 projectile is used with the M242 cartridge. The projectile has a tracer in the base and aluminized composition A-4 in the forward section. It has a combined effect of a high-explosive charge plus a fire-starting ability. The projectile is assembled with the M505A3 PD fuze, the M103 case, and the M52A3B1 electric primer.

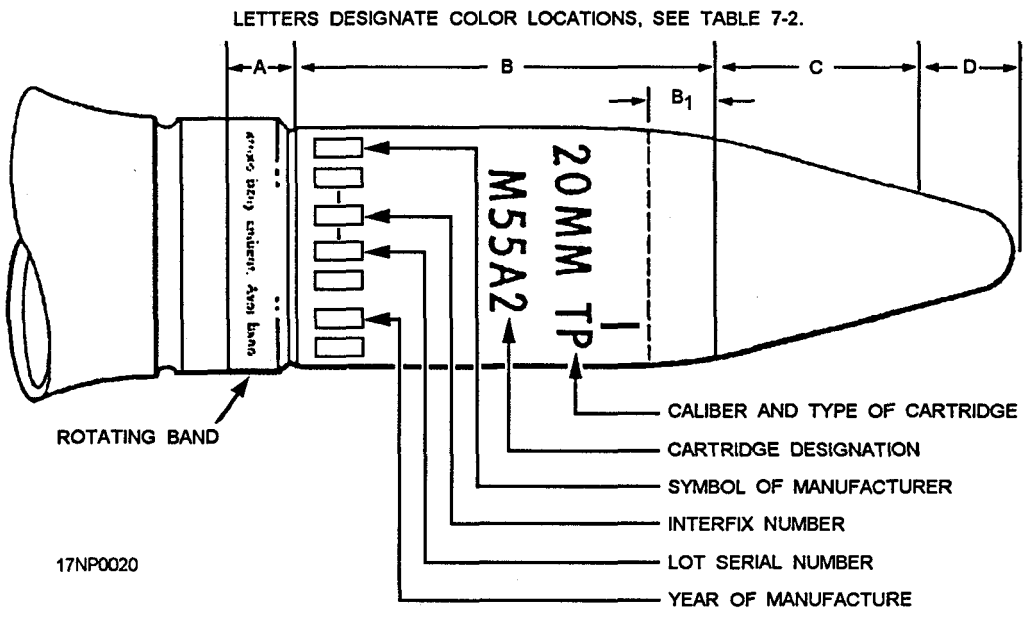


Figure 7-4.—Example of color coding and marking for M50 configuration ammunition.

IDENTIFICATION

Ammunition is identified by the color the projectile is painted and by the lettering on the body of the projectile.

Lettering

The lettering (fig. 7-4) is stenciled in waterproof marking ink around the body of the projectile. The first line of lettering identifies the caliber and type of

Table 7-2.—Color Coding and Marking for M50 Configuration Ammunition

Projectile Type (Expect as noted)	Color of Painting				Color of Marking
	Locations (See Figure 7-4)				
	A	B	C	D	
Dummy M51A1B1/M51A2	Chromate finish	Chromate finish	Chromate finish	Chromate finish	Black
High Pressure Test M54A1 (HPT)	No paint (copper)	Purple	Purple	Purple	Black
Target Practice (TP) M55A2/M55A2B1 M55A3/M55A3B1	No paint (copper)	Blue	Blue	Blue	White
High Explosive Incendiary (HEI) M56A3/M56A4	No paint (copper)	Yellow Red band in B_1 area	No paint (chromate)	No paint (chromate)	Black
Target Practice Tracer (TP-T) M221 (M220 cartridge)	No paint (copper)	Blue	Blue	Blue	White with Orange T's (at location B_1)
High Explosive Incendiary-Tracer (HEI-T) M242	No paint (copper)	Yellow Red band in B_1 area	No paint (chromate)	No paint (chromate)	Black with Red T's (below B_1)
Plastic Dummy Cartridge M254	No paint (white plastic)	No paint (white plastic)	No paint (white plastic)	No paint (white plastic)	Black

cartridge; for example, 20MM HEI, 20MM TP, or 20MM HEI-T. The second line gives the cartridge designation; for example, M254, M55A2, or M220. The last line consists of a code number that identifies the manufacturer, interfix number, lot serial number, and year of manufacture. The color of the letters has no meaning.

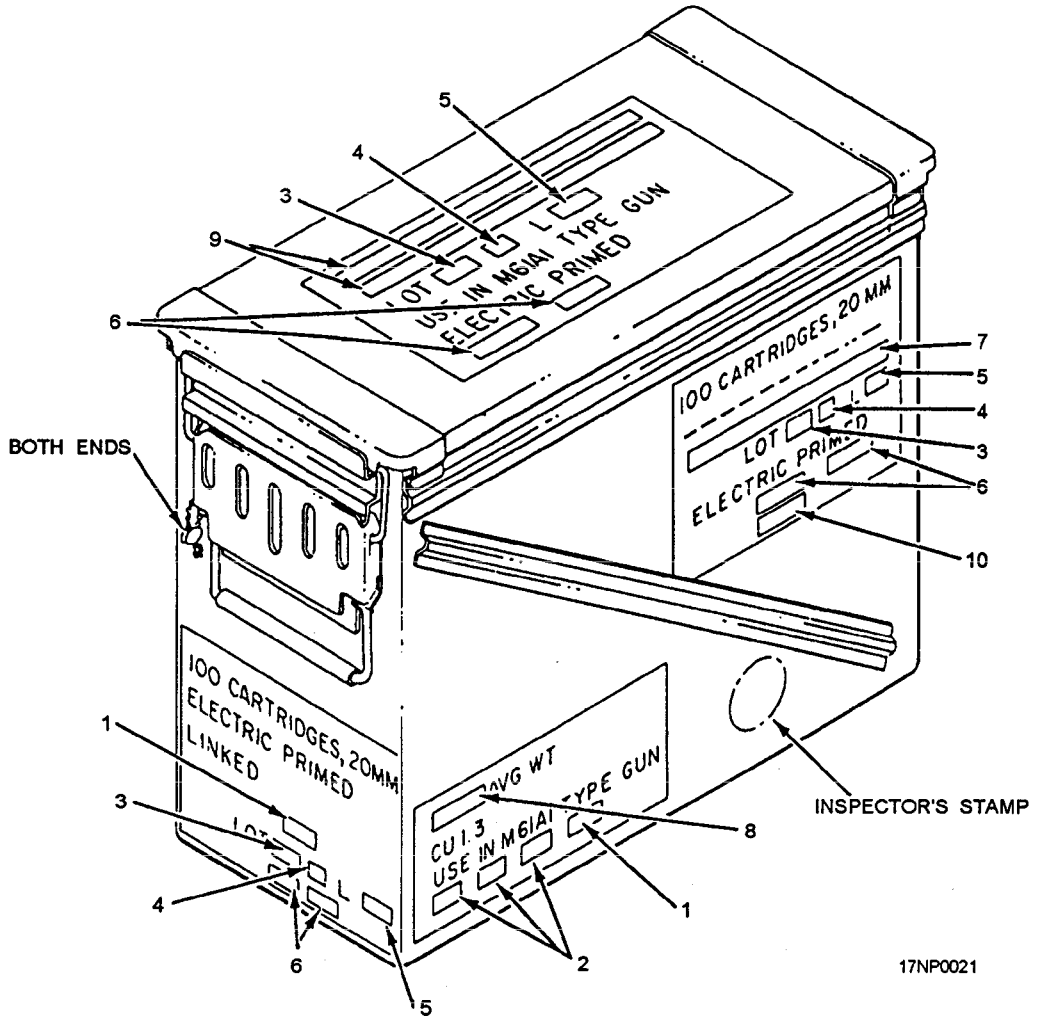
Color Coding

The color codes for the M50-configured 20-mm ammunition are listed in table 7-2. You can see exactly where colors are located on the projectile. The projectile (fig. 7-4) is divided into sections marked A, B, C, and D. The sections on the projectile match the color code to columns in the figure.

By looking at table 7-2, you can identify high-explosive incendiary-tracer round M242. First, find the projectile and its color code in column A. Then, look at section A of the projectile. This section of the projectile isn't painted; therefore, section A of the projectile remains the natural color of the metal (copper). Look at column B and find the color for section B. Refer to section B of the projectile. This area is painted yellow (high explosives), and section B1 is painted red (incendiary). Use the same procedures for sections C and D. Also note the red T markings in the section B area just outside of the B1 section. The red T, and in some cases orange T, shows the presence of an incendiary explosive (tracer).

AMMUNITION CONTAINER M548

The M548 container (fig. 7-5) is made of metal. The lid is attached by quick-release latches at both ends.



1. **DOD cartridge identification code**
2. **Federal stock number of cartridge**
3. **Symbol of cartridge manufacturer**
4. **"S" if steel cartridge case**
5. **Lot number of cartridge**
6. **Month and year of cartridge manufacture**
7. **Type and model of cartridge**
8. **Average weight of packed container**
9. **Type of projectile**
10. **Coast Guard classification**

Figure 7-5.—Ammunition container M548 (typical).

Required information about the ammunition contained inside is listed on the outside of the container. Do **not** break the moisture-resistant seal between the lid and the container until the ammunition is to be used.

NOTE: M50 series ammunition is normally packed in the M548 container as loose rounds (not prebelted). The Linkless Ammunition Loading System (LALS) eliminated the requirement for prebelted ammunition.

The rounds are packed in the container in layers. There are cardboard partitions between each layer and between the rounds on all sides of the container. Each round has a tubular-shaped cardboard protector around the projectile. Use these cardboard partitions and tubular protectors when repacking the ammunition in the containers.

LINKLESS AMMUNITION LOADING SYSTEM

LEARNING OBJECTIVE: *Identify the components of the linkless ammunition loading system to include loader ammunition transporter, drum loader and drum unload assemblies, and the conveyor system. Identify the operating procedures to follow when loading/downloading the transporter and aircraft gun system.*

The Linkless Ammunition Loading System (LALS) (fig. 7-6) consists of a loader ammunition transporter, a drum loader assembly, a conveyor system, and a drum unload assembly. The components of the LALS allow 1,400 rounds of electrically primed, M50-series ammunition to be handled without the use of links while the ammunition is still RADHAZ safe. The system is used to transport ammunition, load and download aircraft, and load and download the loader ammunition transporter.

COMPONENTS

A brief description of the components in the Linkless Ammunition Loading System (LALS) is contained in the following paragraphs.

Loader Ammunition Transporter

Unfired rounds and/or empty cases are stored in the loader ammunition transporter, also known as the *transporter* (fig. 7-7). The transporter is primarily intended to move rounds/cases through the exit and

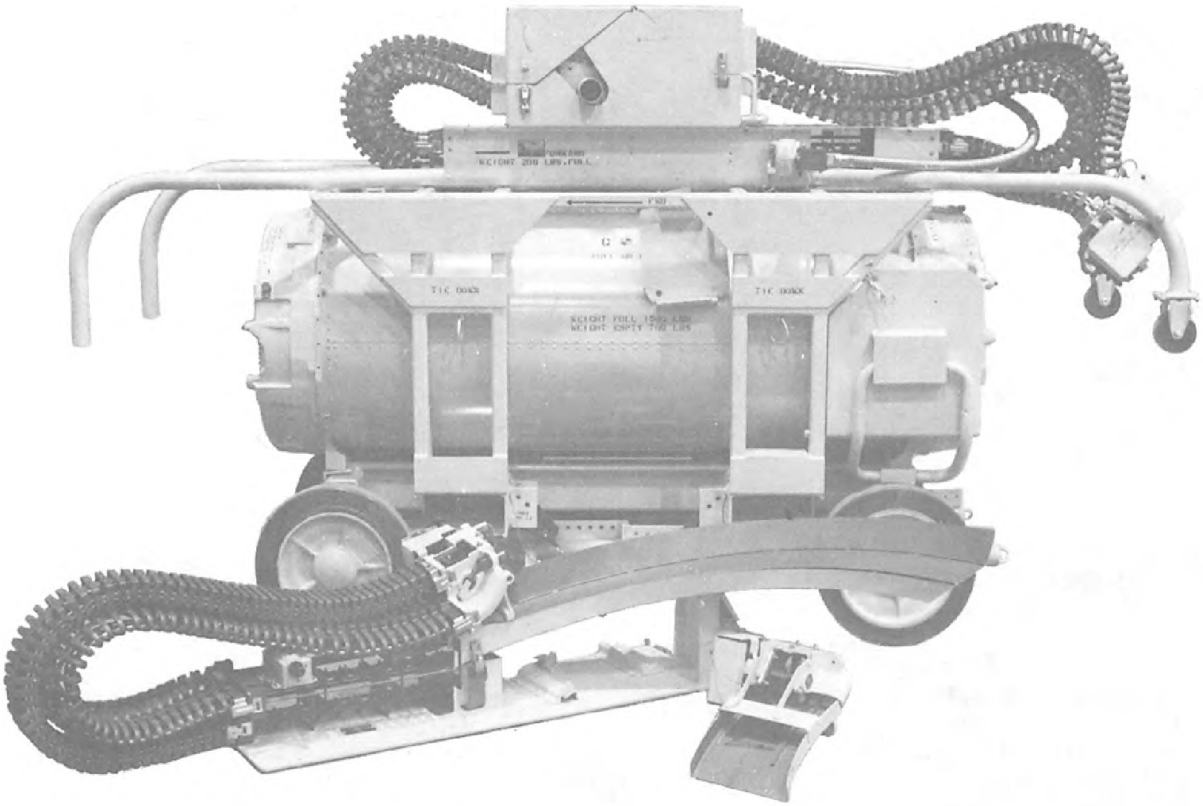


Figure 7-6.—Linkless ammunition loading system (LALS).

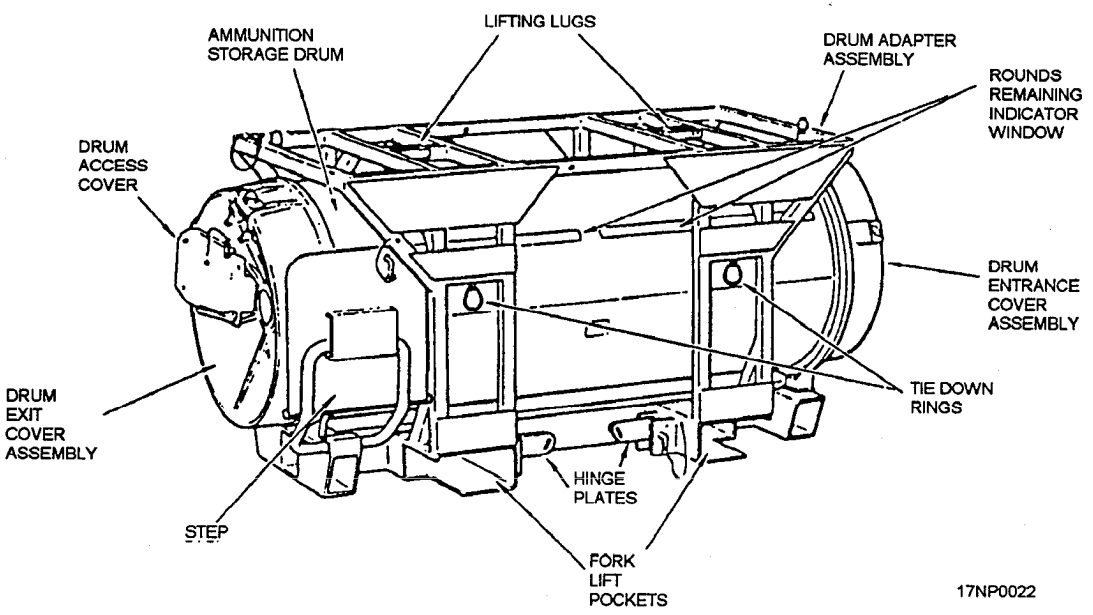


Figure 7-7.—Transporter

entrance ends during operation. Except for size, the transporter is similar to the aircraft drum assembly.

The transporter can be locked onto the MHU-191 transporter or stacked three high for storage purposes. The transporter has an ammunition drum mounted in a rigid-frame drum adapter assembly.

The drum adapter assembly is a box-type structure that allows the transporters to be stacked. Four hinge plates and four quick-release pins are used to lock the transporter onto the MHU-191 transporter. Two lifting lugs (on 30-inch centers) mate with a weapons carrier so that an overhead crane can be used to lift the transporter. Additionally, there are two forklift pockets that allow the forklift truck to move the transporter. There are four tie-down rings to secure the transporter to the deck. Foldout steps, if needed, are located at the exit end of the transporter to provide personnel with the additional height to operate the LALS.

The ammunition drum is a cylindrical structure that consists of an outer drum structure, an inner drum, two scoop disk assemblies, and two cover assemblies.

OUTER DRUM.— The outer drum is a storage container for ammunition, and it provides a housing for the inner drum. There is a rounds-remaining indicator window so you can determine the number of rounds remaining in the drum. The drum partitions, mounted longitudinally within the outer drum to hold the rounds in place, hold the rounds radially around the outer drum with their bases in an outward direction.

INNER DRUM.— The inner drum is a welded assembly with a mounting ring at each end. There are sheet metal leaves welded to the outer surface of the core that form a double-lead helix. When the inner drum is rotated, it moves the rounds along the drum partitions from the entrance end to the exit end of the drum.

SCOOP DISK ASSEMBLIES.— A scoop disk assembly is mounted on each end of the inner drum. There are three rails on the scoop disk assemblies, forming a continuation of the inner drum helix. Also, two sets of gear-driven sprockets and scoop extensions are located on the scoop disks 180 degrees apart. These sprockets and scoop extensions transfer the rounds from the entrance cover to the outer drum partitions and from the outer drum partitions to the exit cover. The entrance scoop disk has two pins that hold the scoop extensions closed when they are activated by a cam in the outer drum. This prevents feeding rounds into the empty space where the drum partitions cannot control the rounds.

DRUM COVER ASSEMBLIES.— A drum cover assembly is mounted on each end of the outer drum. The drum cover assemblies accept rounds from the entrance unit, load units, or from the scoop disk assembly. It then places the rounds into the scoop disk assembly (entrance end) or exit unit, respectively. The retainer partitions on the retainer gear maintain control of the rounds between the scoop disk assemblies and the entrance or exit units. A spring-loaded timing pin on each drum cover is used to index the drum during installation of the entrance and

exit units. The exit drum cover assembly also contains brackets for mounting a drive assembly.

Drum Loader Assembly

The drum loader assembly (fig. 7-8) is used to load the transporter with unlinked ammunition. The drum loader assembly places the unlinked rounds into the conveyor elements, which carry the rounds to the load unit assembly. The load unit assembly removes the rounds from the elements and places them into the retainer partitions in the entrance drum cover. You can time the load unit assembly by inserting a pin through the cover, through a hole in one of the gears, and into a hole in the housing. The drum loader consists of a load tray (onto which the rounds are placed), a belt of elements, two chutes (which control the rounds and elements when they are between the tray and the load unit), and a load unit assembly. The load unit assembly contains two gear-driven sprocket assemblies that transfer the rounds from the belt of elements to the drum cover partitions and a gearbox that drives the drum loader assembly. The gearbox can be driven by a 1/2-inch drive hand crank, making it easier to transport the rounds. A resettable counter indicates the number of rounds that have been loaded into the transporter.

Drum Unload Assembly

The drum unload assembly (fig. 7-9) removes rounds and/or spent cases from the transporter and separates them from each other. The drum unload assembly contains a gear-driven sprocket that removes the rounds/spent cases from the drum exit cover and places them on a tray. The tray has a hole that lets spent cases drop through while the rounds must travel the length of the tray. You can time the drum unload assembly by inserting a pin through the cover, through a hole in one of the gears, and into a hole in the housing.

Conveyor System

The conveyor system (fig. 7-10) transports rounds from the transporter to the aircraft system. It simultaneously transports spent cases and cleared rounds from the aircraft system to the transporter. The conveyor system is mounted on the top of the transporter. It consists of a chute support assembly, three ammunition chutes, two element chutes, an exit unit assembly, an interface unit assembly, an entrance unit assembly, and a drum drive assembly that is driven by a flexible drive shaft.

CHUTE SUPPORT ASSEMBLY.— The chute support assembly is a rigid structure that supports other units. It also provides stowage for other units when they aren't in use. A portion of the chute that is required for the control of spent cases and elements is a rigid wire-form chute. This chute is part of the chute support assembly. Casters are provided on one end of the chute support assembly to aid in moving the assembly when it is not mounted on a transporter.

CHUTES.— The ammunition and element chutes control the elements and rounds or spent cases when the system is operating. The chutes are flexible enough to permit interconnection of the various units.

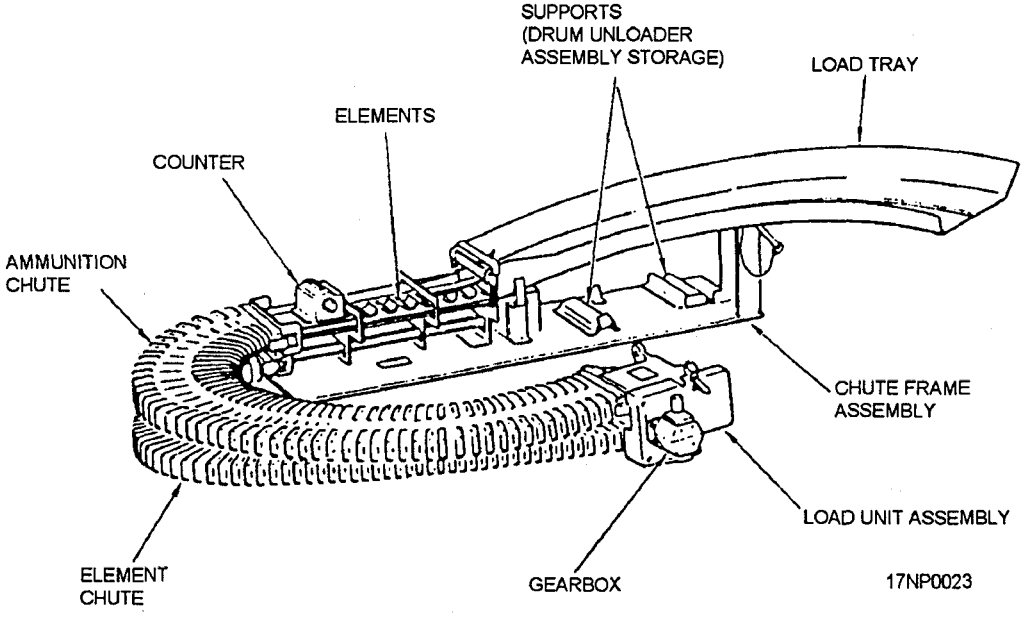


Figure 7-8.—Drum loader.

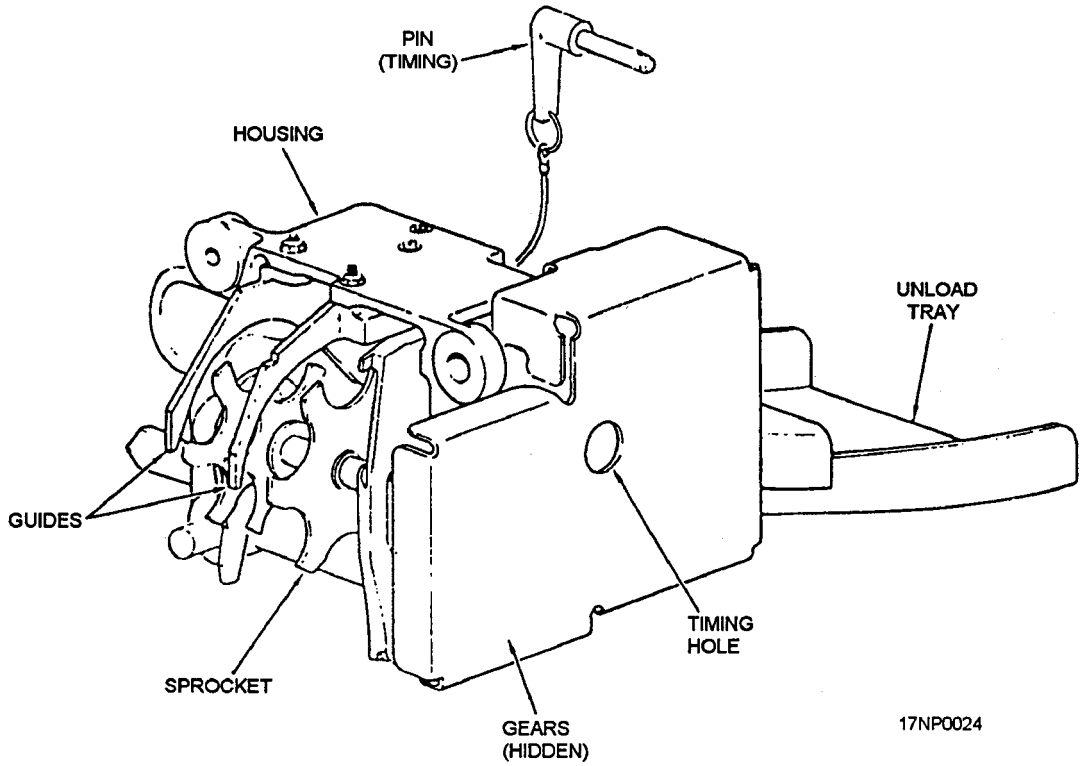


Figure 7-9.—Drum unloader.

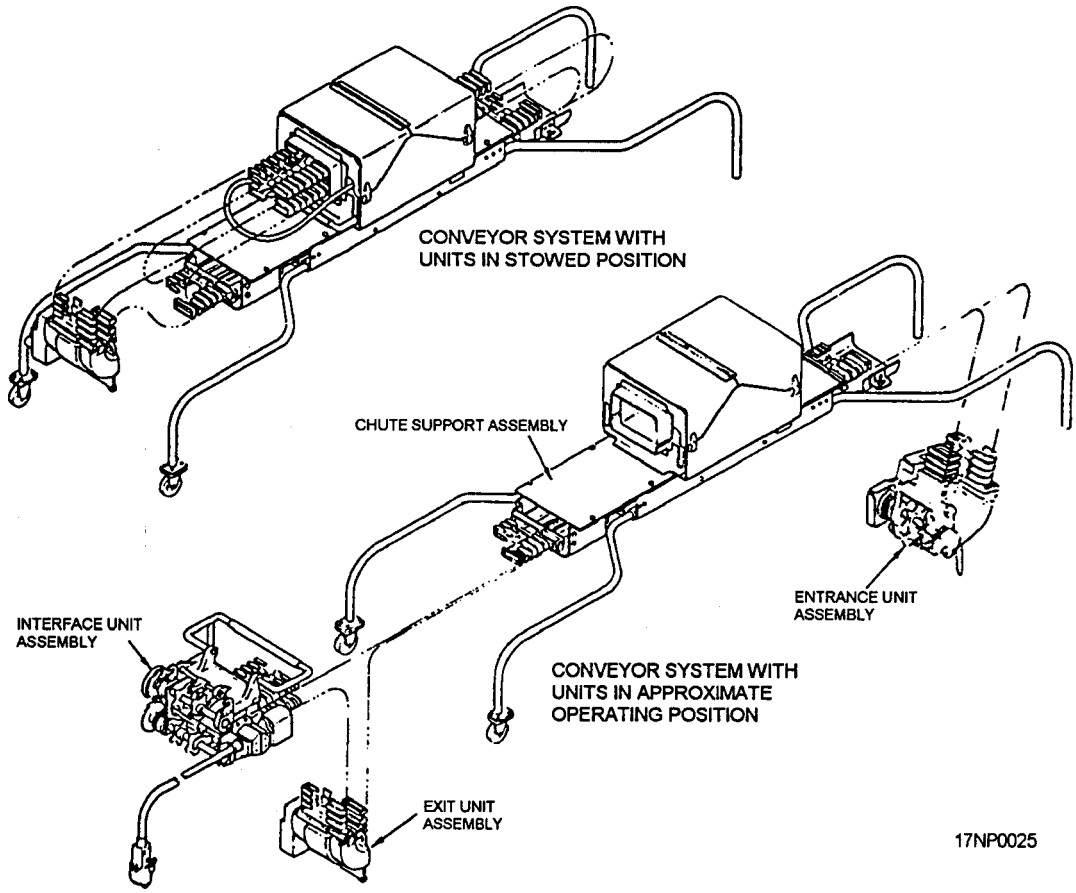


Figure 7-10.—Conveyor system.

EXIT UNIT ASSEMBLY.— The exit unit assembly removes rounds from the transporter and places them into the elements. Two gear-driven sprocket assemblies are used to transfer the rounds from the transporter to the elements. You can time the exit unit assembly by inserting a pin through the cover, through a hole in one of the gears, and into a hole in the housing.

INTERFACE UNIT ASSEMBLY.— The interface unit assembly transfers the rounds coming from the exit unit assembly to the aircraft system and the spent cases coming from the aircraft system to the elements going to the entrance unit. A bypass mode of operation permits the rounds to be cycled through the transporter/conveyor system without an interchange of rounds at the interface unit. The interface unit assembly has a gearbox drive that drives the transporter/conveyor system at the speed required for correct hand-off between the interface unit and the aircraft system. The three gear-driven sprockets control the elements and rounds as they pass through the interface unit assembly. A resettable counter indicates the number of rounds that have been loaded into the aircraft system.

ENTRANCE UNIT ASSEMBLY.— The entrance unit assembly removes spent cases/cleared rounds from the elements and places them into the transporter. There are three gear-driven sprockets that control the elements and spent cases as they pass through the entrance unit assembly. A counter indicates the total number of elements that have been cycled.

DRUM DRIVE ASSEMBLY AND FLEXIBLE DRIVE SHAFT.— The drum drive assembly is mounted on the exit end of the transporter and drives the transporter drum. The drive power is transmitted from the interface unit to the drum drive assembly by the flexible drive shaft.

REVIEW NUMBER 1

Q1. List the components of the Linkless Ammunition Loading System (LALS).

Q2. How many rounds of electrically primed, M50 ammunition can be loaded on the components of the LALS?

Q3. What weapons skid is used with the LALS?

Q4. What is the purpose of the loader ammunition transporter?

Q5. What is the purpose of the drum loader assembly?

Q6. What is the purpose of the conveyor system?

Q7. What components transfer rounds from the transporter to the elements in the exit unit assembly?

Q8. The drive power is transmitted from the interface unit to the drum drive assembly by the _____.

OPERATION

Operation of the LALS is divided into three modes: loading/downloading the transporter; loading/downloading aircraft gun systems; and bypass.

Loading/Downloading Transporter

Ammunition primers are exposed when you conduct transporter loading/downloading operations. Therefore, loading/downloading must be done in a RADHAZ safe area.

As you read this section, refer to figure 7-11. When you are loading the transporter, attach the timed drum loader assembly to the timed drum entrance cover of the transporter, and attach the timed drum unload assembly to the timed drum exit cover. If you are simultaneously loading/downloading, attach both the timed drum loader assembly and drum unload assembly to the timed drum entrance cover and to the timed drum exit cover. When downloading only, the transporter is driven by a handcrank in the retainer at the center of the entrance end of the transporter. When loading or simultaneously loading/downloading, the transporter is driven by the load unit assembly.

Ammunition is placed in the load tray of the drum loader at the specified ratio. The curve and tilt of the tray lets the rounds roll freely toward the elements. As the load unit assembly is driven by the handcrank, each element picks up one round and carries it through the ammunition chute to the load unit assembly. As the rounds enter the ammunition chute, the rounds counter is actuated. The load unit assembly removes the rounds from the elements and places them in the retainer partitions of the drum entrance cover. The scoop disk assembly removes the rounds from the retainer partitions and places them into the drum partitions, where the inner drum (helix) moves them from the entrance cover toward the exit cover. Since there is a space in the outer drum where no controlling partitions exist, a cam on the outer drum engages a pin on the scoop disk assembly that closes the scoop extension. With the scoop extension closed, no rounds can be placed in the

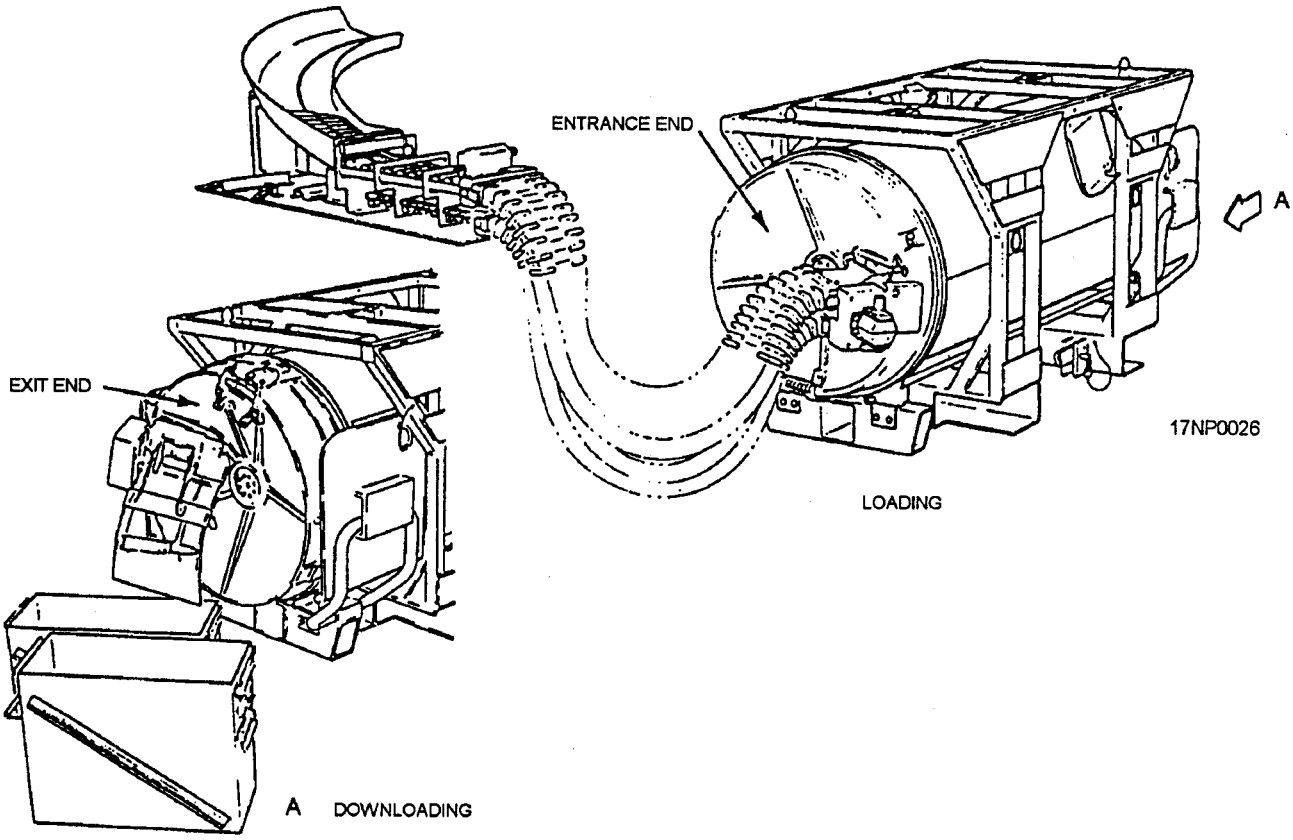


Figure 7-11.—Loading and downloading transporter.

empty space. As the inner drum moves the rounds or spent cases toward the drum unload assembly, the scoop disk assembly removes the rounds from the drum partitions and places them into the retainer partitions of the drum exit cover.

The drum unload assembly removes the rounds from the retainer partitions and places them on the unload tray. A hole in the unload tray lets spent cases drop into a spent case container. Rounds are moved across the hole in the tray to a live-rounds container. These rounds must be restrained to prevent impact with the container or other rounds.

Loading/Downloading Aircraft Gun Systems

In a load and/or download operation, any combination of the following conditions may exist: A fully loaded, partially loaded, or empty transporter may be mated to a fully loaded, partially loaded, or empty gun system. Each set of possible combinations dictates a unique load and/or download operational sequence. The load or download operational sequence explained in the following paragraph refers to a fully loaded transporter mated to a fully loaded gun system.

For you to load or download an aircraft gun system, the conveyor system must be mounted on the transporter with the timed entrance and exit unit assemblies mounted to a timed drum. The timed interface unit assembly must be mated to the timed aircraft gun system by the aircraft adapter assembly. The rounds pass from the transporter, through the exit unit assembly, through an ammunition chute, to the interface unit assembly. When the interface unit assembly mode selector is in the bypass position

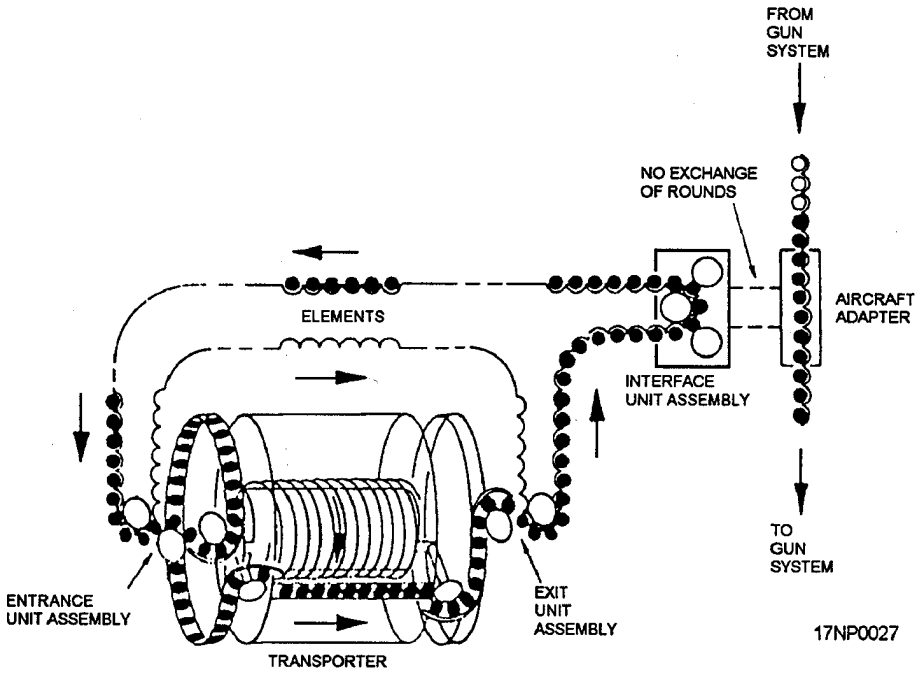


Figure 7-12.—Ammunition flow in bypass mode.

(fig. 7-12) and the system is cycled, the rounds are guided around the element sprocket and into an ammunition chute, which returns them to the entrance end of the transporter.

When you first connect or remove the interface unit to or from the aircraft adapter, the interface unit assembly must be in the bypass position. When the interface unit assembly mode selector is in the load

REVIEW NUMBER 1 ANSWERS TO QUESTIONS Q1. THROUGH Q8.

A1. The Linkless Ammunition Loading System (LALS) consists of a loader ammunition transporter, a drum loader assembly, a conveyor system, and a drum unload assembly.

A2. The LALS can hold 1,400 rounds of electrically primed, M50 ammunition.

A3. The Aero 21 weapons skid is used with the LALS.

A4. The loader ammunition transporter is used to move rounds/cases through the exit and entrance ends during operation.

A5. The purpose of the drum loader assembly is to load the transporter with unlinked ammunition.

A6. The conveyor system is used to transport rounds from the transporter to the aircraft system. It simultaneously transports spent cases and cleared rounds from the aircraft system to the transporter.

A7. Two gear-driven sprocket assemblies in the exit unit assembly transfer rounds from the transporter to the elements.

A8. The drive power is transmitted from the interface unit to the drum drive assembly by the flexible drive shaft.

position (fig. 7-13) and the system is cycled, the rounds are removed from the elements by a sprocket and guided into the elements in the aircraft adapter.

The rounds are carried from the aircraft adapter to the aircraft drum. The elements entering the aircraft adapter from the aircraft system contain spent cases or cleared rounds. These rounds are removed from the aircraft elements and are guided by a sprocket into the elements of the conveyor system for transfer to the transporter.

REVIEW NUMBER 2

Q1. In what type of environment must transporter loading or downloading operations be conducted?

Q2. List the conditions that might exist in a given load or download operation.

Q3. When you connect or remove the interface unit to or from the aircraft adapter, it must be in what position ?

MAINTENANCE AND TESTING

LEARNING OBJECTIVE: *Identify maintenance and testing procedures at the organizational and intermediate levels of maintenance.*

Maintenance of the LALS is concentrated at the intermediate maintenance level. The scheduled maintenance procedures are outlined on preoperational and calendar MRCs. The unscheduled maintenance procedures are outlined in *Linkless Ammunition Loading System,* NAVAIR 19-01-125.

Organizational-level maintenance requirements are minimal. Proper use of the LALS reduces unscheduled maintenance. Before use, you need to check the general condition of the LALS for obvious damage. Proper timing of the LALS system before mating one unit with another unit or to the aircraft gun system is the most important part in the organizational maintenance of the LALS.

REVIEW NUMBER 3

Q1. The LALS is maintained at the _____.

Q2. Scheduled maintenance procedures for the LALS are outlined in_____.

Q3. At the organizational level, what is the most important maintenance practice you should follow when working on the LALS?

SAFETY PRECAUTIONS

LEARNING OBJECTIVE: *Identify safety precautions to follow when working with the LALS.*

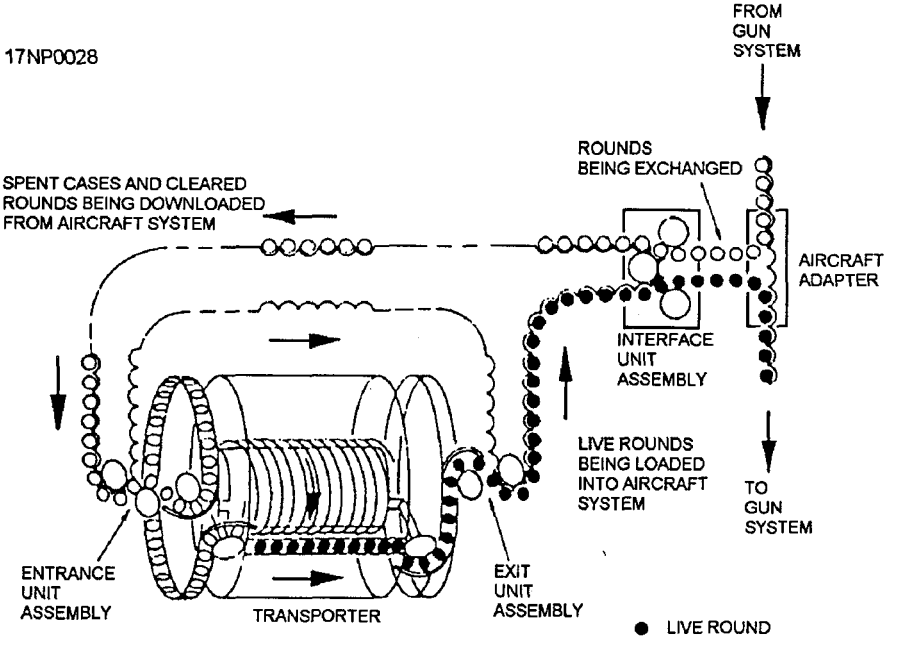


Figure 7-13.—Ammunition flow in load/download mode.

The following general safety precautions are not related to any specific equipment or procedure. These precautions are recommended safety precautions that all personnel should follow when operating and maintaining equipment.

- All persons who supervise or perform work in connection with the ammunition handling should be familiar with the *United States Ordnance Safety Precautions,* NAVSEA OP 3347.

- When test firing is conducted using live ammunition, observe all existing range regulations.

- Before undertaking any operation for which a checkoff list exists, you must read the checkoff list to all personnel who will take part in the operation.

- When provided, always use safety devices to prevent accidents. Keep safety devices in good operating order at all times.

- Electrically primed ammunition can be fired by percussion. NEVER cycle live ammunition through a gun for testing purposes.

- The explosive elements in electric primers are highly sensitive to static electricity. Make sure the primer button does not come into contact with the human body.

- Observe fire regulations and maintain good ventilation when using cleaning solvents and other volatile maintenance materials.

- Before performing maintenance actions involving pneumatic or hydraulic pressurized components, ensure that all pressure is removed and the component is in the safest possible condition.

REVIEW NUMBER 4

Q1. If a checkoff list is to be used during an operation, what action must take place first ?

Q2. To prevent explosive primers on gun ammunition from being exposed to static electricity what action should be taken?

REVIEW NUMBER 2 ANSWERS TO QUESTIONS Q1. THROUGH Q3.

A1. When transporter loading/downloading operations are conducted, they must be done in a RADHAZ-free environment.

A2. In a given load/download operation, any of the following conditions may exist: A fully loaded, partially loaded, or empty transporter may be mated to a fully loaded, partially loaded, or empty gun system.

A3. When you connect or remove the interface unit to or from the aircraft adapter, it must be in the bypass *position.*

REVIEW NUMBER 3 ANSWERS TO QUESTIONS Q1. THROUGH Q3.

A1. The LALS is maintained at the intermediate level of maintenance.

A2. Scheduled maintenance procedures for the LALS are outlined in the preoperational and calendar MRCs.

A3. At the organizational level, proper timing of the LALS system before mating one unit with another unit or to the aircraft gun system is the most important maintenance practice to follow when working on the LALS.

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REVIEW NUMBER 4 ANSWERS TO QUESTIONS Q1. AND Q2.

A1. If checkoff list is to be used during an operation, it must be read to all personnel who will take part in the operation.

A2. To prevent explosive primers on gun ammunition from being exposed to static electricity, make sure that the primer button of the ammunition doesn't come into contact with the human body.

CHAPTER 8

TARGETS AND ASSOCIATED EQUIPMENT

Aerial targets and associated equipment are used in gunnery, rocketry, and for missile practice by ships and shore installations. They are also used in air-to-air firing exercises. Firing at targets that simulate moving aircraft improves the battle efficiency of the Navy and provides useful information for evaluating armament control/weapons systems under development for operational use by the fleet.

Target systems are divided into three categories: aerial targets, land targets, and tow target systems. Table 8-1 depicts a matrix of targets by category and type. In the following paragraphs we will discuss aerial targets and tow target systems.

Tow target systems are divided into two subsystems: aerial tow reeling machine and launchers and aerial tow. Both systems are discussed in the following text.

TOWED TARGETS, SYSTEMS, AND EQUIPMENT

LEARNING OBJECTIVE: *Identify towing systems and associated equipment to include external gunnery tow systems, tow target reeling machine-launcher systems, and tow cables and associated equipment. Describe the operating theory of the external gunnery tow system.*

There are two basic classes of tow targets-textile and rigid tow targets. Textile tow targets are flexible targets woven from a synthetic fiber, such as nylon.

Rigid tow targets are made of a rigid material, such as fiber glass. They are shaped and constructed to prevent drag and withstand severe air loads when towed at high speeds. This type of target is normally fin stabilized. All rigid targets provide an auxiliary aid for the radar fire control system in the attacking aircraft.

Table 8-1.—Target Categories and Types

Target	Aerial Target		Land Target	Tow Target Systems	
	Subscale	Full Scale		Aerial Tow Reeling Machine	Aerial Tow
BQM-34A/S	X				
BQM-34E/T	X				
BQM-74C/E	X				
AQM-37C	X				
RMK-19/A47U-3				X	
RMK-31/A47U-4				X	
RMK-34/A47U-4/A				X	
RM-1				X	
TDU-32A/B					X
TDU-34A/A					X

TEXTILE TOW TARGETS

The TDU-32A/B and TDU-32B/B aerial banner tow targets (fig. 8-1) are effective low-cost devices for air-to-air and surface-to-air gunnery training. They are constructed of nylon fabric and are rectangular in shape. The TDU-32B/B is laser retroflective, while the TDU-32A/B is radar reflective.

The TDU-32A/B and TDU-32B/B banner tow targets have a weighted steel tow bar and bridle assembly attached to the rectangular fabric panel. There is a 60-foot safety nylon webbing bridle attached between the tow bar and tow cable. Both nonradar- and radar-reflective panels are 7 1/2 feet by 40 feet. For visual tracking, the panels have a 12-inch orange border and a 48-inch orange bull's eye centered on the white portion

The targets, attached approximately 1,800 feet behind the tow aircraft, are launched from the runway by standard drag takeoff procedures. Target recovery is accomplished by dropping the target in a recovery area following the mission.

RIGID TOW TARGET

A rigid target is specially designed to simulate high-speed aircraft in speed and maneuverability. It can be towed by jet aircraft at speeds within the attacking range of jet fighters. The target is aerodynamically designed to reduce drag and limit the performance of the tow plane as little as possible. A rigid target can be used for air-to-air and surface-to-air gunnery and guided missile training.

The TDU-34/A aerial tow target (fig. 8-2) is a training device that will replace other tow targets now in use, with the exception of the banner targets discussed in this chapter. Its primary purpose is for air-to-air and surface-to-air missile and gunnery training.

The TDU-34/A is a passive radar target. It can be adapted to carry other payloads internally. It consists of a reinforced aluminum tube body, four aluminum fins, a steel towline adapter, and radar-reflective nose and tail sections. The nose is a thin, fiber glass shell with four aluminum corner reflectors and a lead ballast weight bonded inside. The tail section is a short ABS plastic tube with a single aluminum comer reflector riveted inside. The dimensions and weight of the target are shown in figure 8-2.

The TDU-34/A can be towed by any aircraft capable of using the A/A47U-3 or A/A47U-4 reeling machine-launcher systems.

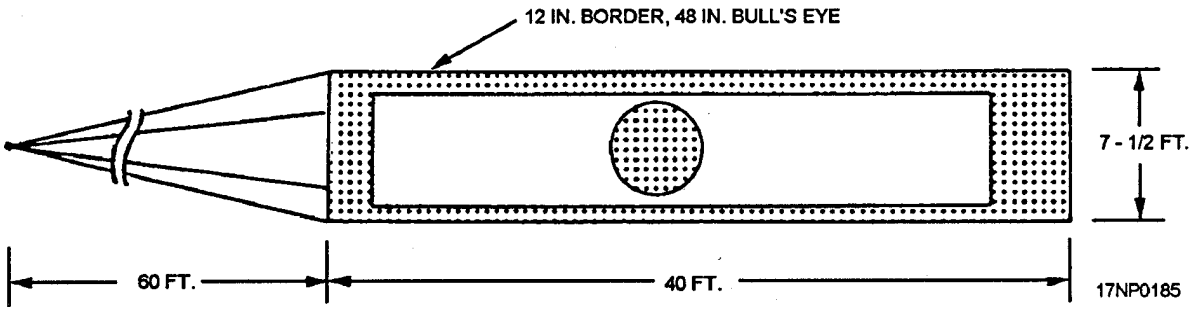
REVIEW NUMBER 1

Q1. What are the two basic classes of tow targets?

Q2. Textile targets are made of _____.

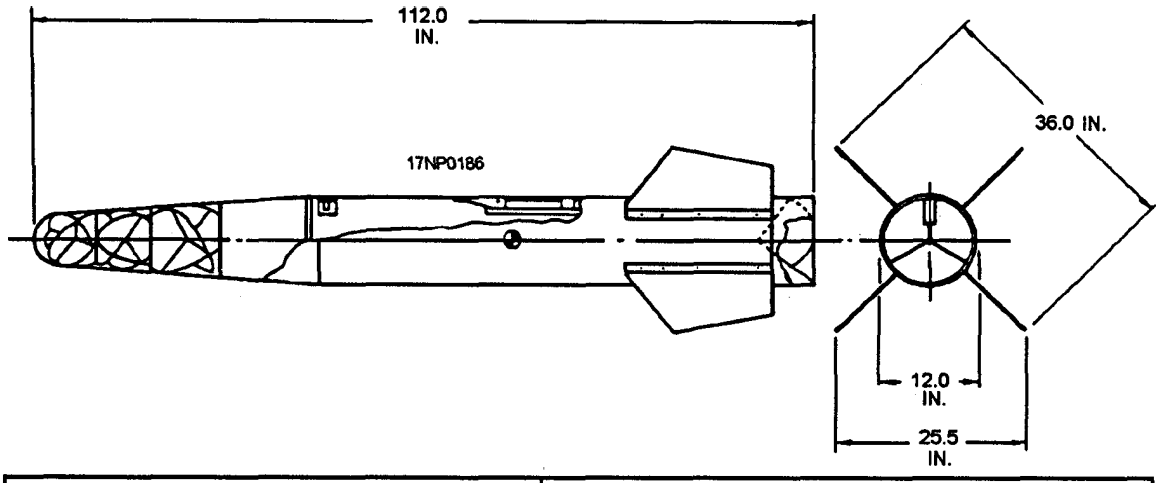
Q3. What type of target is an auxiliary aid for the radar fire control system in the attacking aircraft?

Q4. List the textile targets that are effective low-cost devices for air-to-air and surface-to-air gunnery training.



RADAR REFLECTIVITY	90% (AB), 0% (B)
SCORING	VISUAL HOLE COUNT
COLOR	WHITE, ORANGE BORDER AND BULL'S EYE
WEIGHT	23 POUNDS
MAXIMUM TOWING VELOCITY	250 KNOTS
TOW AIRCRAFT	A-4, T-2, A-6, F-4, F-14, A-7, F/A-18
AUGMENTATION	NONE

Figure 8-1.—Characteristics of the TDU-32A/B and TDU-32B/B aerial banner tow target.



ALTITUDE	35,000 FEET
WEIGHT	75 POUNDS
MAXIMUM TOWING VELOCITY	0.9 MACH
TOW AIRCRAFT	A-4, 1-6, F-4
AUGMENTATION	RADAR REFLECTIONS

Figure 8-2.—Characteristics of the TDU-34/A aerial tow target.

Q5. Describe the difference between the TDU-32A/B and TDU-32B/B targets.

Q6. What is the size of the TDU-32A/B?

Q7. Rigid tow targets are specifically designed to_____.

Q8. What tow target is a passive radar target that can be adapted to internally carry other payloads?

A/A47U-3A AND A/A47U-4 TOW TARGET REELING MACHINE-LAUNCHER SYSTEMS

The A/A47U-3A tow target reeling machine-launcher system (fig. 8-3) is an airborne weapons training system. It is used to tow aerial targets for gunnery and aircraft missile firing exercises. The system is a semiautomatic tow-reel and target-launching mechanism externally mounted on the aircraft.

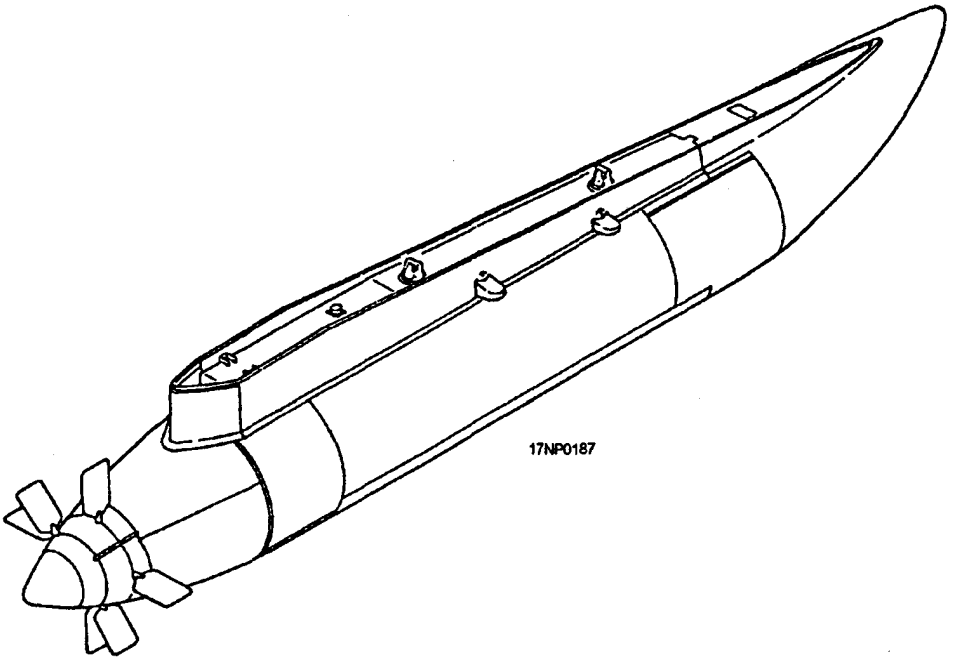


Figure 8-3.—A/A47U-3A tow target reeling machine-launcher system.

The A/A47U-3A system consists of an RMK-19 A/A47U-3 reeling machine launcher, a PEK-84/A47U-3 reeling machine-launcher control, and the applicable interconnection cable assemblies. The system uses saddle-mounted aerial targets from 7 to 12.5 inches in diameter that weigh up to 225 pounds. Target towlines, which have constant diameters or stepped diameters with combinations of monofilament and/or stranded wire, are used. The system operates with various towline splices, ranging in diameter up to 0.250 inch and with flexible lengths up to 106 inches. Typical towlines consist of 10,000 feet of 0.190-inch diameter 3 by 7 stranded steel cable (5,400-pound tensile strength) or 42,000 feet of 0.097-inch diameter 1 by 7 stranded steel cable (2,060-pound tensile strength). The reeling machine-launcher system has a nominal reeling speed capability of 3,500 feet of towline per minute. Adjusting the power unit blade angle limitations increases the speed to a maximum of 5,000 feet per minute.

The system is manually controlled by the operator, and it provides launcher up/down, brake on/off, and reel in/out functions. You can control target reeling and recovery speeds by manually adjusting the power unit blade angle. Operation of the system is controlled from the PEK, which is located in the cockpit of the launching aircraft.

The A/A47U-4 tow target reeling machine-launcher system is identical to the A/A74U-3A except for weight and size. The lighter weight and smaller size design of the A/A47U-4 was developed to adapt this towing system to a variety of aircraft.

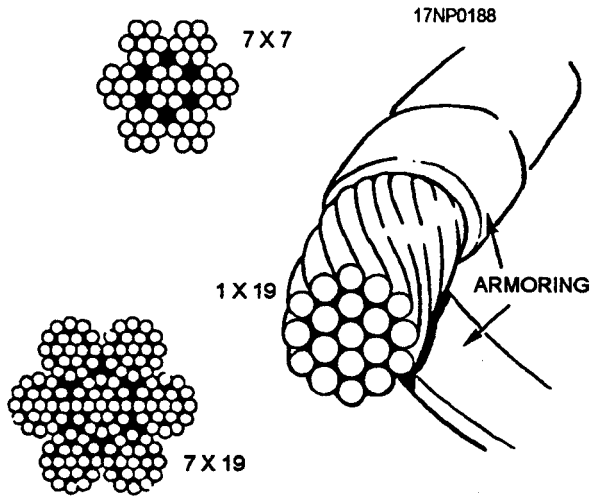


Figure 8-4.—Cross-sectional view of tow cables.

If you want more information on the A/A47U-3A tow target reeling machine-launcher system, refer to *Tow Target Reeling Machine-launcher System A/A47U-3A,* NAVAIR 28-10A-16.

TOW CABLES AND ASSOCIATED EQUIPMENT

Steel cables used in target towing are manufactured specifically for that purpose. Three of the several types of cables used are discussed here: the 3/32-inch, 7 by 7 cable; the 1/8-inch, 7 by 19 cable; and the 1/8-inch, 1 by 19 armored cable.

REVIEW NUMBER 1 ANSWERS TO QUESTIONS Q1. THROUGH Q8.

A1. The two basic classes of tow targets are the textile and rigid tow targets.

A2. Textile targets are made of woven synthetic fiber such as nylon.

A3. The rigid tow target is an auxiliary aid for the radar fire-control system in the attacking aircraft.

A4. The TDU-32A/B and TDU-32B/B textile targets are effective low-cost devices for air-to-air and surface-to-air gunnery training.

A5. The TDU-32B/B target is 90-percent radar reflective.

A6. The TDU-32A/B is 7 1/2 feet by 40 feet.

A7. Rigid tow targets are specifically designed to simulate high-speed aircraft.

A8. The TDU-34/A tow target is a passive radar target that can be adapted to internally carry other payloads.

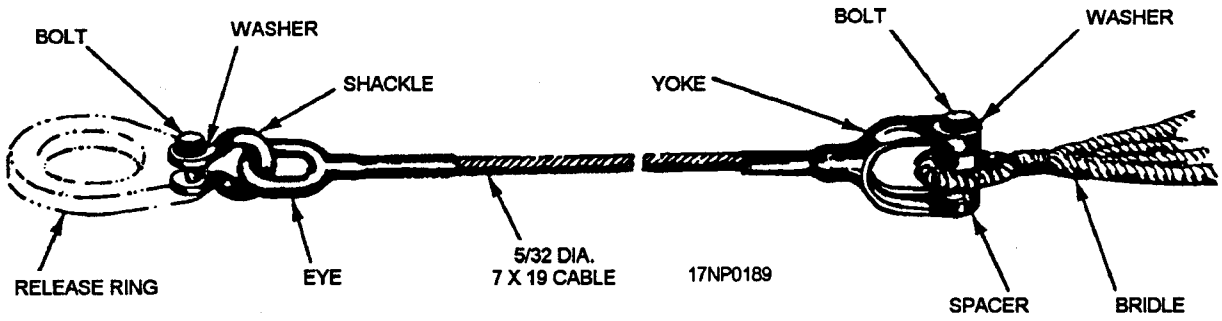


Figure 8-5.—Mk 1 target leader.

The 3/32-inch cable comes in 10,000-foot spools, has a minimum breaking strength of 920 pounds when new, and is 7 by 7 in construction. It consists of seven strands; each strand has seven wires, and is commonly referred to as 7 by 7. This cable weighs 1.5 pounds per 100 feet.

The 1/8-inch cable is shipped in either 11,500-to 12,500-foot spools or 7,000-to 7,500-foot spools. It has a minimum breaking strength of 2,000 pounds when new. It is 7 by 19 in construction (7 strands, 19 wires per strand) and weighs 2.9 pounds per 100 feet.

The 1/8-inch armored cable is shipped in spools. It has a minimum breaking strength of 2,160 pounds. It is constructed of one strand of 19 wires, with a flat armoring wire swaged spirally around the strand with a minimum of 6 turns per inch. The armored cable weighs 4 pounds per 100 feet. Cross-sectional views of these three cables are shown in figure 8-4.

These cables are not lubricated. The use of grease, oil, paraffin, or other lubricants on the cable is a fire hazard. An explosive vapor is created in the towing aircraft as the cable is reeled out at high speeds. Since the cables are not lubricated, they must be stored in a dry place, or cleaned and coated with corrosion-preventive compound according to instructions.

Continual use of a cable reduces its strength. Target towing subjects the cable to severe stress in addition to the damage caused by gunfire. You need to inspect cables frequently. The cable should be repaired or replaced if there are indications of fraying (broken wires), birdcaging (partial unwinding of the strands along the cable), or snarling (unwinding of the strands and wires at the end of the cable). Running a cloth along the cable will help you locate broken wires, as they will catch in the cloth. Never run your bare hand along the cable because the broken wires will catch in the flesh. Also, you should never use a knot to attach a target, since the knot weakens the cable by 50 percent or more. An eye splice is recommended for this purpose.

Mk 1 Target Leader

The Mk 1 target leader (fig. 8-5) is used to attach targets and target-release messengers to the release ring. In turn, the target ring is held by the Mk 7 Mod 4 target release. When the target is dropped, the leader and ring drop with it.

The leader is a 34-inch length of 5/32-inch diameter 7 by 19 steel cable swaged into a yoke at one end with an eye at the other end. To use the leader, you attach the bridle eye of the target to the yoke of the leader. Then, secure the eye end of the leader with a shackle to the release ring or snarl catcher that slides along the tow cable.

Mk 8 Target Release Ring

The Mk 8 target release ring (fig. 8-6) is made of case-hardened alloy steel and is about 3 inches long. The smaller eye is 1/2 inch in diameter, while the larger eye is 1 1/2 inches in diameter. You should attach the target leader to the smaller eye (securing eye). The larger loop (hole) slides along the cable, and is held by the target release when the target is towed with a reel.

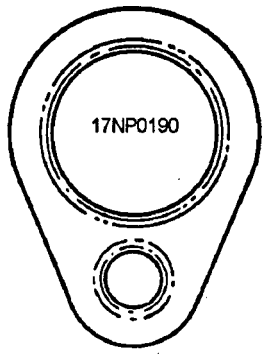


Figure 8-6.—Mk 8 target release ring.

Release rings are also used in drag takeoffs and container launchings. In container launchings, you should attach the ring directly to the towline, and then to the target-release device of the aircraft.

Klein "Chicago" Grip

The Klein "Chicago" grip (fig. 8-7) provides a means of transferring the target drag load from the reel to a structural member of the towing aircraft. This procedure is used to take the strain off the reel while the target is streamed.

The grip is a standard commercial item. It is about 10 inches long and composed of a series of spring-loaded linkages and a shackle. The jaws are opened by compressing the entire grip in line with the extended shackle. It will grip bare wires, solid or stranded, from 0.081 to 0.162 inch in diameter.

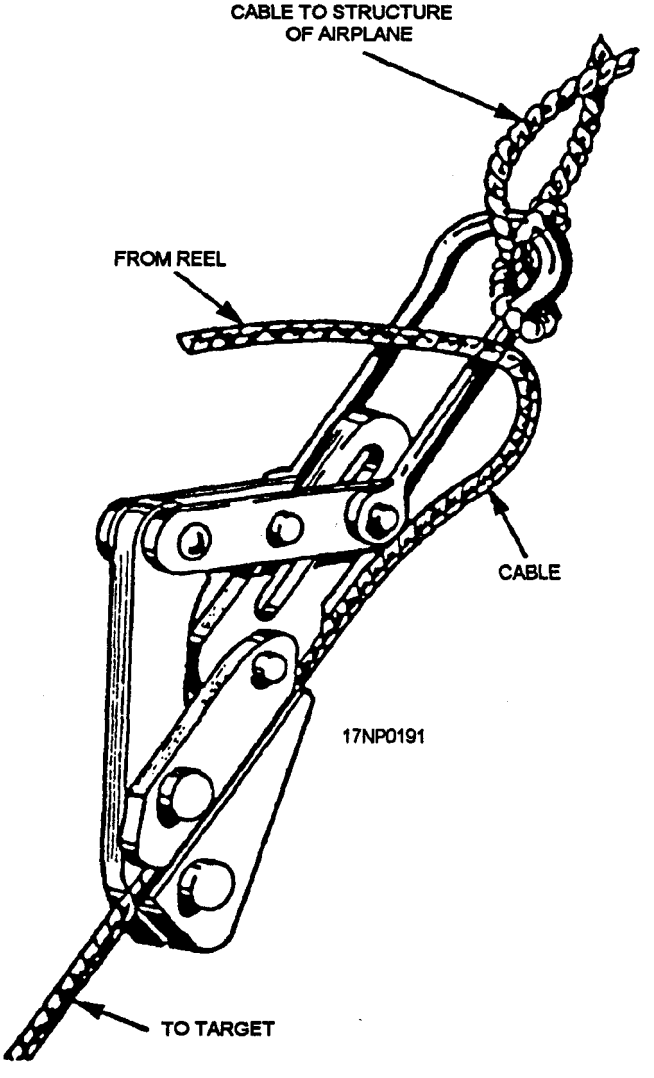


Figure 8-7.—Klein "Chicago" grip.

The grip is first secured by a cable to the aircraft's internal structure. Then, it is attached to the tow cable near the outrigger sheave. Slightly unwinding the reel transfers the load from the reel to the grip. The greater the drag load, the tighter the jaws grip the cable.

CAUTION

Do NOT apply loads greater than 1,500 pounds to the grip. It will accept cable with a much greater breaking strength than that of the grip itself. As a safety measure, set the reel brake while the grip is in use, keep the clutch in the IN position, and keep the slack in the tow cable between the grip and reel at a minimum.

REVIEW NUMBER 2

Q1. The one-way reel mounted in the center section of the tow-reel pod carries _____ *on its spool.*

Q2. List the components of the A/A47U-3A tow target launching system.

Q3. What is the major difference between the A/A47U-3A and A/A47U-4 tow target reeling machine-launcher systems?

Q4. List the types of steel cables used in target towing.

Q5. Why are cables frequently inspected?

Q6. The Mk 8 target release ring is made of _____.

Q7. What component provides a means of transferring the target drag load from the reel to a structural member of the towing aircraft?

Q8. What maximum load can be applied to the Klein "Chicago" grip?

AERIAL TARGETS

LEARNING OBJECTIVE: *Identify aerial targets to include the missile target, target drone, and target system.*

The Navy uses three aerial targets-the AQM-37C missile target, BQM-74C/E target drone, and BQM-34A/S and BQM-34E/T target system. A simplified discussion of aerial targets is presented in this section of the TRAMAN.

AQM-37C MISSILE TARGET

The AQM-37C missile target (fig. 8-8) is a realistic simulation of offensive missile and aircraft threats. It is used to conduct weapons systems evaluation, operationally train air-to-air missile crews, and exercise missile weapons systems. The AQM-37C missile target is an expendable, rocket-powered missile target capable of flying at various altitudes and cruise speeds. The target is designed for straight-and-level flight at selectable speeds from Mach 0.7 to Mach 4.0 at cruise altitudes of 1,000 to 100,000 feet, with a maximum range of approximately 155 nautical miles.

The AQM-37C is an air-launched target. It is launched from both carrier- and land-based aircraft. The launcher carries the target as an external store. The target's mission profile is determined by launch altitude, speed, and heading. This profile has controlled rocket engine thrust, cruise altitudes, and flight time parameters preset by ground crew personnel before flight.

The target is equipped with a gyro-referenced autopilot, radar augmentation, infrared augmentation, antennas, and an aerodynamic destruct system for flight termination. It is powered by the LR-64 liquid propellant rocket engine, which is a self-contained

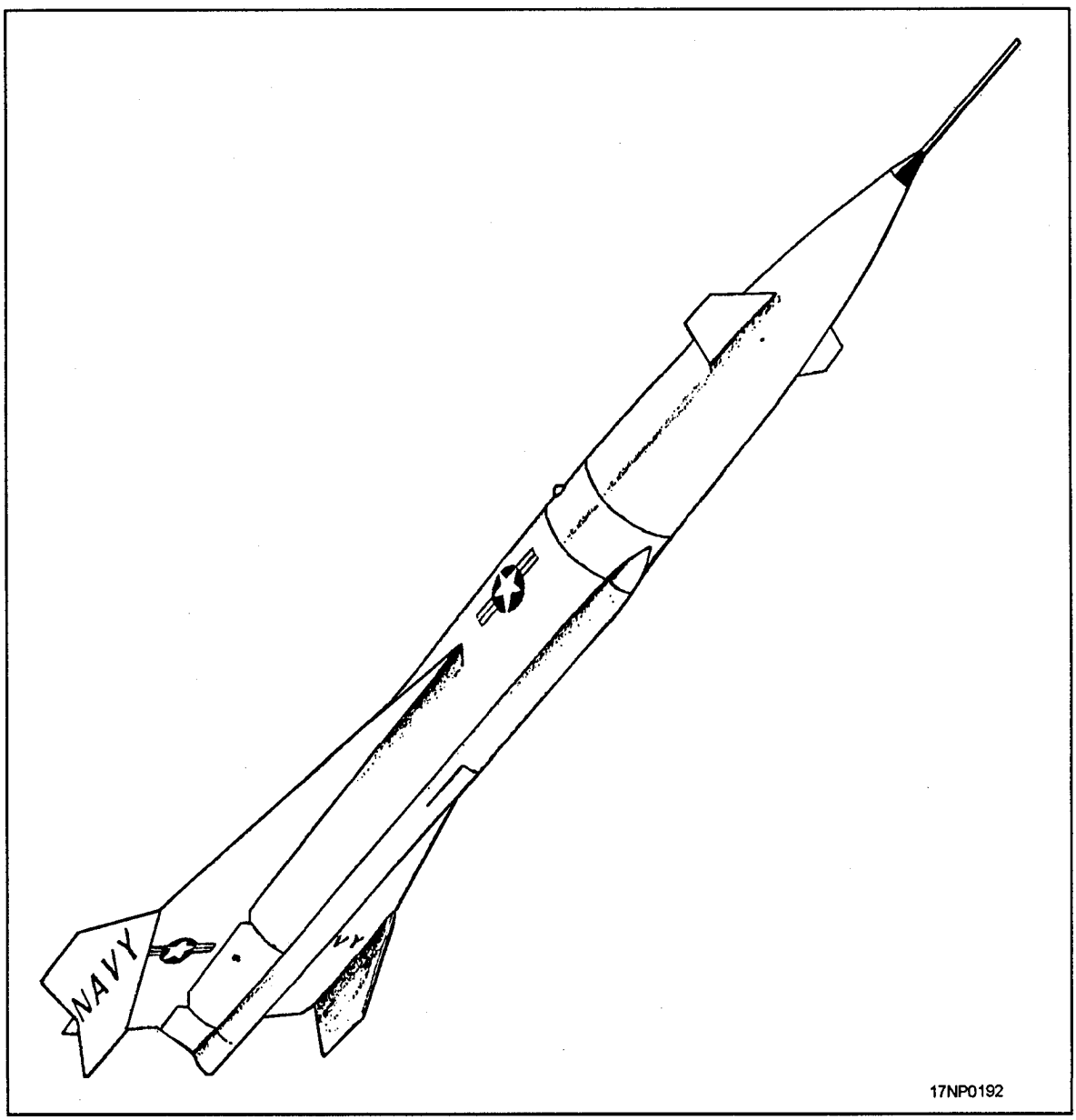


Figure 8-8.—AQM-37C missile target.

propulsion system. The maximum weight of the target, including radar augmentation, IR flare, and scorer, is 559 pounds.

Scoring System

The AQM-37C missile target contains the antennas and necessary interconnecting cables for the installation of the AN/DRQ-4 transponder. The primary purpose of the transponder is to receive a frequency-modulated signal from the missile, convert the signal to a new center frequency-modulated signal, and transmit the new signal to the miss-distance measuring system ground station.

The ground station receiver compares the shifted frequency of the target signal with the reference frequency of the strike missile signal. The outputs from the ground station accurately measure the miss distance between the target and the missile. The transponder is installed only in a target that is used for a surface-to-air missile with a telemetering head. The transponder is not used in an air-to-air weapons system. Only one telemetering missile at a time should be shot at a target. After the first missile has destructed, a second shot may be attempted if the target was not destroyed.

Aerodynamic Destruct System

The AQM-37C missile target's aerodynamic destruct system causes the target to enter a spiral dive to impact. This prevents the target from becoming a hazard to other aircraft or impacting the ground in undesired areas. The destruct system is activated by any one of four conditions:

1. Flight timer setting (ground adjustable at 2-minute intervals after 4 minutes of flight time have elapsed)

2. Off-course flight (more than 10-degree heading deviation) for a period of 30 seconds or longer

3. Loss of electrical power or low-battery voltage

4. 12.5 seconds after jettison from the launching aircraft

For further details concerning the AQM-37C missile target, you should refer to *Manual Operational Mission Planning Guide for Navy Model AQM-37C Missile Target,* NAVAIR 01-90TBA-1T. Procedures for loading/unloading of the AQM-37C are contained in the appropriate aircraft airborne weapons/stores loading manual.

BQM-74C/E TARGET DRONE

The BQM-74C/E target drone (fig. 8-9) is a high midwing monoplane of conventional design with an inverted-Y empennage. The airframe is a modified monocoque structure made of aluminum alloy and

REVIEW NUMBER 2 ANSWERS TO QUESTIONS Q1. THROUGH Q8.

A1. The one-way reel mounted in the center section of the tow reel pod carries 2,000 feet of 3/16-inch cable or 5,000 feet of 1/8-inch cable on its spool.

A2. The A/A47U-3A tow target launching system consists of an RMK-19A/A47U-3 reeling machine launcher, a PEK-84/A47U-3 reeling machine launcher control, and applicable interconnecting cable assemblies.

A3. The major difference between the A/A47U-3A and A/A47U-4 tow target reeling machine-launcher systems is their weight and size.

A4. The types of steel cables used in target towing are 3/32-inch, 7 by 7 cable; 1/8-inch, 7 by 19 cable; and 1/8-inch, 1 by 19 armored cable.

A5. *Cables are frequently inspected because continual use reduces its strength.*

A6. *The Mk 8 target release ring is made of case-hardened steel alloy.*

A7. *The Klein "Chicago" grip provides a means of transferring the target drag load from the reel to a structural member of the towing aircraft.*

A8. The maximum load that can be applied to the Klein "Chicago" grip is 15,000 pounds.

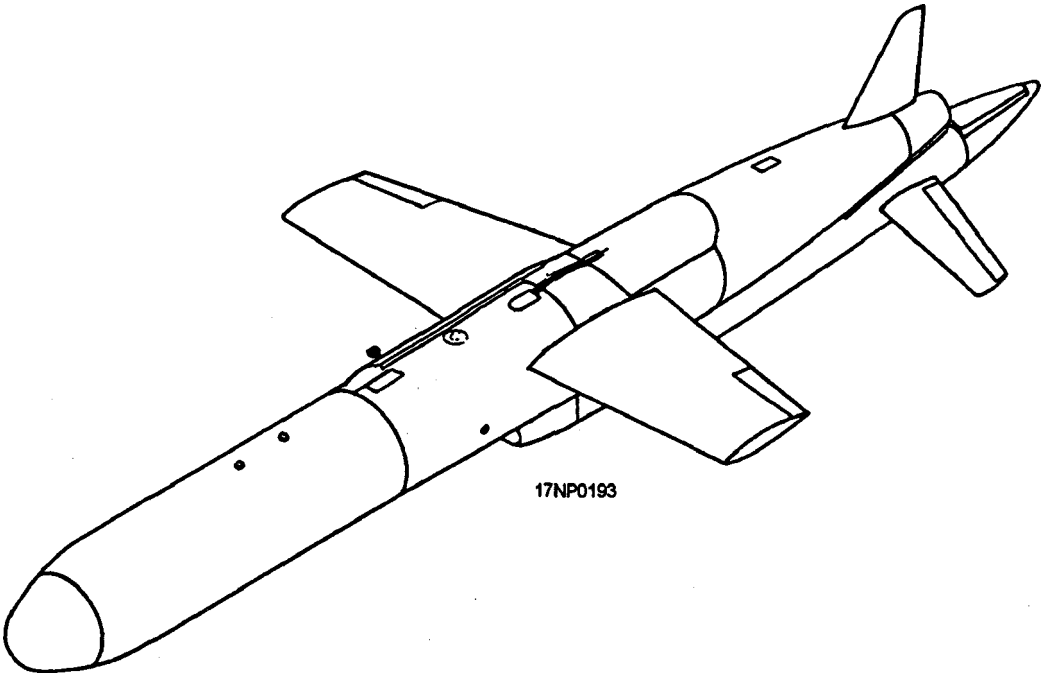


Figure 8-9.—BQM-74C/E target drone.

reinforced fiber glass construction. There is a vertical rack in the target nose section for mounting equipment. Equipment is mounted on both sides of the rack for convenient equipment removal, installation, and checkout. The target is powered by a YJ400-WR-403 variable speed, turbojet engine, which produces a minimum of 190 pounds (240 pounds of thrust E model) of static thrust at sea level. The 16.2-gallon fuel tank is mounted in the fuselage center section.

The BQM-74C/E target drone is air launched from either the A-6E or TA-4J aircraft. The target can be surface launched from the ground or a ship. The target flight path is remote controlled by radio commands. Target stabilization is maintained by a gravity-erected, two-axis, vertical displacement gyroscope. The target is equipped with a parachute recovery subsystem and an active flotation subsystem. After water entry, these subsystems keep the target afloat for a minimum of 24 hours. The target has retrieval attachments that are compatible with shipboard or helicopter retrieval equipment.

When the basic BQM-74C/E target drone is configured for mobile sea range (MSR) and on-range target (ORT) operations, specific mission-peculiar equipment is added. The mission-peculiar equipment and installation and checkout procedures are listed in *Maintenance Manual Instructions,* NAVAIR 01-BQM-74C-2-1. For further information concerning the basic BQM-74C/E target drone, you should refer to *Maintenance Instructions Target Drone Navy Model BQM-74C/E,* NAVAIR 01-BQM-74C-2-2.

BQM-34A/S TARGET SYSTEM

The BQM-34A/S target system (fig. 8-10) is a recoverable, jet-powered target with a service ceiling of

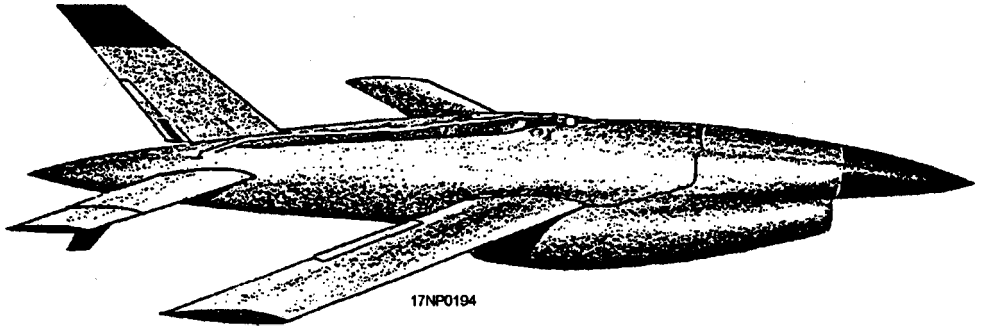


Figure 8-10.—BQM-3A/S target system.

50,000 feet and a maximum speed of 600 knots. Unlike the AQM-37C, this target requires extensive support equipment and preparation before launching.

BQM-34E/T MISSILE TARGET

The BQM-34E/T missile target is a remotely controlled supersonic, recoverable target capable of speeds up to Mach 1.7 and altitudes of up to near 60,000 feet. It is propelled by a Y-69 turbojet engine and is capable of performing preset maneuvers up to 5 G.

Mk 28 Mod 3

This target flare is used to provide an infrared source on the BQM-74C/E target during missile firings.

Mk 37 Mod 0

This target flare is used to provide an infrared source on the missile target to enhance survivability of the target during missile firings.

REVIEW NUMBER 3

Q1. List the three aerial targets used by the Navy.

Q2. The AQM-37C has a speed range between _____.

Q3. What means is used to launch the AQM-37C?

Q4. What propellant is used in the self-contained propulsion system of the AQM-37C?

Q5. What is the purpose of the aerodynamic destruct system of the AQM-37C?

Q6. The BQM-74C/E is powered by a _____.

Q7. What aircraft are used to launch the BQM-74C/E target drone?

Q8. What is the maximum speed of the BQM-34A/S target system?

AIR-LAUNCHED DECOY

LEARNING OBJECTIVE: *Identify the purpose and use of the air-launched decoy.*

Air-launched decoys are air-launched vehicles whose purpose is to minimize, nullify, or confuse enemy air defense systems.

The tactical air-launched decoy (TALD) (fig. 8-11) is a nonpowered, air-launched, aerodynamic vehicle. The TALD provides false imagery to defense acquisition systems by using chaff/electromagnetic and radar signature augmentation. There are three TALD vehicles: A/B37U-1(V)1, chaff vehicle; A/B37U-1(V)2, RF vehicle; and ADM-141 A, RF vehicle. TALD vehicles are loaded on multiple or triple ejector racks (IMER/ITER/BRU-41/BRU-42). The TALD (fig. 8-12) consists of a nose cone, left and right antenna/wing assemblies, an empennage, a vertical stabilizer, left and right stabilizer, a vertical fin, a flight computer, a pilot battery, and a main battery.

RECORD KEEPING AND REPORTING

LEARNING OBJECTIVE: *Identify the purpose and use of target logbooks, aerial target expenditure reports, and target performance reports.*

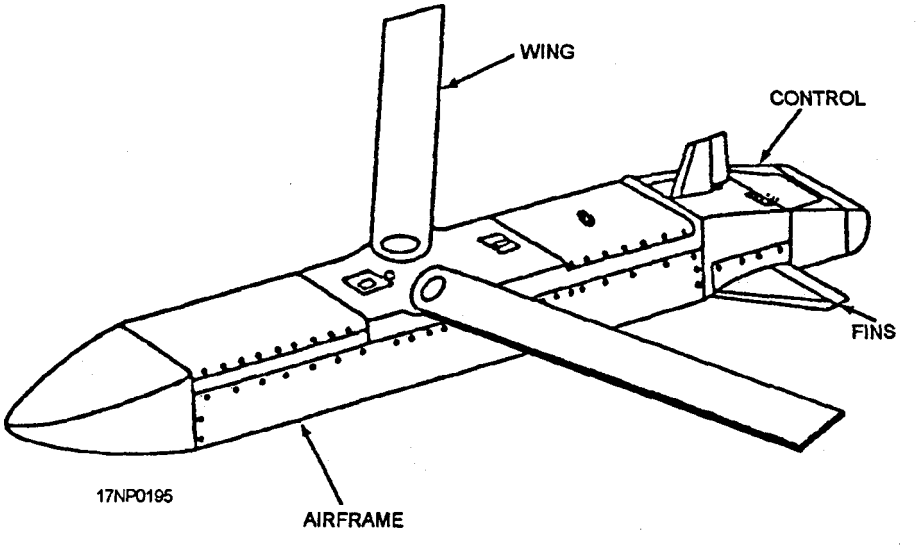


Figure 8-11.—Typical tactical air-launched decoy (TALD).

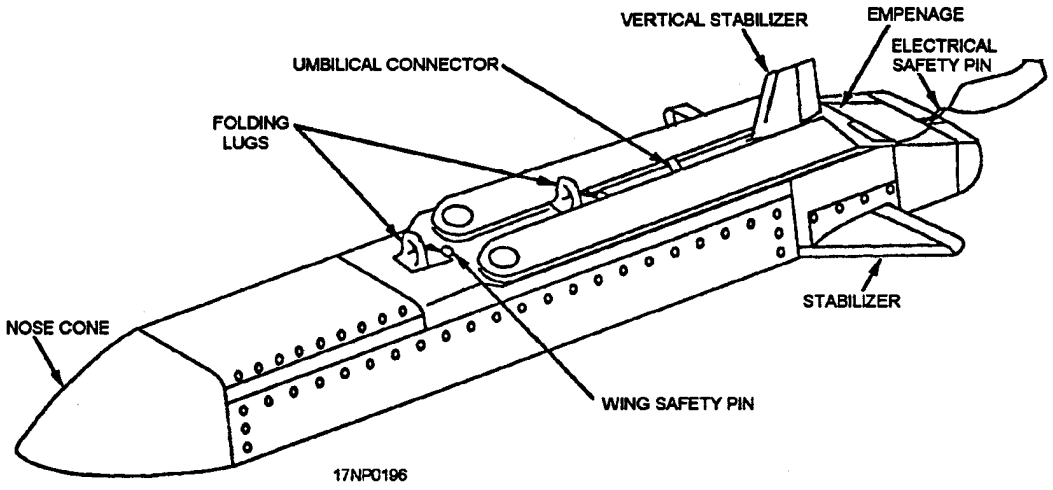


Figure 8-12.—Typical tactical air-launched decoy (TALD) component locations.

Maintenance performed on targets is based on the concept that maintenance should be performed at the lowest maintenance level capable of performing the work, AU maintenance is performed in accordance with approved NAVAIRSYSCOM maintenance plans, maintenance instruction manuals, and maintenance requirements cards.

Organizational maintenance activities are responsible for maintaining target logbooks, target discrepancy books, target performance reports, and the Visual Information Display System/Maintenance Action Forms (VIDS/MAFs).

TARGET LOGBOOKS

Logbooks are maintained for each target, and are the administrative means of providing managers with target age, status, operational history, modification, configuration, and transfer and receiving data. This information is maintained throughout the target's life cycle. Refer to Volume II of OPNAVINST 8600.2B for a list of all applicable publications for target systems.

TARGET DISCREPANCY BOOK

The Target Discrepancy Book, maintained by maintenance control, for each target assigned is setup by target serial number, which must accurately reflect the status of all pending maintenance requirements as shown on the maintenance control and work center VIDS board. Discrepancy books are not maintained on tow banners and tow lines. Flight records on target drones are separated by the Aircraft Inspection and Acceptance Record, OPNAV 4790/141 (fig. 8-13).

AIRCRAT INSPECTION AND ACCEPTANCE RECORD — OPNAVINST 4790.2D

1. A/C BU/SER NO.	2. T/M/S	3. RPT. CUST.	4. OXY	5. FUEL		6. OIL					7. DATE
				GRADE	QTY	GRADE	1	2	3	4	

8. ORDNANCE/SPECIAL EQUIPMENT/LIMITATIONS/REMARKS	9. I have personally inspected this aircraft IAW the applicable MRCs/checklists. Any discrepancies noted have been entered on OPNAV Form 4790/38.
SAMPLE	SIGNATURE OF PLANE CAPTAIN — RANK/RATE
	10. Certification of safe for flight condition by the MO, MMCO, or MCO. Other persons may sign this for if authorized.
	SIGNATURE — RANK/RATE
	11. I have inspected the last____discrepancy reports, insure proper filing of weight and balance data and accept this aircraft for flight.
	SIGNATURE OF PILOT IN COMMAND — RANK/RATE

OPNAV 4790/141 (REV. 2-86) REPLACES OPNAV 3760/2D WHICH MAY BE USED UNTIL SUPPLIES ARE EXHAUSTED S/N 0107-LF-047-9706

17NP0197

Figure 8-13.—Aircraft Inspection and Acceptance Record.

TARGET PERFORMANCE REPORTS

The information contained on a Target Performance Report targets performance, and is consolidated into an automated data base for Navywide use. Target performance data is submitted on OPNAV 8600/15 (fig. 8-14).

TARGET EXPENDITURE REPORTING

Target operating activities are required to transmit a message report (fig. 8-15) within 24 hours of target loss listing target, serial number, calendar date, activity charged, weapons system used. All aerial towed targets (TDU-32, TDU-34, etc.) maybe transmitted weelky. Reports must be timely and accurate because they are used to determine allocations for the current fiscal year and out years.

SAFETY PRECAUTIONS

LEARNING OBJECTIVE: *Identify safety precautions to follow when working with aerial targets and associated equipment.*

There are many safety precautions associated with the target towing service. Some of these safety precautions are discussed as follows:

- Preservatives and lubricants may NOT be used on tow cables. Friction caused by high-speed reeling-out generates heat. This heat can generate explosive vapors from the lubricants in the tow compartment.

- A cable should be uncoiled by standing the coil on its edge, holding the end, and unrolling the coil. Do NOT attempt to take cable from either a coil or roll by pulling the cable when the coil or roll is lying flat. The cable will snarl and kink,

- When you cut nylon towline, the ends have to be bound. Otherwise, apply enough heat to the cut ends to melt the nylon. This prevents raveling.

- Safety tow webbing must be used between the target and the end of the towline. When the pilot shoots off the towline, this webbing can prevent it from becoming tangled in the target. Multistrand safety webbings (100 feet long) are used with banner targets.

- The snarl catcher must NOT be used during air-to-air gunnery exercises. It may clamp on the towline before it reaches the end of the cable. This means there will be a long, free section of the cable whipping about behind the target.

- All personnel involved in target towing operations must know the standard hand signals for controlling aircraft on the ground.

- Perform a preflight inspection of all tow equipment.

REVIEW NUMBER 3 ANSWERS TO QUESTIONS Q1. THROUGH Q8.

A1. The three aerial targets used by the Navy are the AQM-37C, BQM-74C, and BQM-34/S.

A2. The AQM-37C has a speed range between Mach 0.7 and Mach 4.0.

A3. The AQM-37C is an air-launched target.

A4. LR-64 liquid propellant is used in the self-contained propulsion system of the AQM-37C.

A5. The aerodynamic destruct system of the AQM-37C is used to prevent the target from becoming a hazard to other aircraft and from impacting the ground in undesired areas.

A6. The BQM-74C/E is powered by a YJ400-WR-402 variable speed, turbojet engine.

A7. The A-6E and TA-4J aircraft are used to launch the BQM-74C/E target drone.

A8. The maximum speed of the BQM-34A/S target system is 600 knots.

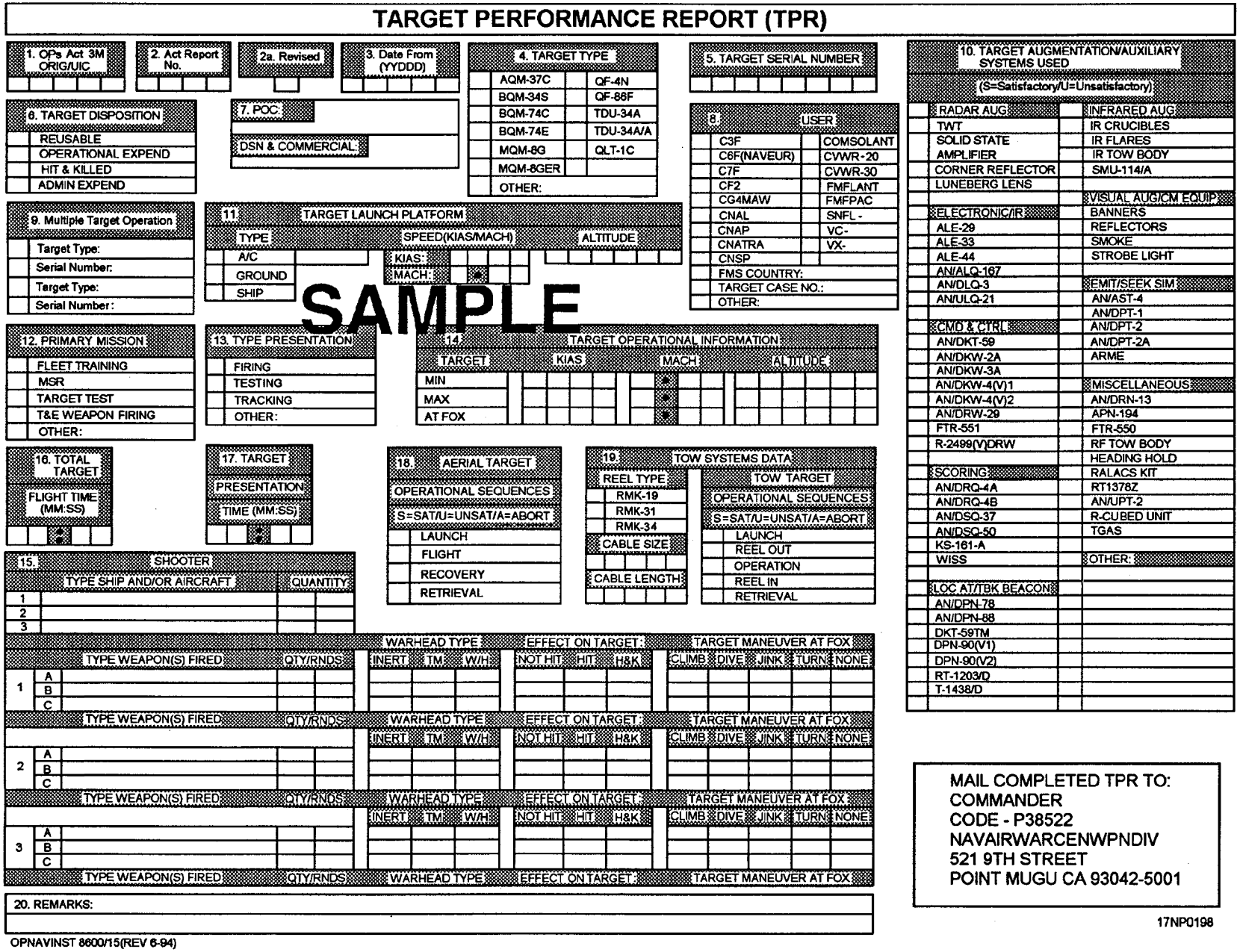


Figure 8-14.—Target Performance Report.

FM ACTIVITY

TO COMNAVAIRWARCENWPNDIV POINT MUGU CA//P3855//

INFO TYCOM//AIRLANT//AIRPAC//
PEOCMPANDUAV WASHINGTON DC//PMA-208//
CDM CHARGED//

BT
UNCLAS //N08840//

SUBJ: AERIAL TARGET EXPENDITURE REPORT//

MSGID/GENADMIN/

REF/A/DOC/OPNAVINST 3110.18S
REF/B/DOC/OPNAVINST 8600.2B

NARR/REF A IS OPNAVINST 3110.18S. REF B IS OPNAVINST 8600.2B TARGET EXPENDITURE REPORTING REQUIREMENTS//

POC/ / /DSN /TEL: //

RMKS/1. FOL AERIAL TARGETS EXPENDED IS REPORTED IAW REFS A AND B

TGT TYPE	SER NBR	DATE	CMD CHARGED	WEAPONS SYS
BQM-74C	123456	10 FEB 93	CNAL	HIT & KILLED 76MM

BT

17NP0199

Figure 8-15.—Aerial Target Expenditure Report.

- Make sure you are clear of the cable when launching a target.

- Do NOT wear loose clothing when operating rewind equipment. Keep your hands clear of moving parts when the equipment is in operation.

- Observe RADHAZ precautions when working with cable-cutting cartridges and tracking flares.

- Exercise caution when it is necessary to work in close proximity of pneumatic, hydraulic, spring, or cartridge-operated components.

CHAPTER 9

AMMUNITION HANDLING EQUIPMENT

How you handle aviation ammunition depends on the time, place, and situation. The ammunition and explosives handling task is hazardous. Equipment is designed so you can safely handle ammunition in any given situation. This includes railroad, industrial, and automotive equipment used for transporting ammunition. It also includes equipment used to manually handle ammunition, such as skids, pallets, carriers, and aircraft loading equipment.

Often, the equipment you use to handle ammunition afloat and ashore is the same. However, differences in stowage accommodations, fixed installations, working areas, and space limitations require the use of equipment and techniques especially designed for the job. Regardless of the situation, only use the equipment designed for a particular task and approved by NAVSEASYSCOM or NAVAIRSYSCOM.

You can identify the command that has control over a particular item of ammunition handling equipment by the item designation. If the item is identified by Mark and Mod number designations, NAVSEASYSCOM controls it. If the item is identified by designations, such as Aero, ADU, ADK, and HLK, NAVAIRSYSCOM controls it.

The number and availability of different ammunition handling equipment configuratiom are extremely large. The equipment that is routinely used by most of the operating units (ashore and afloat) is discussed in the following paragraphs. You can find a complete listing and description of approved handling equipment in *Approved Handling Equipment for Weapons and Explosives,* NAVSEA OP 2173, Volume 1 (NAVAIR 19-100-1.1) and Volume 2 (NAVAIR 19-100-1.2).

ARMAMENT WEAPONS SUPPORT EQUIPMENT

LEARNING OBJECTIVE: *Identify the categories and subcategories of armament weapons support equipment.*

Armament weapons support equipment (AWSE) is support equipment required on the ground. The AWSE is classified as either common or peculiar and maybe avionics or nonavionics. There are three subcategories (fig. 9-1), armament support equipment (ASE), weapons support equipment (WSE), and logistics support equipment (LSE).

ARMAMENT SUPPORT EQUIPMENT

The ASE includes all equipment whose primary function is to support the installed aircraft systems and is used primarily by an aircraft intermediate maintenance department or squadron.

Armament Handling Equipment includes special tools used to support the aircraft in providing handling, movement, installation, configuration, arming, loading and downloading of air-launched weapons, airborne armament systems, or weapon related components. Armament handling equipment includes bomb hoists, single hoist loading systems, weapon loaders, boresights, and special tools used to remove, replace, repair, test, assemble, or service aircraft bomb racks, missile launchers, installed machine guns, or gun pod units.

WEAPONS SUPPORT EQUIPMENT

The WSE includes all equipment whose primary function is to support explosive ordnance components or weapons. The WSE is divided into two categories, weapons handling equipment and weapons test equipment.

Weapons Handling Equipment includes both peculiar and common ordnance handling and transportation equipment, as well as tools used for canning and decanning, magazine handling, and assembly of weapons or ordnance-related commodities. The WSE includes hoisting beams, weapons carriers, strongbacks, handlift trucks, weapon skids, trailers, bomb trucks (nonself-powered), and their associated weapons assembly tables, maintenance stands, and other weapon-related equipment. The WSE supports both air- and surface-launched weapons.

LOGISTICS SUPPORT EQUIPMENT

The LSE consists of equipment used for packaging, bulk handling storage, or stowage and transportation of

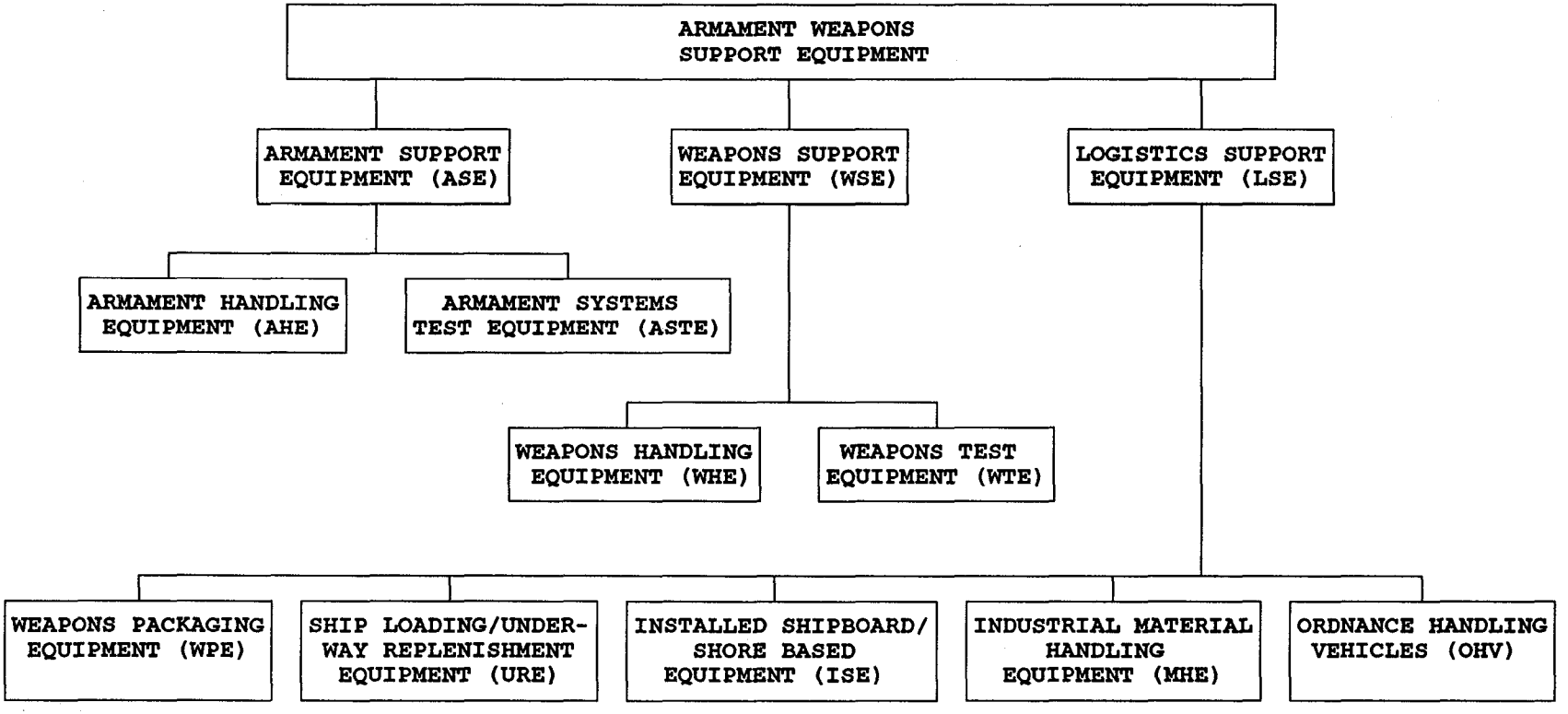


Figure 9-1.-Armament weapons support equipment breakdown.

weapons and weapon components within the weapon logistics cycle. LSE includes weapons packaging equipment ship loading or underway replenishment equipment, installed shipboard or shore-based equipment, and industrial materials handling equipment.

Weapons Packaging Equipment consists of missile containers, pallets, boxes, and fleet-issue unit loads that contain ordnance and ancillary equipment,

Ship Loading and Underway Replenishment Equipment consists of connected replenishment slings, vertical replenishment pole pendants, spreader bars, beams, missile transfer dollies, etc.

Installed Shipboard or Shore-Based Equipment includes dunnaging, C-grabs, birail or monorail hoist, tie-downs, davits, bomb elevators, conveyors, and other fixed or moveable handling equipment.

Industrial Material Handling Equipment includes forklifts, warehouse tractors, pallet trucks, platform trucks, etc.

PALLETS

LEARNING OBJECTIVE: *Identify the purpose and use of pallets to include safe loads.*

A pallet is a wood or metal platform used to stack material for movement from one area to another. You use pallets to store and handle bombs, cartridge tanks, projectiles, rocket containers, rocket heads, rocket motors, and unit loads. When live ammunition and explosives are involved, use metal pallets. Metal pallets are more durable than wood pallets, are not subject to warping, and do not present a fire hazard,

STANDARD FOUR-WAY WOOD PALLET

The standard four-way pallet (fig. 9-2) is a nine-post wood pallet that provides four-way entry for forklift and pallet trucks. The wings (overhang) at each end allow

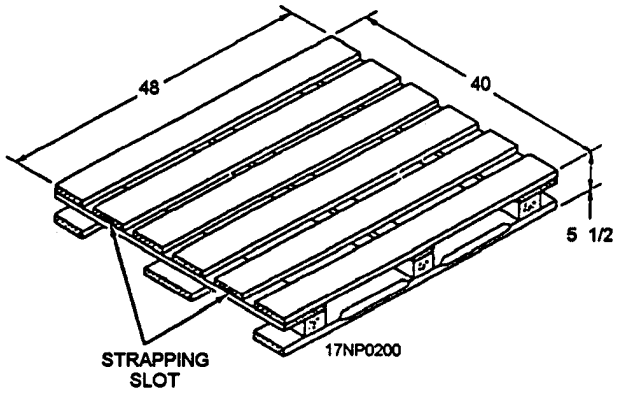


Figure 9-2.—Standard four-way pallet.

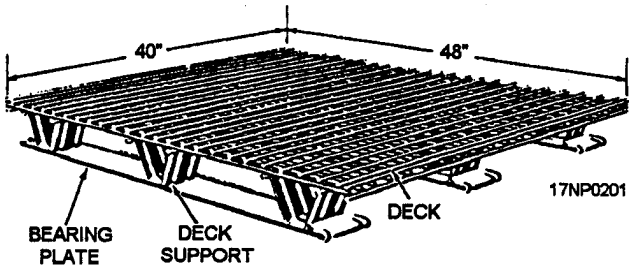


Figure 9-3.—Mk 3 Mod 0 pallet.

sling installations. The slots in the two top-deck members are used to install steel strapping, which provides load restraint. The pallet measures 48 inches in length and 40 inches in width. It has a safe working load (SWL) of 4,000 pounds. It is a general-purpose pallet used primarily for shipment of domestic unit loads of ordnance.

MK 3 MOD 0 PALLET

The Mk 3 Mod 0 pallet (fig. 9-3) is a steel wire weldment. The deck is made of steel wire, formed into a grid pattern of 2-inch squares, and is welded to the deck supports. Nine steel deck supports are welded to the bearing plates and to the deck. The complete pallet is galvanized. The pallet measures 48 inches in length and 40 inches in width. It has an SWL of 4,000 pounds.

The Mk 3 Mod 0 pallet is a general-purpose, four-way pallet used to handle unit loads aboard ship and at shore stations. A forklift or pallet truck is used to transport and stack loads. It is also used to hoist loads by using pallet slings. The Mk 3 Mod 0 pallet is used for fleet issue unit loads.

MK 12 MOD 1 PALLET

The Mk 12 Mod 1 pallet (fig. 9-4) is a steel wire and formed sheet steel weldment. It consists of a deck, supports, and runners. The deck is made of steel wire bent and assembled into a grid pattern of 2.5-inch

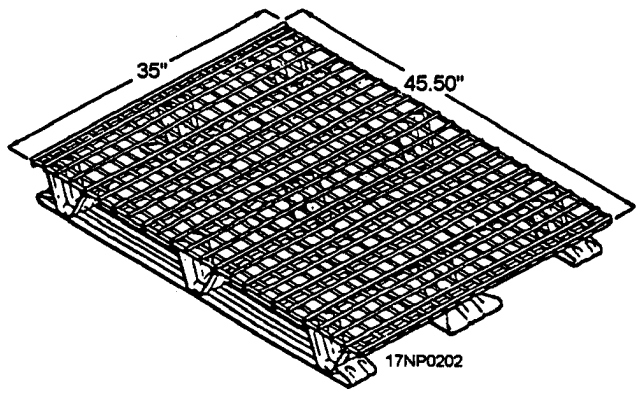


Figure 9-4.—Mk 12 Mod 1 material handling pallet.

squares. The deck is welded to supports and runners. Steel edge strips protect the wire endings. The pallet measures 45.5 inches in length and 35 inches in width. It has an SWL of 4,000 pounds.

The Mk 12 Mod 1 pallet is a four-way pallet used to palletize weapon components and containers for storage, handling, and shipping. This pallet is used to transport and stack loads, by using a forklift or pallet truck, and to hoist loads by using pallet slings. The Mk 12 Mod 1 pallet is used for fleet issue unit loads.

AMMUNITION PALLET CRATE

The ammunition pallet crate (fig. 9-5) comes in three sizes. It consists of a steel four-way pallet on which steel wire sides and ends are attached to form an open-top container. One end of the pallet crate is removable. A hinge is located in the center so the top half folds down over the lower half for loading and unloading operations. Twelve locks secure the sides and ends, and four lifting eyes allow it to be used with hooks on appropriate slings. The deck supports are designed for stacking.

The ammunition pallet crate is used at naval shore activities to handle loose ammunition and inert items during on-station handling and transportation. This pallet is particularly useful in combatant ship loadouts or offloads at dockside or anchorage where palletization is either impractical or inefficient. Projectiles, cartridges, and powder tanks up to 6 inches in diameter, boxed ammunition, and various inert loads are typical of the items handled with this pallet crate.

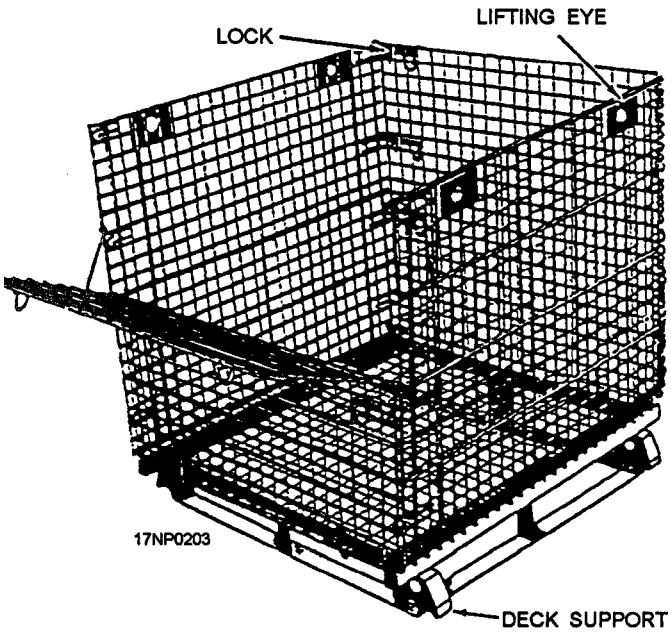


Figure 9-5.—Ammunition pallet crate.

REVIEW NUMBER 1

Q1. For a complete listing and description of approved handling equipment, you should look in _____.

Q2. What is the general purpose of the standard, four-way, wood pallet?

Q3. What is the safe working load (SWL) of the Mk 3 Mod 0 and Mk 12 Mod 2 pallets?

Q4. What is the purpose of ammunition pallet crates?

CARRIERS

LEARNING OBJECTIVE: *Identify weapons carriers and recognize their purpose and use.*

Carriers are a quick and safe means of attaching a crane cable or other hoisting device to ammunition for movement from one area to another. Some carriers are designed for horizontal lifting and some for vertical lifting. Others are used for both horizontal and vertical lifting. Vertical carriers are used for surface-employed ammunition; therefore, only horizontal carriers are discussed in the following paragraphs.

MK 43 MOD 1 WEAPONS CARRIER

The Mk 43 Mod 1 weapons carrier (fig. 9-6) is made of a 5/8-inch steel plate with two safety hooks attached by shackles. The carrier has two sets of holes for attaching the safety hooks, one set spaced at 16 7/8 inches and the other at 14 inches. It is used in conjunction with two Mk 49 Mod 1 weapons carriers to lift Mk 82 bombs (500 pounds) in tandem off different skids and trailers.

MK 49 MOD 1 WEAPONS CARRIER

The Mk 49 Mod 1 weapons carrier (fig. 9-7) is constructed of two steel plates welded together, It has four hoisting points and two attaching studs. A fixed stud at the B end of the strongback is engaged in one of the weapon suspension lugs. Then, the pivoting stud at the A end is engaged in the remaining lug and locked in place with a quick-release pin. The Mk 49 Mod 1 weapons carrier is used for horizontal lifting of weapons

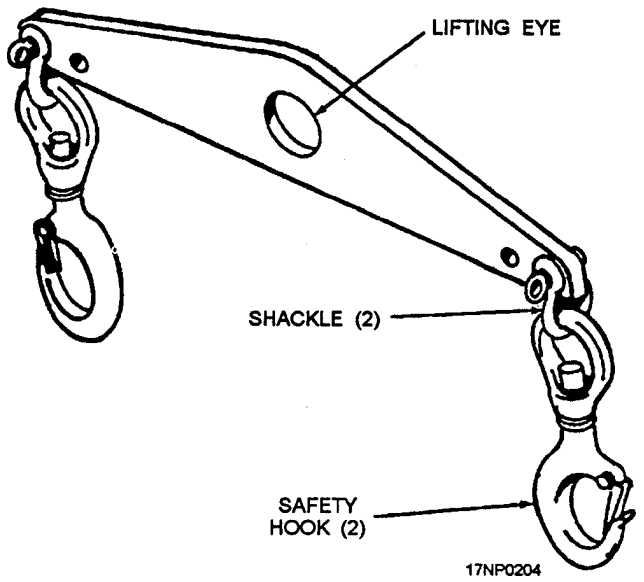


Figure 9-6.—Mk 43 Mod 1 weapons carrier.

with 14-inch suspension lugs, and it has an SWL of 2,500 pounds.

MK 51 MOD 1 WEAPONS CARRIER

The Mk 51 Mod 1 weapons carrier (fig. 9-8) is an aluminum channel that is plate-carrier fitted with two steel hooks. A fixed position hook with a spring-loaded pinned latch is located at the aft end of the carrier. The forward hook is adjustable to let you attach the carrier to weapons or stores with 14- or 30-inch suspension lugs. The forward hook is held in place by a quick-release pin. Eight lifting eyes allow you to handle weapons with different centers of gravity.

Before you attach the carrier to the load, put the adjustable hook in the appropriate suspension placement hole, which is held in place by a quick-release

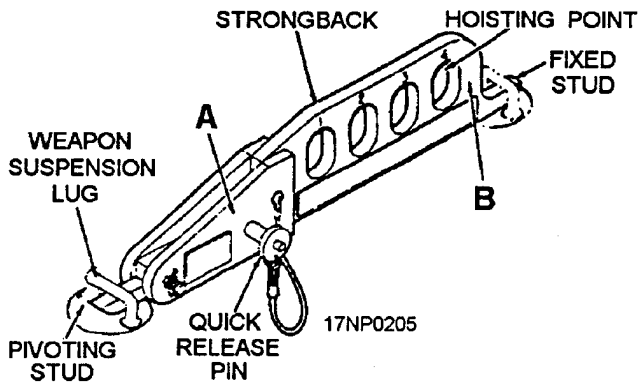


Figure 9-7.—Mk 49 Mod 1 weapons carrier.

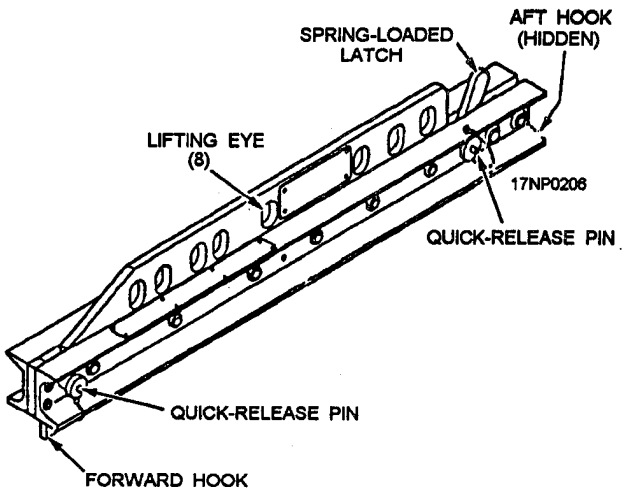


Figure 9-8.—Mk 51 Mod 1 weapons carrier.

pin. With the spring-loaded latch unpinned and depressed, the carrier hooks are engaged with the weapon lugs, Release the spring-loaded latch and pin the latch in place with a quick-release pin to secure the load An instruction plate, mounted on the carrier, makes it easer for you to match the correct lifting eye to the load. The Mk 51 Mod 1 weapons carrier is used for horizontal lifting. It has an SWL of 4,000 pounds.

REVIEW NUMBER 2

Q1. What is the purpose of a carrier?

Q2. *The Mk 49 Mod 1 weapons carrier is constructed of* _____ .

Q3. The Mk 49 Mod 1 and Mk 51 Mod 1 weapons carriers are used to _____ .

Q4. *What is the SWL of the Mk 51 Mod 1 weapons carrier?*

STANDS

LEARNING OBJECTIVE: *Recognize the purpose and use of stands to include the A/E32M-4 maintenance and reconfiguration stand, the A/F 32K-1/1A bomb assembly stand, and the A/F32K-10 small bomb assembly platform stand.*

Stands are metal frameworks used to support a weapon that is being assembled or maintained. Stands may be immobile or equipped with pivoting casters. The stands discussed in the following paragraphs are of the immobile type.

A/E32M-4 MAINTENANCE AND RECONFIGURATION STAND

The A/E32M-4 maintenance and reconfiguration stand (fig. 9-9) is made of steel and aluminum. The stand consists of maintenance ring assemblies MXK-663/E32M-4 (forward), MXK-664/E32M-4 (aft), and deck post assembly MXK-665/E32K-4 that supports each ring assembly. The ring assemblies can be rotated 180 degrees for convenient load accessibility.

The A/E32M-4 maintenance and reconfiguration stand is used to hold the F-14 aircraft weapons rail during general maintenance. It is also used for configuring the F- 14 weapons rail with associated bomb racks.

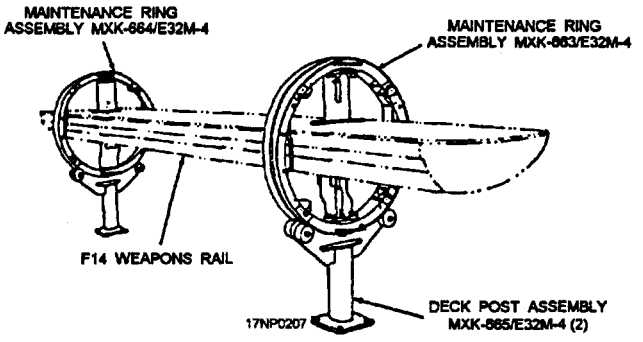


Figure 9-9.—A/E32M-4 maintenance and reconfiguration stand.

A/F32K-1/1A BOMB ASSEMBLY STAND

The A/F32K-1/1A bomb assembly stand (fig. 9-10) consists of three interchangeable and interlocking 49-inch sections. The stand must be secured to the deck. It has four trays that are placed on top of conveyor rollers to permit a 360-degree rotation of the weapon. Stops are located at each end to prevent the trays from moving beyond the end of the conveyor. Each of the sections are collapsible for stowage purposes.

The stand is designed to support Mk 80 series general-purpose bombs during the assembly process. However, the stand may be used to support various other weapons during the assembly process.

REVIEW NUMBER 1 ANSWERS TO QUESTIONS Q1. THROUGH Q4.

A1. For a complete listing and description of approved handling equipment, you should refer to NAVSEA OP 2173, Volume 1.

A2. The general purpose of the standard four-way wood pallet is for use when shipping domestic unit loads of ordnance.

A3. The safe working load (SWL) of the Mk 3 Mod 0 and Mk 12 Mod 2 pallets is 4,000 pounds.

A4. Ammunition pallet crates are used at naval shore activities to handle loose ammunition and inert items during on-station handling and transportation.

REVIEW NUMBER 2 ANSWERS TO QUESTIONS Q1. THROUGH Q4.

A1. A carrier is used as a quick and safe way of attaching a crane cable or other hoisting device to ammunition for movement from one area to another.

A2. The Mk 49 Mod 1 weapons carrier is constructed of two steel pallets welded together.

A3. The Mk 49 Mod 1 and Mk 51 Mod 1 weapons carriers are used to lift weapons with 14-inch suspension lugs. The Mk 51 Mod 1 carrier can also lift weapons with 30-inch suspension lugs.

A4. The SWL of the Mk 51 Mod 1 weapons carrier is 4,000 pounds.

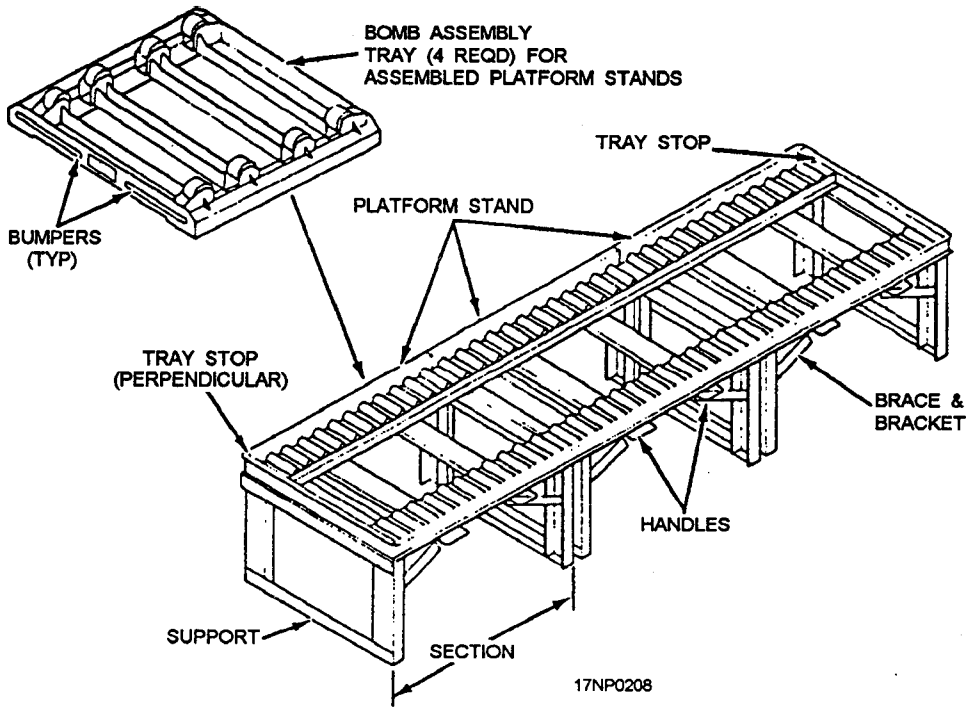


Figure 9-10.—A/F32K-1/1A bomb assembly stand.

A/F32K-10 SMALL BOMB ASSEMBLY PLATFORM STAND

The A/F32K-10 small bomb assembly platform stand (fig. 9-11) consists of two table assemblies, a center insert, and three tray assemblies. Rollers are permanently affixed to the tables. Support is provided by folding legs located at both ends of each table assembly, which are unfolded and pinned into position. An insert is placed in the gap between the tables and

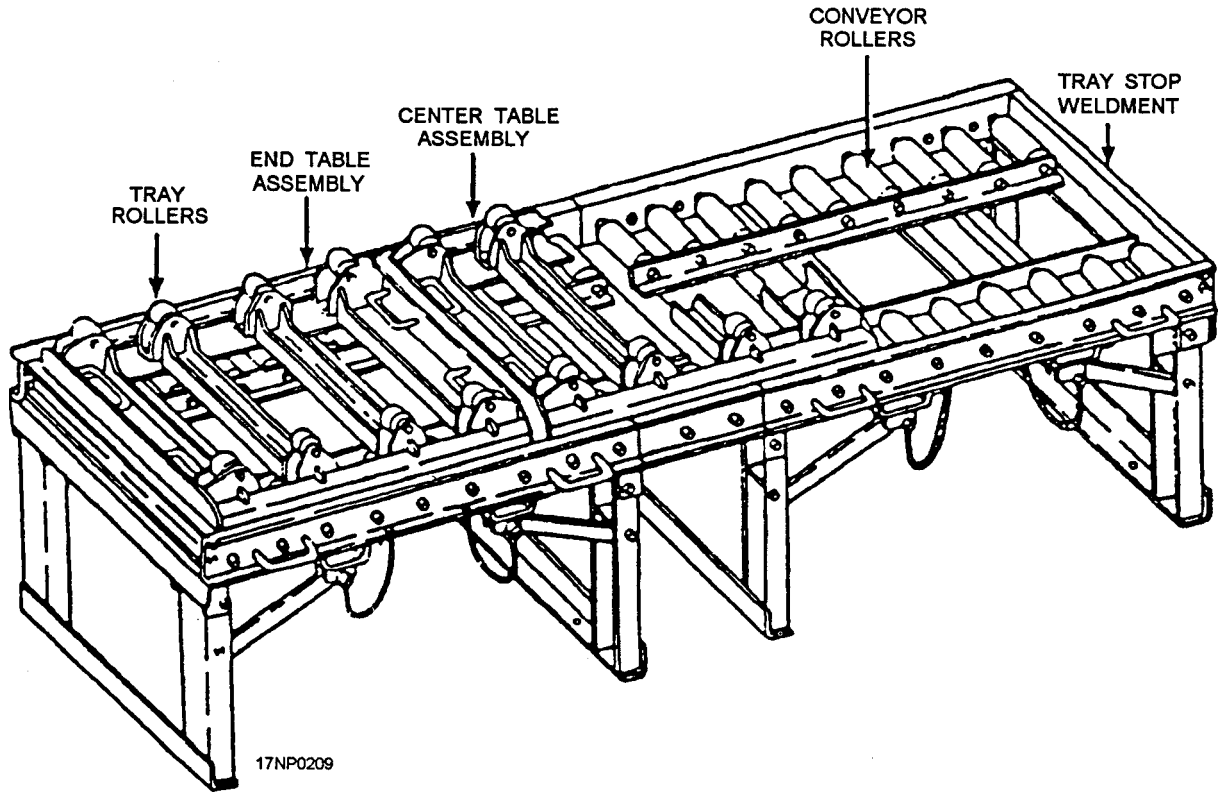


Figure 9-11.—A/F32K-10 small bomb assembly platform stand.

secured with four bolts. There are also three tray assemblies with rollers on top. When placed on the main stand assembly, the trays ride on the permanent rollers, allowing them to be pushed along the length of the stand. The top-mounted rollers actually contact the skin of the weapon and support its weight, permitting a 360-degree rotation of any weapon and allowing access to screws and other parts.

The A/F32K-10 is primarily designed for use on amphibious assault ships (LPH/LHA/LHD). It is used in a predesignated magazine or bomb assembly area in conjunction with an overhead rail and hoist system for assembling bombs of various weights and sizes.

HOISTING BARS

LEARNING OBJECTIVE: *Recognize the purpose and use of hoisting bars.*

Hoisting bars are used for carrying, lifting, and handling weapons. They are normally used during weapons handling and loading evolutions.

AERO 64A1 HOISTING BAR

The Aero 64A1 hoisting bar (fig. 9-12) consists of a cradle, strap, and two carrying handles. The cradle is a weldment frame that has four padded braces. The handles have knurled gripping surfaces. A missile is secured in the cradle by a web strap attached to the tie-down assembly and the bar buckle.

Two Aero 64A1 hoisting bars must be used to manually lift a Sparrow or Shrike missile from a missile skid to an aircraft wing or fuselage-mounted launcher.

AERO 68A HOISTING BAR

The Aero 68A hoisting bar (fig. 9-13) is a bar within a bar that has a hook assembly attached. The length of the bar can be increased by extending the internal bars 15 7/8 inches each.

To manually lift the weapon you must hook the Aero 68A hoisting bar into the weapon lugs. This bar is used to handle or transport any weapon having standard lugs. Weapons weighing up to 1,000 pounds can be lifted if two bars are used

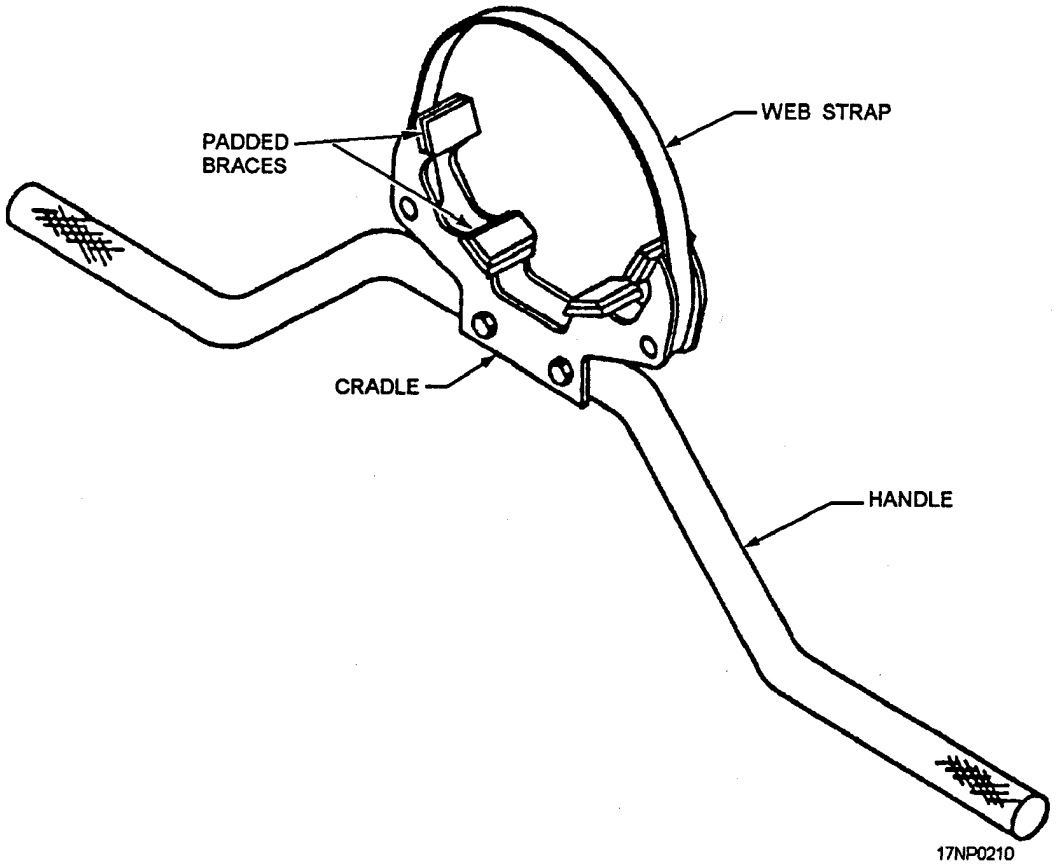


Figure 9-12.—Aero 64A1 hoisting bar.

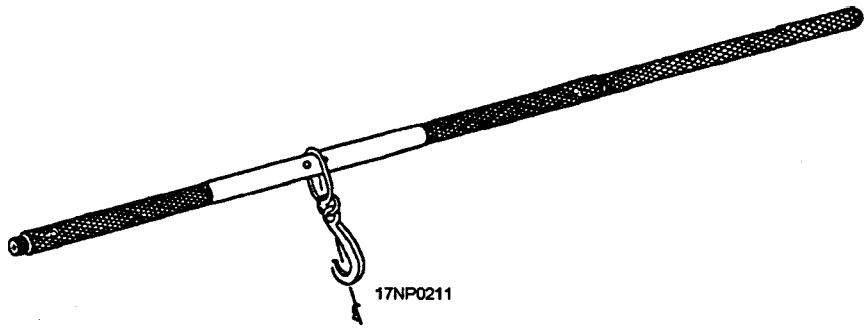


Figure 9-13.—Aero 68A hoisting bar.

HLU-256/E MANUAL HOISTING BAR

The HLU-256/E manual hoisting bar (fig. 9-14) consists of a round steel bar with a removable bomb nose plug connector and tail stop plates on one end. A quick-release pin secures the nose plug connector to the bar. When a tee configuration is desired, the nose plug can be relocated to a position at the bar's midpoint. The opposite end of the bar can be used as a lift point in the bomb's tail end. A tail stop is situated 18 inches from this end of the bar.

The HLU-256/E manual hoisting bar is used to manually lift Mk 80 series general-purpose bombs that weigh up to 1,000 pounds during aircraft loading/unloading operations. It is also used for weapons assembly purposes.

REVIEW NUMBER 3

Q1. What is the purpose of stands?

Q2. What maintenance ring assembly is used with the A/E32M-4 maintenance and reconfiguration stand?

Q3. What is the purpose of the A/E32M-4 maintenance and reconfiguration stand?

Q4. What is the maximum rotation of the A/E32K-1/1A bomb assembly stand?

Q5. The Aero 64A1 hoisting bar is used to _____.

Q6. When you use two Aero 64A1 hoisting bars, what is the maximum weight that can be lifted?

Q7. What hoisting bar is used to manually lift Mk 82 bombs?

BEAMS

LEARNING OBJECTIVE: *Recognize the purpose and use of beams and identify the loads that each carries.*

A beam is a rigid metal item that has an I, H, T, or circular cross section. The rigid portion is fitted with a lifting eye, a sling or sling attaching points, and devices for attaching a load.

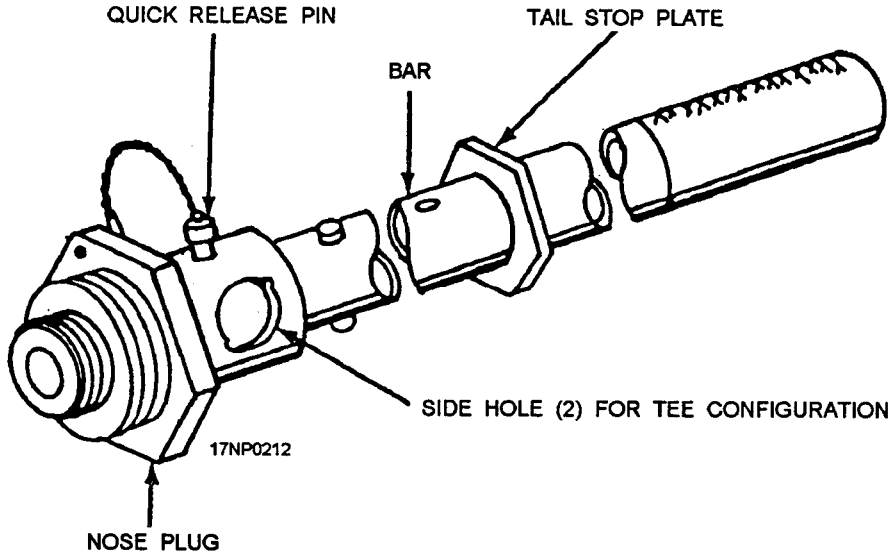


Figure 9-14.—HLU-256/E manual hoisting bar.

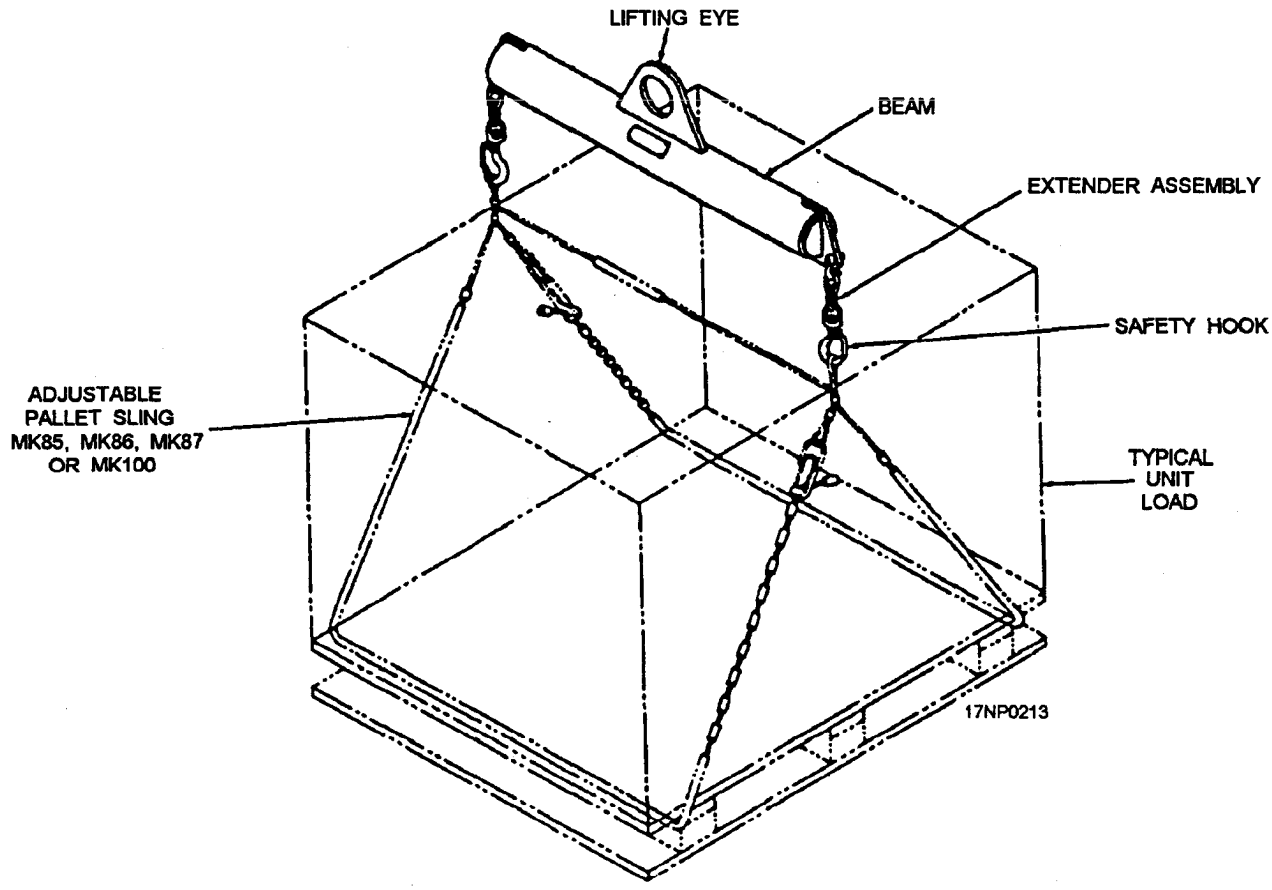


Figure 9-15.—Mk 18 Mod 1 handling beam.

MK 18 MOD 1 HANDLING BEAM

The Mk 18 Mod 1 handling beam (fig. 9-15) is a structural steel weldment that consists of a cylindrical beam with a lifting eye at its center of gravity and hook-extender assemblies with safety hooks at each end. The Mk 18 Mod 1 is used during connected underway replenishment operations for transferring

REVIEW NUMBER 3 ANSWERS TO QUESTIONS Q1. THROUGH Q7.

A1. Stands are used to support a weapon being assembled or maintained.

A2. The MXK-663/E32M-4 (forward) maintenance ring assembly is used with the A/E 32M-4 maintenance and reconfiguration stand.

A3. The A/E 32M-4 maintenance and reconfiguration stand is used to hold the F-14 aircraft weapons rail during general maintenance.

A4. The maximum rotation of the A/F 32K-1/1A bomb assembly stand is 360 degrees.

A5. The Aero 64A1 hoisting bar is used to manually lift Shrike and Sparrow missiles.

A6. When using two Aero 64A1 hoisting bars, 1,000 pounds is the maximum weight that can be lifted.

A7. The HLU-256/E hoisting bar is used to manually lift Mk 82 bombs.

palletized unit loads. The beam is designed for coupling with cargo hoisting assembly Mk 20 Mod 0, and normally it is used with adjustable pallet slings for making the transfer.

ADU-399/E GUIDED MISSILE HOISTING BEAM

The ADU-399/E guided missile hoisting beam (fig. 9-16) is an aluminum weldment that consists of a beam supported on forklift channels and structural members. These components form the base assembly. Rubber-lined cradles mounted fore and aft on the beam prevent metal-to-metal contact. The cradles have side supports held in position by quick-release pins. When you are loading or unloading the beam, remove the quick-release pins to let the side supports swing down out of the way. There are two adjustable tubular extenders on the fore end of the beam that support a vinyl-covered housing. The housing protects the weapon's radome. Quick-release pins secure the extenders to the beam and the radome protector to the extenders. There are cable hoists mounted on the base assembly and held in the hoisting position by quick-release pins. When the pins are removed, the hoists swing down and forward into the stowed position.

The ADU-399/E guided missile hoisting beam is used for ground support handling of the Phoenix missile during aircraft loading/unloading operations. This beam may be used in conjunction with the HLU-196B/E bomb hoist, the A/M32K-1A/1B/1C SATS loader, or the ADU400/E weapon skid loading adapter.

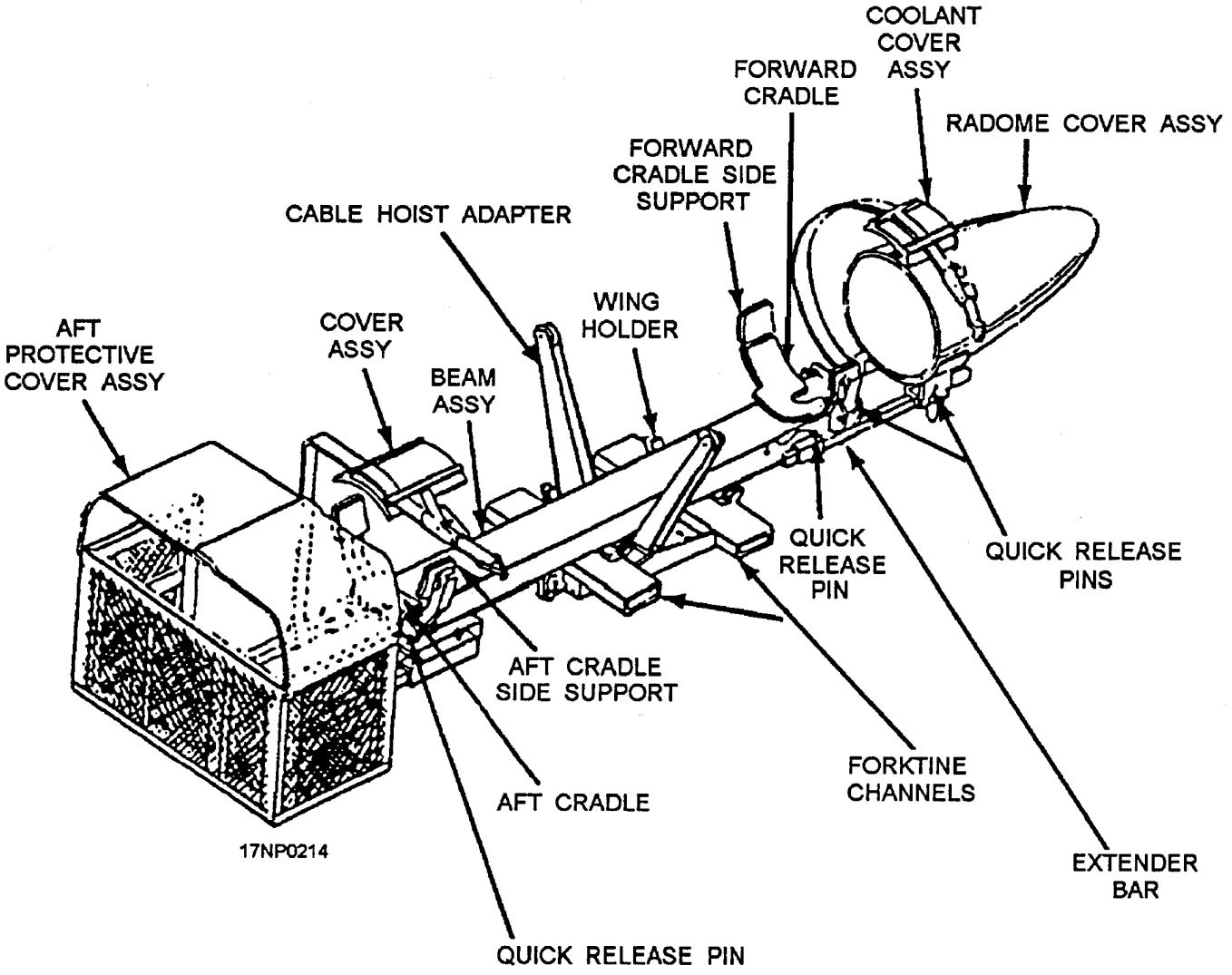


Figure 9-16.—ADU-399/E guided missile hoisting beam.

MHU-129/E GUIDED MISSILE HOISTING BEAM

The MHU-129/E guided missile hoisting beam (fig. 9-17) is an aluminum I-beam with a lifting eye mounted on the top of two removable lifting-shoe assemblies. The shoe assemblies are secured to the lower flange of the beam with quick-release pins designed to engage the forward and aft launch lugs of the Phoenix guided missile. The safety latches in the shoe assemblies secure the beam to the missile.

The MHU-129/E guided missile hoisting beam is used aboard ship (aircraft carriers) to handle a previously assembled Phoenix guided missile.

MK 37 MOD 0 LIFT BEAM

The Mk 37 Mod 0 lift beam (fig. 9-18) is an aluminum alloy beam with an adjustable lifting eye secured to it by two quick-release pins. The suspension lug adapters at each end of the lift beam are used to engage the forward and aft suspension lugs on the Harpoon air-launched missile. A quick-release pin in the aft suspension lug adapter is used for securing the beam to the missile.

The Mk 37 Mod 0 lift beam is used with an overhead crane or hoist to lift the Harpoon air-launched missile from the container to the missile assembly stand, or from the missile assembly stand into the container.

REVIEW NUMBER 4

Q1. What is the shape of a beam?

Q2. What beam is used during ground support handling of the Phoenix missile during aircraft loading/downloading operations?

Q3. When you move a Harpoon missile from its container to the missile assembly stand, you would use

SLINGS

LEARNING OBJECTIVE: *Recognize the purpose and use of ammunition handling slings.*

Slings are lifting devices used to handle weapons. They are made up of various materials, reinforced nylon and heavy cotton mesh, steel cables, welded rings, and safety devices.

MK 85 MOD 0, MK 86 MOD 0, MK 87 MOD 0, AND MK 100 MOD 1 PALLET SLINGS

The Mk 85, Mk 86, Mk 87, and Mk 100 pallet slings (fig. 9-19) are wire rope basket slings that are adjustable for load height. These slings accommodate a full range of load heights (13 to 70 inches) on 40-inch by 48-inch pallets. A section of colored tubing on the cross bridle

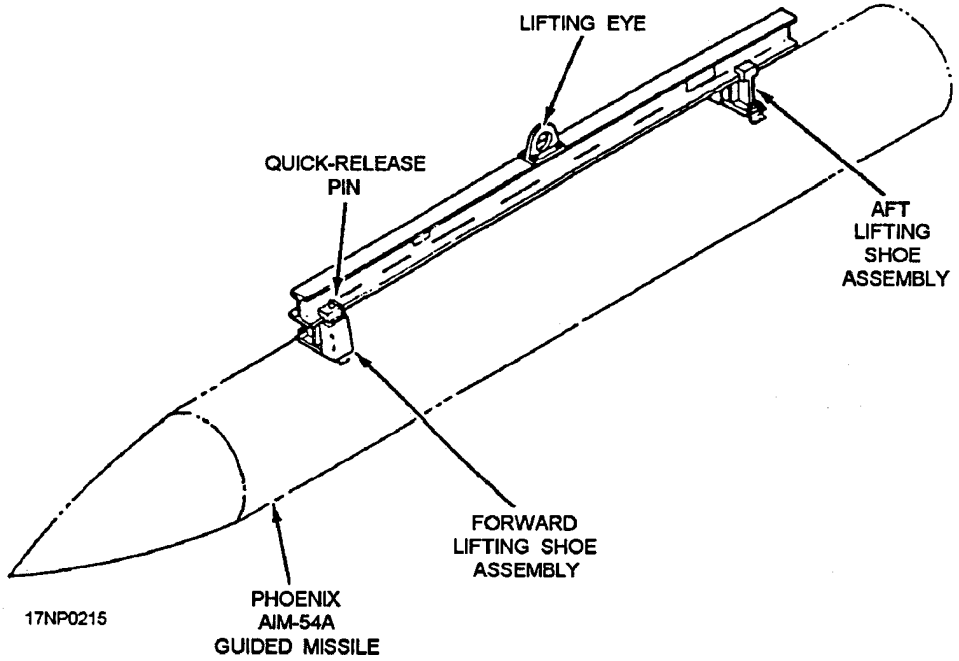


Figure 9-17.—MHU-129/E guided missile hoisting beam.

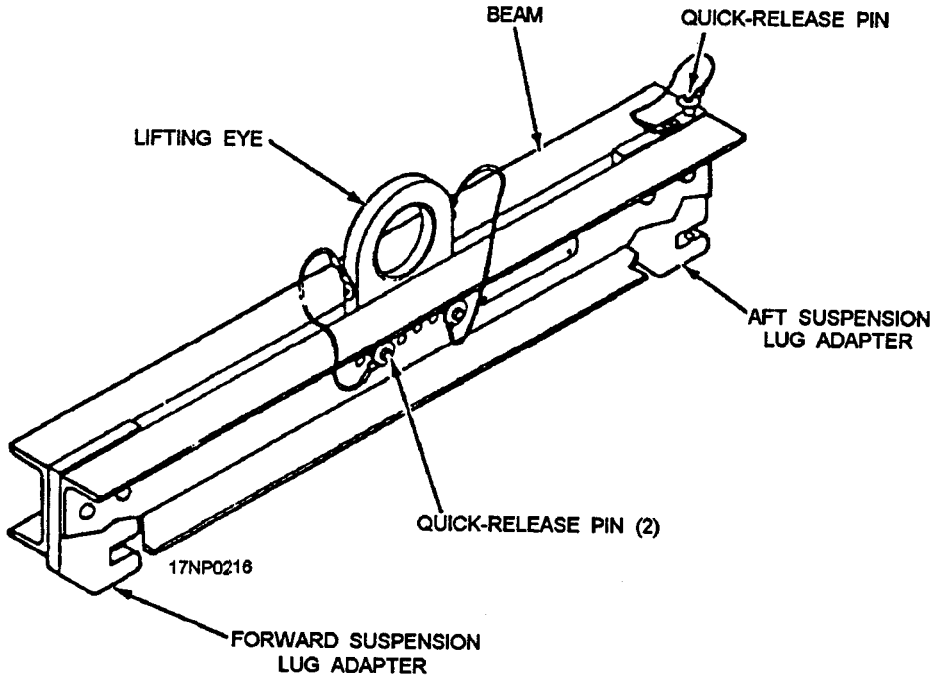


Figure 9-18.—Mk 37 Mod 0 lift beam.

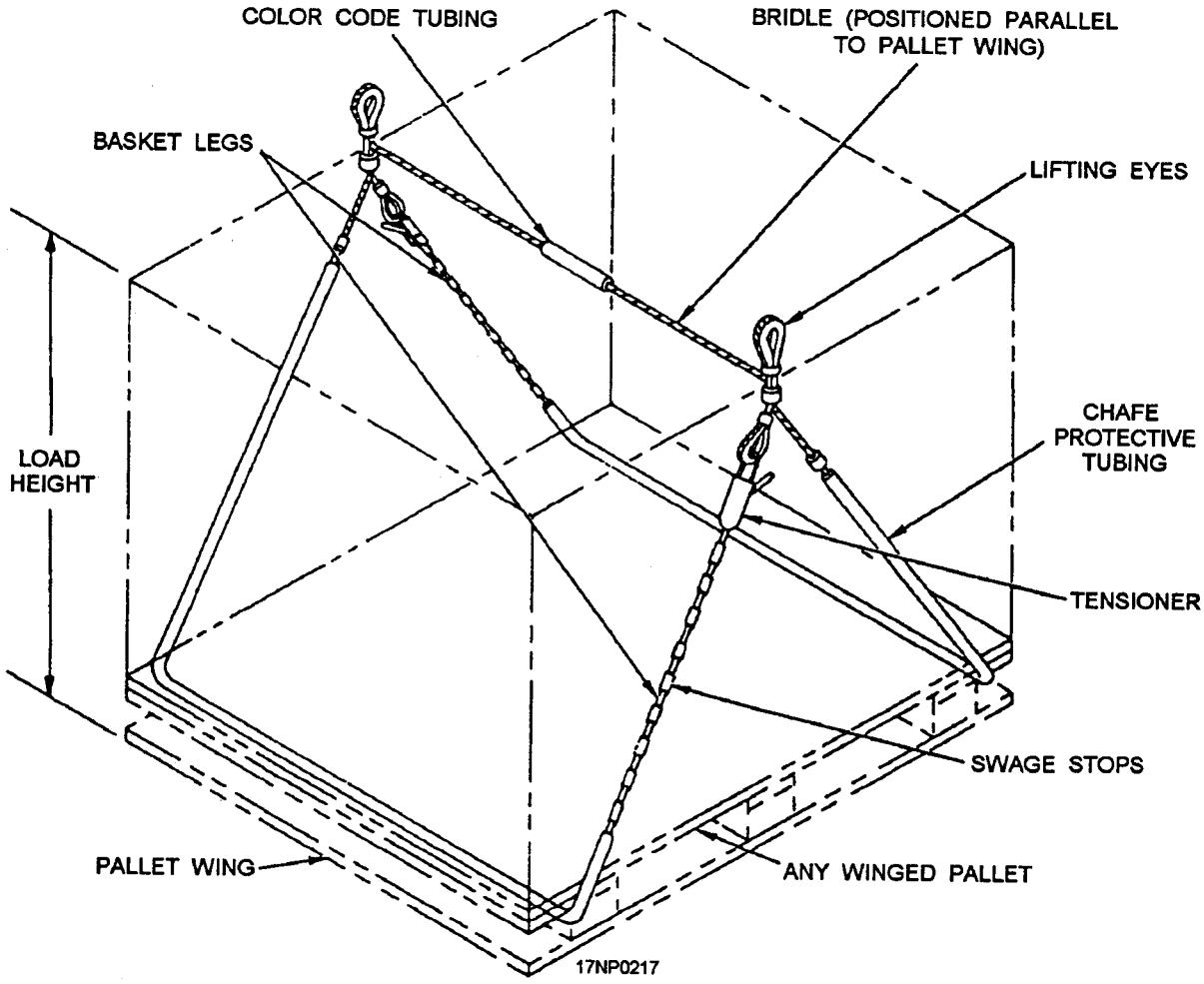


Figure 9-19.—Mk 85, Mk 86, Mk 87, and Mk 100 pallet slings.

Table 9-1.—Physical Data for Pallet Slings

Mk/Mod	Color of Coded Tubing	Load Height (in.)	Capacity (lb)	Weight (lb)
85/0	Red	13	2,200	13
		16	2,800	13
		20	3,400	13
		24	3,950	13
		26 to 31	4,000	13
86/0	Black	29 to 40	4,000	13
87/0	Green	36 to 50	4,000	14
100/1	Yellow	48 to 70	4,000	15

indicates the sling type. Table 9-1 lists physical data for the separate types of slings.

MK 105 MOD 0 HOISTING SLING

The Mk 105 Mod 0 hoisting sling (fig. 9-20) is a braided nylon rope that consists of a pendent and a leg assembly. Each end of the pendent has a spliced eye, one for the helicopter hook and one for the legs. Legs are rated at 3,000 pounds; with two or more legs, the assembly is rated at 6,000-pound capacity. Longer legs (122 inches) also are available for long or stacked containers. The shorter legs are orange in color; the longer legs are green.

MK 109 MOD 0 CONTAINER LIFTING SLING

The Mk 109 Mod 0 container lifting sling (fig. 9-21) consists of an adjustable wire rope and chain assembly fitted with a lifting eye and spreader bars. The spreader bars are modified turnbuckles that permit adjustment of sling-leg width within the range of 25 inches to 41 inches. Height adjustment of the bars is provided by the swage stops. The Mk 109 is designed to fit most of the containers and cradles currently in the system.

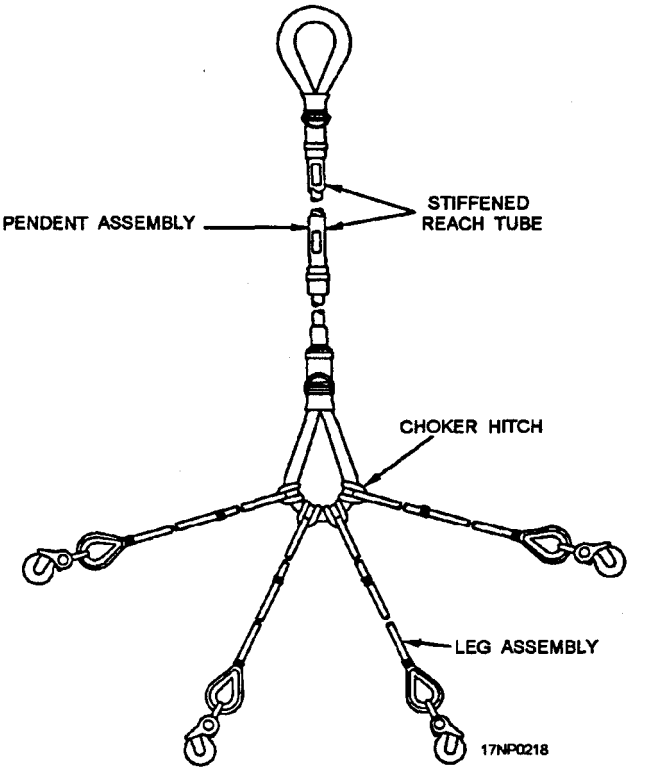


Figure 9-20.—Mk 105 Mod 0 hoisting sling.

H416 BOMB AND CONTAINER SLING

The H416 bomb and container sling (fig. 9-22) consists of four wire-rope legs shackled in pairs to each end of a lifting ring spreader bar weldment. Safety hooks are located at each end.

BOMB HOISTS

LEARNING OBJECTIVE: *Recognize the purpose and use of bomb hoist and identify the loads for each.*

A hoist is a mechanism that provides a mechanical advantage when raising or lowering heavy loads, such as bombs, mines, and torpedoes.

REVIEW NUMBER 4 ANSWERS TO QUESTIONS Q1. THROUGH Q3.

A1. A beam is a rigid metal item that has an I, H, T or circular cross section.

A2. The ADU-399/E guided missile hoisting beam is used during ground support handling of the Phoenix missile.

A3. When you move a Harpoon missile from its container to the missile assembly stand, you would use the Mk 7 Mod 0 lift beam.

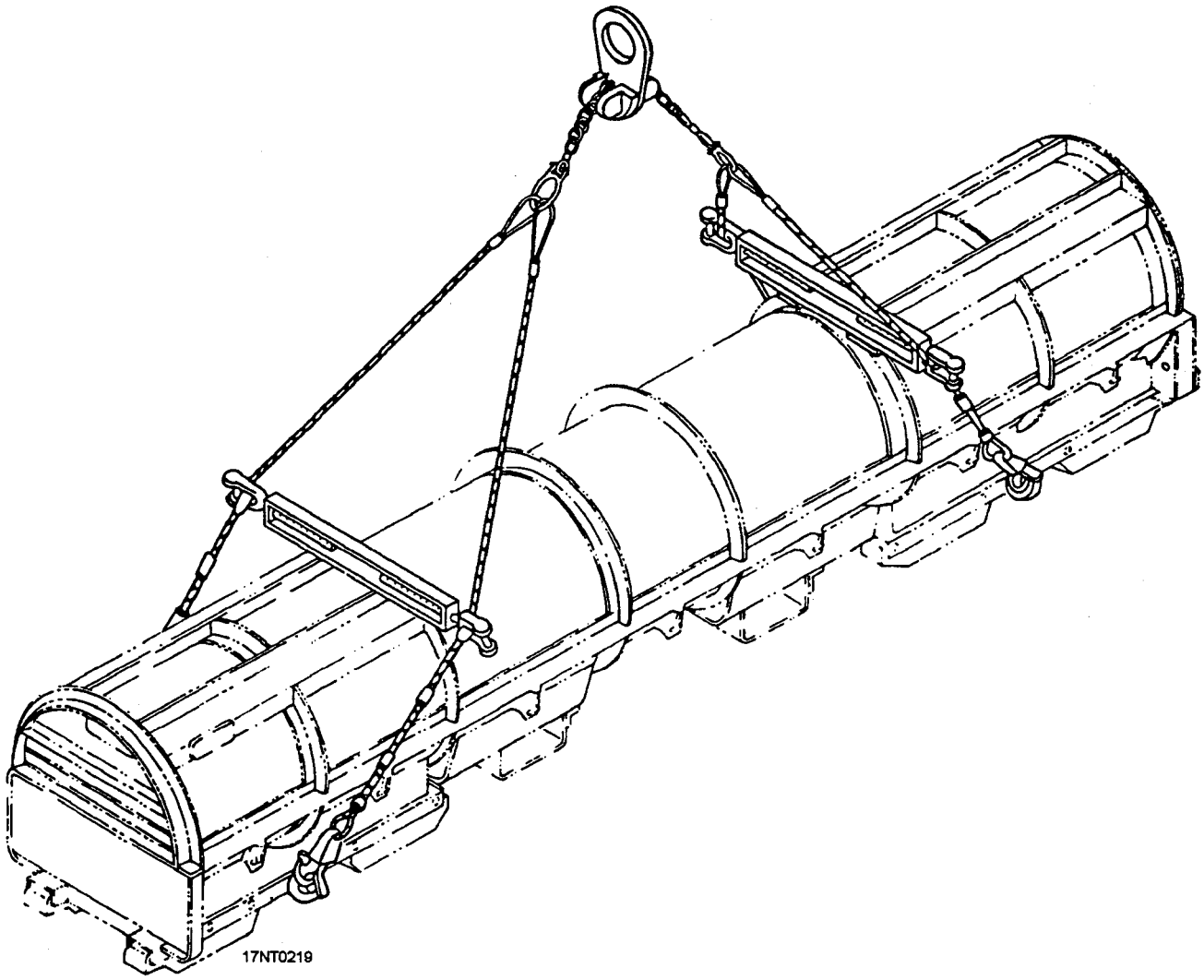


Figure 9-21.—Mk 109 Mod 0 container lifting sling.

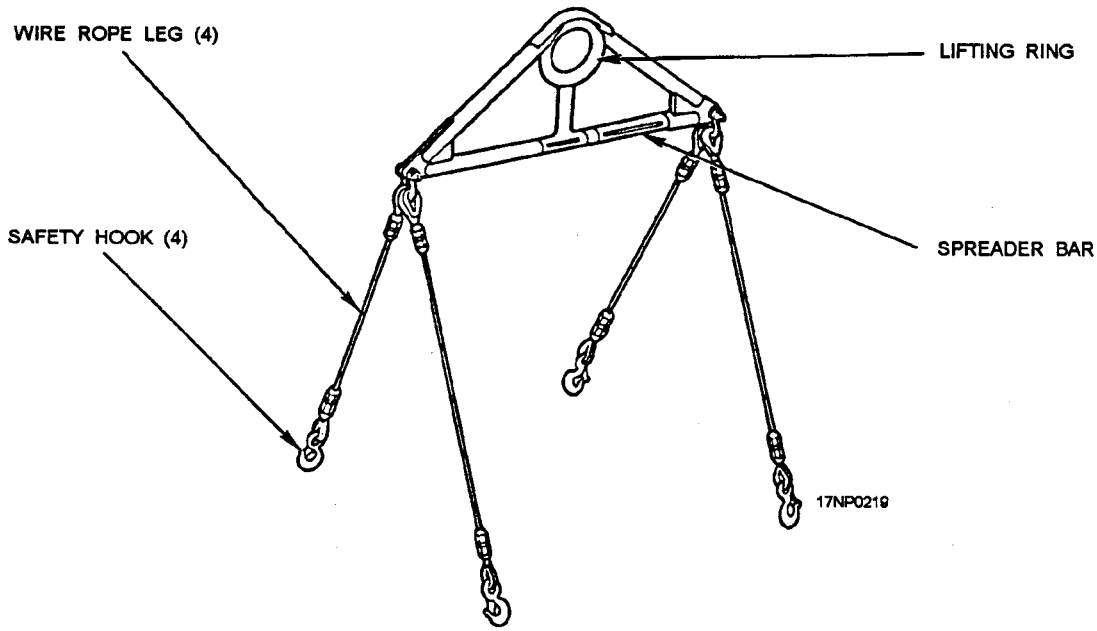


Figure 9-22.—H416 bomb and container sling.

HLU-288/E BOMB HOIST

The HLU-288/E bomb hoist (fig. 9-23) consists of a gear train, drum and cable, brake mechanism, fishing pole type of extension tube, a rachet crank, and a brake crank. The cable drum rotates in the direction opposite to that of the cranks. The rachet crank is used to help hoist the load, and it can be disengaged from the gear train by latching the rachet pawl. The brake crank is used to hoist and lower the load. After a load is lifted, a clutch-type brake locks the gear train.

The HLU-288/E bomb hoist is used with single hoist ordnance loading system (SHOLS) adapters to load various weapons onto a variety of aircraft. The hoist can use a short or long cable for loading onto wings, fuselage, and bomb bay stations. The HLU-288/E replaces the Aero 14C bomb hoist, which is obsolete.

HLU-196B/E BOMB HOISTING UNIT

The HLU-196B/E bomb hoisting unit (fig. 9-24) is a lightweight, portable, gasoline, engine-driven unit. It consists of a gasoline engine, speed-reducing gearbox and brake, and a cable assembly and storage drum that incorporates a clutch and a boom. All components and controls are mounted on a two-wheeled frame assembly. The entire unit weighs 75 pounds. It has a direct, single-cable lift capacity of 2,000 pounds. A double-cable lift capacity of 4,000 pounds is obtainable by using various trolleys and rack adapters that are available. You can extend the cable by disengaging the clutch and manually pulling it until the necessary length is withdrawn. To reel the cable in, you must start the engine, engage the clutch, and carefully throttle the engine to control the reel-in speed of the cable. Maximum reel-in speed of the cable is 15 feet per minute.

The HLU-196B/E unit is used to single or, by the use of various trolleys and adapters, double hoist various weapons and stores.

HOISTING BANDS

Hoisting bands are used to encircle a load and provide a means for attaching hoisting equipment or

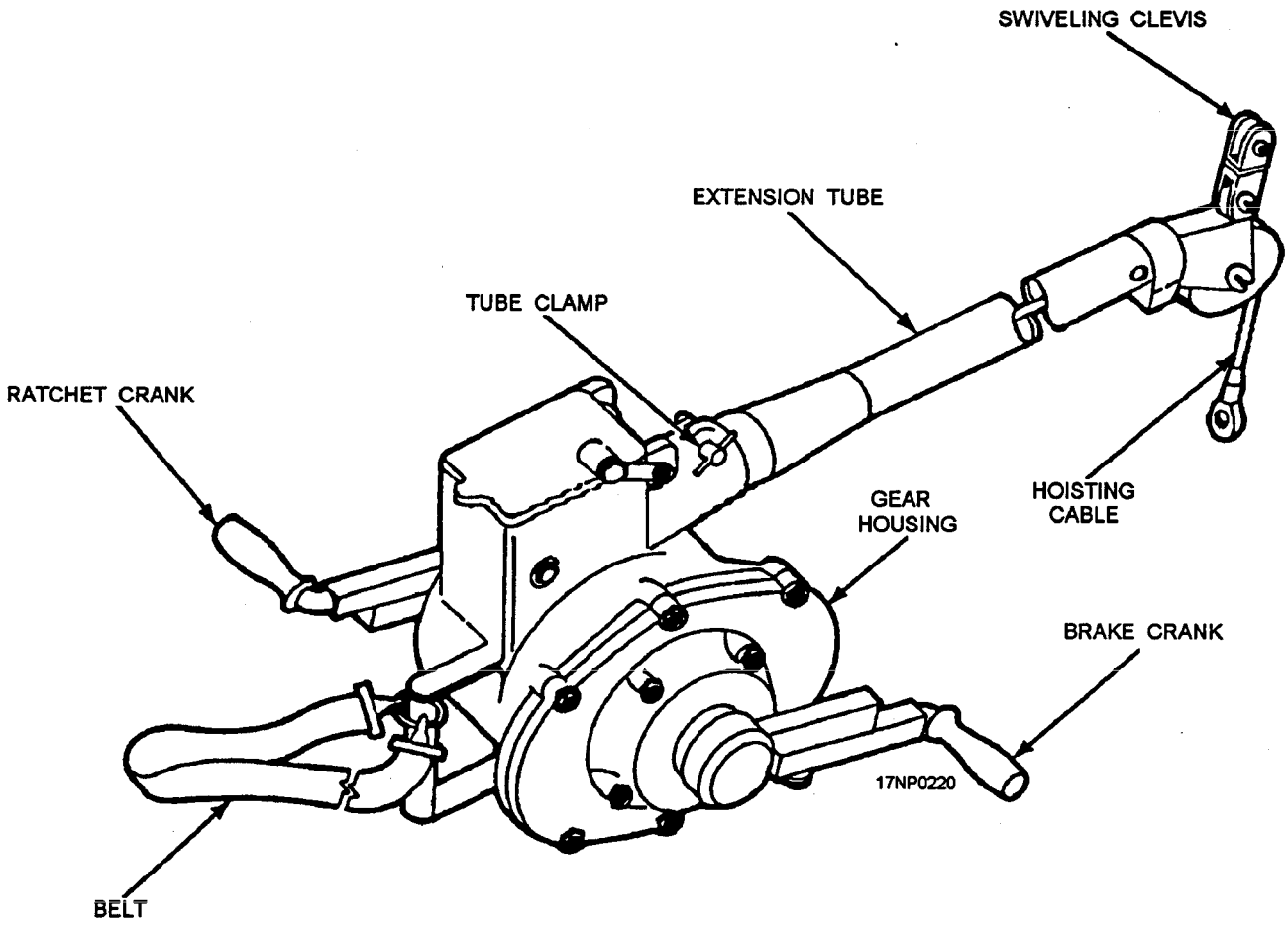


Figure 9-23.—HLU-288/E bomb hoist.

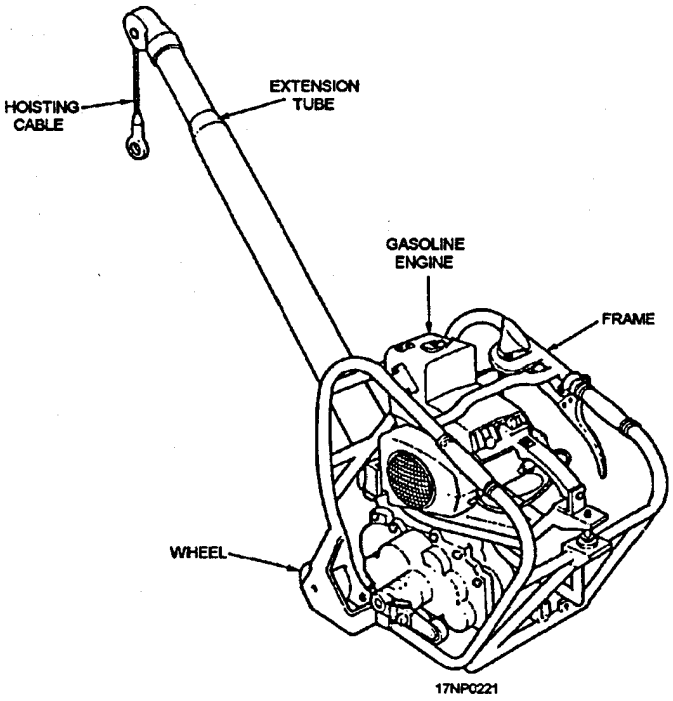
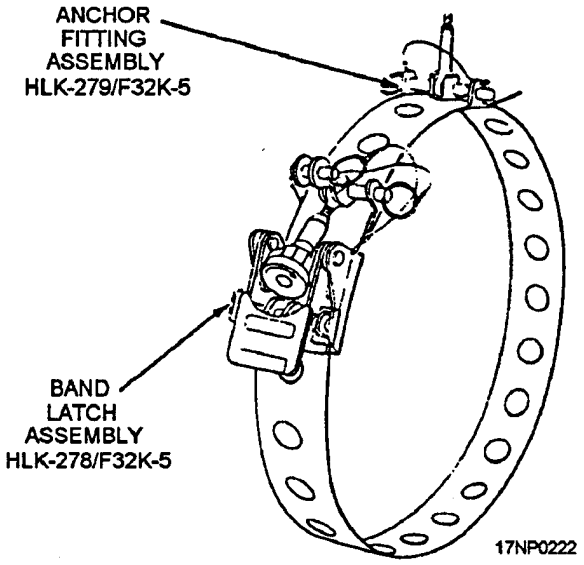


Figure 9-24.—HLU-196B/E bomb hoisting unit.

other handling equipment. The hoisting bands are steel straps with either one or two points used to attach them to the hoist equipment.

Look at figure 9-25. It shows a hoisting band configured with a HLK-278/F32K-5 band latch assembly and a HLK-279/F32-5 anchor fitting assembly. The band latch assembly is used to clamp the band around the weapon. The anchor fitting assembly is used to secure the eyebolt of the latch to the band, or to attach the eye of a hoisting cable to the sling. Configuration of these two assemblies with the bands



SINGLE-POINT, SINGLE BAND ARRANGEMENT

Figure 9-25.—Example of a hoisting band configuration.

makes it possible to accommodate many different sizes, shapes, and weights of stores.

There are three different bands available-the short, light-gauge hoisting band (HLK-275/F32K-5), the long, light-gauge hoisting band (HLK-276/F32K-5), and the heavy-gauge hoisting band (HLK-277/F32K-5). These bands can be arranged for single- or double-point hoisting. (See table 9-2.)

There are many different types of hoisting bands available, but the hoisting bands described above are predominately used throughout the aviation ordnance field They are used with the HLU-288/E and HLU-196B/E bomb hoists during aircraft loading operations.

Table 9-2.—Load Limitations for Common Arrangements of Hoisting Bands

CONFIGURATION	MAXIMUM DIAMETER	SWL	REMARKS
Single, long light-gauge band, single-point suspension	18 inches	1,000 pounds	----
Single, short light-gauge band, single-point suspension	15 inches	2,500 pounds	----
Single, heavy-gauge band, single-point suspension	30 inches	1,500 pounds	----
Single, long light-gauge band, double-point suspension	25 inches	2,500 pounds	Latch-assembly point must be located above the horizontal centerline of the store
Single, heavy-gauge band, double-point suspension	30 inches	3,200 pounds	An additional band is required if store exceeds 30 inches in diameter

REVIEW NUMBER 5

Q1. List the components of the HLU-288/E bomb hoist.

Q2. What component of the HLU-288/E bomb hoist is used to hoist or lower the load?

Q3. List the components of the HLU-196B/E bomb hoisting unit.

Q4. What is the single-cable lift capacity of the HLU-196B/E bomb hoist?

Q5. What is the purpose of hoisting bands?

Q6. List the types of available hoisting bands.

SKIDS, WEAPONS TRANSPORTERS, AND ASSOCIATED ADAPTERS

LEARNING OBJECTIVE: *Identify the purpose and use of skids, weapons transporters, and associated adapters. Recognize the safe loads for each.*

A skid or weapon transporter is a mobile piece of equipment with a welded frame-type construction mounted on two or four rubber-tired wheels. It is used with various adapters to support a load for movement from one area to another.

Wheeled skids or weapons transporters are generally equipped with a brake mechanism so the skid won't move when unattended. Handles are attached to all mobile skids and weapons transporters to provide a means of moving and controlling the units. The units are not self-propelled and require either manpower or power equipment to move them. They are used for handling various weapons and miscellaneous ammunition items during the aircraft rearming process aboard aircraft carriers and at shore stations.

You can't use skids and weapons transporters without adapters. Adapters are an interface between the skid or weapon transporter and the weapon or store to be supported They provide a support surface and a means of securing the weapon or store to the skid or transporter. This prevents any inadvertent movement. There are many different types of adapters available for any one particular skid or weapon transporter, or an adapter may be compatible with several different skids or weapons transporters. Adapters are attached to the skids or weapons transporters by quick-release pins or other types of quick-change devices.

AERO 12C BOMB SKID

The Aero 12C bomb skid (fig. 9-26) is a wheelbarrow skid. It consists of a cradle frame mounted on two rubber-tired wheels and equipped with two supporting legs. The skid has two tubular steel handles that you can quickly latch or unlatch. You can reposition

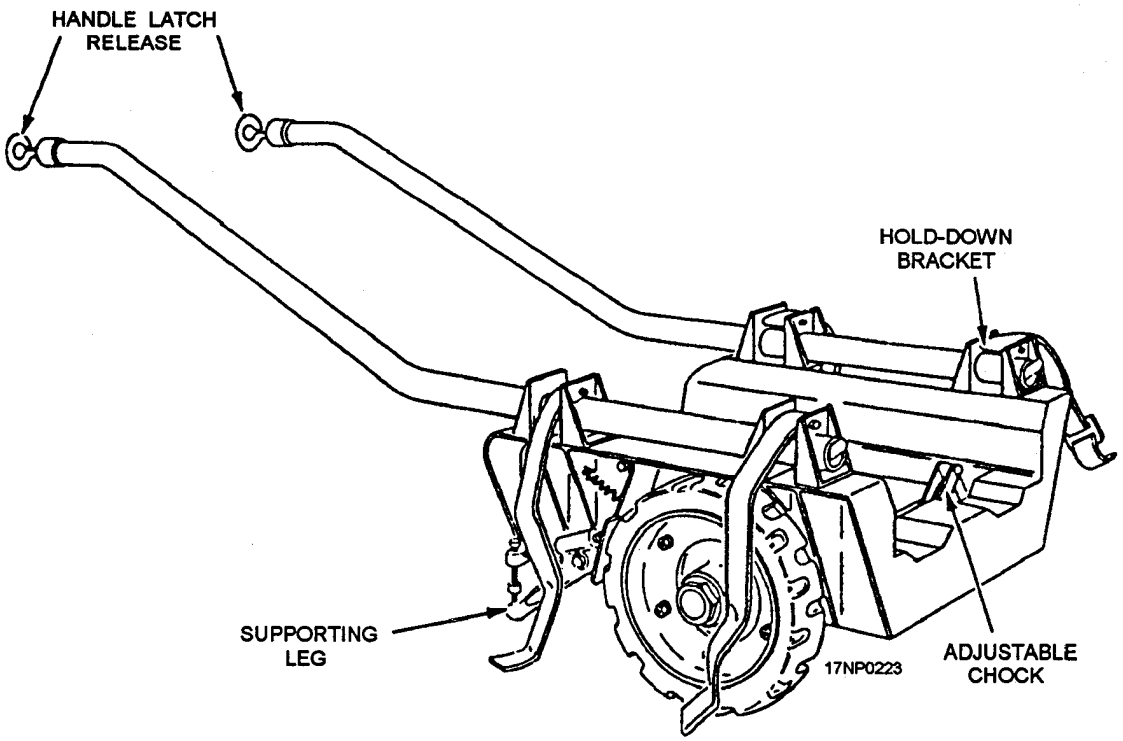


Figure 9-26.—Aero 12C bomb skid.

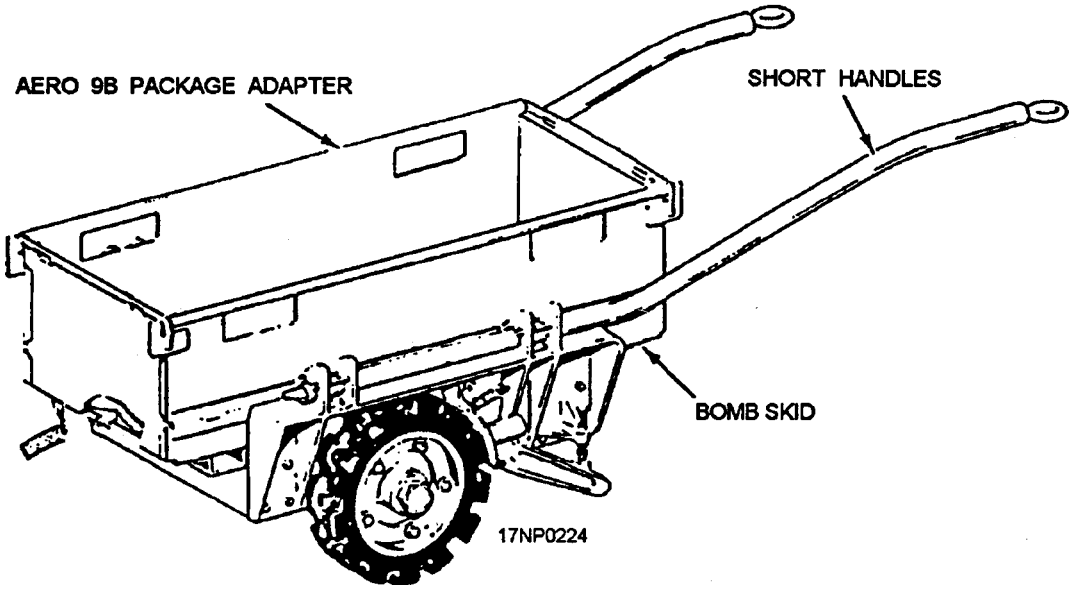


Figure 9-27.—Aero 9B/C bomb skid adapter mounted on an Aero 12C bomb skid.

or remove the handle by using the handle release on the aft end of each handle.

The wheels are braked by two brake shoes applied to the wheels by the support legs. Apply the brakes by lowering the skid so the supporting legs come in contact with the deck or runway. The brakes are released when the skid is raised high enough for the supporting legs to clear the deck or runway.

The skid is equipped with adjustable chocks on the bed of the frame. These chocks let you properly position the load on the skid. Each side of the skid is equipped with two hold-down brackets. One set of brackets accommodates the long or short handles. The other set of brackets is used for attaching tie-down straps.

The Aero 12C bomb skid is used to transport weapons that have a diameter between 4 and 18 inches. With the exception of Mk 81 bombs, weapons are transported singly or in pairs. The skid has an SWL of 1,250 pounds.

Aero 9B/C Bomb Skid Adapter

The Aero 9B/C bomb skid adapter (fig. 9-27) consists of an aluminum boxlike frame with collapsible walls. It is constructed with stiffeners at the sides and bottom. The adapter is secured to the skid by two spring-loaded latches. Hand holes are provided in the sides of the adapter for manual handling.

The Aero 9B/C bomb skid adapter is used with the Aero 12C bomb skid to handle and transport miscellaneous ammunition items. The adapter has an SWL of 1,000 pounds.

Aero 39B Bomb Skid Adapter

The Aero 39B bomb skid adapter (fig. 9-28) consists of seven hexagonal aluminum tubes welded together. It is flat on one side and contoured around the hexagonal tubes on the other three sides. The assembly has three handles mounted on it for lifting and a hinged door at one end for loading.

The Aero 39B bomb skid adapter is used with the Aero 12C bomb skid to transport and store nitrogen-filled bottles used as a coolant on the LAU-7A guided missile launcher. The adapter has an SWL of seven nitrogen bottles.

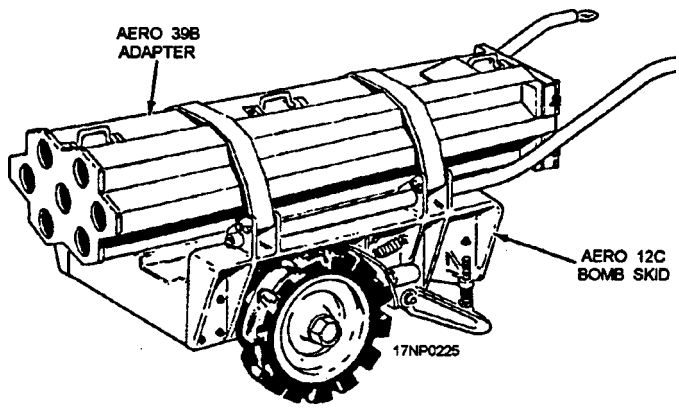


Figure 9-28.—Aero 39B bomb skid adapter mounted on an Aero 12C bomb skid.

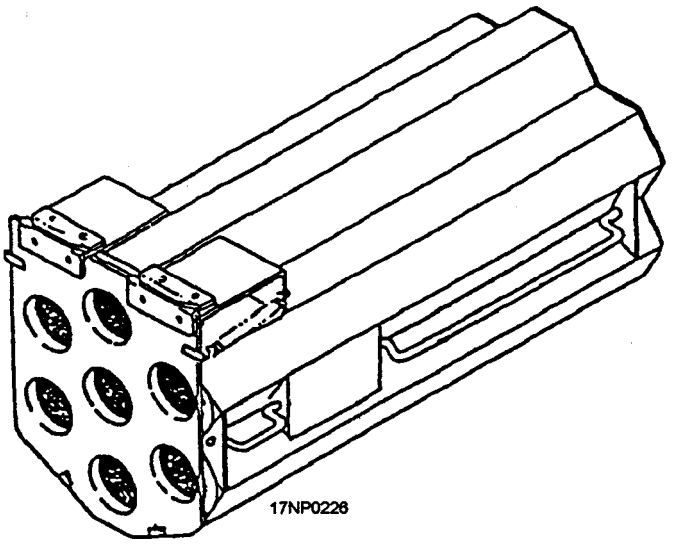


Figure 9-29.—ADU-602A/E nitrogen receiver adapter.

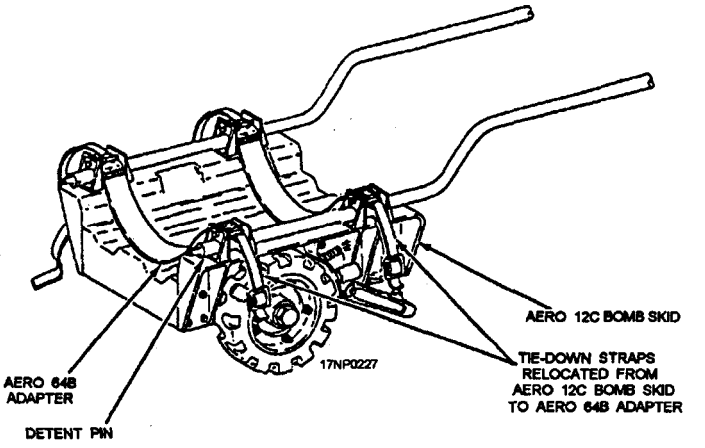


Figure 9-30.—Aero 64B soft-belt adapter mounted on an Aero 12C bomb skid.

ADU-602A/E Nitrogen Receiver Adapter

The ADU-602A/E nitrogen receiver adapter (fig. 9-29) is an aluminum container with seven hexagonal tubes. A welded plate is fitted with contoured urethane pads to fit the nitrogen bottles of the LAU-127 launcher. The hinged plate is spring loaded and dual clasped for security. Two handles located on the side aid in lifting and carrying.

Aero 64B Soft-Belt Adapter

The Aero 64B soft-belt adapter (fig. 9-30) consists of a flexible, neoprene-covered, woven-wire sling. The adapter has slots at the ends for attaching tie-down straps. The adapter is also equipped with brackets for attaching it to the skid.

Two Aero 64B soft-belt adapters support or store a soft-skin weapon up to 20 inches in diameter on the Aero 12C bomb skid. Each Aero 64B adapter has an SWL of 2,500 pounds.

ADU-488/E Wing, Fin, and Fuze Adapter

The ADU-488/E wing, fin, and fuze adapter (fig. 9-31) is an aluminum container that contains different features to transport a variety of ordnance components. Preformed urethane channels that provide protection for

REVIEW NUMBER 5 ANSWERS TO QUESTIONS Q1. THROUGH Q6.

A1. The components of the HLU-288/E bomb hoist include a gear train, drum and cable, brake mechanism, fishpole extension tube, and two cranks.

A2. The break crank of the HLU-288/E bomb hoist is used to hoist or lower the load.

A3. The components of the HLU-196/E bomb hoisting unit include gasoline engine, speed-reducing gearbox and brake, a cable assembly, and storage drum.

A4. The single cable-lift capacity of the HLU-196/E bomb hoist is 2,000 pounds.

A5. Hoisting bands are used to circle a load and as a means of attaching hoisting equipment or other handling equipment.

A6. *Hoisting bands include the short light-gauge hoisting band, long light-gauge hoisting band, and the heavy-gauge hoisting band.*

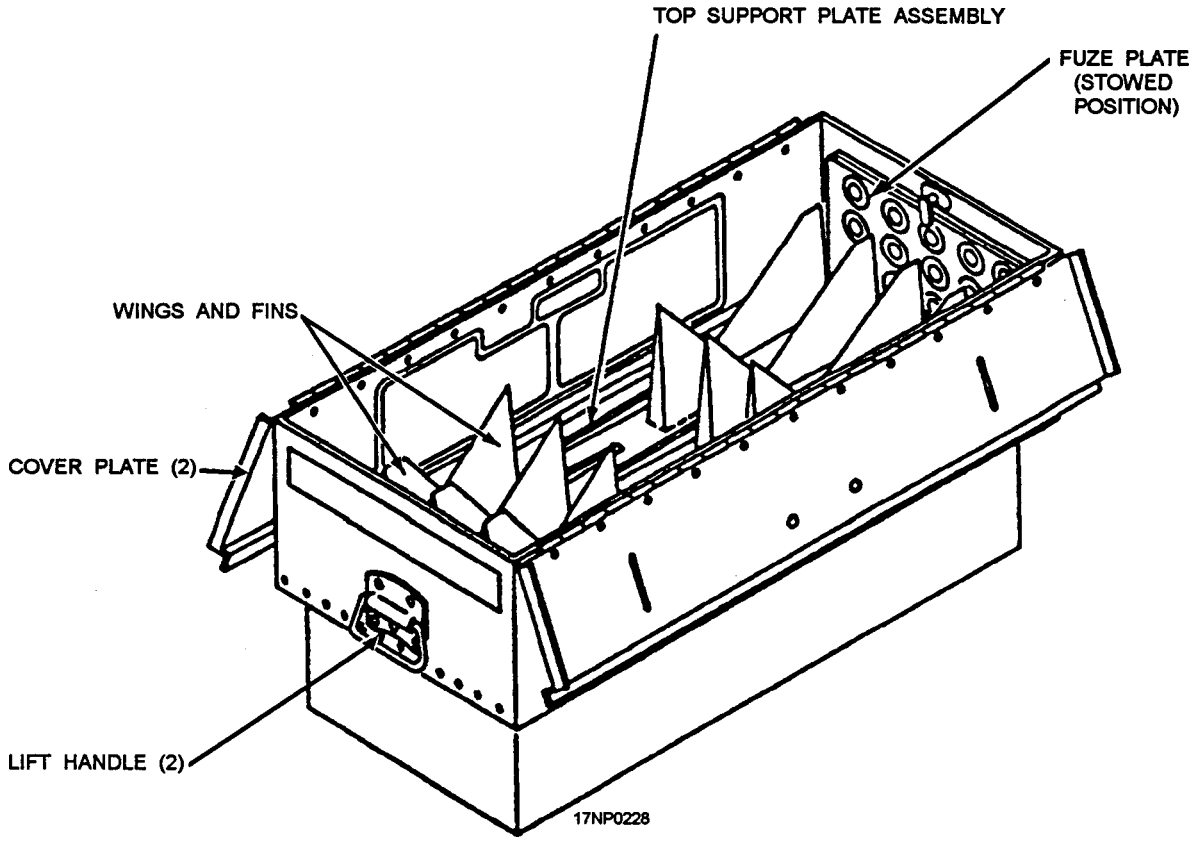


Figure 9-31.—ADU-488/E wing, fin, and fuze adapter.

wings and fins are installed in the base. Above the base are two hinged plates, which are lowered onto the wings and fins to hold them in place. There are two cushioned plates that are lowered from their stowed position and that provide holes for fuzes.

The ADU-488/E wing, fin, and fuze adapter is used by ordnance personnel to transfer different ordnance and ordnance components from weapons breakout areas to the flight deck/flight line.

AERO 21C WEAPON SKID AND MHK-128/M32K-5(V) MUNITIONS TRANSPORTER

The Aero 21C weapon skid (fig. 9-32) is a welded tubular frame equipped with a box section of drilled

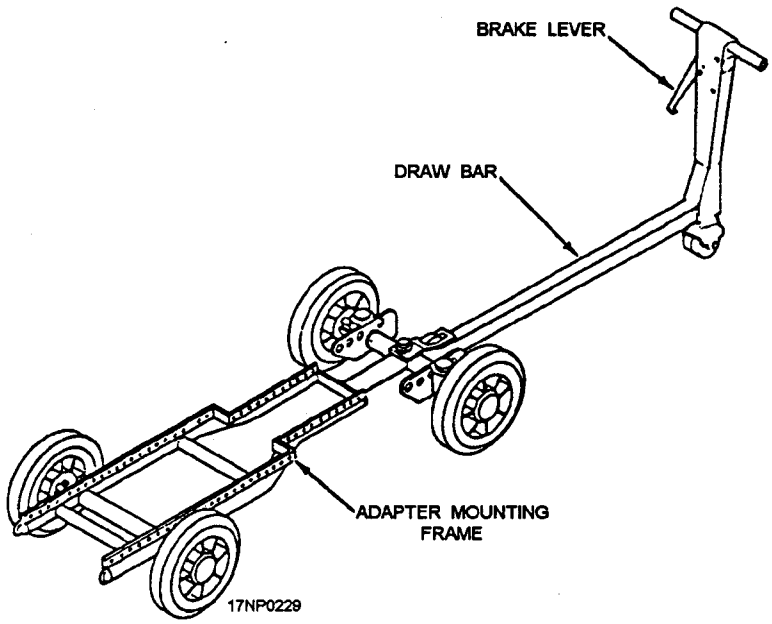


Figure 9-32.—Aero 21C weapon skid.

steel bars, which provide the mounting holes for attaching various adapters. It has two axles and four rubber wheels. The two front wheels are equipped with drum brakes. The brakes are actuated by the brake lever located on the draw bar. The brakes are applied automatically when the spring-loaded brake lever is in the down position. To release the brakes, pull the brake lever upward toward the T on the drawbar. The brakes shoes are actuated through the mechanical linkage located inside the drawbar. The brake lever is continually held in the upward position so the skid can move. Be careful when you release the brake lever; it is spring-loaded and can cause the lever to snap downward. This may result in damage to the mechanical linkage system. The drawbar is attached to the skid by a quick-release pin. This pin also connects the brake linkage between the skid and the brake lever on the drawbar.

Two drawbars are available for use with the Aero 21C weapon skid. Use the short drawbar to transport short weapons or when working in an area where a long handle cannot be used. Use the long drawbar to transport long weapons, such as missiles, flare dispensers, or rocket launchers. The skid has an SWL of 5,000 pounds. It is used with various adapters to transport or load weapons, stores, and equipment.

The MHU-191/M munitions transporter (fig. 9-33) has a tubular frame with four rubber-tired wheels and a telescoping drawbar. The MHU-191/M is essentially the same as the Aero 21C weapon skid, except that the MHU-191/M has an improved braking system. When equipped with various adapters, it is used to transport and load various weapons, stores and equipment.

The MHK-128/M32K-5(V) munitions transporter (fig. 9-34) consists of a frame assembly with 53 pairs of mounting holes, four 14-inch wheels with solid tires, and a retractable or nonretractable drawbar. It has a mechanically actuated deadman and drum brakes on the two front wheels. Release the brake by using the hand lever on the drawbar handle. You steer the transporter by horizontally moving the drawbar.

The MHK-128/M32K-5(V) munitions transporter is used with the ADK-362/M32K-5(V) multiweapons adapter to transport a preconfigured multiweapon or single-weapon load from the stowage area to the aircraft. The transporter has a low-frame structure. It can be positioned under low wing stations of an aircraft. The MHK-128/M32K-5(V) munitions transporter has an SWL of 5,000 pounds. It is used with various adapters.

Aero 58A Skid Adapter

The Aero 58A skid adapter (fig. 9-35) has a front and rear section. These sections are similar in design. The primary difference is the base-the front section has a 10-inch base and the rear section has a 15-inch base, These front and rear sections fit on the rails of the

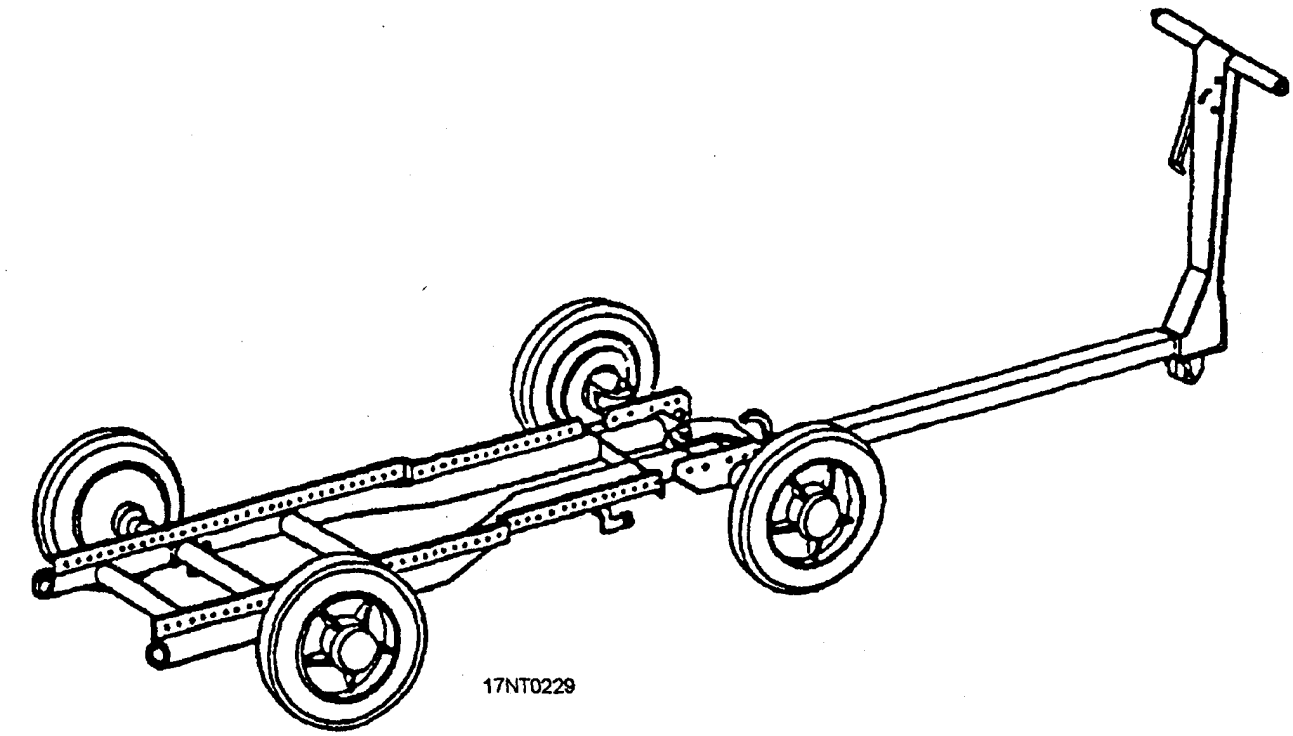


Figure 9-33.—MHU-191/M munitions transporter.

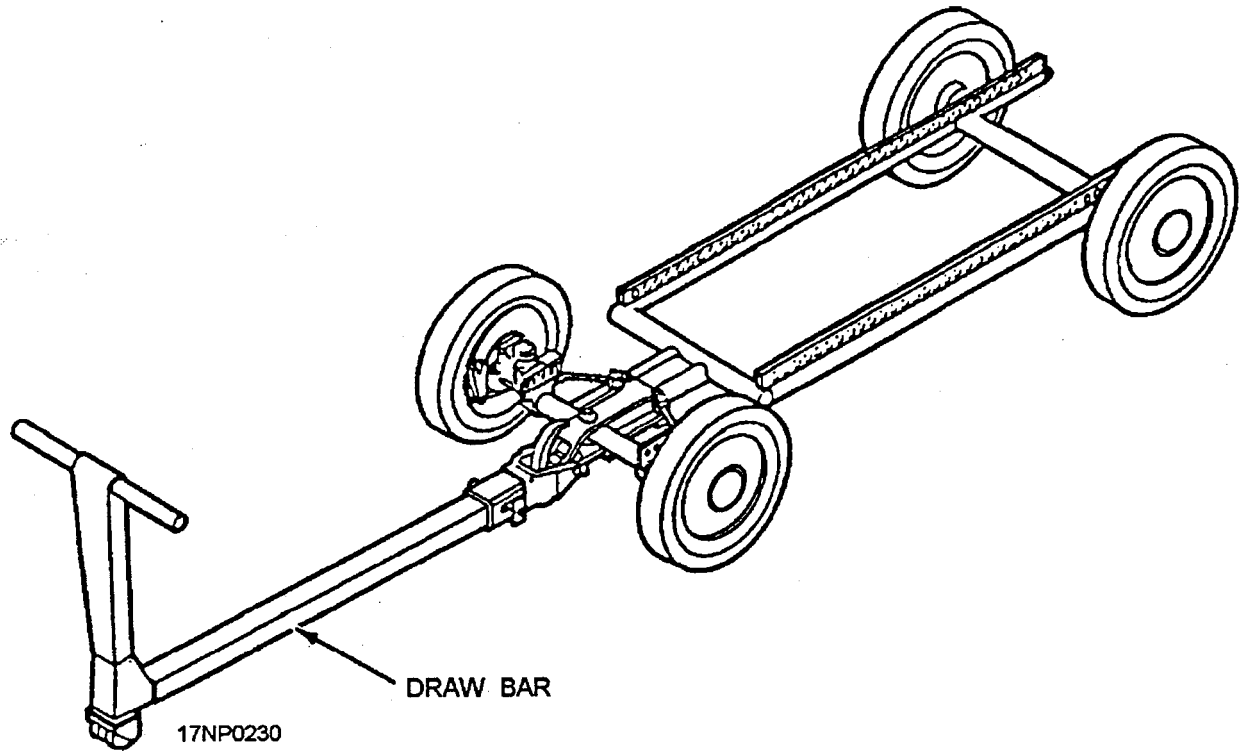


Figure 9-34.—MHK-128/M32K-5(V) munitions transporter.

skid. Each adapter section has two removable rubber rollers supporting the weapon. These rollers are adjustable from one to six positions to accommodate weapons of different diameters. Nylon straps hold the weapon in place.

One set of Aero 58A skid adapters has an SWL of 5,000 pounds. It holds a single weapon up to 30.5 inches in diameter. This adapter can also be used with the MHU-125/E platform skid, MHU-126/M munitions trailer, and the MHK-128/M32K-5 munitions transporter.

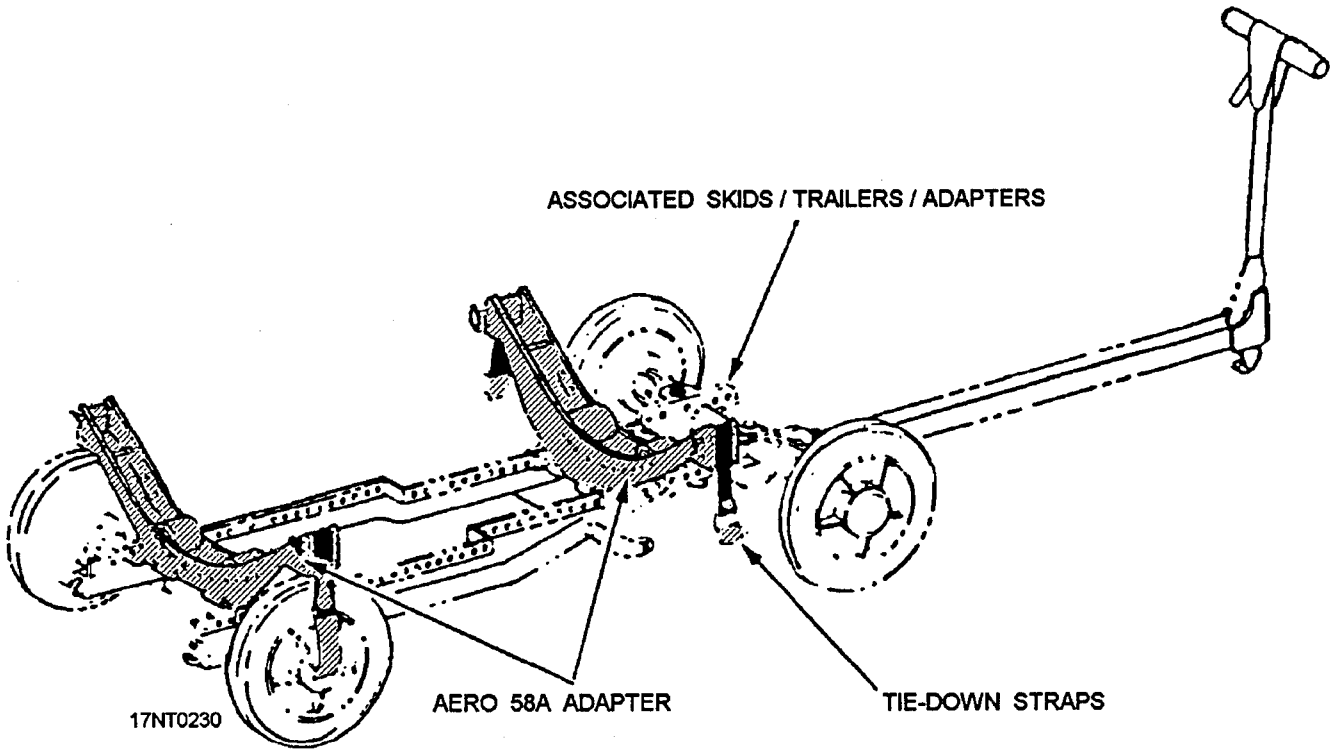


Figure 9-35.—Aero 58A skid adapter mounted on an Aero 21C weapon skid.

ADU-483/E SKID ADAPTER ASSEMBLY.— The ADU-483/E skid adapter assembly (fig. 9-36) consists of one steel upper-frame section with two removable rubber rollers and a nylon tie-down strap with a buckle. A quick-release pin is used to attach and secure the two adapter assemblies together at the top. This forms a complete load-bearing assembly that supports two cylindrical weapons side by side. The position of the outboard roller is fixed. The inboard roller can be positioned in either of two positions to hold weapons of different diameters.

The ADU-483/E skid adapter assembly is used in pairs with the Aero 58A skid adapters. When mounted on the top of two Aero 58A skid adapters (front and rear) and secured with quick-release pins, the ADU-483/E skid adapter assembly supports two weapons from 9 to 16 inches in diameter. Two pairs of the ADU-483/E skid adapters have an SWL of 4,000 pounds. When the skid adapter assemblies are installed, the Aero 58A skid adapter is limited to weapons with a maximum diameter of 16 inches.

ADU-496A/E SINGLE STORE ADAPTER.— The ADU-496A/E (fig. 9-37) consists of a steel body and urethane pad bonded together to form a single unit.

The adapter is used in sets of four to support a single weapon, and 10-inch diameter and larger weapons/stores during handling and transport on the MHU-191/M munitions transporter. The adapter attaches to the AERO-58A, ADU-483/E, and ADU-397/E Skid and cradle adapters.

The ADU-496A/E is used to support the AGM-88 HARM missile and 10-inch diameter and larger stores.

AERO 91A BRACKET ADAPTER— The Aero 91A bracket adapter (fig. 9-38) consists of an arm weldment, two sleeve weldments, connecting pins, hooks, T bolts, and clamp weldments. You can adjust the bracket to hold loads varying between 28 and 40 inches in width.

The Aero 91A bracket adapter is attached to the Aero 58A skid adapters to convert the Aero 21C weapon skid into a flatbed vehicle capable of handling weapon pallets, cradles, and containers. Two bracket adapters are required for each skid. A set of two Aero 91A bracket adapters has an SWL of 4,000 pounds.

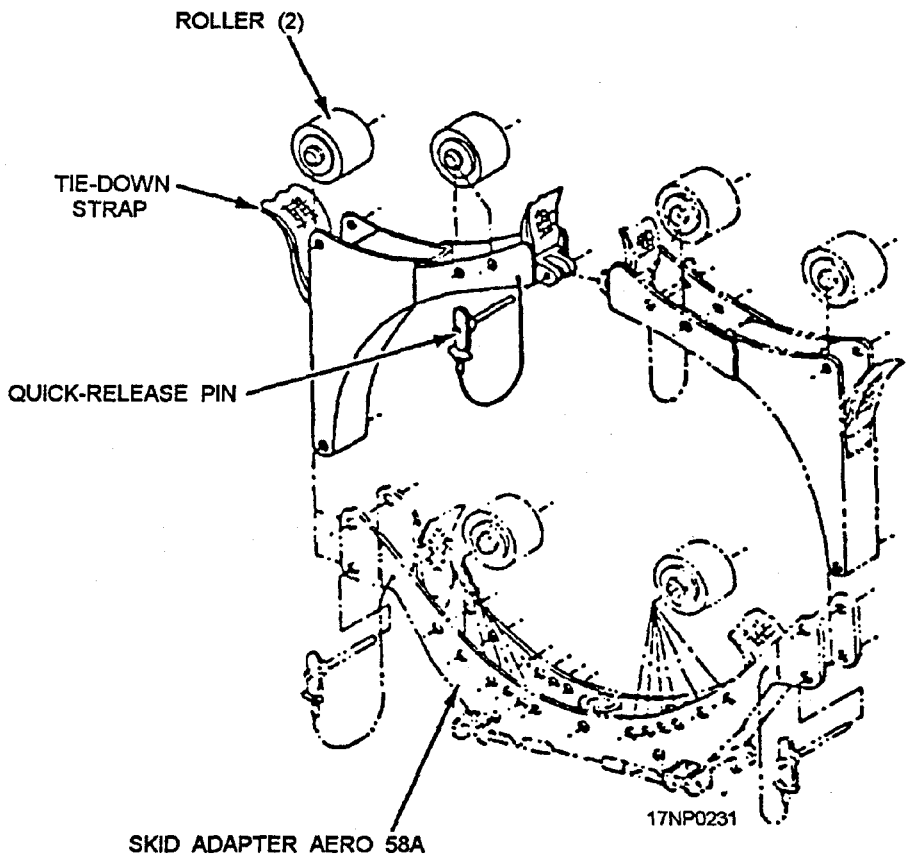


Figure 9-36.—ADU-483/E skid adapter assembly.

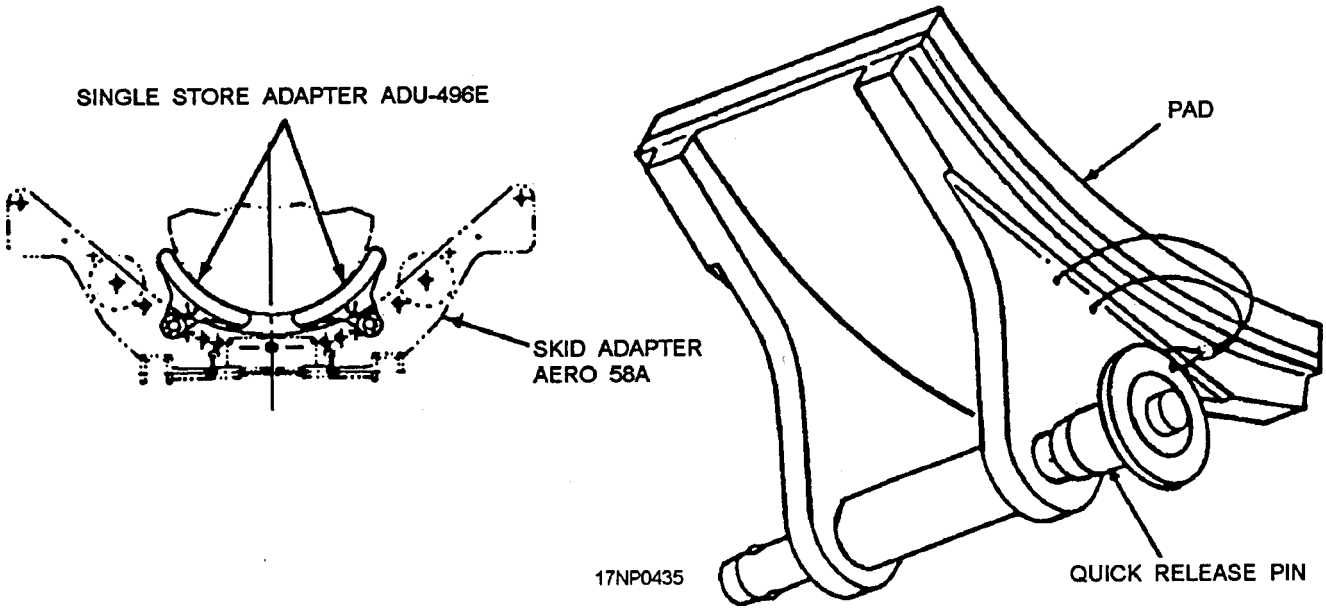


Figure 9-37.—ADU-496A/E single store adapter.

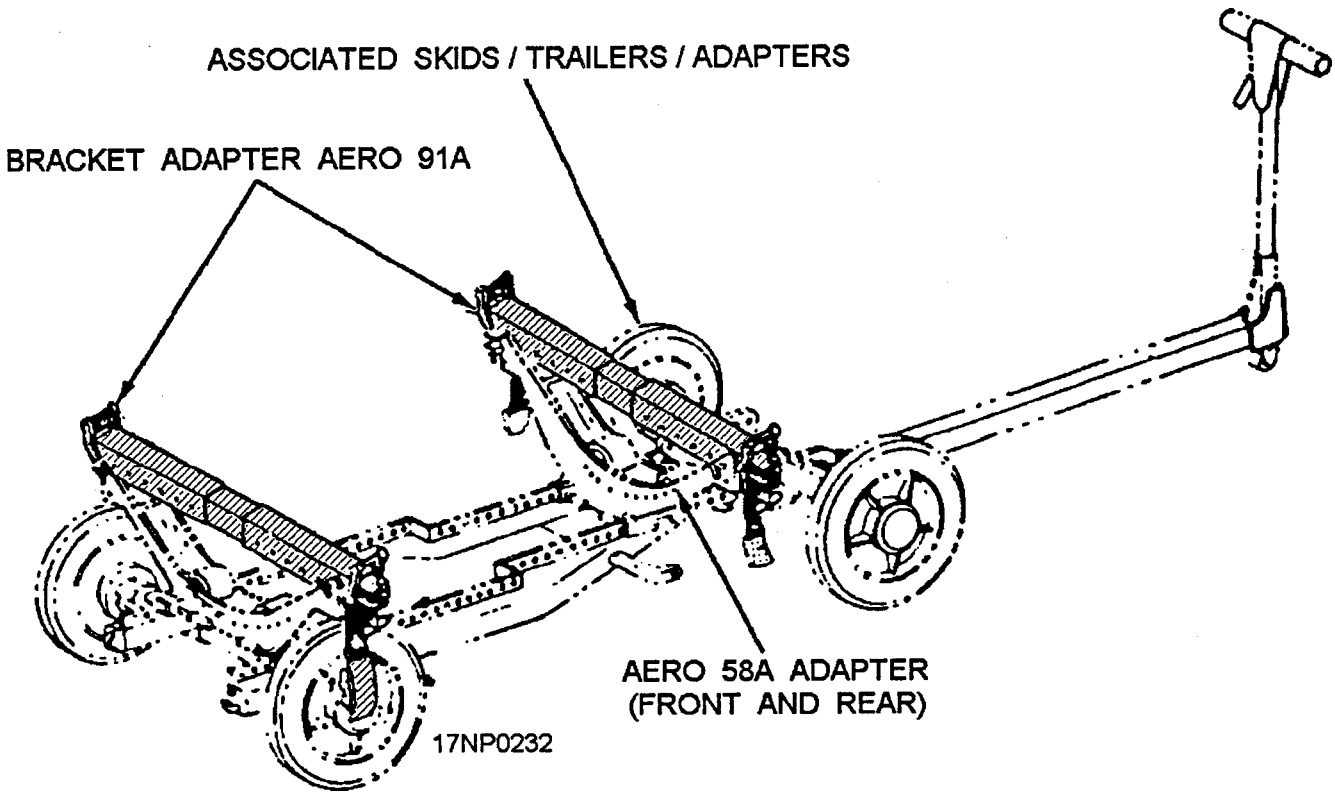


Figure 9-38.—Aero 91A bracket adapter mounted to Aero 58A skid adapters/Aero 21C weapon skid.

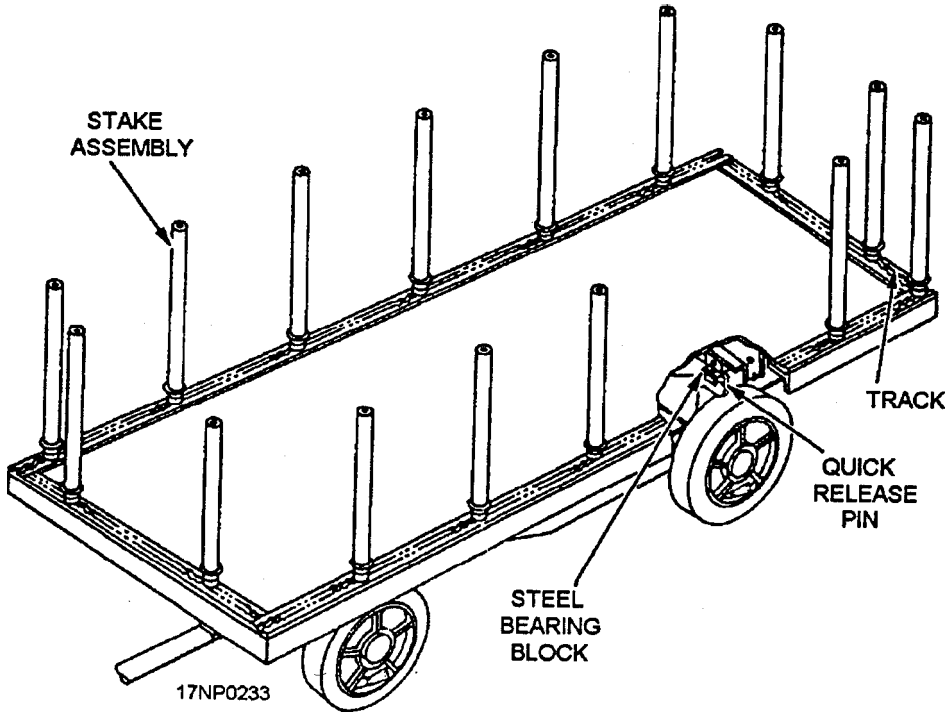


Figure 9-39.—Aero 71A skid adapter mounted to Aero 58A skid adapters/Aero 21C weapon skid.

AERO 71A SKID ADAPTER.— The Aero 71A skid adapter (fig. 9-39) consists of a welded aluminum angle frame, sheet aluminum deck, and steel tube stakes. The adapter is secured to a weapon skid by quick-release pins. An extruded aluminum track around the edges of the flatbed allows the attachment of the steel tube stakes.

When using the Aero 71A, you must use two Aero 58A skid adapters in order to form a flatbed conveyance for transportation of the weapon component containers and a variety of other materials. The Aero 71A can be used with various skids, transporters, and trailers. The adapter has an SWL of 4,000 pounds.

AERO 64A SOFT-BELT ADAPTER— The Aero 64A soft-belt adapter (fig. 9-40) consists of a flexible neoprene-covered, woven-wire sling, The adapter has slots at the ends for attaching tie-down straps. The adapter is also equipped with brackets for attaching it to the skid.

Two soft-belt Aero 64A adapters support a soft-skin store up to 30 inches in diameter. Each adapter has an SWL of 2,500 pounds. The Aero 64A is designed for use with Aero 58A skid adapters, and is used with various skids, transporters, and trailers.

AERO 83A TRANSPORT ADAPTER— The Aero 83A transport adapter (fig. 9-41) consists of a

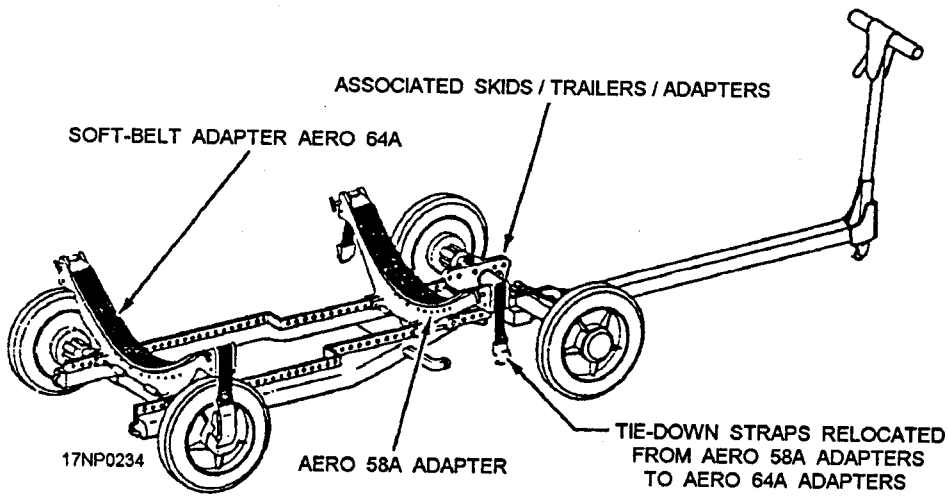


Figure 9-40.—Aero 64A soft-belt adapter mounted to Aero 58A skid adapters/Aero 21C weapon skid,

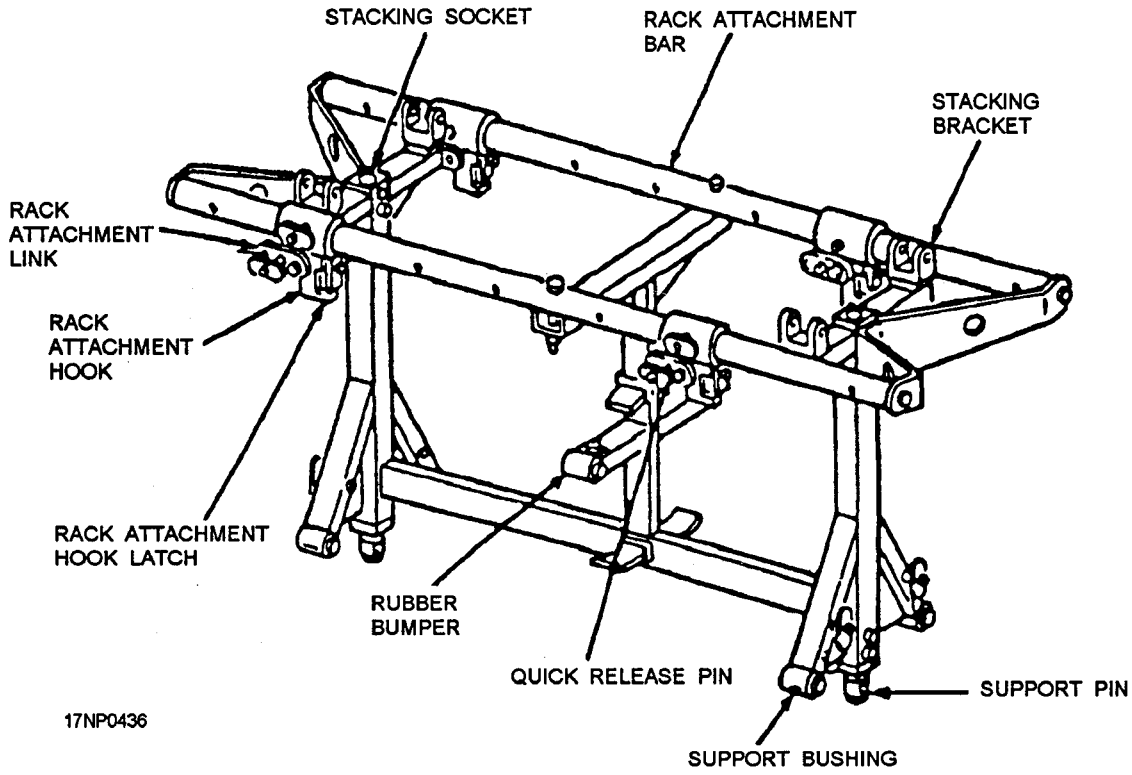


Figure 9-41.—Aero 83A transport adapter.

tubular aluminum frame with a system of movable suspension assemblies. The adapter is equipped with four rack-attachment hooks adjusted to accept 14- or 30-inch suspension lugs. The adapter is equipped with two tie-down straps to secure the load against the rubber bumpers.

The Aero 83A transport adapter is used with the Aero 58A skid adapter on the Aero 21C weapon skid for transporting empty multiple ejector racks (MERs) and triple ejector racks (TERs). One adapter can handle two MERs or two TERs. The adapters can be stacked two high so four racks can be transported. Stack the adapters by inserting the support pins of the upper adapter into the stacking sockets of the lower adapter. Then mount the adapter on the skid by inserting the Aero 83A transport adapter support pins into the front and rear sockets of the Aero 58A. The Aero 83A has an SWL of 5,000 pounds.

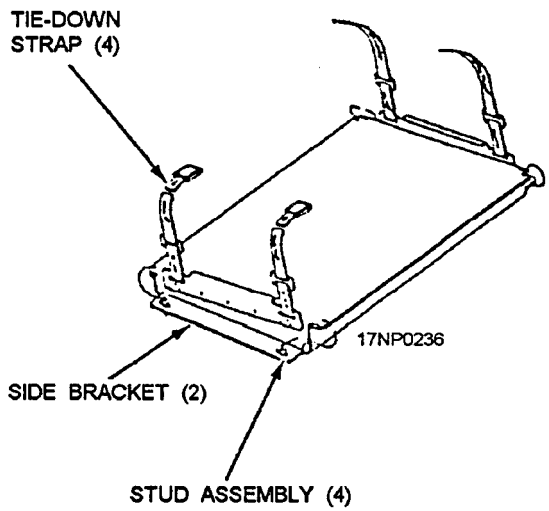


Figure 9-42.—MXU-661/E skid platform adapter assembly.

MXU-661/E SKID PLATFORM ADAPTER ASSEMBLY.— The MXU-661/E skid platform adapter assembly (fig. 9-42) consists of an aluminum platform weldment, two side brackets with straps and buckles, and four stud assemblies. Two skid platform adapter assemblies are fastened to the side frames of the Aero 71A skid adapter. One MXU-661/E skid platform adapter assembly is located at each end of the Aero 71A skid adapter and attached by means of a platform stud assembly.

The MXU-661/E adapter is used on the Aero 71A. It is mounted on the front and rear parts of the Aero 58A skid adapter. This forms a flatbed on the Aero 21C weapon skid capable of holding and transporting up to 32 sonobuoys in containers.

ADU-514A/E Small Missile Adapter

The ADU-514A/E small missile adapter (fig. 9-43) is an aluminum weldment that consists of upper and lower frames with support pads, two side blocks, and buckle and strap. The adapter is used in pairs and features a three-tier design. The missile support pads are gel filled to provide contoured cradling of missiles and weapons.

The ADU-514A/E small missile adapter is used on a variety of weapon skids, transporters, and trailers for transporting up to six each of the following missiles: AIM-7 series, AIM-120 series, AMRAAM, AIM-9 series, and AGM-114B.

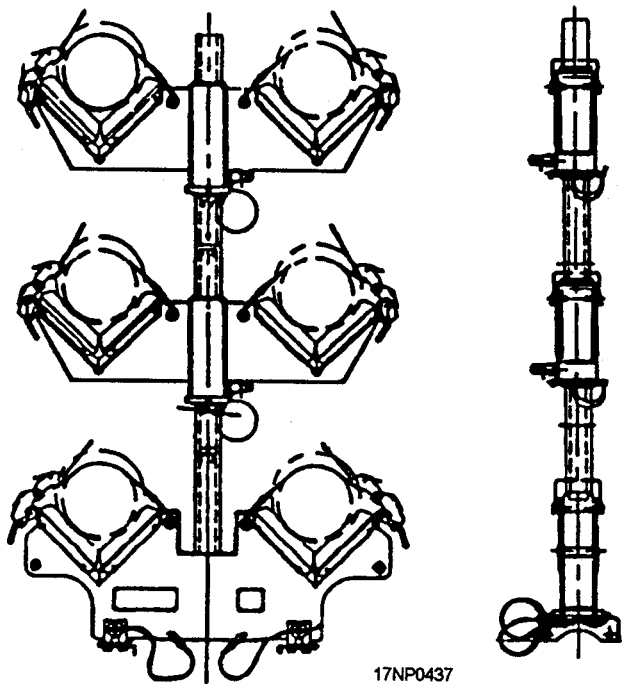


Figure 9-43.—ADU514A/E small missile adapter.

ADU-567/E Wing/Fin Guard Adapter

The ADU-567/E adapter (fig. 9-44) consists of a tube extension, pivot tube, two guards, main tube

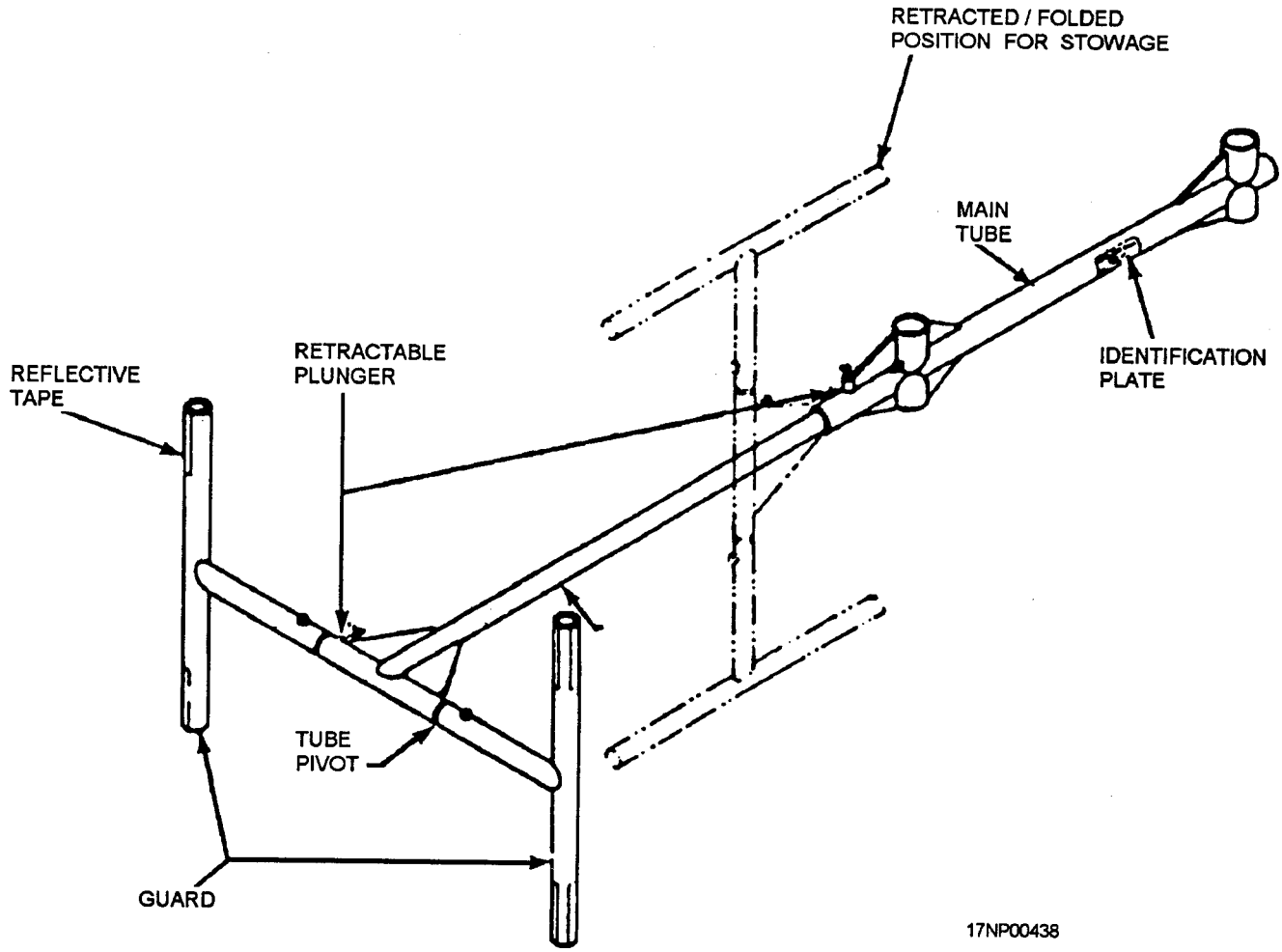


Figure 9-44.—ADU-567/E wing/fin guard adapter.

weldment, and retractable spring-locking plungers. The tube extension can be retracted and locked into the main tube weldment, and the two guards can be pivoted and locked in a flat position to create a compact shipping and stowage package.

The ADU-567/E adapter provides protection for Sidewinder AIM-9 wings and fins when attached to the ADU-514/E small missile adapter during transporting and handling.

ADU-511A/E Adjustable Weapons Adapter

The ADU-511A/E adapter (fig. 9-45) has adjustable chocks that can be configured for different diameter weapons. Designed to carry two stores side by side, the adapter may also be configured to carry single stores.

The ADU-511A/E adapter is used in support of the AIM-7, AIM-120, ARMAAM, AGM-88, and the AGM-65 missiles for transporting and loading operations.

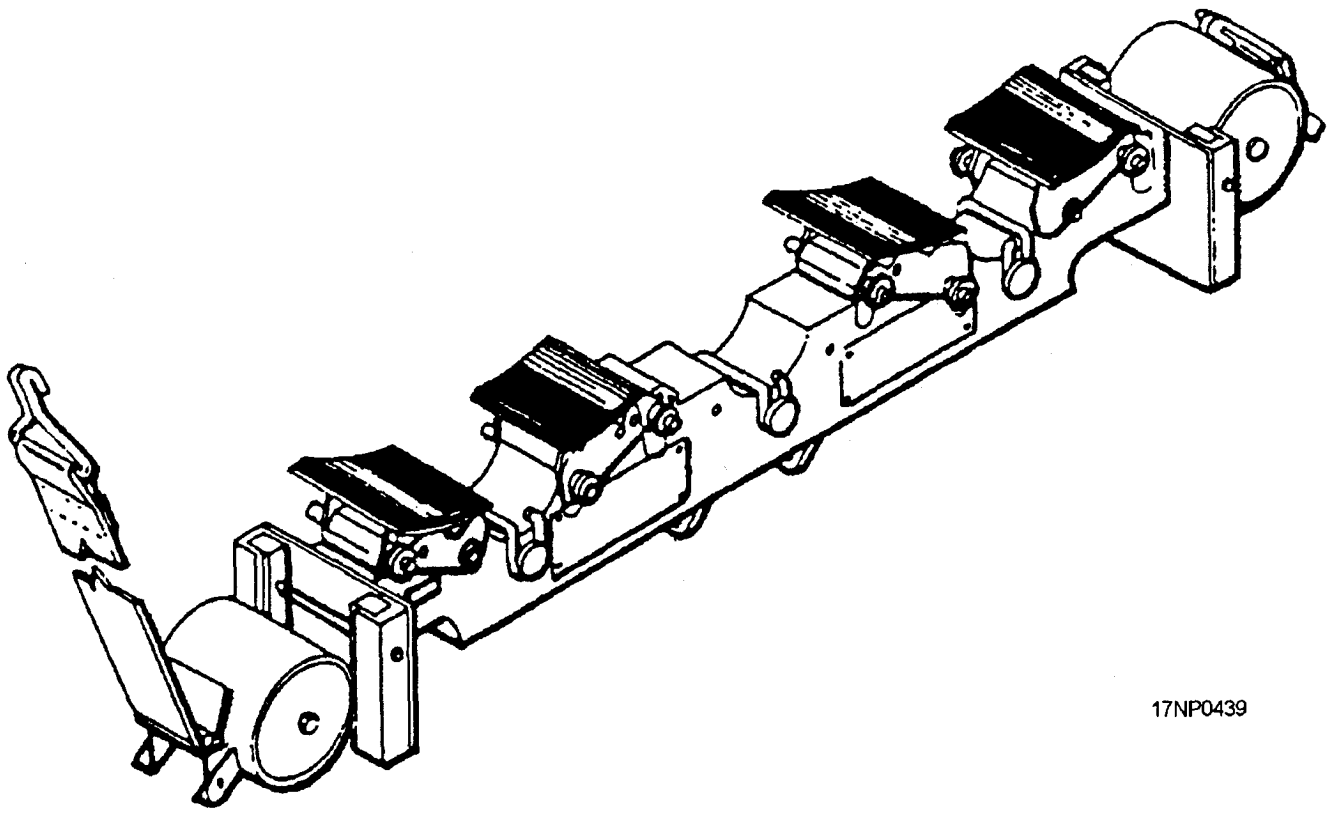


Figure 9-45.—ADU-511A/E adjustable weapons adapter.

ADK-362/A/B/M32K-5(V) Multiple Weapon Adapter

The ADK-362/A/B/M32K-5(V) multiple weapon adapter (fig. 9-46) consists of a 10-inch support assembly, two 15-inch support assemblies, two weapon cradle adapter assemblies, two MER/TER (female) rails and two MER (male) rails. The A model added an F- 14 aircraft weapon rail capability. The B model modified the weapon cradle for cost reduction purposes. These assemblies and rails are used in various combinations on the MHK-128/M32K-5(V) munitions transporter. It can be fitted with a drawbar, which lets you use the transporter with any one of six munitions handling configurations. The ADK-384/M32K-5(V) space adapter provides an interface between the ADK-362 adapter and the Aero 21C weapon skid.

Various configurations of the ADK-362/A/B/ M32K-5(V) multiple weapon adapter can carry stores that have different lengths, diameters, and weights. The physical data are listed in table 9-3. The single-weapon configuration is used for hard-shell and soft-shell weapons up to 24 inches in diameter. The two-weapon configuration is for 13-inch to 14-inch diameter weapons. Its low-frame structure enables a two-weapon set to be positioned under the low wing stations of an aircraft. The three-weapon configuration is arranged in either a low-position or a high-position assembly. The low-position assembly holds weapons up to 10 3/4 inches in diameter. The high-position assembly is for weapons larger than 10 3/4 inches in diameter. The multiweapon configuration (fig. 9-47) can carry six weapons from 9 to 16 inches in diameter or four weapons from 9 to 18 3/4 inches in diameter.

ADU-400/E Weapon Skid Loading Lift Adapter

The ADU-400/E weapon skid loading lift adapter (fig. 9-48) consists of a hydraulically controlled steel lift

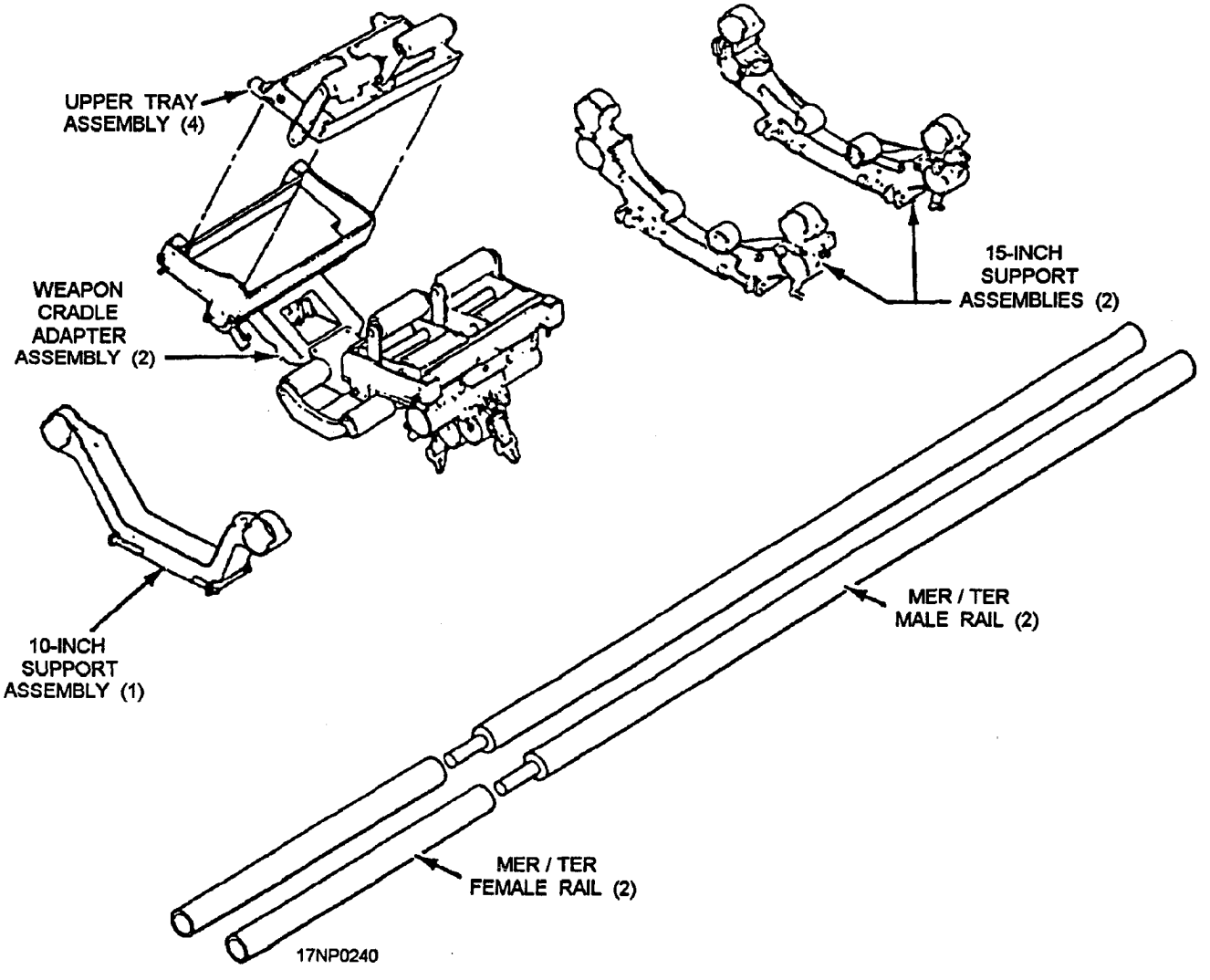


Figure 9-46.—ADK-362/A/B/M32K-5(V) multiple weapon adapter.

Table 9-3.—ADK-362/A/B Multiple Weapon Adapter Physical Data

Configuration	SWL (lbs)	*Weight (lbs)	*Length (in.)	*Width (in.)	*Height (in.)
Single-Weapon, Hard-Shell	4,000	56	**	31.06	17.50
Single-Weapon, Soft-Shell	2,000	84	**	31.06	17.50
Two-Weapon (Alternate low position)	***2,000	98	28.00	33.37	15.12
Three-Weapon, High Position	***3,000	202	32.00	Variable from: 31.50 to 39.00	Variable from: 22.20 to 23.71
Three-Weapon, Low Position	***3,000	202	32.00	Variable from: 31.50 to 39.00	Variable from: 18.11 to 19.62
Multiweapon	***5,000	413	112.00	Variable from: 31.50 to 39.00	Variable from: 22.20 to 23.71

* Values do not include those of Munitions Transporter MHK-128/M32K-5(V).

** Variable, depending upon weapon.

***1,000 pounds each station (limited, for multiweapon configuration, to the capacity of the Munitions Transporter MHK-128/M32K-5(V).

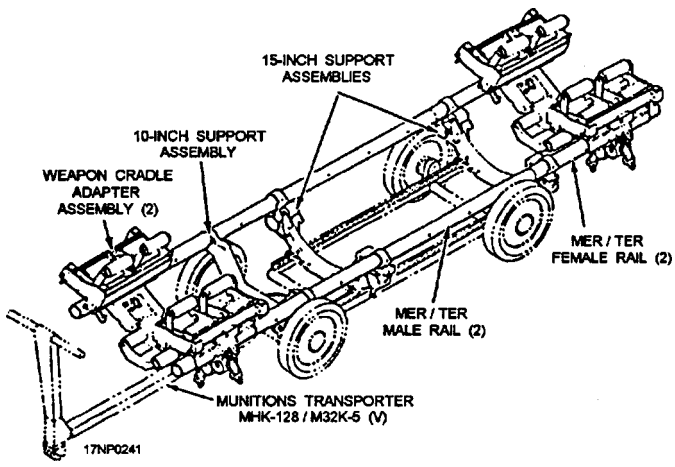


Figure 9-47.—Multiweapon configuration.

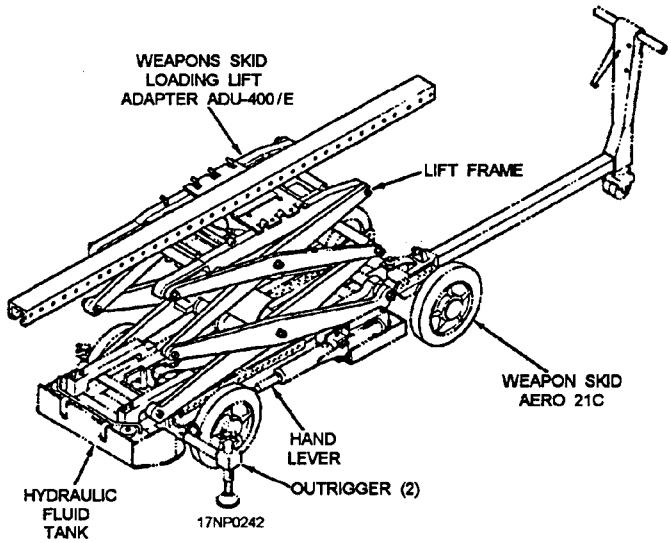


Figure 9-48.—ADU-400/E weapon skid loading life adapter mounted to an Aero 21C weapon skid.

frame that supports a drilled steel tubular beam. The hydraulic system includes a fluid tank, hand lever, cylinder, and pressure gauge. There are extendable outriggers with height adjustment handles to provide stability when the adapter is mounted on the appropriate transporter.

The ADU-400/E adapter is mounted on the Aero 21C weapon skid. It is used with a variety of adapters to lift and position armament and maintenance devices on the aircraft. This adapter has an SWL of 2,500 pounds.

Aero 36A Bomb Truck Adapter

The Aero 36A bomb truck adapter (fig 9-49) consists of tie-rods, tubes, transverse screw, nut, brackets, protective sleeving, rollers and shafts, rocket brackets, baseplate, pins, cradle supports, and cradles for 14-inch, 22-inch, and 30-inch diameter stores. The cradles are adjustable horizontally, either left or right 8 1/4 inches from the center position.

The Aero 36A bomb truck adapter is used on the Aero 33D/E bomb truck or the Aero 21C weapon skid with the Aero 65A skid adapter. This allows you to center stores in the aircraft without moving the bomb truck or weapon skid. The Aero 36A has an SWL of 4,000 pounds.

REVIEW NUMBER 6

Q1. *What is the purpose of adapters when used with skids and weapons transporters ?*

Q2. Describe how the brakes work on the Aero 12C bomb skid.

Q3. What is the SWL of the Aero 12C bomb skid?

Q4. List the adapters used with the 12C bomb skid.

Q5. What adapter should you use to store a soft-skin weapon on an Aero 12C bomb skid?

Q6. What is the SWL of the Aero 21C bomb skid?

Q7. What is the SWL of the MHK-128/M32K-5(V) munitions transporter?

Q8. List the adapters/adapter assemblies used with the Aero 58A skid adapter

Q9. When mounted on the Aero 58A skid adapter, the ADU-483/E skid adapter assembly can support two weapons of what diameter?

Q10. What weapon skid loading lift adapter consists of a hydraulically controlled steel lift frame?

Q11. What is the SWL of the Aero 36A bomb truck adapter?

TRUCKS

LEARNING OBJECTIVE: *Identify trucks used for ordnance handling to include ammunition handling, forklift, pallet, and Aero 33D/E bomb trucks. Recognize the safe loads for each.*

The term *truck* applies to either a manually propelled or self-propelled vehicle. Self-propelled trucks are powered by gasoline engines, diesel engines, or electric motors.

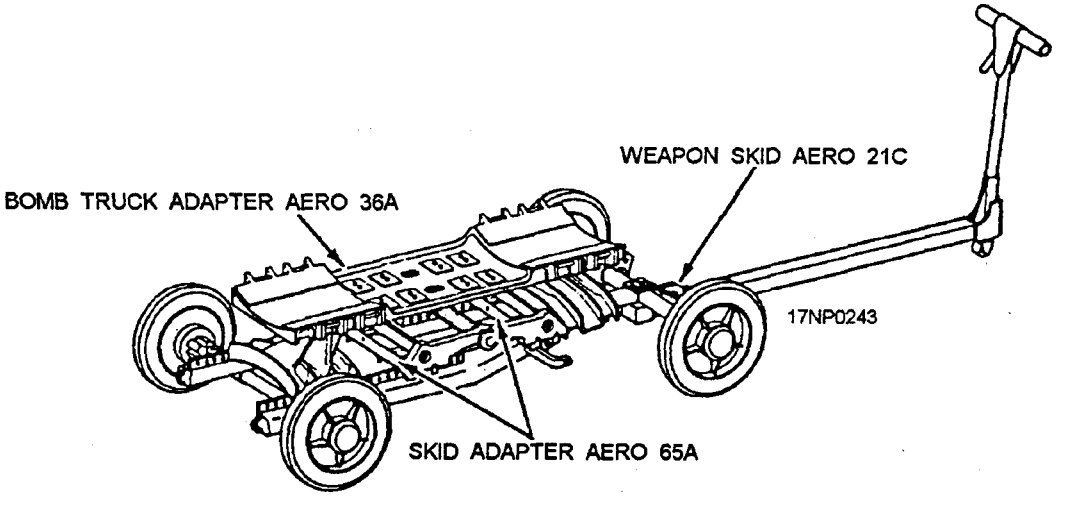


Figure 9-49.—Aero 36A bomb truck adapter mounted to an Aero 21C weapon skid.

Gasoline- or diesel-powered trucks are equipped with exhaust system spark arresting devices. These devices help ensure safe operation of the trucks in areas where there is danger of fire or explosion caused by sparks. These vehicles must meet rigid mechanical and safety inspections. **Do not use vehicles that don't meet the minimum established inspection and safety criteria in ordnance handling evolutions.**

FORKLIFT TRUCKS

The forklift truck is a mobile four-wheel or three-wheel unit that lets one person pick up, transport, and lift the load to different heights. The forklift truck is designed on the cantilever principle. The front wheels act as a fulcrum. The load is counterbalanced because the weight of the truck is directly behind the front wheels.

The forklift truck has two fork tines secured to the supporting frame. Both tines and the supporting frame are located in the front of the truck. The tines are moved vertically on the supporting frame by a hydraulic lift. The supporting frame may be either telescoping (to provide greater lift) or nontelescoping. The tines and supporting frame can be tilted forward from the vertical position to pickup the load. The frame can be tilted backward from a vertical position to help balance the load. The tines can also be fitted with an adapter hook, Mk 91 Mod 0 (fig. 9-50), which converts a forklift truck tine assembly into a fork/boom assembly, for lifting and transporting various loads.

Forklift trucks are powered by gasoline engines, electric motors, or diesel engines. The electric motor or diesel engine forklift trucks are normally used during ordnance evolutions. Forklift trucks are equipped with braking systems and with either automobile- or lever-type steering mechanisms. Forklift trucks have solid rubber cushion tires for use over smooth and hard surfaces, such as paved roads, magazine and warehouse floors, and piers. Pneumatic tires are used for rough and uneven terrain, in mud, or over soft, sandy ground.

Diesel Engine Forklift Trucks

A wide variety of diesel engine forklift trucks are available for use throughout the Navy. They range from a 4,000-pound capacity to a 20,000-pound capacity.

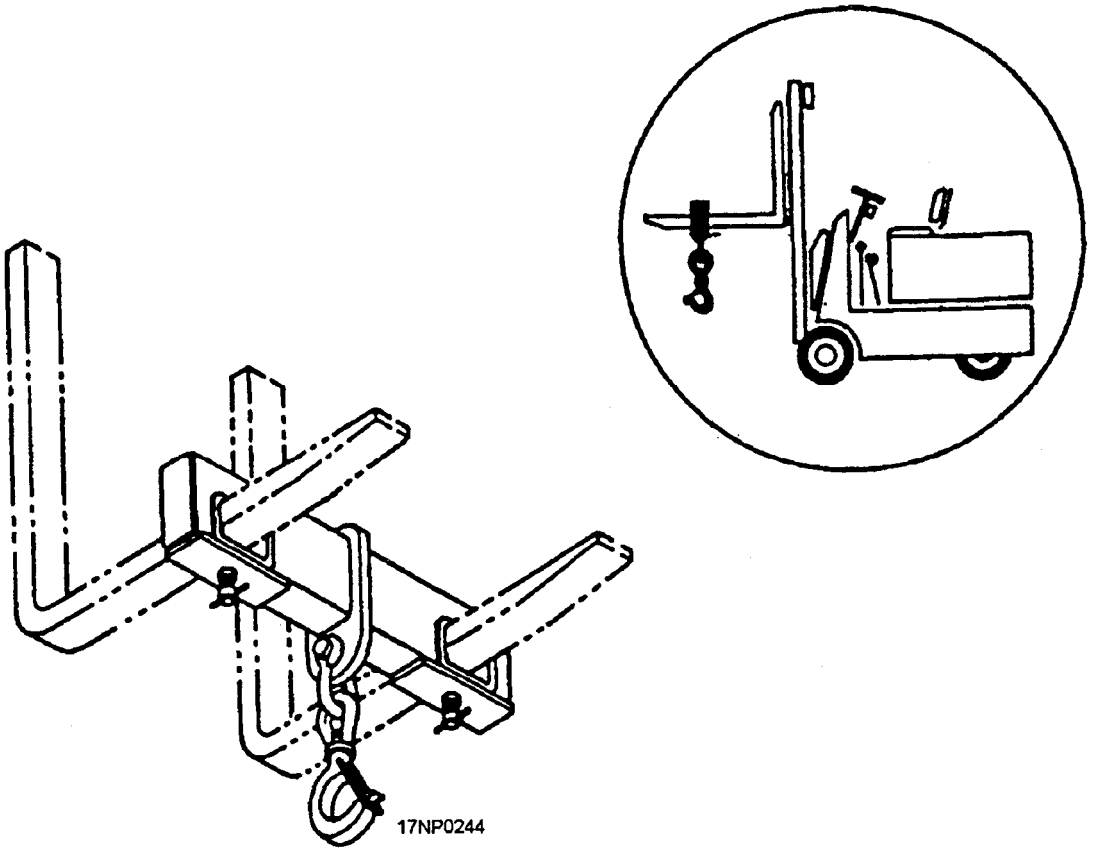


Figure 9-50.—Mk 91 Mod 0 adapter hook.

Look at figure 9-51. It shows a typical 6,000-pound capacity forklift truck. This truck has a diesel engine and four pneumatic rubber tires. It is typical of the size and capacity ordnancemen usually use. A number of different models of this forklift truck are used at naval activities. Every model has an adjustable two-tine fork. The tines are secured to a vertical supporting frame that can be telescoped and tilted. The lifting and tilting mechanisms are hydraulically operated. An overhead guard is also provided for the operator's safety. Forklift trucks have either dual or single front wheels, diesel engines, power-shifted transmissions, and either pneumatic or cushion tires. The main difference between the 4,000- and 6,000-pound trucks is in load-carrying capacity and in overall truck dimensions and weight. The exhaust systems of these trucks have spark-arresting devices that are used even when handling ammunition in the open.

Electric Forklift Trucks

Electric forklift trucks are used frequently by ordnancemen. They are discussed in the following paragraphs.

ELECTRIC FORKLIFT TRUCK, 4,000 - POUND CAPACITY.— A typical 4,000-pound

REVIEW NUMBER 6 ANSWERS TO QUESTIONS Q1. THROUGH Q11.

A1. When used with skids and weapons transporters, adapters are used to support a load for movement from one area to another.

A2. The brakes on the Aero 12C bomb skid are applied by lowering the aft end of the skid to the deck

A3. The SWL of the Aero 12C bomb skid is 1,250 pounds.

A4. The adapters used with the 12C bomb skid include the Aero 9B/C bomb skid adapter, Aero 39B bomb skid adapter, and Aero 64B soft-belt adapter.

A5. You should use a 64B soft-belt adapter to store a soft-skin weapon on an Aero 12C bomb skid.

A6. The SWL of the Aero 21C bomb skid is 5,000 pounds.

A7. The SWL of the MHK-128/M32K-5(V) munitions transporter is 5,000 pounds.

A8. The adapters/adapter assemblies used with the Aero 58A skid adapter include the 58A skid adapter ADU-483/E skid adapter assembly, Aero 57A skid adapter, Aero 91A bracket adapter, Aero 71A skid adapter, Aero 64A soft-belt adapter, 83A transport adapter, and MXU-661/E skid platform adapter.

A9. When mounted on the Aero 58A skid adapter the ADU-483/E skid adapter assembly can support two weapons between 9 and 16 inches in diameter.

A10. The ADU-400/E weapon skid loading lift adapter is a hydraulically controlled steel lift frame.

A11. The SWL of the Aero 36 bomb truck adapter is 4,000 pounds.

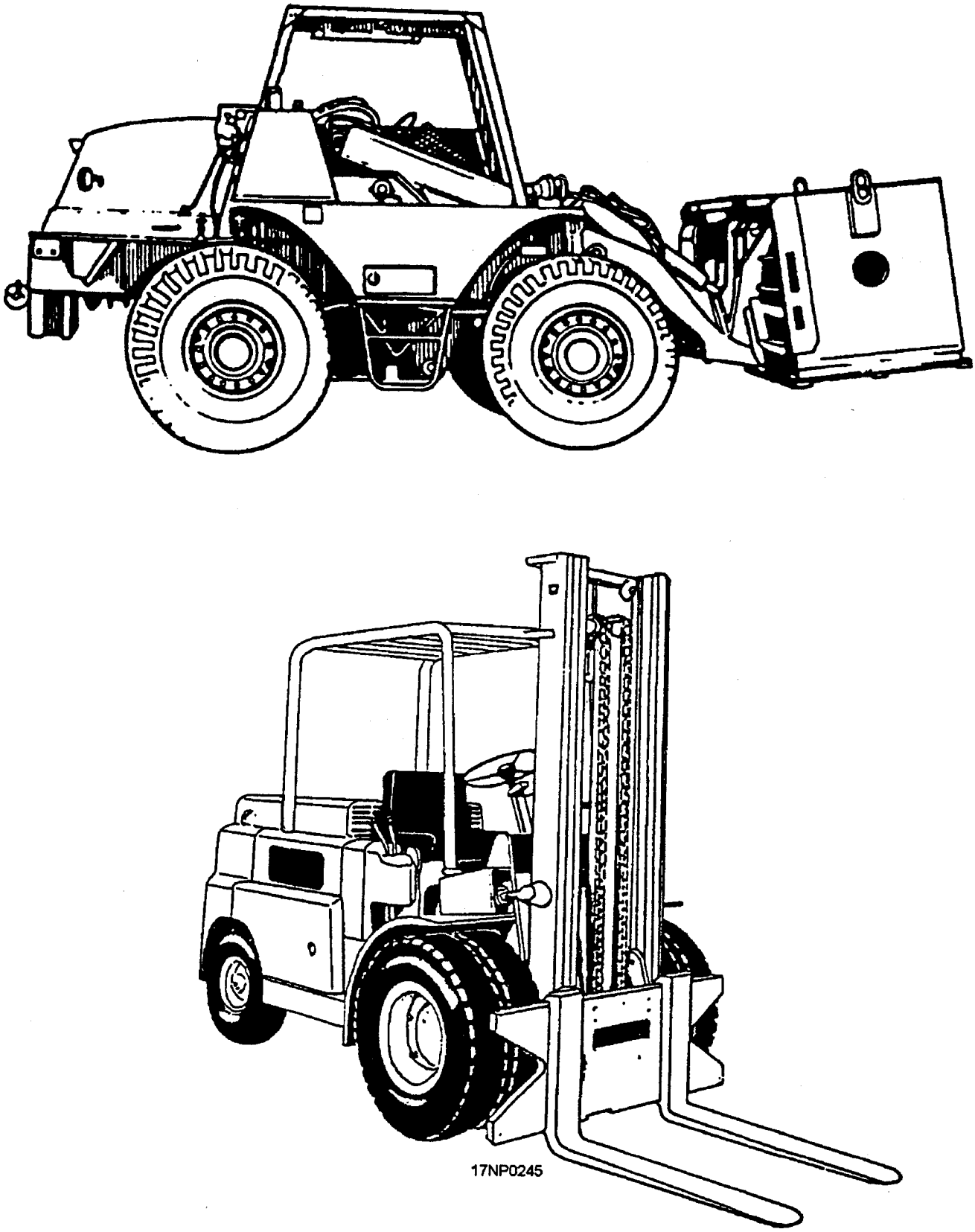


Figure 9-51.—Typical 6,000-pound capacity diesel forklift trucks.

capacity electric forklift truck is shown in figure 9-52. Many different models are currently used at naval activities. Every model has an adjustable two-tine fork secured to a vertical supporting frame, which can be telescoped and tilted. An overhead guard may be provided for the operator's safety.

A rechargeable battery provides power for the operation of the truck and its hydraulic lift and tilt mechanisms. This type of forklift truck can pick up, transport, and lift loads weighing up to 6,000 pounds. It can also handle boxes of ammunition and other hazardous materials that can be properly supported across the fork tines. When you handle ammunition, the truck is spark-enclosed or explosiveproof.

ELECTRIC FORKLIFT TRUCK (REACHING AND TIEING, CONTINUOUS DUTY, NARROW AISLE), 4,000-POUND CAPACITY.— A typical 4,000-pound electric (reaching and tieing, continuous duty, narrow aisle) forklift truck is shown in figure 9-53. Several different models of this type of truck are in use at naval activities. Every model has an adjustable two-tine fork. The tines are secured to a vertical supporting frame that can be telescoped and tilted. The tines are elevated by a hydraulic-mechanical lift mechanism. An overhead guard is provided for the operator's safety. All models of this truck have outriggers to provide a rigid structure. A rechargeable battery provides the power for the operation of the truck and its hydraulic lift and tilt mechanisms. The forklift truck has mechanical or hydraulic brakes that the operator applies by using a foot pedal.

This truck is used to pick up, transport, stack, and unstack palletized unit loads weighing up to 4,000 pounds. It is intended for use in warehouses that have narrow aisles, low floor-load ratings, and aboard aircraft carriers. When you use the truck to handle ammunition, it is spark-enclosed.

PALLET TRUCKS

The pallet trucks used most frequently by ordnancemen are discussed in the following paragraphs.

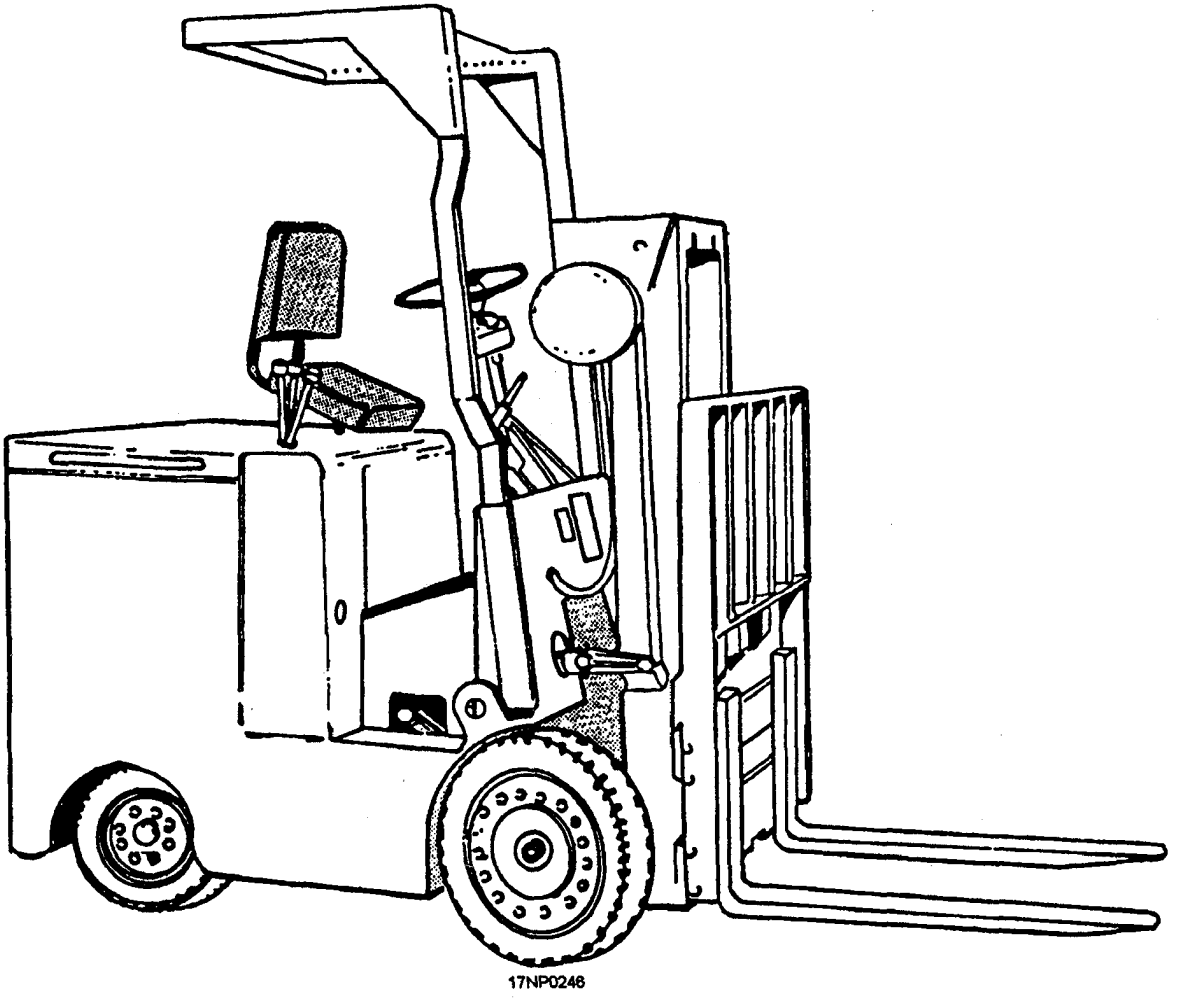


Figure 9-52.—Typical 4,000-pound capacity electric forklift truck.

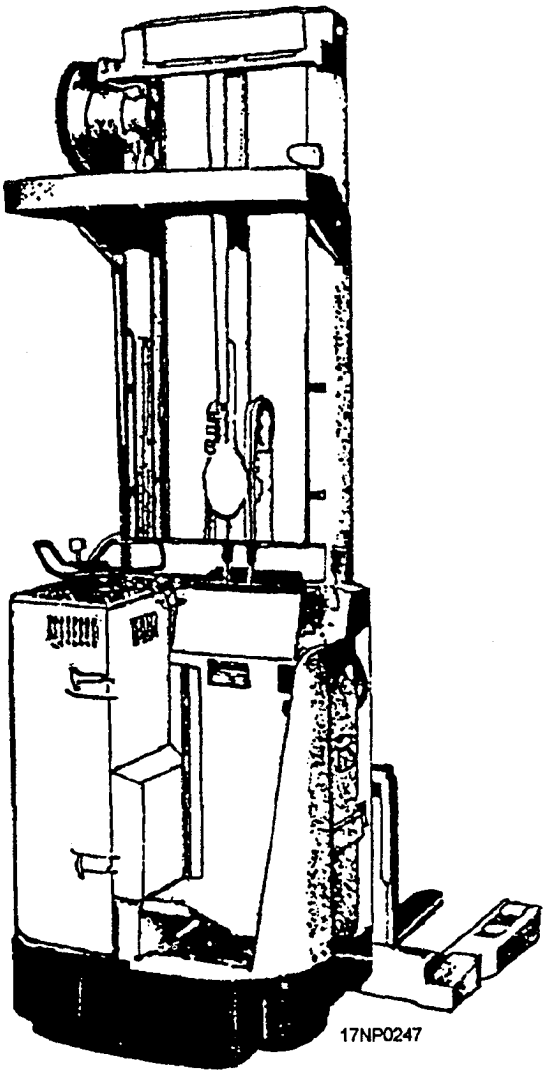


Figure 9-53.—Typical 4,000-pound capacity reaching and tieing (continuous duty, narrow aisle) electric forklift truck.

Electric Pallet Truck (Low Lift)

A typical 6,000-pound capacity electric (low lift) pallet truck is shown in figure 9-54. Several different models of this pallet truck are used at naval activities.

Each model of the pallet truck has a two-tine fork that supports a palletized load The tines are raised or lowered by a hydraulic lift mechanism. Depending upon the model, the lift mechanism is either electrically or manually operated The power source for truck traction is a rechargeable battery. It is steered by using the steering handle, with a possible right-angle turn in either direction. The truck is equipped with mechanical brakes, which, when applied, automatically shut off the electrical power.

The pallet truck is used to pick up, transport, and deposit palletized loads that do not exceed 6,000 pounds. This truck is used on hard and smooth surfaces, such as warehouse and magazine floors. The pallet truck is spark-enclosed when used to handle ammunition.

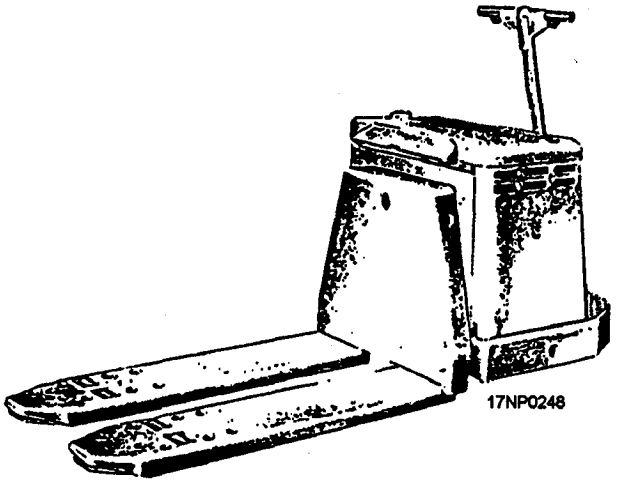


Figure 9-54.—Typical 6,000-pound capacity, low lift, electric pallet truck.

Hand Pallet Truck (Low Lift)

A typical 4,000-pound capacity (low lift) hand pallet truck is shown in figure 9-55. Many different models of this pallet truck are used at naval activities. Since the trucks all operate in the same way, the following general description applies to all models.

The 4,000-pound hand pallet truck has a two-tine fork that supports a palletized load. The tines are raised or lowered by a hydraulic or mechanical lift mechanism.

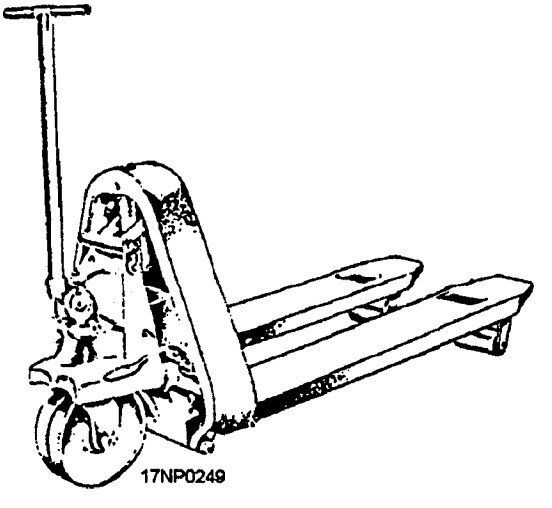


Figure 9-55.—Typical 4,000-pound capacity, low lift, hand pallet truck.

The height of lift differs from model to model but is generally in the range of 2 to 4 inches. Depending upon the model, the lift mechanism is operated by the tow handle, a foot pedal, or a hand lever. The truck is not self-propelled and requires manpower for locomotion. It is steered by the tow handle. A right-angle turn is possible in either direction without moving the truck. The drive wheel is located directly beneath the tow handle. It is usually one solid rubber tire. The load wheels, located approximately 6 inches from the ends of the fork tines, can be arranged in a single or double (tandem) fashion under each tine.

The hand truck is used to pick up, transport, and deposit palletized unit loads on single- or double-faced pallets that don't exceed 4,000 pounds in weight. This truck is particularly useful and economical for moving loads a short distance. It must be used in areas that have hard and smooth surfaces.

MK 45 MOD 2 HANDLIFT TRUCK

The Mk 45 Mod 2 handlift truck (fig. 9-56) body is mounted on two wheels equipped with polyurethane tires. The lifting mechanism, which includes a lift arm and a mounting pin for engaging the load, is manually operated by using a reversible, rachet-type, cranking lever to raise or lower the lift arm assembly. A handlebar is connected to the axle for steering the truck.

The Mk 45 Mod 2 is intended for use in lifting and maneuvering long, heavy containers and cradles within the weight capacity of two trucks (5,000 pounds). These trucks are used in pairs, with one truck positioned at each end of the container being handled.

AERO 33D/E BOMB TRUCK

The Aero 33D/E bomb truck (fig. 9-57) is a high-lift bomb truck designed to transport and load stores on

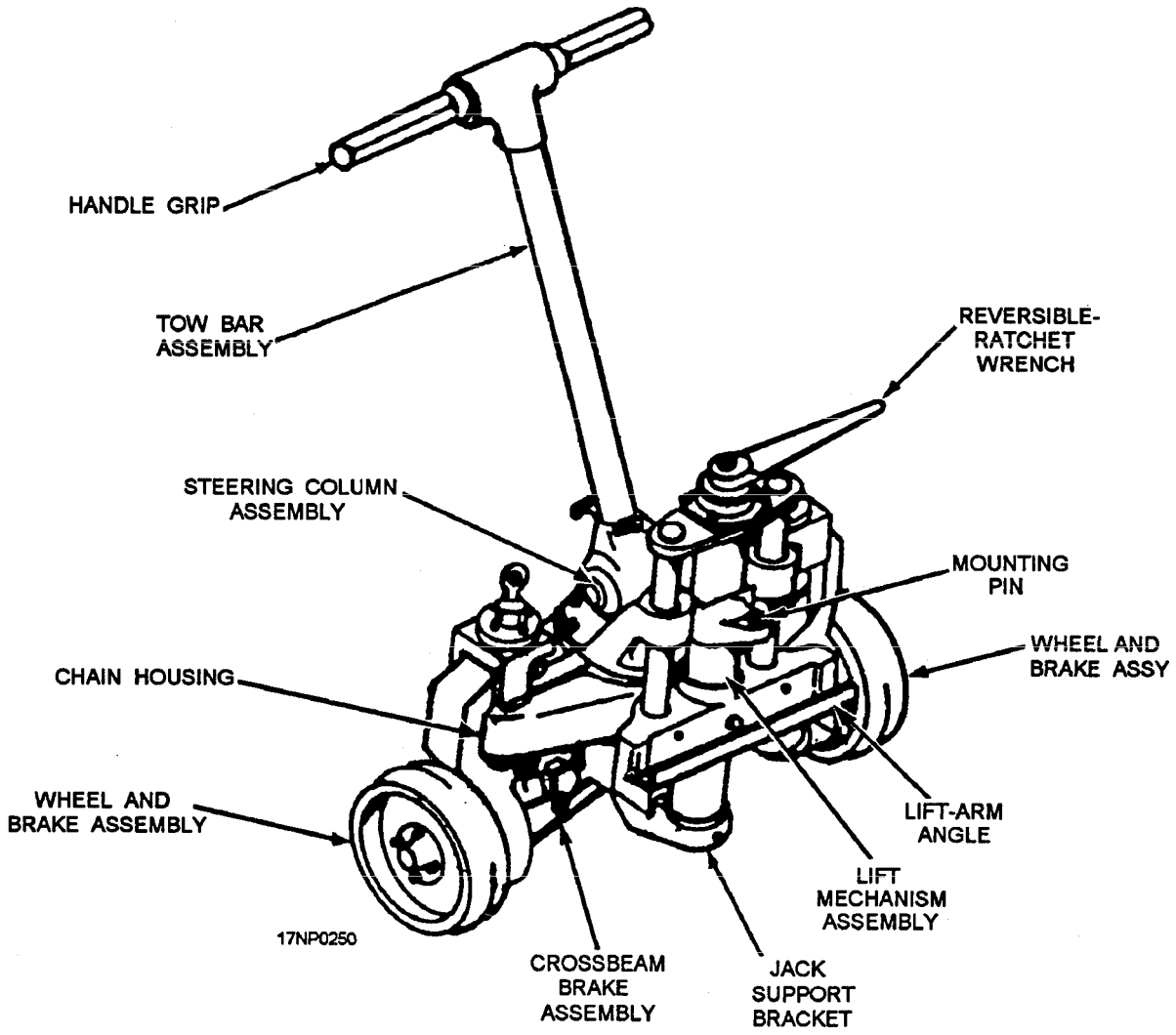


Figure 9-56.—Mk 45 Mod 2 handlift truck.

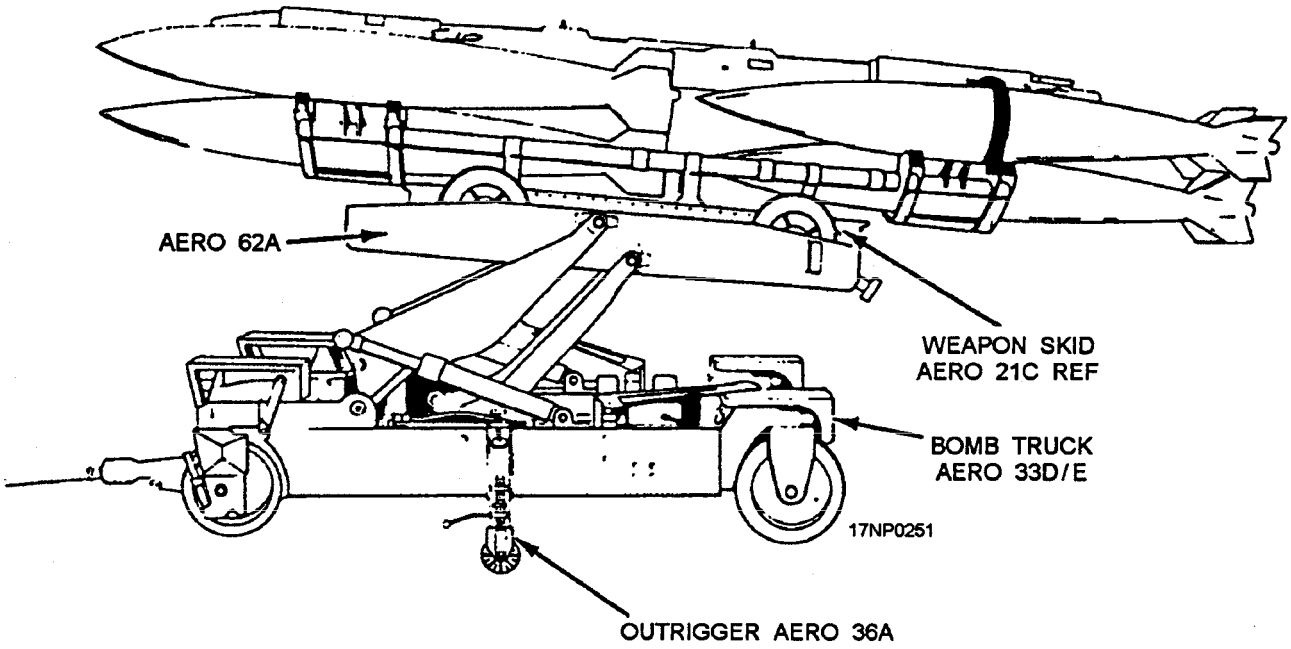


Figure 9-57.—Aero 33D/E bomb truck with an Aero 62A tray adapter and an Aero 36A outrigger assembly installed.

naval aircraft. The major difference between the Aero 33D and the Aero 33E models is that the Aero 33D model has both electric and manual controls, while the Aero 33E model features only manual controls for use with a hydraulic lift system. Except for the electrical features on the Aero 33D, the information contained in the following paragraphs is applicable to both models.

The Aero 33 D/E bomb truck is a high-lift, heavy-duty truck. The main frame is welded steel. The hydraulically operated arms have a variable lifting height between 30 and 63 inches. The truck has an SWL of 4,000 pounds. The truck is equipped with front-wheel mechanical brakes that are normally in the locked position. You can release the brakes by actuating the brake release handle on the drawbar or by the deadman brake lever on the drawbar socket.

The bomb truck is equipped with an Aero 62A tray adapter (fig. 9-57) attached to the lifting arms. The Aero 62A adapter is a rectangular metal tray, One end is open so the MHU-191 weapon skid can be easily pushed onto the bottom plate. A pair of hooks mounted in two brackets on the bottom of the tray hold the skid in place. The brackets have 40 holes spaced 1 inch apart. This lets you move the hooks to a suitable positions for holding stores of varying lengths. The hooks are secured to the brackets by two detent pins and can be swiveled from a vertical to a horizontal position. A cable assembly provides control of the hooks from outside the tray. You can tilt the tray in the fore and aft vertical plane (20 degrees nose up or 10 degrees nose down) by turning a tilt control crank, located on either side of the truck This lets you horizontally match the store being loaded with the attitude of the aircraft.

The bomb truck is a four-wheel vehicle equipped with solid rubber tires. By moving the drawbar, you can rotate the front wheels through an 84-degree arc. When positioning the bomb truck for store loading, you can rotate all four wheels through slightly more than a 180-degree arc as the wheel locking pins are pulled up and disengaged from the wheel swivel.

The hydraulic system is suitable for operation at a maximum of 3,000 psi hydraulic pressure. This is required to lift capacity loads with the truck. The hydraulic manual controls are duplicated on either side of the truck. A hydraulic control valve is located inboard and under the left battery box. It actuates part or all of the hydraulic system. With the valve in the open position, you can operate both the left and the right lifting arm simultaneously if either or both of the hydraulic pumps are actuated. Closing the control valve permits manual operation of either the left- or right-hand lifting arm. This is accomplished by manually operating the appropriate left- or right-hand hydraulic pump. When only one lifting arm is being actuated, limit load movements to a few inches. When the control valve is open, both of the lifting arms can be lowered simultaneously by using either the left- or right-hand manual release valves. The manual release valves will lower the lifting arms at a variable rate of speed. Restrict this operation to moving the load only a few inches.

The pump speed-control valves have three positions-fast, medium, and slow. The speed-control valve lets the operator adjust the flow of hydraulic fluid from the manual pumps in proportion to the weight of the load-fast for light loads and slow for heavy loads. Set both the left- and right-hand speed controls at the same speed

REVIEW NUMBER 7

Q1. What type of tires should you use on the forklift truck when using it in rough terrain?

Q2. The electric forklift truck has rigid structures, which allow it to carry off-balance loads. What are these structures ?

Q3. What is the maximum capacity of the hand pallet truck?

Q4. The Aero 33D/E bomb truck can lift loads to a height between _____.

Q5. What is the SWL of the Aero 33D/E bomb truck?

Q6. The Aero 62A tray adapter consists of _____

Q7. By moving the drawbar, the front wheels of the Aero 33D/E can be rotated through an arc of _____

Q8. What is the maximum hydraulic pressure of the Aero 33D/E?

Q9. To overcome an imbalance condition when using the Aero 33D/E, what outrigger assembly should you use?

Q10. *What model of the Aero 33 has an electrical and a manual lift system?*

TRAILERS

LEARNING OBJECTIVE: *Identify trailers used for ordnance handling to include the Mk 7 and Mods bomb, small munitions, SATS rough terrain, and Aero 51C munitions trailers.*

A trailer is a transport vehicle towed by another vehicle, such as a truck or tractor. All trailers are equipped with load-supporting bodies or frames and with wheels for locomotion. Trailers may be divided into three categories—weapon trailers, weight handling trailers, and warehouse trailers. Only trailers within the weapon trailer category are discussed in this TRAMAN because they directly support aircraft weapon loading operations ashore.

A weapon trailer consists of a heavy channel or tubular frame mounted on two axles and wheels that are equipped with four pneumatic tires. The frame is supported by automotive leaf-type springs. The front axle is steerable and the rear axle is fixed The trailer is equipped with a tow bar or tow handle that has a towing eye on its end. Use the towing eye to couple the trailer to the towing vehicle. Some trailers have draw heads at the rear to couple the towing eye of another trailer.

A weapon trailer has cradles or brackets that fit the contours of the weapon being transported The cradles or brackets on the trailer can be removed or adjusted for carrying loads of various sizes. Hold-down devices, such as chains or straps, secure the load during transport. Some weapon trailers have hydraulic systems to load weapons on aircraft, or for similar uses.

Weapon trailers are used to transport weapons, such as bombs, mines, missiles, and torpedoes of various sizes. In general, the trailers are capable of operating over moderately soft or moderately rough terrain. The short airfield tactical site (SATS) trailers operate over very rough terrain. These trailers are towed by vehicles such as the cargo truck (pickup). When coupled together, the SATS trailers form a train behind the truck. Don't use more than four trailers in one train.

MK 7 AND MODS BOMB TRAILER

The Mk 7 Mods 3, 4, and 5 bomb trailers (fig. 9-58) are made of a low-slung, heavy, channel steel frame mounted on four wheels. The trailers have a hydraulic elevating system actuated by a manually operated pump.

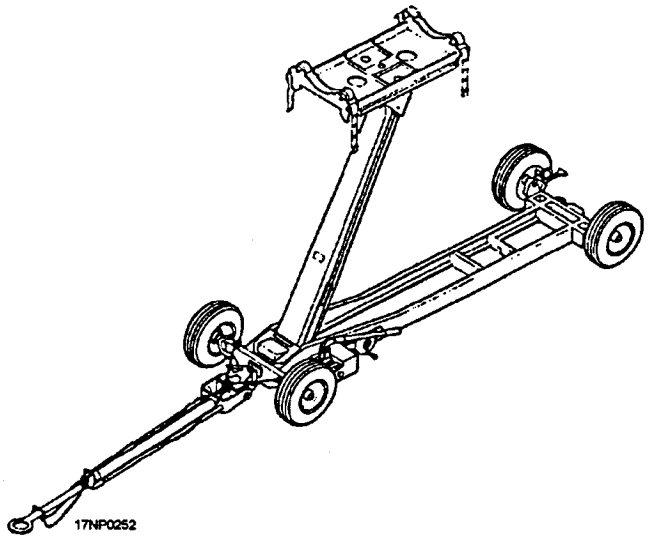


Figure 9-58.—Mk 7 Mods 3, 4, and 5 bomb trailer.

The elevating assembly consists of an elevating arm, upon which a cradle assembly is mounted. The cradle assembly consists of a tilting table and cradle. The cradle is equipped with rollers for positioning the weapon. The tilting table and cradle can be tilted 30 degrees forward or backward in a vertical plane by using a hand wheel. The cradle can be adjusted in the horizontal plane and rotated around its center with travel fixed by the table lock plate. The cradle is also capable of lateral movement. It can be rolled on table rollers from side to side with travel fixed by the table. The cradle movements are used to align and stabilize the weapon during loading. The cradle is equipped with tie-down straps to secure the load. Outriggers may also be used to provide greater stability during weapon elevation.

The front axle is steerable and equipped with a drawbar, which has a towing eye on its end. The towing eye is used to couple the trailer to a towing vehicle. A pintle hook welded to the rear frame lets you couple it with another trailer to form a train. Pad eyes are located on the front and rear of the trailer for use with a safety chain assembly provided with the trailer. The trailer is equipped with a safety chain connected to the towing vehicle. When multiple trailers form a train, the safety chain is connected between trailers to prevent the drawbar from dropping to the ground if a drawbar or pintle hook fails. The trailer is also provided with a static chain to ground static electricity. All Mods of the trailers are equipped with a rear-wheel mechanical parking brake.

Mk 7 Mods 3, 4, and 5 bomb trailers are used to transport and load a variety of weapons and stores. For transport, a towing vehicle is required, and more than one trailer can be towed. The Mk 7 bomb trailer has an SWL of 2,250 pounds. For aircraft loading and unloading operations, manpower is used to position the trailer. Tow the trailer at a safe speed. Speed is determined by the user activity; tow a single trailer with a specified load at a speed not to exceed 15 miles per hour. Tow multiple trailers in a train at a speed not to exceed 5 miles per hour.

MHU-126/M SMALL MUNITIONS TRAILER

The MHU-126/M small munitions trailer (fig. 9-59) has a low-slung, channel steel frame and four wheels with pneumatic rubber tires. Lengths of drilled steel

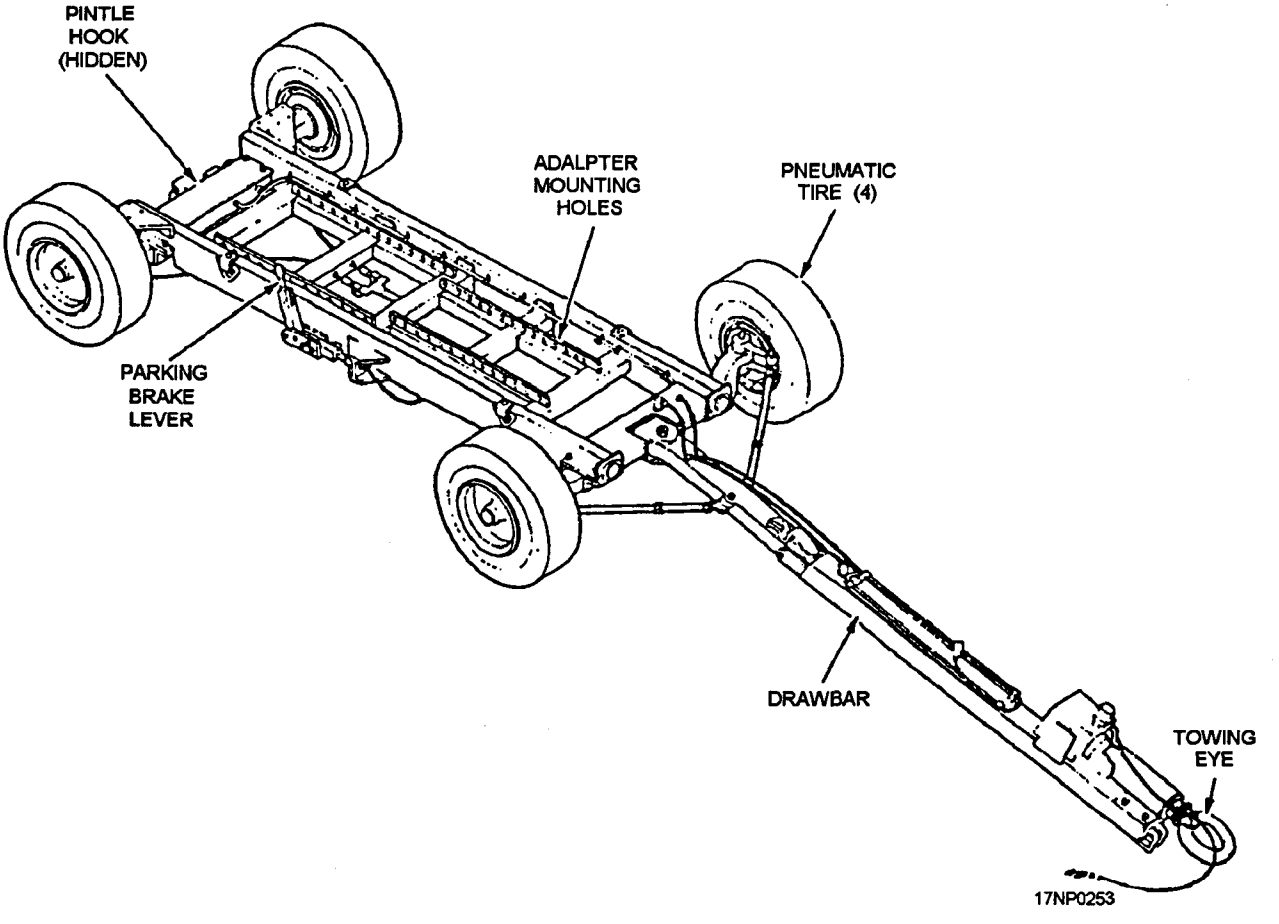


Figure 9-59.—MHU-126/M small munitions trailer.

bars welded to crossmembers of the frame provide mounting holes for the various adapters. The front axle is steerable and equipped with a drawbar that has a towing eye on its end to couple the trailer to a towing vehicle. A pintle hook on the rear of the frame permits coupling with another trailer. The wheels are equipped with hydraulic service brakes. Mechanical parking brakes are provided on two of the four wheels.

When it is equipped with adapters, you can use the MHU-126/M small munitions trailer to transport and load various weapons, stores, and equipment. The recommended maximum towing speed is 15 miles per hour for a single trailer and 5 miles per hour for multiple trailers being towed in a train. The MHU-126/M has an SWL of 5,000 pounds.

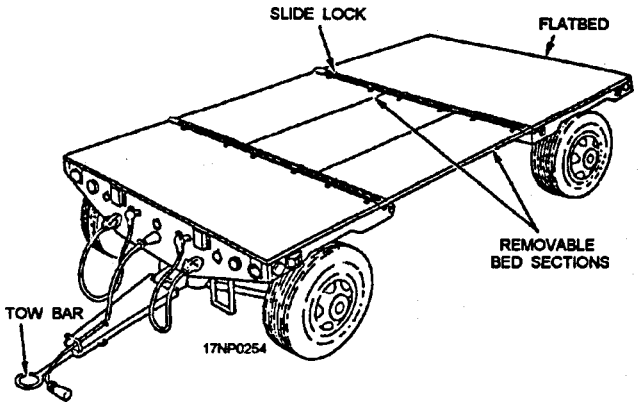


Figure 9-60.—A/M 32K-4A SATS rough terrain trailer.

A/M 32K-4A SATS ROUGH TERRAIN TRAILER

The A/M 32K-4A SATS rough terrain trailer (fig. 9-60) is a transport vehicle that consists of a chassis and a lightweight, flatbed, aluminum body. The chassis has two axles and four single wheels that are equipped with pneumatic tires. A torque box provides strength and rigidity to the body. You can remove two sections of the nonskid flatbed to use a forklift truck to load and unload the trailer. The trailer is equipped with a tow bar, multiple leaf springs, service brakes, and parking brakes. The trailer has 12 cradle tie-down fittings to hold the weapon cradles securely on the bed.

The A/M 32K-4A SATS rough terrain trailer is used to transport air-launched weapons from an ammunition dump to a SATS airstrip. You can operate it over very rough terrain. It is normally used at advanced bases.

REVIEW NUMBER 7 ANSWERS TO QUESTIONS Q1. THROUGH Q10.

A1. When using the forklift truck in rough terrain, pneumatic tires should be used.

A2. The electric forklift truck has outriggers, which are rigid structures allowing it to carry off-balance loads.

A3. The maximum capacity of the hand pallet truck is 4,000 pounds.

A4. The Aero 33D/E bomb truck can lift loads to a height between 30 and 63 inches.

A5. The SWL of the Aero 33D/E bomb truck is 4,000 pounds.

A6. The Aero 62A tray adapter consists of a rectangular metal tray with one end open so the Aero 21C weapon skid can be pushed onto the bottom plate.

A7. By moving the drawbar, the front wheels of the Aero 33D/E can be rotated through an arc of 84 degrees.

A8. The maximum hydraulic pressure of the Aero 33D/E is 3,000 psi.

A9. To overcome an imbalance condition when using the Aero 33D/E, the Aero 36A outrigger assembly should be used.

A10. The Aero 33D has an electrical and a manual lift system, while the Aero 33E has only a manual lift system.

The trailer holds weapons in cradles that are two tiers in height when equipped with increased load-density weapon cradles. The cradles are secured to the trailer bed by quick-release, positive-locking clips. The SATS trailer can also be equipped with stake sides and used as a utility vehicle for transporting weapon components. The A/M 32K-4A has an SWL of 8,000 pounds.

AERO 51C MUNITIONS TRAILER

The Aero 51C munitions trailer (fig. 9-61) is a transport vehicle that has an automotive chassis and a flat-deck body. The chassis has two axles and four single wheels equipped with pneumatic tires. The center section of the nonskid flat deck is hinged. It can be opened to provide a hatchway across the full width of the vehicle. It also has hinged deck panels that have double rails with holes at intervals to provide a mounting base for cradles and adapters.

The trailer has hydraulic surge brakes and mechanical parking brakes, a tow bar, and cable harness. The cable harness electrically connects the trailer to the towing vehicle for operation of the trailer lights. Accessory items (chocks, tie-down straps, interconnecting electrical harness, etc.) are stored in toolboxes mounted underneath the forward and aft decks.

The Aero 51C munitions trailer is used with a towing vehicle to transport and hold a variety of weapons in ready storage. The weapons are supported on the trailer by adapters or cradles. This trailer is used to transport stores and cargo. The Aero 51C munitions trailer is not used aboard ship. The Aero 51C has an SWL of 8,500 pounds.

REVIEW NUMBER 8

Q1. By using a hand wheel, the tilting table and cradle of the Mk 7 bomb trailer can be tilted _____ forward or backward on the vertical plane.

Q2. What is the SWL of the Mk 7 bomb trailer?

Q3. What is the maximum recommended towing speed of the MHU-126/M small munitions trailer when towed alone and in a train?

Q4. At what location should you use the Aero 51C munitions trailer?

Q5. What is the SWL of the Aero 51C munitions trailer?

LOADERS

LEARNING OBJECTIVE: *Identify the purpose and use of the SATS weapon loader, the Aero 47A, 47A-1, and MJ-7 weapon loaders.*

Loaders are generally used to handle a variety of loads, such as weapons, ammunition, JATO bottles, rockets, pylons, or fuel tanks, during naval aircraft

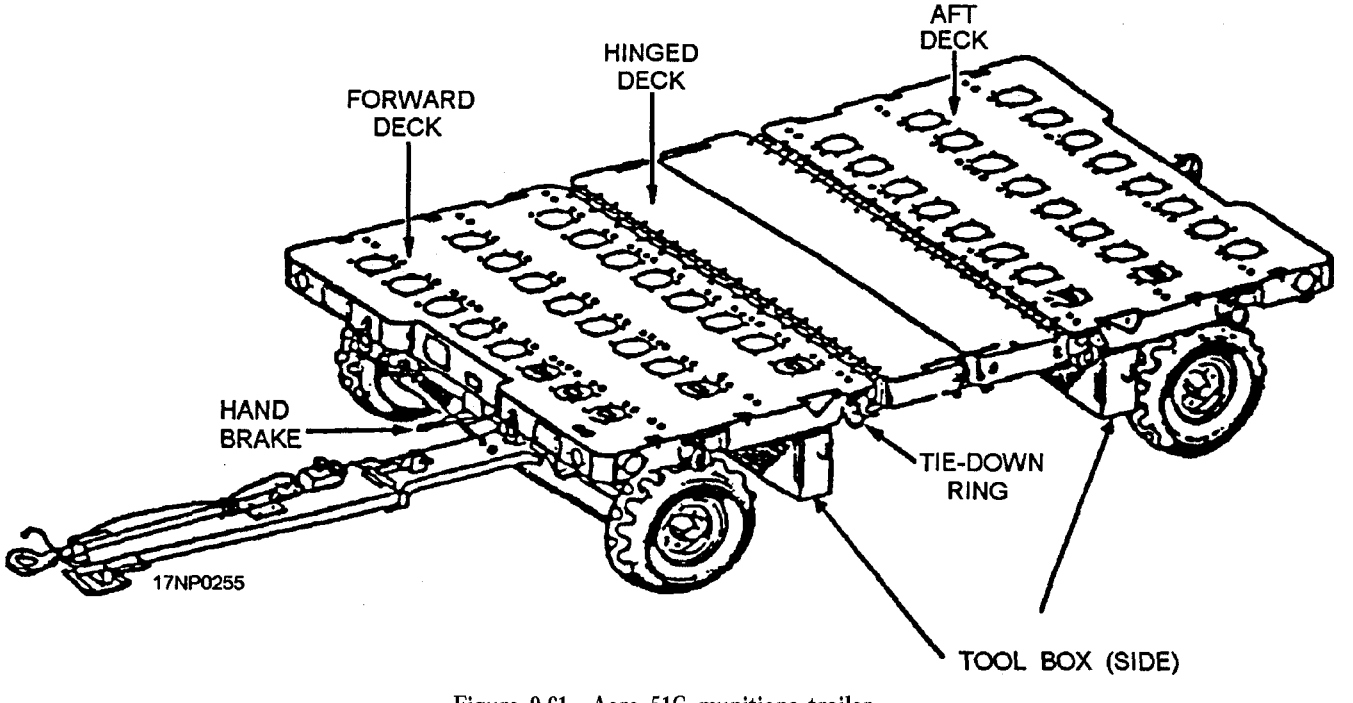


Figure 9-61.—Aero 51C munitions trailer.

loading operations. Some loaders are capable of operating over rough terrain while others are built for smooth surfaces. The types of loaders used to handle ammunition and explosives are equipped with flame- and spark-arresting mufflers.

A/S 32K-1A/1B/1C SATS WEAPON LOADERS

Each A/S 32K-1A/1B/1C SATS weaponloader(fig. 9-62) is a self-propelled vehicle with a low, heavy-duty frame supported by six small, high capacity wheels. Each vehicle has two main functional components. The lifting mechanism has a lift boom, hydraulic system, and manipulating head. The lift boom is operated by a piston-type hydraulic cylinder mounted in the midsection of the boom support. The manipulating head is located at the upper end of the lift boom, and is capable of limited lateral and longitudinal motions, as well as tilting and yawing motions. The head is equipped with lifting forks attached with quick-release pins and mounted in three positions-normal, inverted forward, and inverted rear.

The drive mechanism includes a hydrostatic drive system powered by a power-splitter gearbox, drive shaft with universal joints, limited-slip differential, axle/wheel disconnect hubs, and steerable drive wheels with power-assisted steering.

The power to operate the lift and drive mechanisms is supplied by a four-cylinder, air-cooled gasoline engine. The weapon loader is equipped with four-wheel hydraulic brakes, electric/hydraulic operated parking brakes, and a spark- and flame-arresting muffler. It is also equipped with nylon tie-down straps to hold the load securely during handling, a utility chain to lift items directly off the ground, and lights for night loading operations.

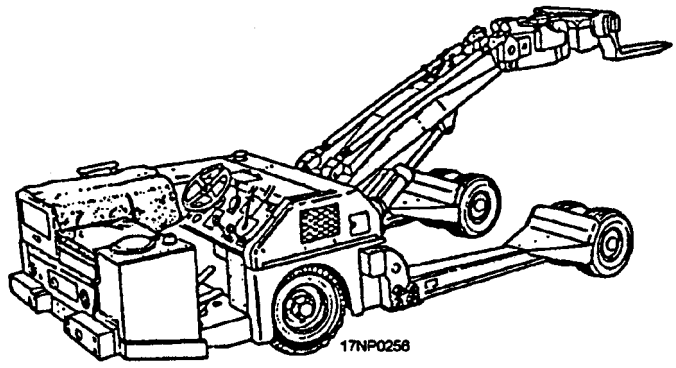


Figure 9-62.—A/S 32K-1A/1B/1C SATS weapon loader.

Each A/S 32K-1A/1B/1C SATS weapon loader has an SWL of 4,500 pounds. It is used to load externally carried munitions, weapons, and stores onto an aircraft. Each SATS weapon loader is used with a variety of adapters and cradles.

AERO 47A, AERO 47A-1, AND MJ-7 WEAPON LOADER

The Aero 47A, 47A-1, and MJ-7 weapon loaders (fig. 9-63) are self-propelled vehicles with low, heavy-duty frames. Each weapon loader's frame is supported by six small high-capacity wheels. Each vehicle consists of two main functional components—the lifting mechanism and the drive mechanism.

The lifting mechanism has a lift boom, hydraulic system, and a manipulating head. The lift boom is operated by a piston-type hydraulic cylinder mounted in

REVIEW NUMBER 8 ANSWERS TO QUESTIONS Q1. THROUGH Q5.

A1. By *using a hand wheel, the tilting table and cradle of the Mk 7 bomb trailer can be tilted 30 degrees forward or backward on the vertical plane.*

A2. The SWL of the Mk 7 bomb trailer is 2,250 pounds.

A3. The maximum recommended towing speed of the MHU-126/M small munitions trailer when towed alone is 15 mph and 5 mph when towed in a train.

A4. You should use the Aero 51C munitions trailer with a towing vehicle to transport and hold a variety of weapons in ready storage.

A5. The SWL of the Aero 51C munitions trailer is 8,500 pounds.

WEIGHT:	6500 LB.
LENGTH:	171.5 IN.
WIDTH:	70 (RETRACTED)
	142 (EXTENDED)
LIFT HEIGHT:	18-109 IN.
CAPACITY:	4500 LB.

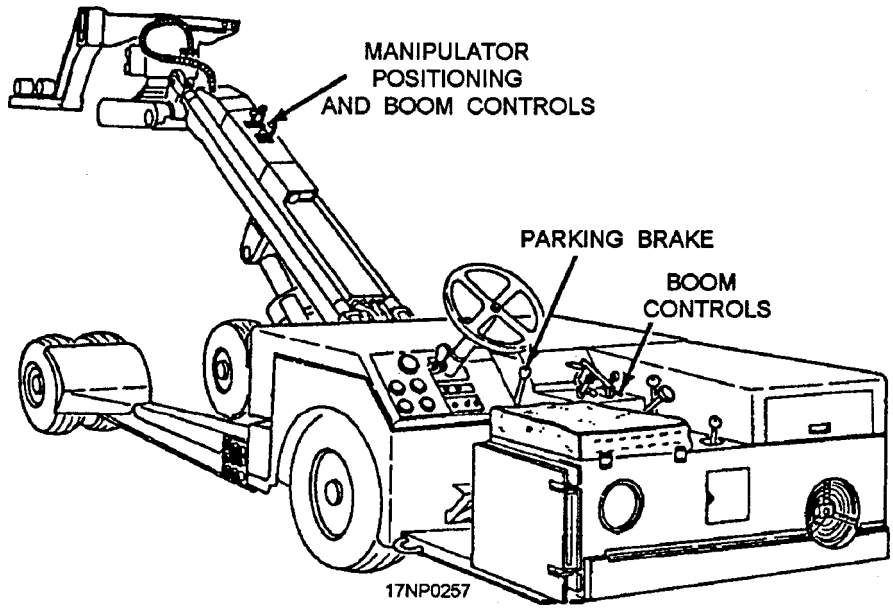


Figure 9-63.—Aero 47A, Aero 47A-1, and MJ-7 weapon loader.

the midsection of the boom support. The manipulating head is located at the upper end of the lift boom and is capable of limited ram, lateral and longitudinal motions, as well as tilting, rolling, and yawing motions. These weapon loaders have a lifting fork attached to the manipulating head by an adapter. The lifting fork can be mounted in three positions—normal forward, inverted forward, and inverted rear. By inverting the adapter plate, the maximum reach of the fork is extended in each of these position.

The drive mechanism includes a conventional automotive clutch, transmission, and rear-wheel drive. These weapon loaders are equipped with four-wheel hydraulic brakes, mechanical parking brakes, and rear-wheel power steering. They also have spark- and flame-arresting mufflers, nylon tie-down straps to hold the load during handling, utility chains for lifting items directly off the ground, and lights for night-loading operations. The hydraulic system controls are located within reach of the operator's seat. The seat is located at the extreme rear of each vehicle. The controls are also located on the boom. Power to operate the lift and drive mechanisms is supplied by a four-cylinder, air-cooled diesel engine.

The Aero 47A, 47A-1, and MJ-7 weapon loaders have an SWL of 4,500 pounds each, They are used to load externally carried weapons, stores, and fuel tanks onto aircraft. These weapon loaders are used with a variety of adapters and cradles.

REVIEW NUMBER 9

Q1. The A/S 32K-1A/1B\1C SATS weapon loader is used to load _____.

Q2. List the two main functional components of the Aero 47A, Aero 47A-1, and MJ-7 weapon loaders.

Q3. What is the SWL of the Aero 47A, Aero 47A-1, and MJ- 7 weapon loaders?

SAFETY PRECAUTIONS FOR HANDLING EQUIPMENT

LEARNING OBJECTIVE: *Recognize the safety precautions to follow when using ordnance handling equipment.*

You must observe the safety precautions and instructions that pertain to the safe operation and use of ammunition and explosives handling equipment, both afloat and ashore. The task of ammunition and explosives handling is hazardous. Accidents involving ammunition and explosives handling kill and injure

personnel, destroy essential supplies, and damage valuable equipment and property. These accidents don't *just happen.* They are caused by carelessness or unfamiliarity with the use and limitations of handling equipment, as well as relaxation or failure to observe safety precautions, orders, and regulations pertaining to the handling and stowage of ammunition and explosives. You can prevent accidents caused by misuse of handling equipment if you take the time to understand the use and limitations of the handling equipment.

Many technical manuals and instructions contain information about safety, inspection, and tests for ordnance handling equipment. For general information, refer to the following publications:

- *Approved Handling Equipment for Weapons and Explosives,* NAVSEA OP 2173, Volume 1 (NAVAIR 19-100-1.1) and Volume 2 (NAVAIR 19-100-1.2)

- *Ammunition Afloat,* NAVSEA Op 4

Ammunition and Explosives Ashore, Safety Regulations for Handling, Storing, Production, Renovation, and Shipping, NAVSEA OP 5, Volume 1

Use approved handling equipment to handle explosive ordnance. Approved handling equipment is described in NAVSEA OP 2173 and NAVSEA OP 4098. Before you can be assigned to operate any explosive ordnance handling equipment, you must receive a thorough indoctrination in general safety precautions applicable to explosive ordnance. You must also be indoctrinated in the specific precautions applicable to the equipment you will be operating. Additionally, you must be qualified and certified under OPNAVINST 8023.2 (series) and other appropriate command directives.

To assure reliability, explosive handling equipment must be inspected and periodically tested. Equipment, such as slings, bands, beams, strongbacks, and spreader bars, is static tested at 200 percent to 215 percent of SWL. If the date and the results of the latest static test are not marked on the equipment or the test is out of date, don't use the equipment.

You must possess a valid explosives drivers license before operating industrial material handling equipment, such as forklift trucks, pickup trucks, platform trucks, crane trucks, and tractors and trailers.

You must never exceed the SWL of the equipment being used. If adapters are being used, you cannot exceed the lowest SWL of the equipment-adapter configuration. For example, if an Aero 12C bomb skid (SWL of 1,250 pounds) is used with an Aero 9C bomb skid adapter (SWL of 1,000 pounds), the maximum capacity of the skid-adapter configuration is limited to 1,000 pounds.

REVIEW NUMBER 10

Q1. What is the primary cause of accidents involving handling equipment?

Q2. To operate handling equipment that carries explosives, you must be qualified and certified according to what instruction?

Q3. Equipment, such as slings, bands, beams, and strongbacks, is weight tested at what percentage of its SWL?

Q4. If the date and results of the latest static test are not current or not marked on the equipment, what should you do?

REVIEW NUMBER 9 ANSWERS TO QUESTIONS Q1. THROUGH Q3.

A1. The A/S 32K-1A/1B/1C SATS weapon loader is used to load externally carried munitions, weapons, and stores onto aircraft.

A2. The two main functional components of the Aero 47A, Aero 47A-1, and MJ-7 weapon loaders are the lifting mechanism and the drive mechanism.

A3. The SWL of the Aero 47A, Aero 47A-1, and MJ-7 weapon loaders is 4,500 pounds.

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REVIEW NUMBER 10 ANSWERS TO QUESTIONS Q1. THROUGH Q4.

A1. The primary cause of accidents involving handling equipment is carelessness or unfamiliarity with the use and limitations of handling equipment, failure to observe safety precautions, orders, and regulations about handling and stowing ammunition and explosives.

A2. To operate handling equipment that carries explosives, you must be qualified and certified according to OPNAVINST 8023.2 (series).

A3. Equipment, such as slings, bands, beams, and strongbacks, is weight tested at 200 to 215 percent of its SWL.

A4. If the date and results of the latest static test are not current or not marked on the equipment, don't use it.

CHAPTER 10

SUSPENSION, ARMING, AND RELEASING EQUIPMENT

The Navy uses complex suspension, arming, and releasing devices in combat aircraft and weapons. The high speed and performance of potential targets and our own aircraft require the electronic operation of suspension, arming, and releasing equipment.

The equipment covered in this chapter is part of the aircraft search or kill stores systems. Generally, these devices operate electrically and are controlled by aircraft electrical circuits. They are actuated manually by a hand switch or automatically by a circuit-closing device in the system.

BOMB RACKS

LEARNING OBJECTIVE: *Identify the purpose and use of bomb racks. Recognize the bomb racks used for various configurations, and identify the operation of bomb racks to include electrical and manual release and arming.*

Aircraft bombs, torpedoes, mines, and other stores are suspended internally or externally from the aircraft by bomb racks. Bomb racks carry, arm, and release stores.

AERO 65A SERIES BOMB RACK

Aero 65A bomb racks are used to suspend, selectively arm, and release 1,000-pound class stores. These stores have suspension hooks spaced 14 inches apart. When used with the Aero 1A adapter assembly, you can suspend weapons/stores with lugs spaced 30 inches apart and weighing up to 2,000 pounds. Some Aero 65A bomb rack models are pylon mounted to the wing stations of the P-3C aircraft.

Aero 65A series bomb racks (fig. 10-1) consist of a frame. Mounted inside the frame are an electrical release unit, two arming solenoids, two hook assemblies (spaced 14 inches apart), a manual release cable assembly, a release linkage assembly, a hook tie linkage assembly, and a cable assembly.

The frame is a U-shaped, alloy steel channel. It has holes at both ends so you can mount it in an aircraft or attach Aero 1A adapter assemblies. Access holes in the frame let you visually verify that the hook closing is latched. These holes let you insert the safety pin, cocking lever, and hoist bracket.

The electrical release unit is a spring-loaded plunger. It is mechanically cocked and electrically released to provide the force that initiates hook release.

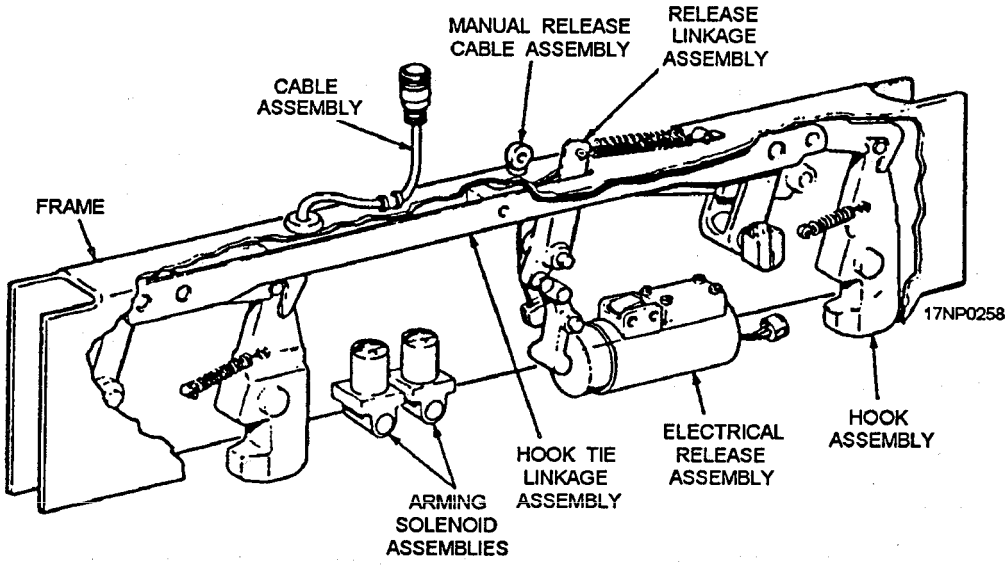


Figure 10-1.—Cutaway view of a typical Aero 65A bomb rack.

The release unit bolts to the bottom of the bomb rack frame near the center. Before the hook tie linkage is cocked, you must cock the release unit plunger. The electrical cable assembly supplies 28 volts of dc through a four-pin male connector. Three types of electrical release units are used-the Aero 7B release unit, the Aero 7B-1 release unit, and the linear electromechanical actuator (LEMA). The external difference between the Aero 7B and Aero 7B-1 is the two-piece plunger barrel on the Aero 7B-1. The LEMA is similar to the Aero 7B-1 release unit. You can identify it by the decal located on the release unit.

There are two arming solenoids at the bottom of the bomb rack frame, slightly forward of the center. The arming units are electrically controlled and mechanically operated continuous-duty solenoids. They provide fully selectable arming for nose, tail, or nose and tail when weapons are armed by arming wires. Arming is selectable in flight by the pilot. The pilot also has a safe selection, which does not energize the arming solenoids.

The weapon/store is suspended from two suspension hook assemblies protruding from the bottom of the bomb rack. Each hook latches independently. You mount it in the bomb rack frame by using a pivot pin. Each hook is made from chrome-plated steel or stainless steel. It has a bushing in the pivot hole, a latch pin engaging the hook tie linkage to latch the hook, and a threaded spring stud to attach a spring to preload the hook in the open position.

A manual release cable assembly is located at the center of the bomb rack. It consists of a pull ring and a cable extending for the depth of the bomb rack. The cable is attached to a manual-release link assembly or a manual-release lever located at the bottom of the bomb reck. When the pull ring is connected to the aircraft's externally routed manual-release cable, the pilot has the option of manual release.

The release-linkage assembly, located at the center of the bomb rack, contains a release bell crank and bell crank link, a sear link, and two attaching pins.

The hook tie linkage assembly extends end-to-end on the bomb rack. It contains a bumper and four moving parts-two latches and two links, which are set between two hook tie links. The tie linkage latch link contains cutouts so you can insert the lock-link assembly and the screw holding the latching pin in place.

The electrical cable assembly consists of five leads. Two leads are attached to the solenoids. The remaining leads are routed along the top inside surface of the bomb rack. They terminate in a female connector that mates with the release unit.

There are two accessories for the Aero 65A bomb rack—an Aero 1A adapter assembly and a safety interlock mechanism. These accessories are issued as required. They do not come with the bomb rack.

Aero 1A Adapter Assembly

The Aero 1A adapter assembly (fig. 10-2) lets you load and carry weapons/stores that have suspension lugs spaced 30 inches apart and weigh up to 2,000 pounds. When you install two Aero lA adapter assemblies on the bomb rack (one on either end), the adapter assemblies let you attach the bomb rack to the aircraft pylon assembly. The Aero 1A adapter linkage attaches to the bomb rack. The movement of the Aero 1A adapter suspension hooks corresponds to the movement of the bomb rack suspension hooks. If you need more information about the Aero 1A adapter assembly, refer to *Bomb Rack Adapter Assembly Aero 1A,* NAVAIR 11-5E-17.

Safety Interlock Mechanism

The safety interlock mechanism is an in-flight, operable bomb-rack lock (IFOBRL) (fig. 10-3). It provides additional safety when the aircraft carries

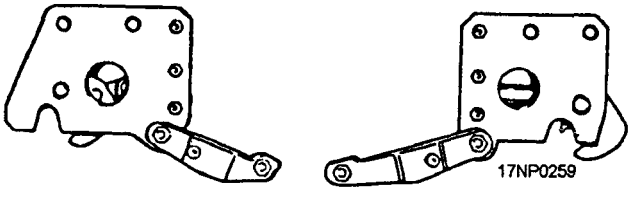


Figure 10-2.—Aero 1A bomb rack adapter assembly.

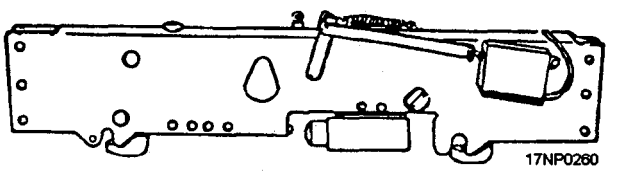


Figure 10-3.—In-fligbt operable bomb rack lock (IFOBRL),

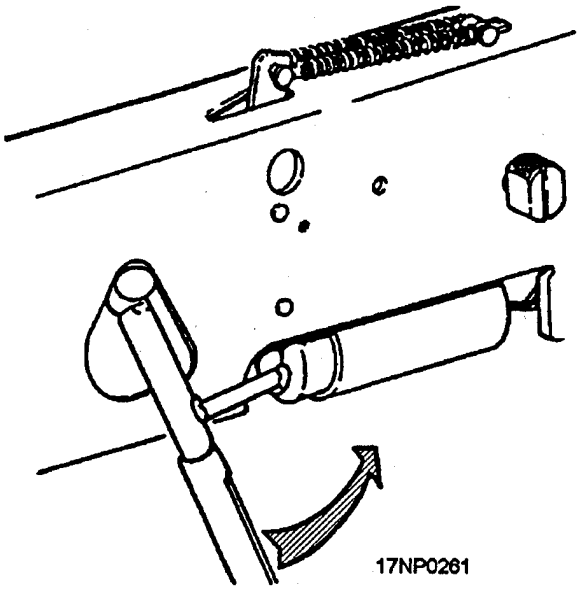


Figure 10-4.—Cocking procedure.

special stores. The Aero 65A series bomb racks use a special stores conversion kit installation. The safety interlock mechanism has a linear electromechanical actuator. When energized, the actuator unlocks the safety interlock mechanism and permits release of the store. You can find more information on the IFOBRL by referring to the applicable aircraft maintenance manual.

Cocking and Latching

Before you load a weapon on the Aero 65A bomb rack, cock and latch the bomb rack linkage assembly. To cock the bomb rack, you must insert a cocking lever assembly in the hoist bracket mounting hole (fig. 10-4). Pull the assembly back until the release unit plunger compresses. To latch the linkage assembly, turn the latch knob as far as it will go in the direction away from the arrow. (This ensures the linkage is aligned for latching.) Then, turn the latch knob in the direction of the arrow (fig. 10-5). Press the release bell crank forward until the sear roller rises above the sear. Then, return the release bell crank to its normal position. If the sear roller does not rest on the sear or is not visible above the sear, rotate the latch knob in the direction away from the arrow to force the sear roller down.

The suspension hooks close independently of each other. During loading of a weapon/store, the lugs pivot the hooks on the hook pins to the closed position. You must inspect the hook latch inspection holes to verify that the hook latch pins are securely held in the hook latches. The hook latches and the ends of the hook latch

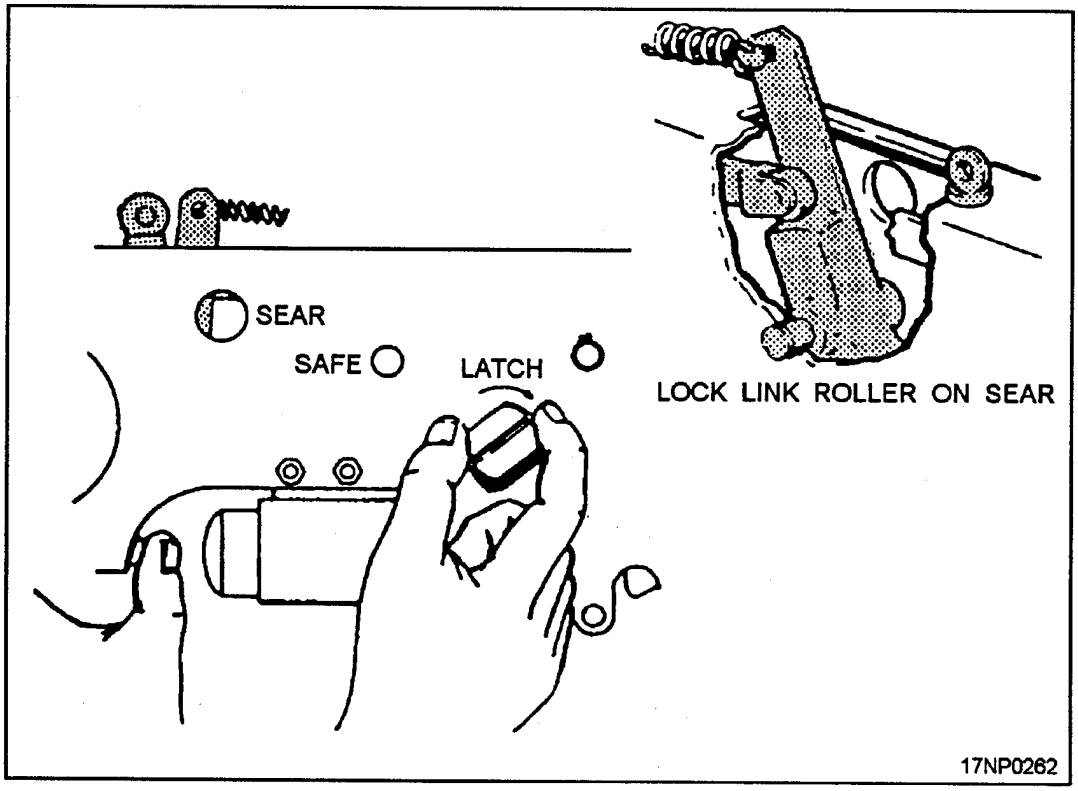


Figure 10-5.—Latching procedure.

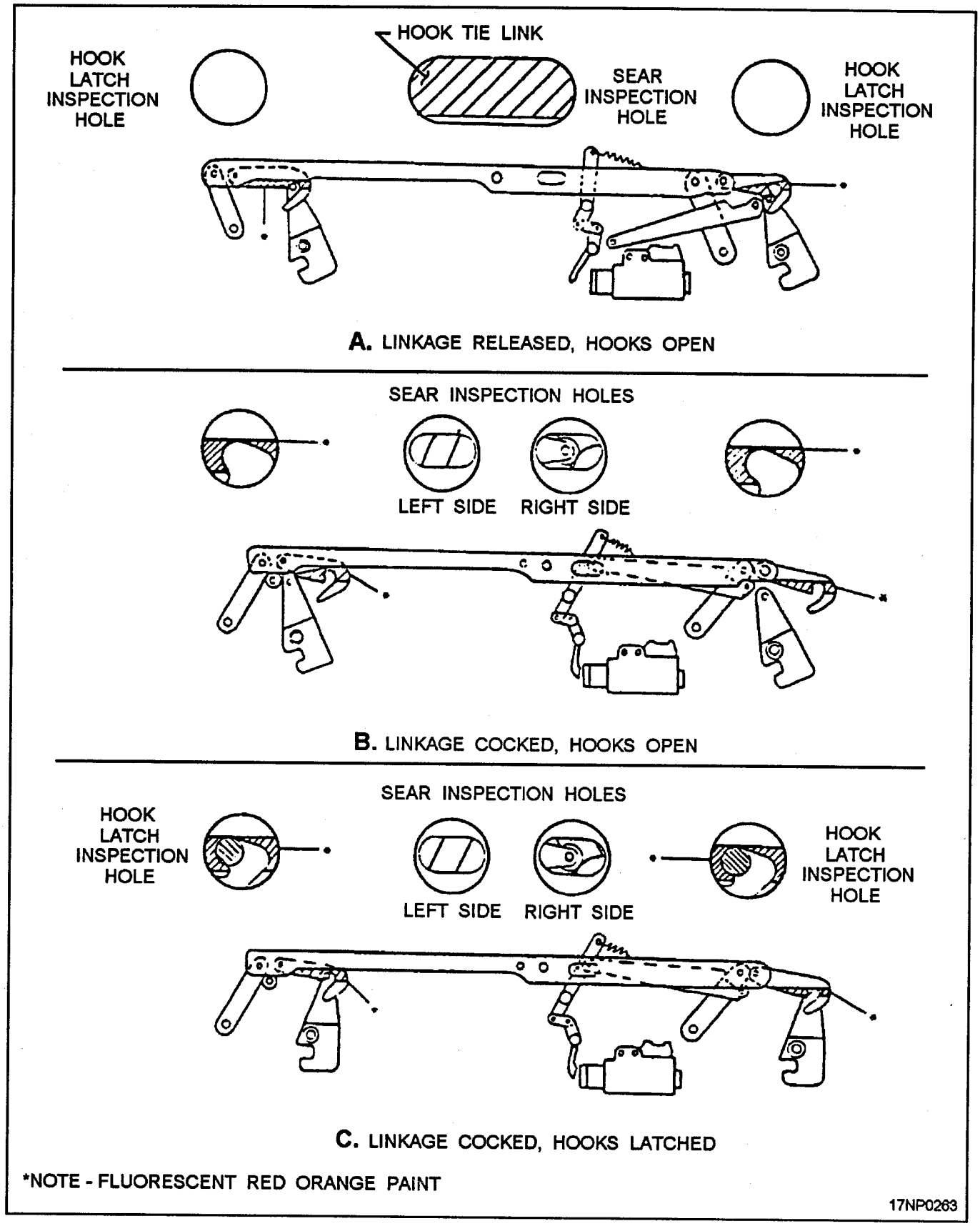


Figure 10-6.—Released, cocked, and latched configuration of the Aero 65A bomb rack.

pins are marked with fluorescent red-orange paint for easy visibility. When the hooks are latched, the painted areas are aligned, as shown in figure 10-6.

Operation

Weapons are armed mechanically and released either electrically or manually.

ELECTRICAL RELEASE.— The electrical release unit is energized through the bomb rack electrical cable assembly by a 28-volt dc power supply, which is located in the aircraft's weapons control system. When power is applied, the release unit plunger strikes the release bell crank Through the connecting link, the sear link rotates to free the lock link As the hook latches move forward, the hook springs and hook-latch springs pull the suspension hooks open. The front hook comes to rest against the hook stop, and the latches are cammed-up out of engagement. The lock link is held against the aft link by the lock link return spring.

MANUAL RELEASE.— The sequence for manual release is the same as for electrical release, except that the release bell crank is actuated by the manual release cable. The manual release cable is routed from the aircraft and connected to the manual-release cable assembly of the bomb rack

ARMING.— A 28-volt dc power supply from the aircraft's weapons control system provides voltage to energize the two arming solenoids. These solenoids electrically control mechanical arming, The arming units are energized individually or simultaneously. When the arming units are energized, the arming wires remain in place. The store is armed as it falls from the bomb rack, When the solenoids are de-energized the store pulls the wires free of the bomb rack, and it isn't armed.

If you want more information about the Aero 65A series bomb rack, refer to *Bomb Rack Models Aero 65A Series,* NAVAIR 11-5E-50.

PENGUIN MISSILE LAUNCH ADAPTER

The MLA attaches to the left outboard pylon of the SH-60 helicopter and provides mechanical attachment points for the missile launch and release system. The missile launch adapter is equipment with the BRU-14 bomb rack with AERO 1B adapters, which provide the rack with 30-inch suspension.

MAU-38/A BOMB RACK

The MAU-38/A bomb rack mounts in the bomb bay of P-3 aircraft (all models). The MAU-38/A bomb rack (fig. 10-7) is a major modification of the Aero 65A bomb rack. The frame is modified; there are only two aircraft mounting bolt holes-one on each end of the frame. Also, the release return and manual release linkage are arranged on the right and left side of the rack frame, respectively. The operation, suspension, and maximum capacity of the MAU-38/A and Aero 65A bomb racks are the same. However, you can't use the Aero 1A bomb rack adapter assembly on the MAU-38/A.

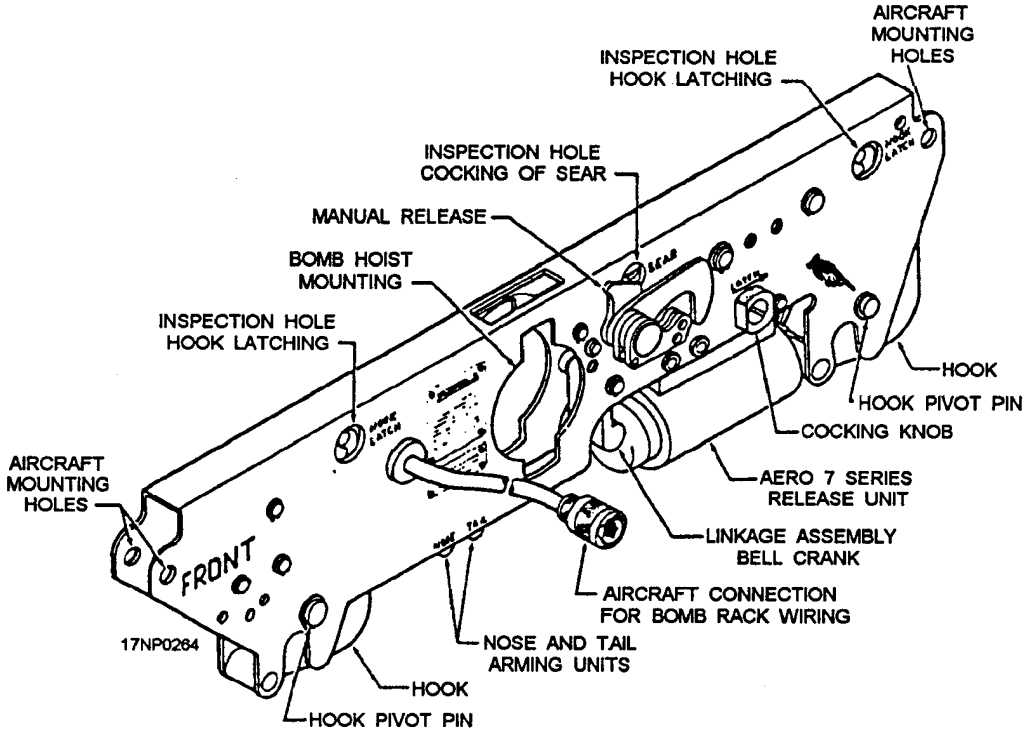


Figure 10-7.—MAU-38A aircraft bomb rack.

For further information concerning the MAU-38/A bomb rack, you should refer to *Bomb Rack Model BRU-12/A and MAU-38/A,* NAVAIR 11-5C-23.

BRU-12/A BOMB RACK

The BRU-12/A bomb racks (fig. 10-8) are MAU-38/A bomb racks that incorporate the AAC 571. Part of the change includes the deletion of the remote manual release capability (you can manually open the rack during ground servicing), a double vice a single release return spring, and replacement of the knurled latch knob by a hexagon knob that requires the use of a 3/4-inch wrench. The BRU-12/A is interchangeable with the MAU-38/A. It mounts in the bomb bay of all models of the P-3 aircraft.

BRU-14/A BOMB RACK

The BRU-14/A bomb racks (fig. 10-8) are suspension and release of conventional and special weapons/stores up to 2,200 pounds with 14-inch suspensions. At times, Aero 1A adapter assemblies are used to increase the bomb rack to 30-inch suspension capacity. The BRU-14/A is a major modification of the Aero 65A-1 bomb rack. You may install it in the bomb bay of the P-3C and S-3 aircraft. The major modifications are discussed in the following paragraphs.

Sway braces are bolted to the rack frame. Installation of an IFOBRL allows remote locking and unlocking of the rack when electrical power is applied to the aircraft.

The BRU-14/A bomb rack has an auxiliary unlock assembly. It releases the IFOBRL if it fails to function in the normal release mode. The auxiliary unlock assembly is a cartridge-actuated device (CAD) that provides a mounting point for the aft end of the IFOBRL. When actuated, the unlock assembly releases the IFOBRL and allows it to move forward. This frees

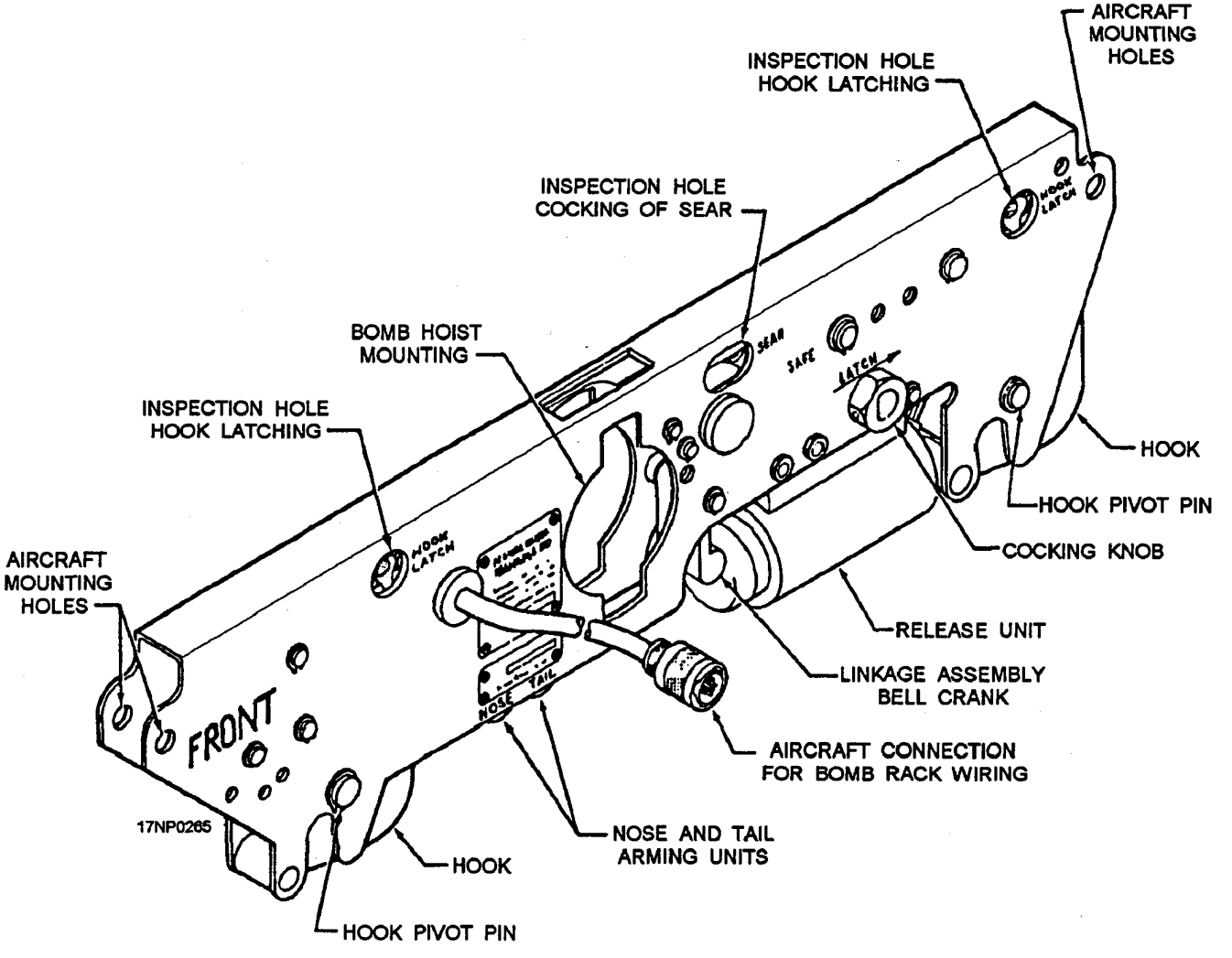


Figure 10-8.—BRU-12/A aircraft bomb rack.

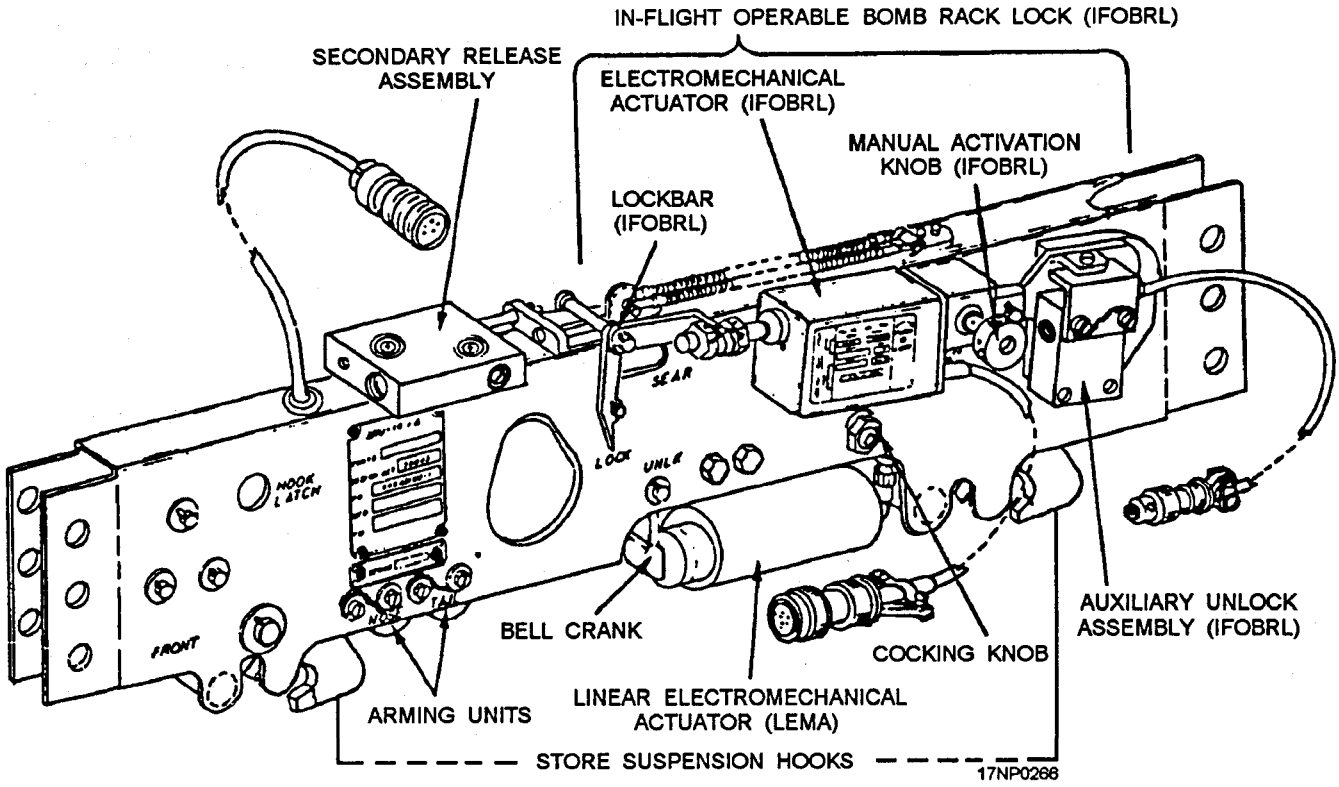


Figure 10-9.—BRU-14A aircraft bomb rack (left-hand configuration).

the sear link from restraint and lets the rack linkage function normally.

The BRU-14A bomb rack has a secondary release assembly. It initiates hook release if the LEMA fails to function. The secondary release assembly is a CAD that consists of a housing, piston, and release slider assembly mounted on the top of the bomb rack frame. When actuated, the secondary release moves the sear link forward to release the bomb rack. The BRU-14/A doesn't have remote manual-release capabilities.

If you want more information about the BRU-14/A bomb rack, refer to *Bomb Rack BRU-14/A and BRU-15/A*, NAVAIR 11-5E-18.

BRU-15/A BOMB RACK

The BRU-15/A bomb rack (fig. 10-10) is installed on the wing stations of the P-3B and P-3C aircraft. It is

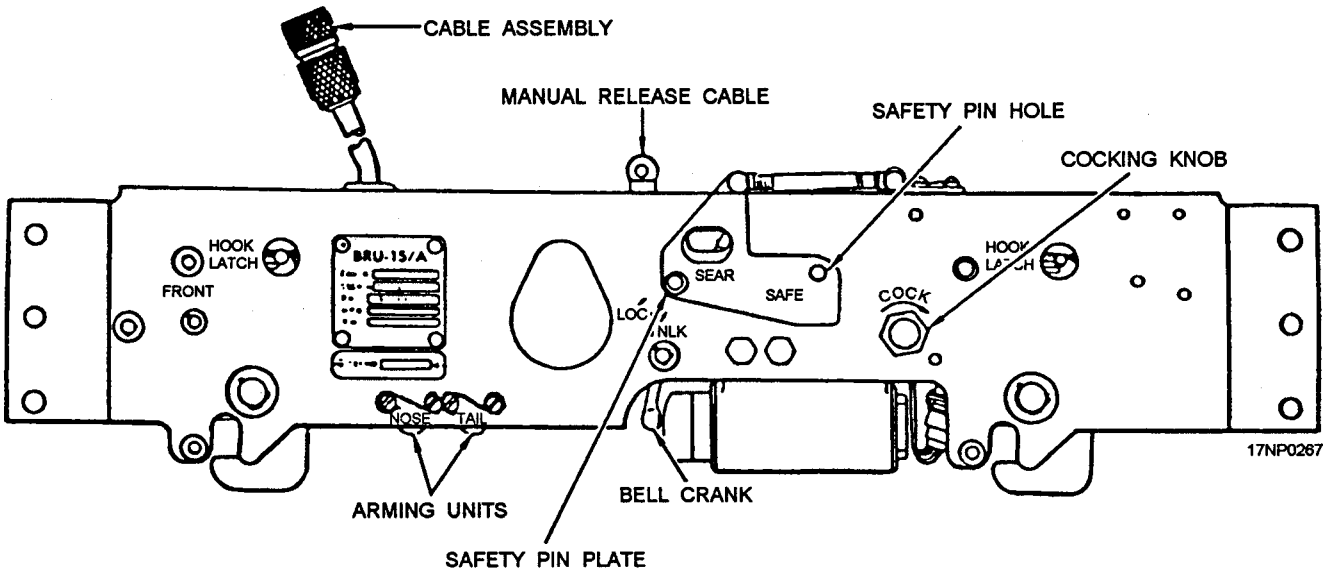


Figure 10-10.—BRU-15/A bomb rack.

used with the aircraft wing store launcher assembly, which is modified to launch a Harpoon missile. You can attach Aero 1A adapter assemblies to increase the bomb rack to 30-inch suspension capacity. Because of the added Harpoon capabilities, the BRU-15/A replaces the Aero 65A as wing suspension racks for the P-3C aircraft.

The BRU-15/A bomb rack is a modification of the BRU-14/A bomb rack. The functional and physical characteristics of the BRU-15/A are shown below.

- The IFOBRL mechanism and associated auxiliary unlock device are not included.
- There is a safety mechanism to positively lock the release mechanism of the bomb rack when a safety pin is installed.
- There is a cable-actuated manual release mechanism that operates the primary release linkage through an added manual release cable and lever.

REVIEW NUMBER 1

Q1. To suspend stores weighing up to 2,000 pounds on the Aero 65A bomb rack, you would use what adapter assembly?

Q2. You are to load a weapon on the Aero 65A bomb rack. What should you do first?

Q3. What voltage is required to energize the release unit of the Aero 65A bomb rack?

Q4. The MAU-38/A bomb rack is mounted on what aircraft?

Q5. If you want to connect a MAU-38/A bomb rack to a BRU-12/A bomb rack, what change would you use?

Q6. The BRU-14/A bomb rack is a major modification of what bomb rack?

Q7. The BRU-14/A bomb rack is installed in what aircraft?

Q8. What bomb rack is used on the wing stations of the P-3C aircraft?

BOMB EJECTOR RACKS

LEARNING OBJECTIVE: *Identify the purpose and use of bomb ejector racks to include their principles of operation, maintenance requirements, and operational description.*

When in flight, today's high-speed fighter and attack aircraft create a vacuum under the fuselage and wings. If a weapon/store is released from the bomb rack, this vacuum can prevent the weapon/store from entering the airstream and falling to the target. If this happens, the weapon/store may physically contact the aircraft structure, causing serious damage to or loss of the aircraft.

Bomb ejector racks are different from bomb racks. Bomb ejector racks use electrically fired impulse cartridges to eject the weapon/store free of the bomb racks. Bomb ejector racks eject the weapon/store from the bomb rack with sufficient force to overcome vacuum buildup and ensure a safe weapon/store launching environment.

AERO 7A-5 AND AERO 7B-4 BOMB EJECTOR RACKS

The Aero 7A-5 and Aero 7B-4 bomb ejector racks are mounted externally on the A-6 aircraft. All EA-6 aircraft models are equipped with an Aero 7B-4 ejector bomb rack on the centerline station and an Aero 7A-5 bomb ejector rack on the wing stations. These bomb ejector racks make up the aircraft's basic weapons suspension. They are normally referred to as *parent racks.* Bomb ejector racks are mounted in fairing-enclosed pylons for aerodynamic purposes. The pylons have removable fairings and hinged doors for easy access to the components of the bomb ejector racks.

Aero 7A-5 Bomb Ejector Rack

The Aero 7A-5 bomb ejector rack assembly (fig. 10-11) consists of a housing that contains the following components:

- Four pairs of tandem suspension hooks
- A dual breech assembly
- Mechanical linkage connecting the hook sears to the ejector and manual release assembly
- An electrical junction box connecting the aircraft firing pulses to the breech
- Two sets of adjustable sway braces
- Mechanical and electrical arming units

There are four separate pairs of suspension hooks on the Aero 7A-5 bomb ejector rack—two pairs for 14-inch suspension and two pairs for 30-inch suspension. The suspension hooks are self-latching,

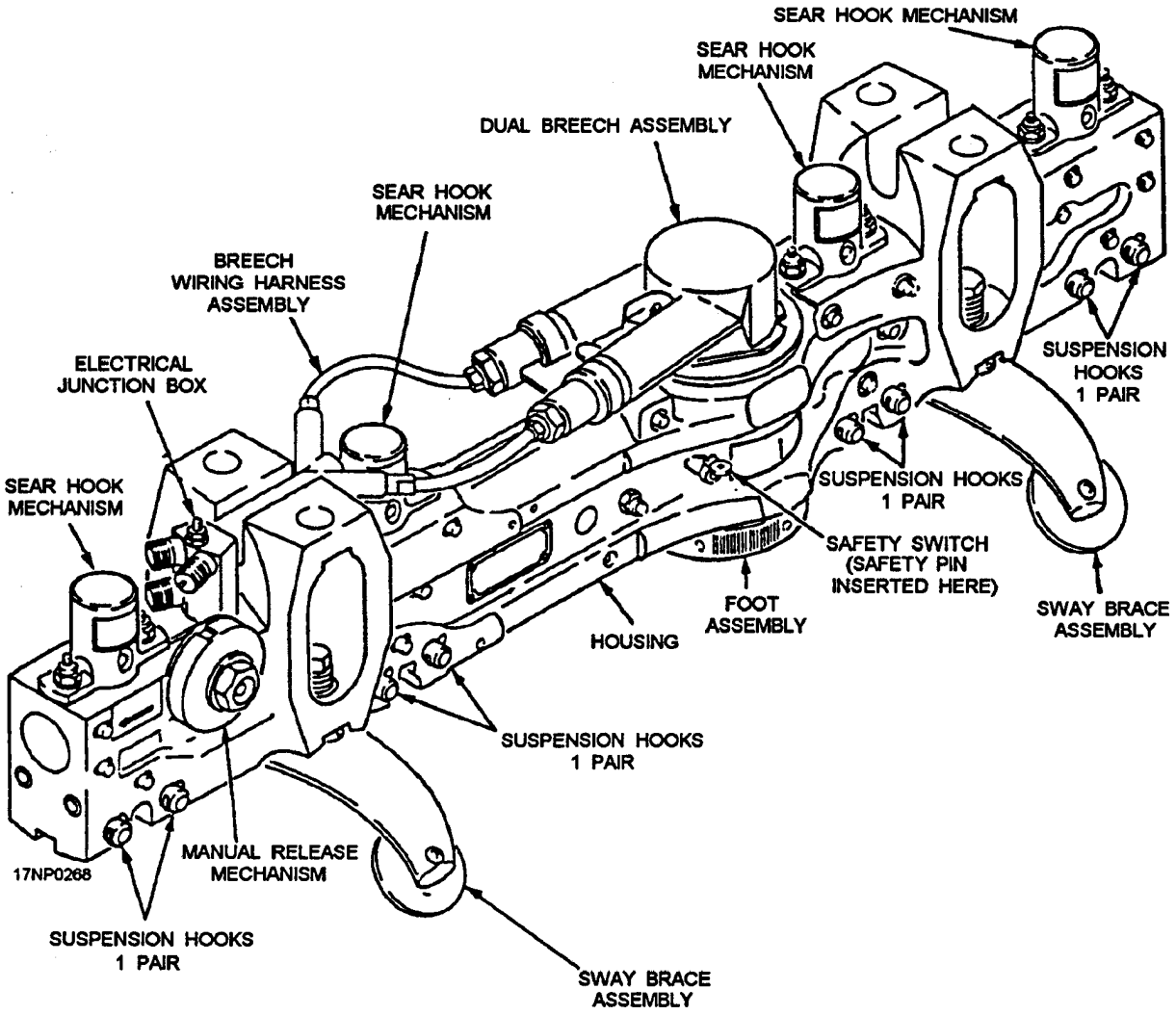


Figure 10-11.—Aero 7A-5 ejector rack assembly.

making it easier for you to load the weapon. Inspection windows, one over each pair of suspension hooks, let you visually check sear engagement of the suspension hooks. Before you let go of the weapon or store when loading, check the inspection windows over the suspension hooks; the hooks must be locked. If the suspension hooks aren't properly engaged by the sear, the inspection window is blank. If the suspension hooks are properly engaged by the sear, you will see a horizontal black line (fig. 10-12) in the inspection window. The 14-inch suspension hooks allow a maximum weapon/store capacity of 1,500 pounds. The 30-inch suspension hooks allow a maximum weapon/store capacity of 3,500 pounds.

The dual breech assembly accommodates two impulse cartridges. It consists of a cylinder, piston, foot ejector sleeve, and an ejector foot. After a weapon or store is loaded, you must adjust the ejector foot flush with the skin of the weapon or store, and then back it off to the first detent. You must never adjust the ejector foot lower than the black scribed line on the foot ejector sleeve, or you will damage internal components.

The mechanical linkage allows the locking or releasing of the suspension hooks. You can manually release the suspension hooks by rotating the 3/4-inch manual release nut (located on the forward left-hand side of the bomb ejector rack) counterclockwise.

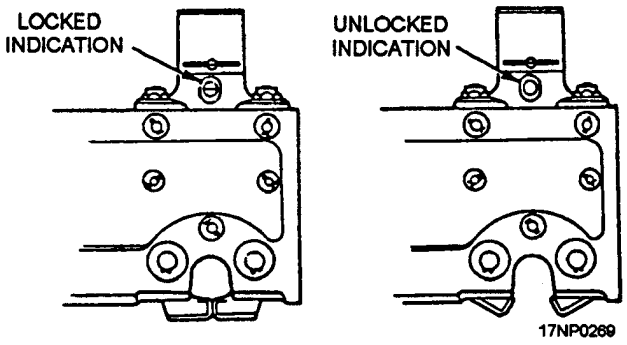


Figure 10-12.—Aero 7A-5 and Aero 7B-4 bomb ejector rack sear indicators

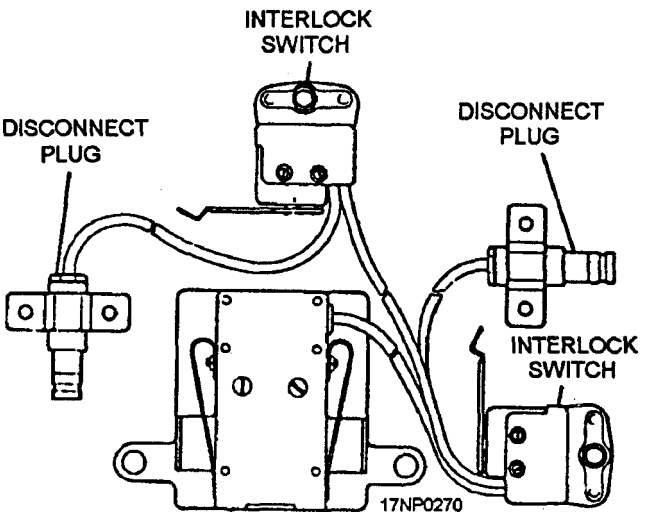


Figure 10-13.—Mk-39 electric fuze arming connector used on the Aero 7A-5 bomb ejector rack.

Rotating the manual release nut mechanically actuates the mechanical linkage. This raises the suspension hook sears and opens the suspension hooks. The mechanical linkage is also activated by the dual breech assembly.

The electrical junction box electrically connects the bomb ejector rack to the aircraft's weapons control system. Electrical power is supplied from the aircraft through the electrical junction box. This operates the mechanical arming solenoids, the dual breech assembly, and provides emergency operation of the rack. The voltage required for electrical arming doesn't pass through the electrical junction box. A separate connector assembly is located on the side of the bomb ejector rack. It connects the Mk 39 electric fuze connector to the aircraft's fuze function control system.

The Aero 7A-5 has mechanical and electrical arming capabilities. Two electromechanical solenoids are attached to the bomb ejector rack. They give the pilot the in-flight option of selecting nose only, tail only, or nose and tail arming capabilities. When an armed drop of an electrically fuzed weapon is desired, the Mk 122 Mod 0 safety arming switch is installed in the weapon. It is electrically connected to the Mk 39 electric fuze arming connector (fig. 10-13) during weapon loading procedures. By using the Mk 122 Mod 0 safety arming switch, the weapon is free of the suspension hooks before forwarding the fuze arming signal to the electric fuze.

Aero 7B-4 Bomb Ejector Rack

The Aero 7B-4 bomb ejector rack (fig. 10-14) is similar in operation to the Aero 7A-5 bomb ejector rack. The Aero 7B-4 bomb ejector rack is 2 inches shorter in height than the Aero 7A-5. This, together with modifications in the aircraft keel, provides 4 inches of additional deck clearance at the centerline fuselage station on the A-6 aircraft. The side location of the dual breech assembly and the rack mounting method also differ from the Aero 7A-5.

REVIEW NUMBER 1 ANSWERS TO QUESTIONS Q1. THROUGH Q8.

A1. To suspend stores weighing up to 2,000 pounds on the Aero 65A bomb rack, you would use the Aero 1A adapter assembly.

A2. Before you load a weapon on the Aero 65A bomb rack, you must cock and latch the rack.

A3. A 28-volt dc is required to energize the release unit of the Aero 65A bomb rack.

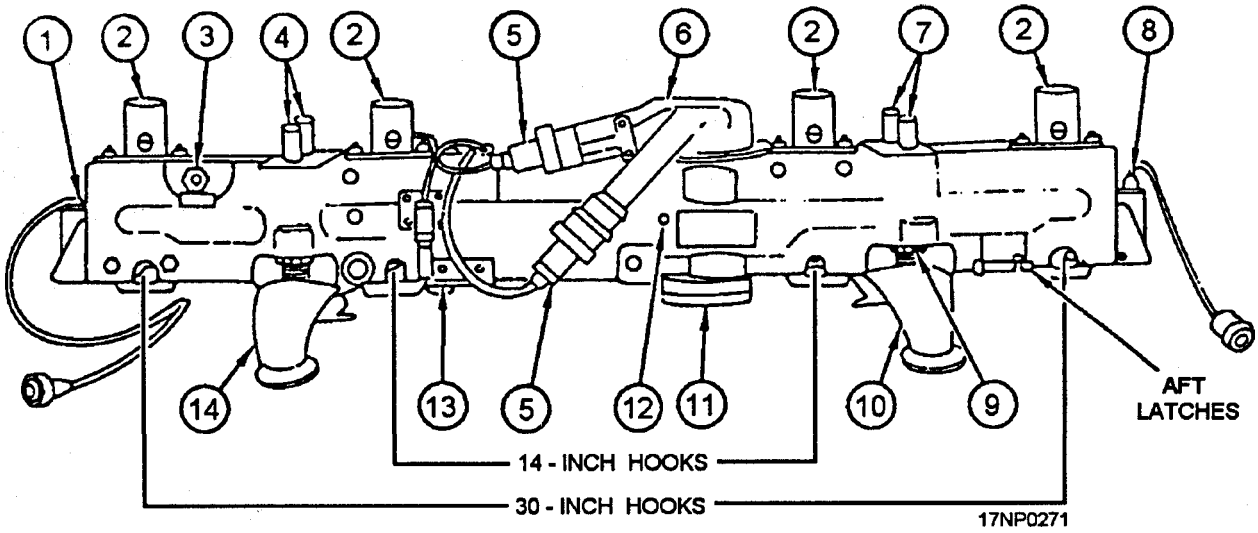
A4. The MAU-38/A bomb rack is mounted on the bomb bays of the P-3 aircraft.

A5. To connect a MAU-38/A bomb rack to a BRU-12/A bomb rack, you would use the AAC 571 change.

A6. The BRU-14/A bomb rack is a major modification of the Aero 65A bomb rack.

A7. The BRU-14/A bomb rack is installed in the P-3C aircraft.

A8. The BRU-15/A bomb rack is used on the wing stations of the P-3C aircraft.



1. **Nose arming solenoid**
2. **Sear indicator**
3. **Manual release**
4. **Forward attaching bolt (2)**
5. **Breech cap (2)**
6. **Dual breech**
7. **Aft attaching bolt (2)**
8. **Tail arming solenoid**
9. **Aft sway brace adjusting bolt (2)**
10. **Aft sway braces**
11. **Ejector foot**
12. **Safety pin receptacle**
13. **Electrical arming receptacle**
14. **Forward sway braces**

Figure 10-14.—Aero 7B-4 bomb ejector rack.

Principles of Operation

Operation of the bomb ejector rack is initiated when 28-volt dc is applied to the two impulse cartridges installed in the dual breech assembly. The two impulse cartridges are fired simultaneously, creating gas pressure in the breech. Gas pressure buildup causes the breech and sleeve assembly, through the mechanical linkage, to raise the hook sears, which opens the suspension hooks. At the same time, gas pressure is applied to the piston assembly to drive the ejector foot downward and eject the store from the bomb ejector rack. After ejection, a spring in the sleeve assembly returns the ejector foot to the sleeve housing. Emergency operation of the rack is identical to normal operation, except that completely separate electrical wiring is used for each impulse cartridge to ensure detonation of the two impulse cartridges.

Mechanical arming is done through the electromechanical arming solenoids. It works in the same manner as the Aero 65A series bomb racks. When an armed drop is to be made by using electric fuzing, an electrical signal is applied to the Mk 39 electric fuze arming connector. When the hooks open, this signal is transmitted to the Mk 122 Mod 0 safety arming switch, which arms the weapon as it clears the rack suspension hooks.

You don't want the bomb ejector rack to fire during ground operations. To prevent firing, insert a safety pin into the safety switch assembly. The safety pin maintains an open firing circuit, grounds the breech cap assembly electrical circuit, and mechanically blocks the linkage to prevent the suspension hooks from opening manually. If the suspension hooks are opened manually, remove the safety pin. If you rotate the manual release nut with the safety pin installed, you will damage the linkage and possibly shear a sear retainer pin. Once the hooks are manually opened, you can reinstall the safety pin to load weapons or stores.

Maintenance Requirements

Organizational-level maintenance for the Aero 7A-5 and the Aero 7B-4 bomb ejector racks is normally performed while the bomb ejector racks are installed on the aircraft. The exception is the 21-day special inspection. In this case, the bomb ejector rack is removed from the aircraft. The bomb ejector racks are also removed from the aircraft and routed to an intermediate-level maintenance activity every 420 days for rework. They are removed from the aircraft every 42 months and routed to a depot-level maintenance activity for overhaul.

Normally, routine maintenance at the organizational level is performed during regularly scheduled servicing

intervals. Servicing intervals are classed as daily inspections, loading inspections, turnaround inspections, special inspections, and inspections performed after five firings or at the end of a firing day, whichever occurs first. A few of the more common organizational maintenance requirements are discussed in the following paragraphs.

Ejector Mechanism Cleaning and Inspection

You must remove the bomb ejector mechanism from the bomb ejector rack for cleaning and inspection after every five shots or at the end of a firing day, whichever occurs first.

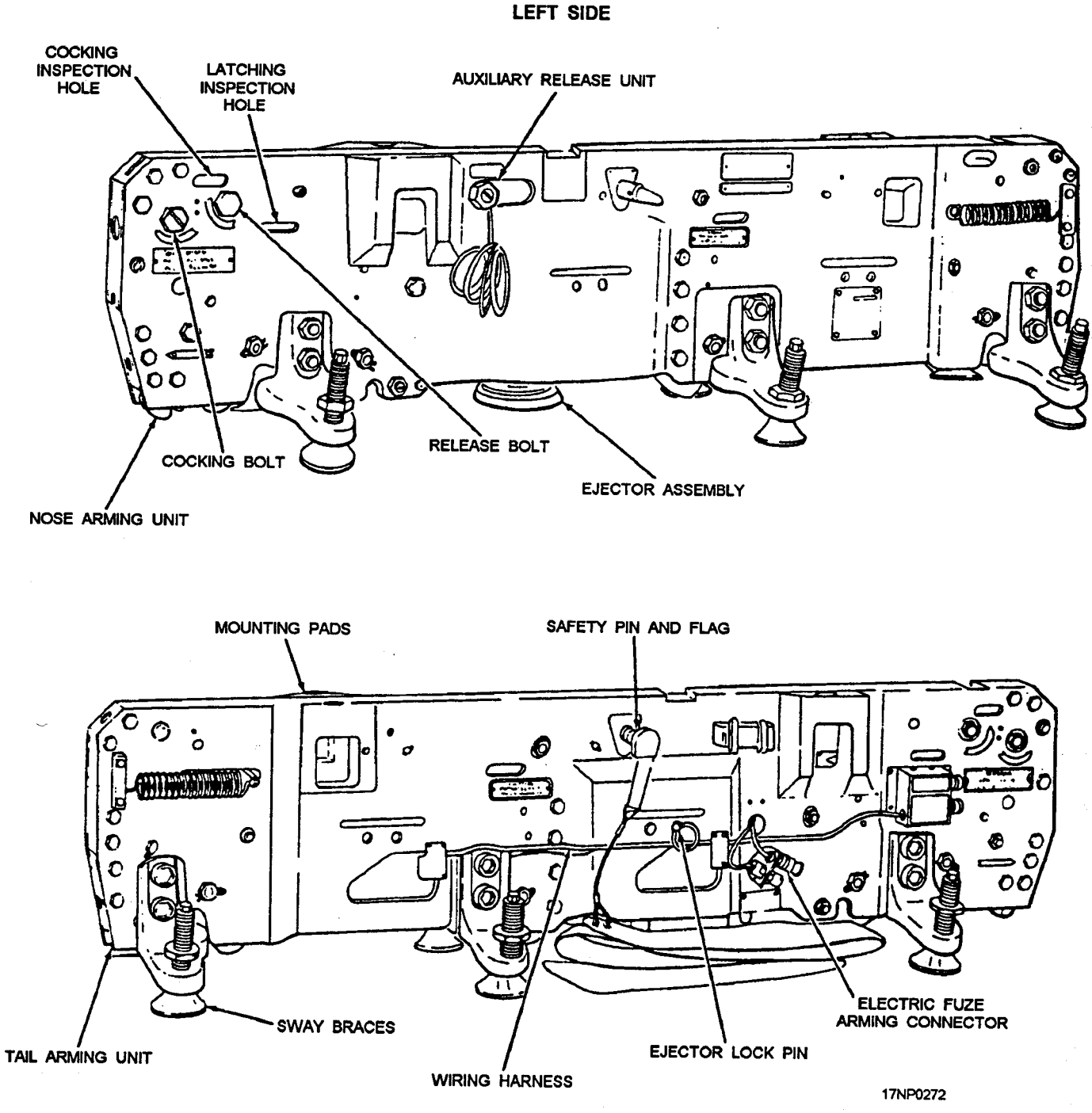


Figure 10-15.—BRU-10A/B bomb ejector rack.

Once the parts have been properly cleaned, you should inspect them for damage or wear and replace or repair the parts as necessary. Before reassembling the ejector mechanism, apply a light coat of general-purpose preservative lubricating oil (VV-L-800). To prevent the piston from locking up, you must wipe off all the excess oil.

For further information concerning the Aero 7A-5 and Aero 7B-4, refer to the publication *Ejector Rack Assembly Model Aero 7A-5,* NAVAIR 11-5D-20.

BRU-10A/B AND BRU-11A/A BOMB EJECTOR RACKS

The BRU-10A/B and BRU-11A/A bomb ejector racks are used to mount and sway brace a single weapon/store or for a variety of multiple weapon/store adapters. The BRU-10A/B bomb ejector rack is pylon mounted on the wing stations of the A-7E aircraft. It is part of the aircraft's basic weapon/store suspension system. It may also be weapons-rail mounted to the F-14 aircraft fuselage. The BRU-11A/A bomb ejector rack is pylon mounted on the wing stations of the S-3 aircraft. It is part of the aircraft's basic weapon/store suspension system.

BRU-10A/B Bomb Ejector Rack

The BRU-10A/B bomb ejector rack (fig. 10-15) has four suspension hooks-two hooks spaced 14 inches apart and two hooks spaced 30 inches apart. It carries weapons/stores weighing up to 4,000 pounds. The bomb ejector rack has the necessary electrical connections, mechanical and electrical arming units, ejection components, and the mechanical linkage for safely suspending and ejecting weapons or stores. Although the BRU-10A/B bomb ejector rack differs from the bomb ejector racks previously discussed, the basic principles of operation are the same, except for the operations discussed in the following paragraphs. As you read them, refer to figure 10-15.

A manual cocking bolt and a manual release bolt are located on the forward left-hand side of the frame assembly, Before you load a weapon or store, manually cock the mechanical linkage by rotating the cocking bolt. This places the linkage sears in a position to lock the suspension hooks when they are moved to the closed position. The suspension hooks may be released (opened) by manually rotating the manual release bolt. To prevent damage to the mechanical linkage, you must remove the safety flag assembly (safety pin) before you rotate either the cocking bolt or the release bolt.

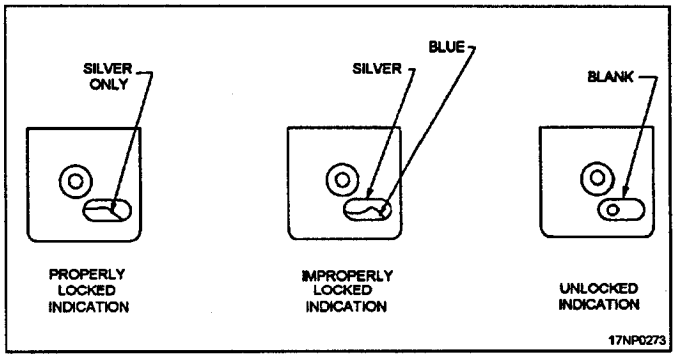
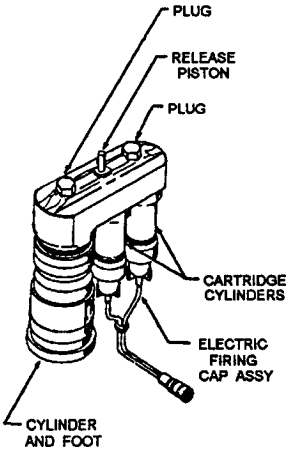


Figure 10-16.—BRU-10A/B bomb ejector rack hook latched indicators.

To find out if the suspension hooks are properly Iocked, you must visually check the latch inspection holes (fig. 10-16) located in the frame assembly above each hook. If the hook is properly locked, you can see a silver latch indicator through the latching inspection hole. If the hook is not locked, you can see a blue or silver latch indicator. If the hooks are unlocked (open), the latching inspection hole will be blank.

The BRU-10A/B bomb ejector rack is designed to hold one ejector assembly that can be inserted in the bomb rack in one of four different positions (fig. 10-17).



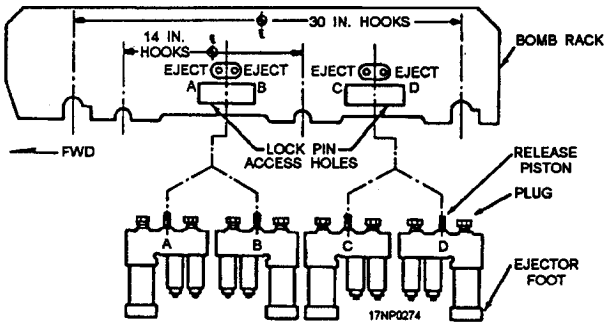


Figure 10-17.—BRU-10A/B bomb ejector rack ejector assembly and installation positions.

The position depends on the aircraft and the weapon/store requirements. For ease of removal and installation, the ejector assembly is secured in the bomb rack by a quick-release LOK pin assembly. The release piston (fig. 10-18) is operated by gas pressure. It is used to actuate the mechanical release linkage during cartridge ejection, and to unlock the suspension hooks.

A properly installed safety pin assembly safes the bomb ejector rack mechanically by blocking the mechanical release linkage. Although the safety flag assembly does not safe the rack electrically, it does prevent ejection of loaded weapons/stores if the cartridges are accidently fired. When the safety flag assembly is inserted in the bomb rack, the safety pin depresses the relief linkage assembly. The relief linkage assembly then depresses one of the two breech relief valves (fig. 10-17) to vent gases if a cartridge is accidently fired. The relief linkage assembly is arranged so that one of the breech relief valves is depressed regardless of which position the ejector assembly is actually installed in the bomb rack.

The BRU-10A/B bomb ejector rack has an auxiliary release unit assembly. It provides an emergency method of release if the ejector assembly or its electrical system should fail. The BRU-10A/B bomb ejector rack auxiliary release unit assembly (fig. 10-18) consists of a pressure control nut, exhaust tube, release piston, breech cap, and a breech cylinder. When the separation cartridge is fired, the expanding gases supply the force to actuate the release piston. The release piston extends to actuate the mechanical release assembly, releasing the suspension hooks. The suspension hooks release the weapon/store. The auxiliary release unit assembly does not eject the weapon/store. If a cartridge in the auxiliary release unit assembly is accidentally fired, the installed

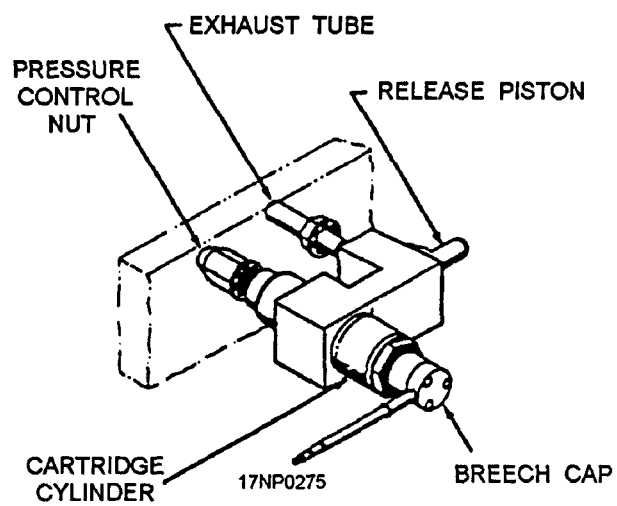


Figure 10-18.—BRU-10A/B bomb ejector rack auxiliary release unit assembly.

safety flag assembly prevents movement of the mechanical release mechanism assembly. The gas pressure generated by the ignition of the cartridge vents to the atmosphere through an exhaust tube on the auxiliary release unit assembly.

Organizational-level maintenance is limited to cleaning, replacing, and corrosion control of damaged parts and assemblies that can be replaced without removal of the bomb rack from the aircraft. If a BRU-10A/B bomb ejector rack requires inspection or repair beyond the scope of the organizational maintenance level, route the bomb rack to the intermediate or depot maintenance level. A few of the routine maintenance requirements are discussed in the following paragraphs.

After every five firings or at the end of the day's operation, whichever occurs first, the ejector assembly must be removed from the bomb ejector rack for cleaning and inspection. The actual cleaning and inspection requirements are the same as for the bomb ejector racks previously discussed. After the ejector assembly has been disassembled, cleaned, and inspected, you should lubricate the parts with a thin coat of MIL-L-19701 lubricant prior to reassembly.

BRU-11A/A Bomb Ejector Rack

The BRU-11A/A bomb ejector rack is a modification of the BRU-10A/B bomb ejector rack. The BRU-11A/A is used on the wing stations of the S-3 aircraft. However, it doesn't operate in exactly the same way. The major difference between the two bomb ejector racks is that the BRU-11A/A is equipped with an IFOBRL. This mechanism consists of a remote-controlled bomb rack lock and a remote-controlled emergency release for the bomb rack lock. This allows the bomb rack to be locked by the use of a remote-controlled actuator during loading and during flight. This eliminates the need for the safety pin assembly used on the BRU-10A/B.

There are several different models of the BRU-10A/B and the BRU-11A/A bomb ejector racks currently in use. Part numbers are assigned to identify the various models of configured bomb racks and are used during maintenance.

If you need more information about the BRU-10A/B and the BRU-11A/A bomb ejector racks, refer to *Bomb Ejector Rack BRU-11A/A,* NAVAIR 11-10C-24.

Once the parts have been properly cleaned, you should inspect them for damage or wear and replace or repair the parts as necessary. Before reassembling the ejector mechanism, apply a light coat of general-purpose preservative lubricating oil (VV-L-800). To prevent the piston from locking up, you must wipe off all the excess oil.

For further information concerning the Aero 7A-5 and Aero 7B-4, refer to the publication *Ejector Rack Assembly Model Aero 7A-5,* NAVAIR 11-5D-20.

BRU-10A/B AND BRU-11A/A BOMB EJECTOR RACKS

The BRU-10A/B and BRU-11A/A bomb ejector racks are used to mount and sway brace a single weapon/store or for a variety of multiple weapon/store adapters. The BRU-10A/B bomb ejector rack is pylon mounted on the wing stations of the A-7E aircraft. It is part of the aircraft's basic weapon/store suspension system. It may also be weapons-rail mounted to the F-14 aircraft fuselage. The BRU-11A/A bomb ejector rack is pylon mounted on the wing stations of the S-3 aircraft. It is part of the aircraft's basic weapon/store suspension system.

BRU-10A/B Bomb Ejector Rack

The BRU-10A/B bomb ejector rack (fig. 10-15) has four suspension hooks-two hooks spaced 14 inches apart and two hooks spaced 30 inches apart. It carries weapons/stores weighing up to 4,000 pounds. The bomb ejector rack has the necessary electrical connections, mechanical and electrical arming units, ejection components, and the mechanical linkage for safely suspending and ejecting weapons or stores. Although the BRU-10A/B bomb ejector rack differs from the bomb ejector racks previously discussed, the basic principles of operation are the same, except for the operations discussed in the following paragraphs. As you read them, refer to figure 10-15.

A manual cocking bolt and a manual release bolt are located on the forward left-hand side of the frame assembly, Before you load a weapon or store, manually cock the mechanical linkage by rotating the cocking bolt. This places the linkage sears in a position to lock the suspension hooks when they are moved to the closed position. The suspension hooks may be released (opened) by manually rotating the manual release bolt. To prevent damage to the mechanical linkage, you must remove the safety flag assembly (safety pin) before you rotate either the cocking bolt or the release bolt.

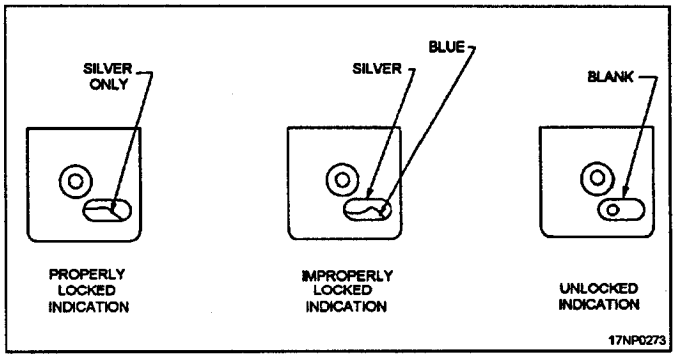
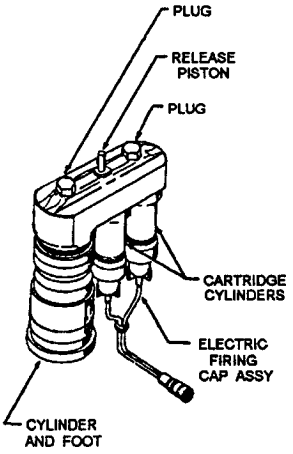


Figure 10-16.—BRU-10A/B bomb ejector rack hook latched indicators.

To find out if the suspension hooks are properly Iocked, you must visually check the latch inspection holes (fig. 10-16) located in the frame assembly above each hook. If the hook is properly locked, you can see a silver latch indicator through the latching inspection hole. If the hook is not locked, you can see a blue or silver latch indicator. If the hooks are unlocked (open), the latching inspection hole will be blank.

The BRU-10A/B bomb ejector rack is designed to hold one ejector assembly that can be inserted in the bomb rack in one of four different positions (fig. 10-17).



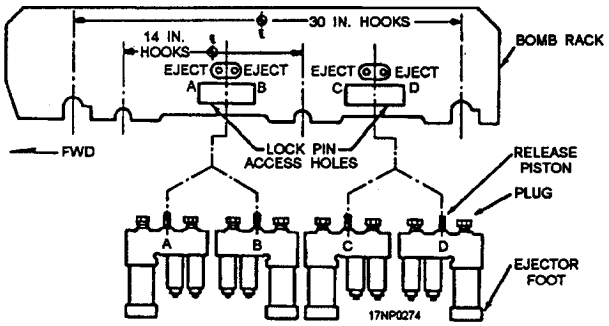


Figure 10-17.—BRU-10A/B bomb ejector rack ejector assembly and installation positions.

REVIEW NUMBER 2

Q1. Aero 7A-5 and 7B-4 bomb ejector racks are mounted on _____.

Q2. There are four separate pairs of suspension hooks on the Aero 7A-5 bomb ejector rack—two pairs for _____ suspensions and two pairs for _____ suspensions.

Q3. What is the maximum store capacity of the 14-inch and 30-inch suspension racks of the Aero 7A-5 bomb ejector rack?

Q4. The Aero 7B-4 bomb ejector rack is mechanically armed through the _____.

Q5. When should you perform organizational-level maintenance on the Aero 7A-5 and 7B-4 bomb ejector racks?

Q6. What is the maximum store capacity of the BRU-10A/B bomb ejector rack?

Q7. The BRU-10A/B ejector assembly should be cleaned and inspected _____.

Q8. What bomb ejector rack is a modification of the BRU-10A/B bomb ejector rack?

BRU-32/A BOMB EJECTOR RACK

The BRU-32/A bomb ejector rack (fig. 10-19) is installed on the F/A-18 aircraft. It is used to suspend single stores, BRU-33/A vertical ejector racks (VER), and LAU-115/A, LAU-117/A, and LAU-118/A missile launchers by using a 14-inch suspension hook.

The BRU-32/A bomb ejector rack has a safety interlock and automatic sway bracing. The safety interlock mechanically prevents the accidental opening of the suspension hooks. It is also used to lock and unlock the suspension hooks during loading operations. Automatic sway bracing is controlled by the opening and closing of the suspension hooks.

Sensing switches are incorporated within the rack to indicate to the stores management processor (SMP) that a store is loaded The primary ejection uses two cartridges to generate the required gas pressure for rack operations. If the primary ejection fails, emergency release is provided by the auxiliary release unit. The

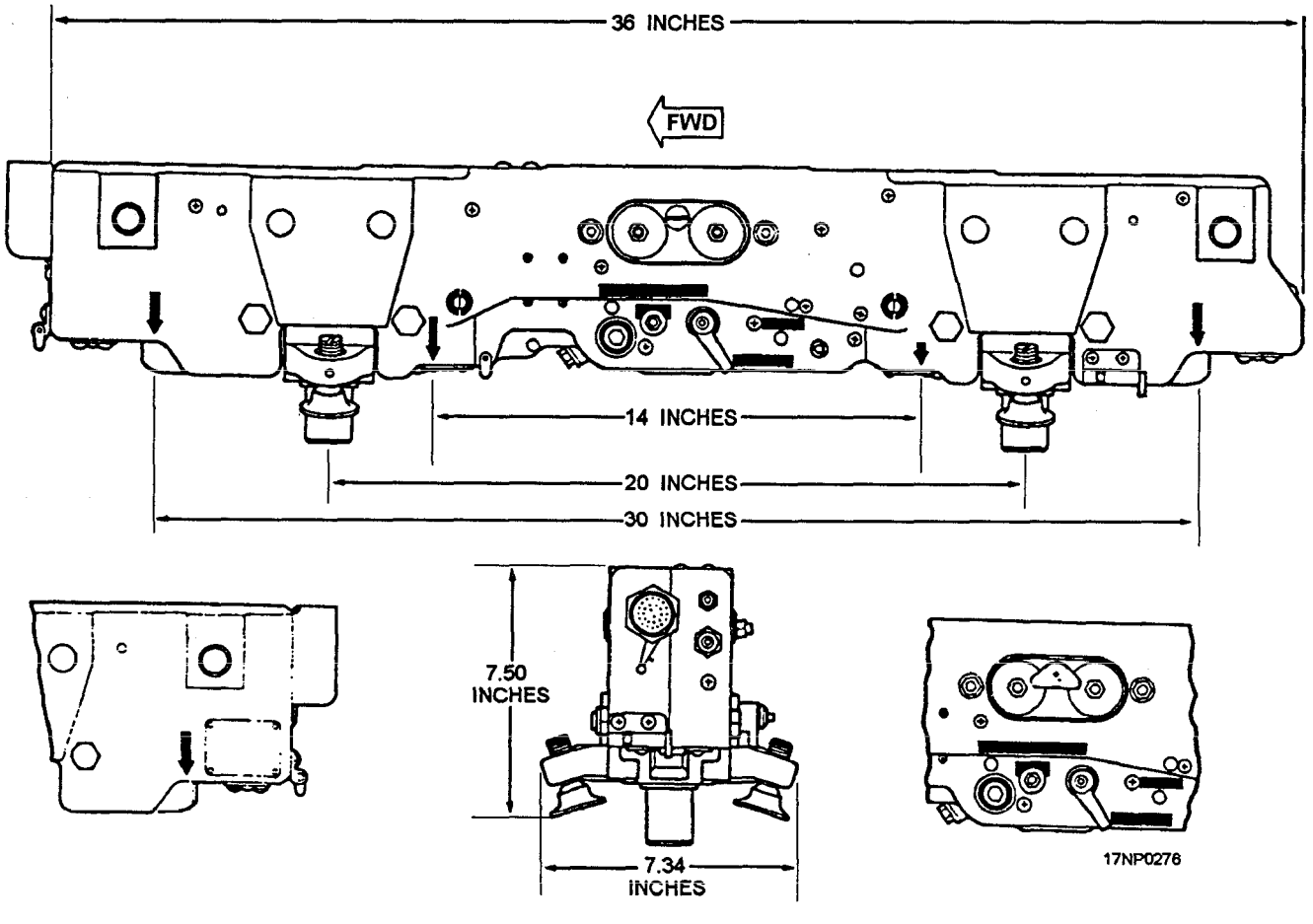


Figure 10-19.—BRU-32/A bomb ejector rack.

auxiliary release unit uses one cartridge that opens the hooks only. Nose and tail arming solenoids are used with mechanical fuzing. The Mk 39 electric fuzing receptacle is used for electric fuzing. The bomb rack is interchangeable with the centerline. or the inboard and outboard pylons.

BRU-33/A AND BRU-33A/A VERTICAL EJECTOR RACK

The BRU-33 vertical ejector rack (VER) (fig. 10-20) is suspended by the BRU-32/A bomb rack. It provides side-by-side and canted side-by-side carriage and release of two 14-inch suspension stores, ranging from 10- to 16-inches in diameter and weighing up to 1,000 pounds. The ejector racks provide automatic swaybracing through the use of spring loaded, self-adjusting wedges. The safety interlock is electrically controlled by the aircraft and mechanically prevents accidental opening of the suspension hooks.

Sensing switches are incorporated to indicate to the SMP that a store is loaded. The rack has provisions for mechanical and electric fuzing. The ejection unit uses two cartridges to generate the required gas pressure for rack operations.

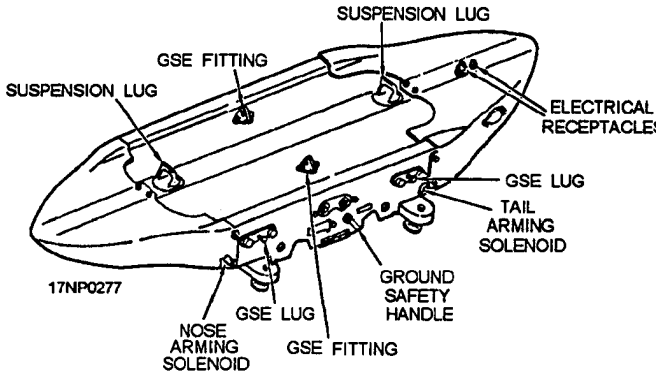


Figure 10-20.—BRU-33/A bomb ejector rack.

For further information concerning the BRU-33 vertical ejector rack, refer to the publication AW-382AC-750-010, Vertical Ejector Rack Assembly BRU-33/A and BRU-33A/A,

A/A37B-6E MULTIPLE EJECTOR RACK (MER) AND A/A37B-5E TRIPLE EJECTOR RACK (TER)

The A/A37B-6E multiple ejector rack (MER) (fig. 10-21) and the A/A37B-5E triple ejector rack

REVIEW NUMBER 2 ANSWERS TO QUESTIONS Q1. THROUGH Q8.

A1. Aero 7A-5 and 7B-4 bomb ejector racks are mounted on all models of the A-6 aircraft.

A2. There are four separate pairs of suspension hooks on the Aero 7A-5 bomb ejector rack—two pairs for 14-inch suspensions and two pairs for 30-inch suspensions.

A3. The maximum store capacity of the 14-inch suspension rack is 1,500 pounds and 3,500 pounds for the 30-inch suspension rack on the Aero 7A-5 bomb ejector rack.

A4. The Aero 7B-4 bomb ejector rack is mechanically armed through the electromechanical arming solenoids.

A5. Organizational-level maintenance is performed on the Aero 7A-5 and 7B-4 bomb ejector racks with the racks installed on the aircraft.

A6. The maximum store capacity of the BRU-10A/B bomb ejector rack is 4,000 pounds.

A7. The BRU-10A/B ejector assembly should be cleaned and inspected after every five shots or at the end of the day, whichever comes first.

A8. The BRU-11A/A bomb ejector rack is a modification of the BRU-10A/B bomb ejector rack.

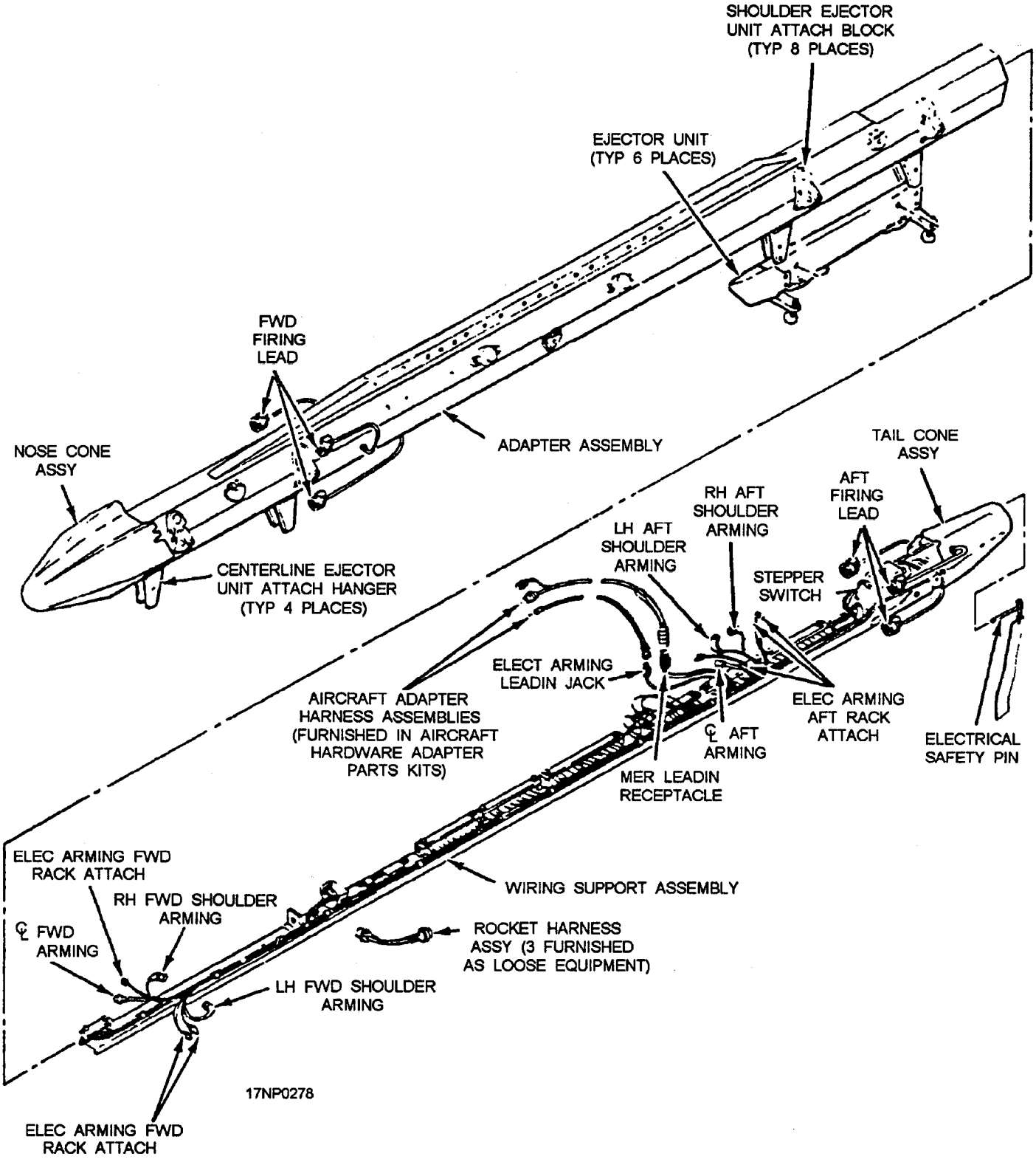


Figure 10-21.—Multiple ejector rack, exploded view.

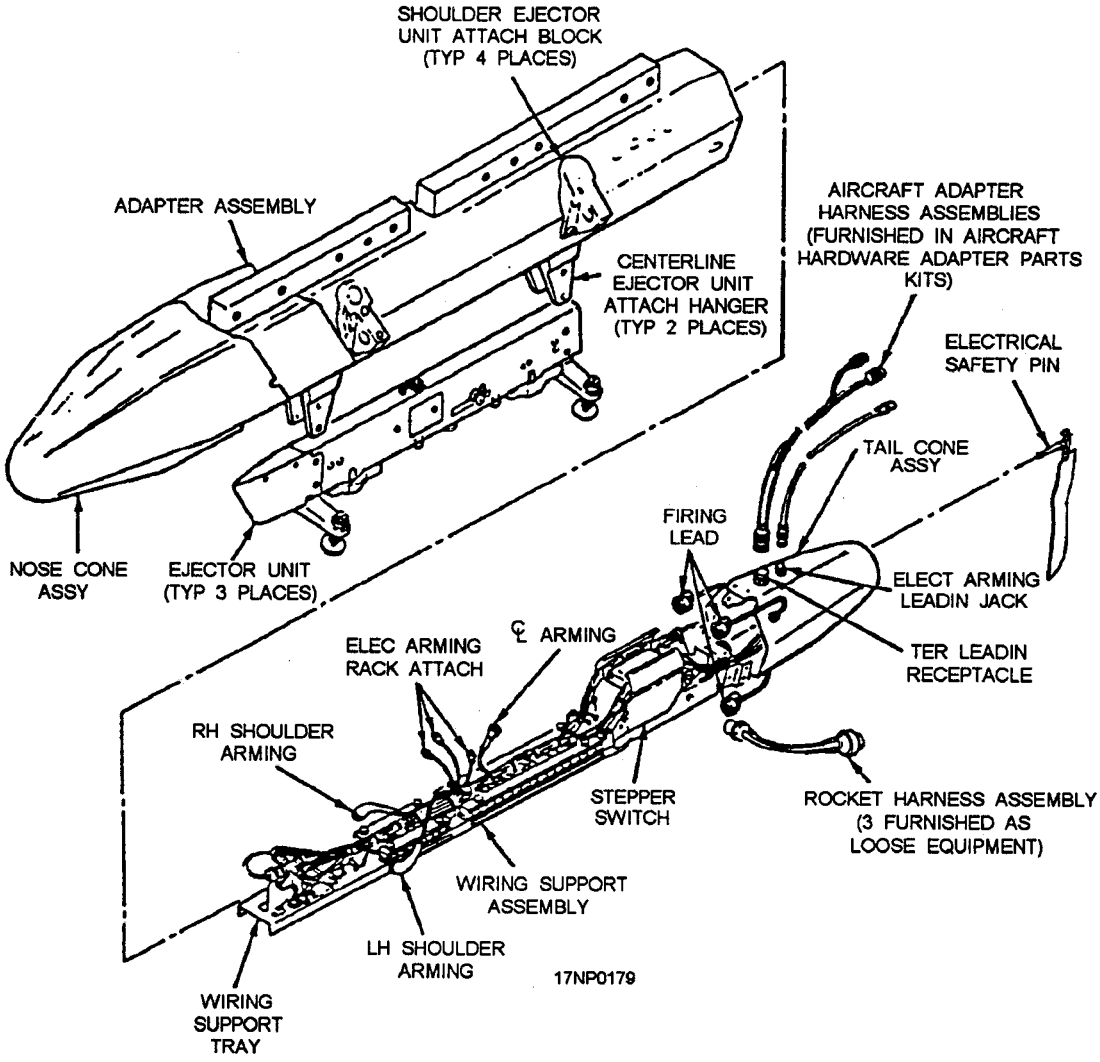


Figure 10-22.—Triple ejector rack, exploded view.

(TER) (fig. 10-22) are known as a *MER* or *TER*. They are essentially the same assemblies except for structural size and the number of stores they can carry. The MER and TER are classified as accessory racks. They are installed on parent bomb racks or pylons to increase the number of stores that can be suspended by a particular station.

Both the MER and TER consist of three major subassemblies-an adapter assembly, a wiring support assembly, and three ejector units for the TER and six ejector units for the MER.

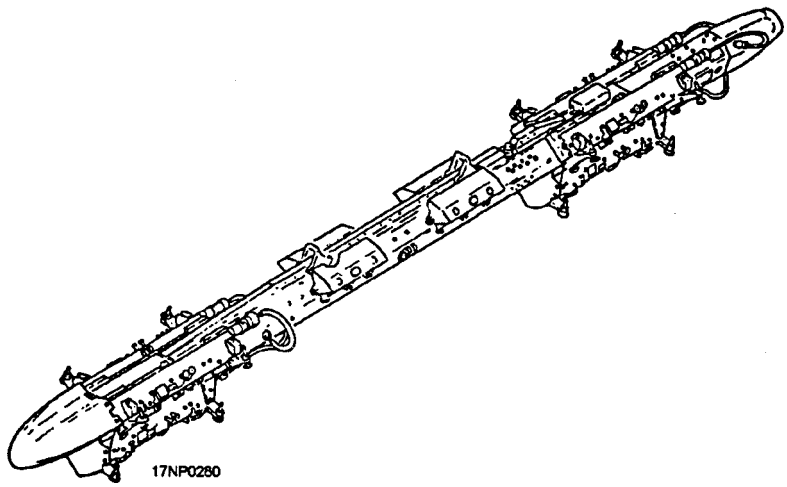
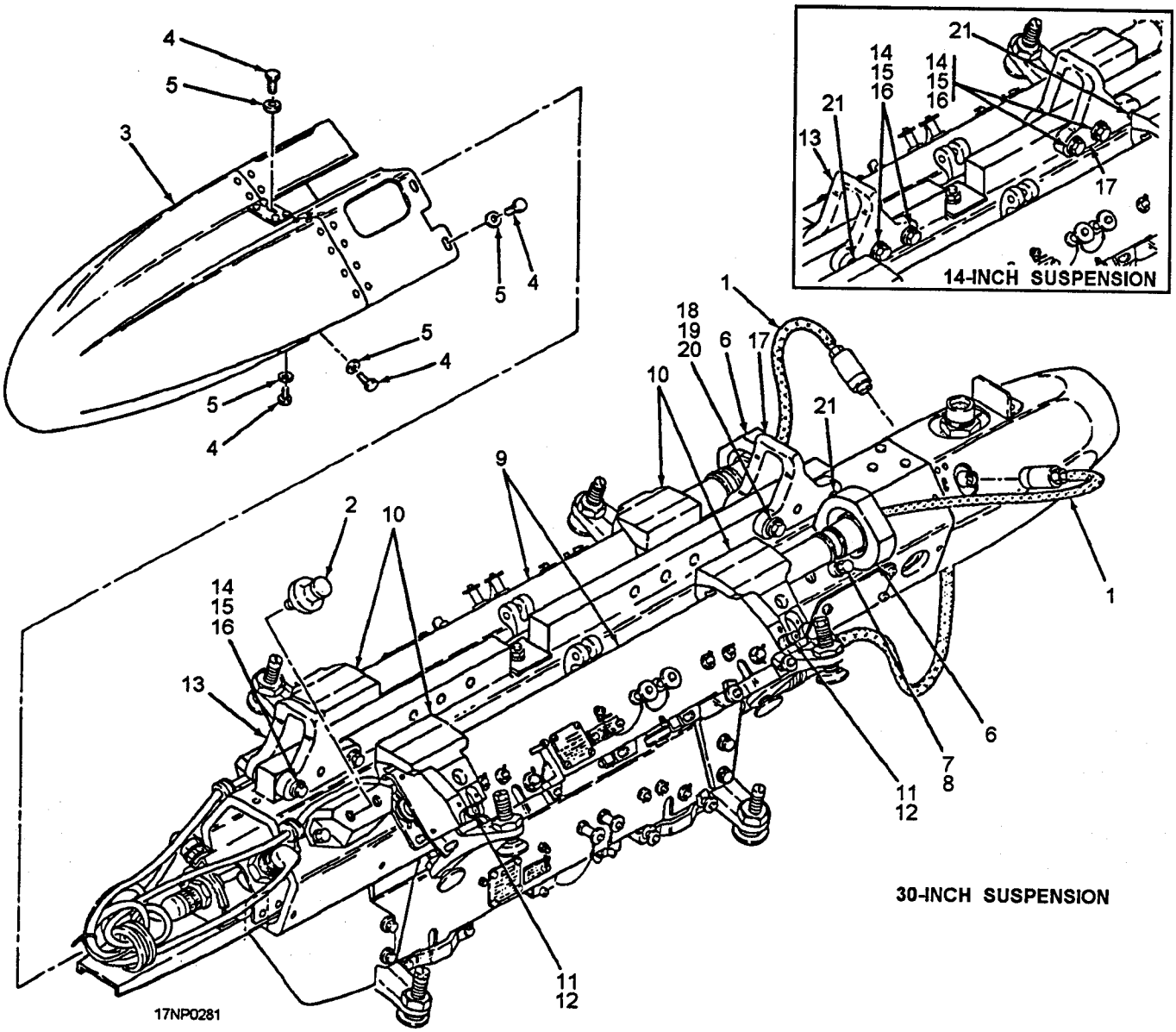


Figure 10-23.—BRU-41/A IMER.

IMPROVED MULTIPLE EJECTOR RACK BRU-41/A (IMER) AND IMPROVED TRIPLE EJECTOR RACK BRU-42/A (ITER)

The BRU-41/A (fig. 10-23) and the BRU-42/A (fig. 10-24) operate and function basically the same. There are four major subassemblies-the structural adapter assembly, the electronic control unit, the cable assembly, and the ejector unit. The electronic control unit and the ejector unit are the same for both the BRU-41/A and the BRU-42/A.



1. Firing lead cables/breech caps
2. Sway brace pad extensions
3. Nose cone
4. Bolts
5. Washers
6. Aft sway brace pads
7. Bolts
8. Washers
9. Shoulder ejector units
10. Sway brace pads
11. Bolts
12. Washers
13. Forward suspension lug
14. Bolts
15. Nuts
16. Washers
17. Aft suspension lug
18. Bolt
19. Nut
20. Washers
21. Pin

Figure 10-24.—BRU-42/A ITER.

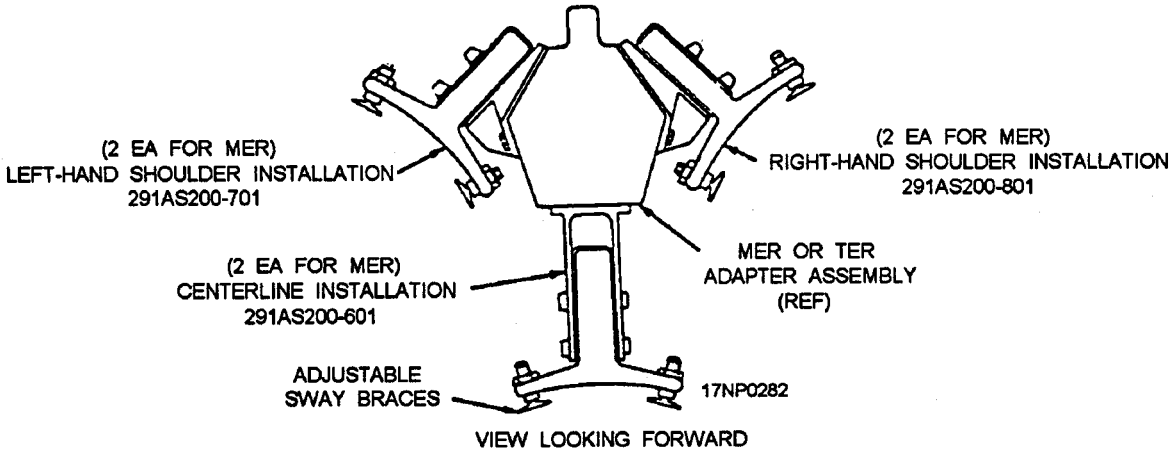
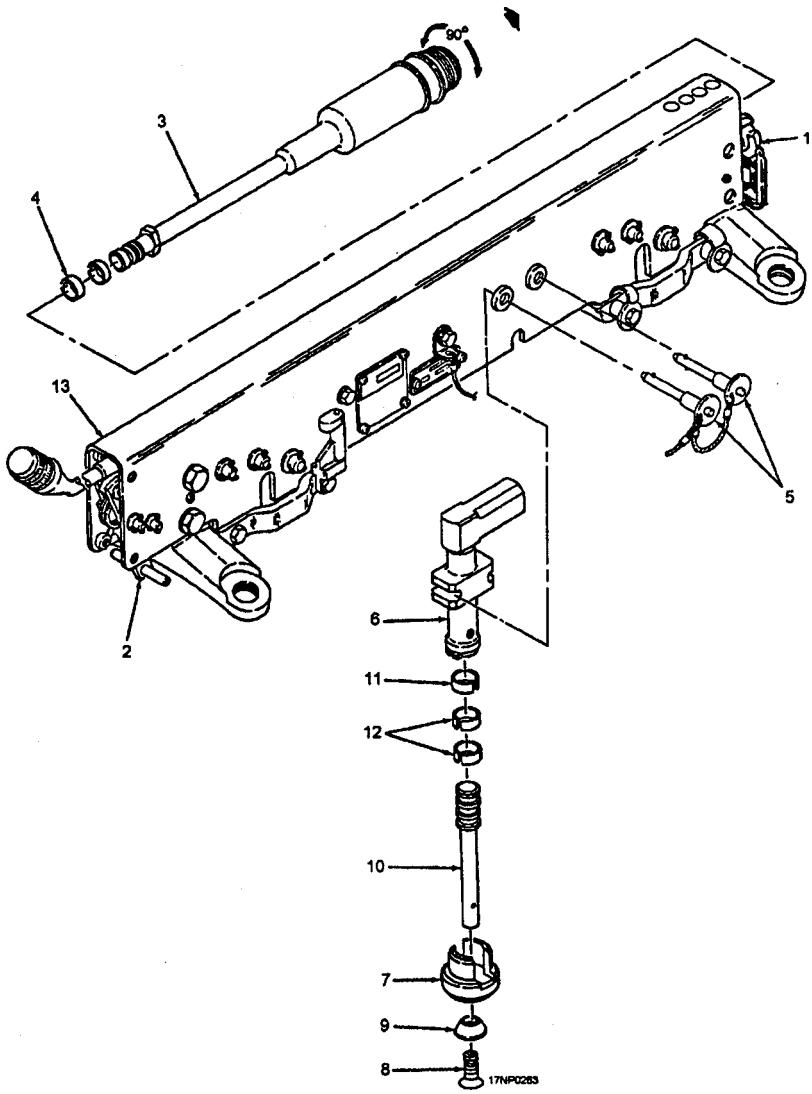


Figure 10-25.—IMER/ITER ejector unit locations.



1. **Safety stop lever**
2. **Manual release lever**
3. **Breech**
4. **Pressure ring (2)**
5. **Gun retaining pin assembly (2)**
6. **Gun assembly**
7. **Retainer**
8. **Bolt**
9. **Washer**
10. **Piston**
11. **Bearing ring**
12. **Pressure ring (2)**
13. **Ejector unit housing**

Figure 10-26.—IMER/ITER ejector unit.

Adapter Assembly

The adapter assembly is a hollow, hexagonal aluminum extrusion that forms the main support for the rack assembly hardware. Attaching points on the adapter assembly provide 14-inch or 30-inch spacing of the suspension lugs, which allows installation on the various types of aircraft.

The adapter assembly houses the electronic control unit and cable assembly and provides for attachment of six or three individual ejector units. A nose-cone assembly and a tail-cone assembly enclose the ends of the adapter assembly for aerodynamic purposes.

Electronic Control Unit

The electronic control unit is a solid-state electronic control unit in a sealed container. The electronic control unit controls all the functions of the bomb rack and has the capability of releasing stores at 35-millisecond intervals. The electronic control unit is disposable. If it malfunctions, replace it with a new one.

Ejector Unit Assemblies

The ejector unit assemblies used on the IMER and ITER are identical. The only difference between them is the internal configuration of the release linkage. The ejector units are configured for right-hand shoulder installation, left-hand shoulder installation, or centerline installation (fig. 10-25). They are identified by part number. The shoulder stations are attached to the adapter assembly by ejector unit attach blocks. The centerline stations are attached by ejector unit attach hangars. A IMER/ITER ejector unit (fig. 10-26) consists of a housing assembly equipped with integral wiring, a breech and ejector mechanism, store suspension hooks, a store sensing switch, two mechanical arming solenoids, an electrical arming unit, adjustable sway braces, and mechanical linkage driven by the breech or manual release lever to open the suspension hooks.

The suspension hooks are spaced 14 inches apart and are independently self-latching. There is a manual release lever, which is used to open the hooks during ground operation. The safety stop lever is used to safe the ejector unit mechanically. Look at figure 10-27. It shows the locked and unlocked positions of the ejector unit safety stop lever. When the safety lever is in the locked position, the hook release rod is physically blocked from rearward movement and prevents suspension hook release. If the hook release rod is not in the full forward position, the safety stop lever cannot be rotated to the locked position. A store sensing switch is located under the forward suspension hook, and is actuated by the opening and closing of the hook.

IMER/ITER Operational Description

The functional description of the IMER/ITER ejector rack is discussed in two categories-ejector unit mechanical operation and IMER/ITER electrical operation.

EJECTOR UNIT OPERATIONAL DESCRIPTION.— All ejector units on the IMER and ITER are operationally the same. The ejection mechanism is actuated by an electrically initiated gas-generating cartridge. As you read this section, look

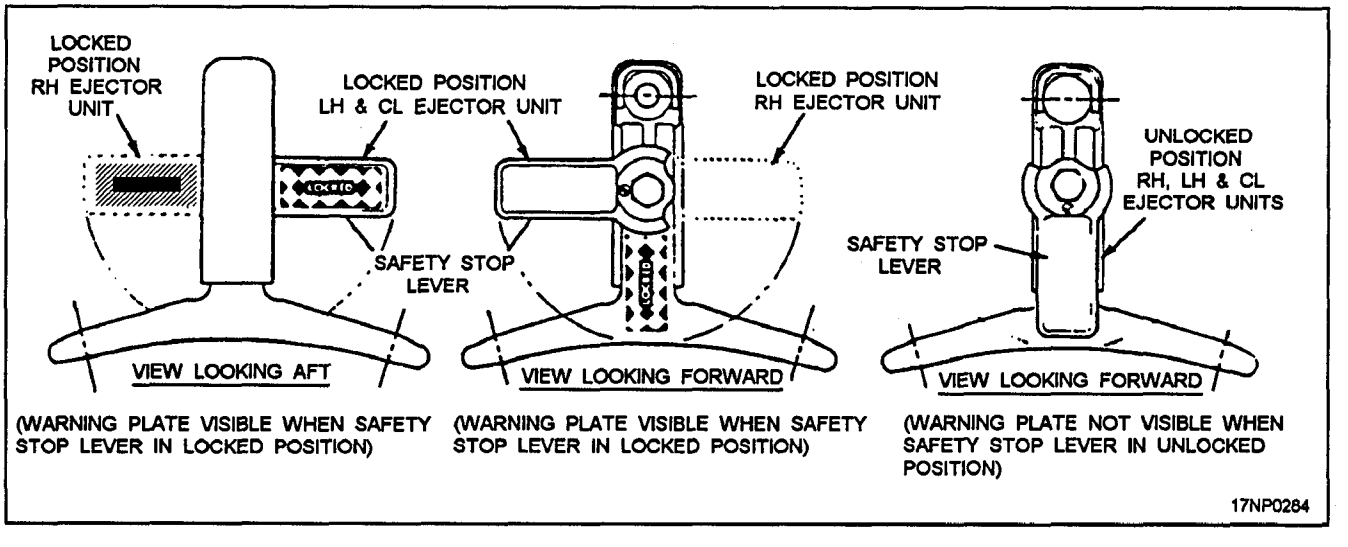


Figure 10-27.—Ejector unit safety stop lever.

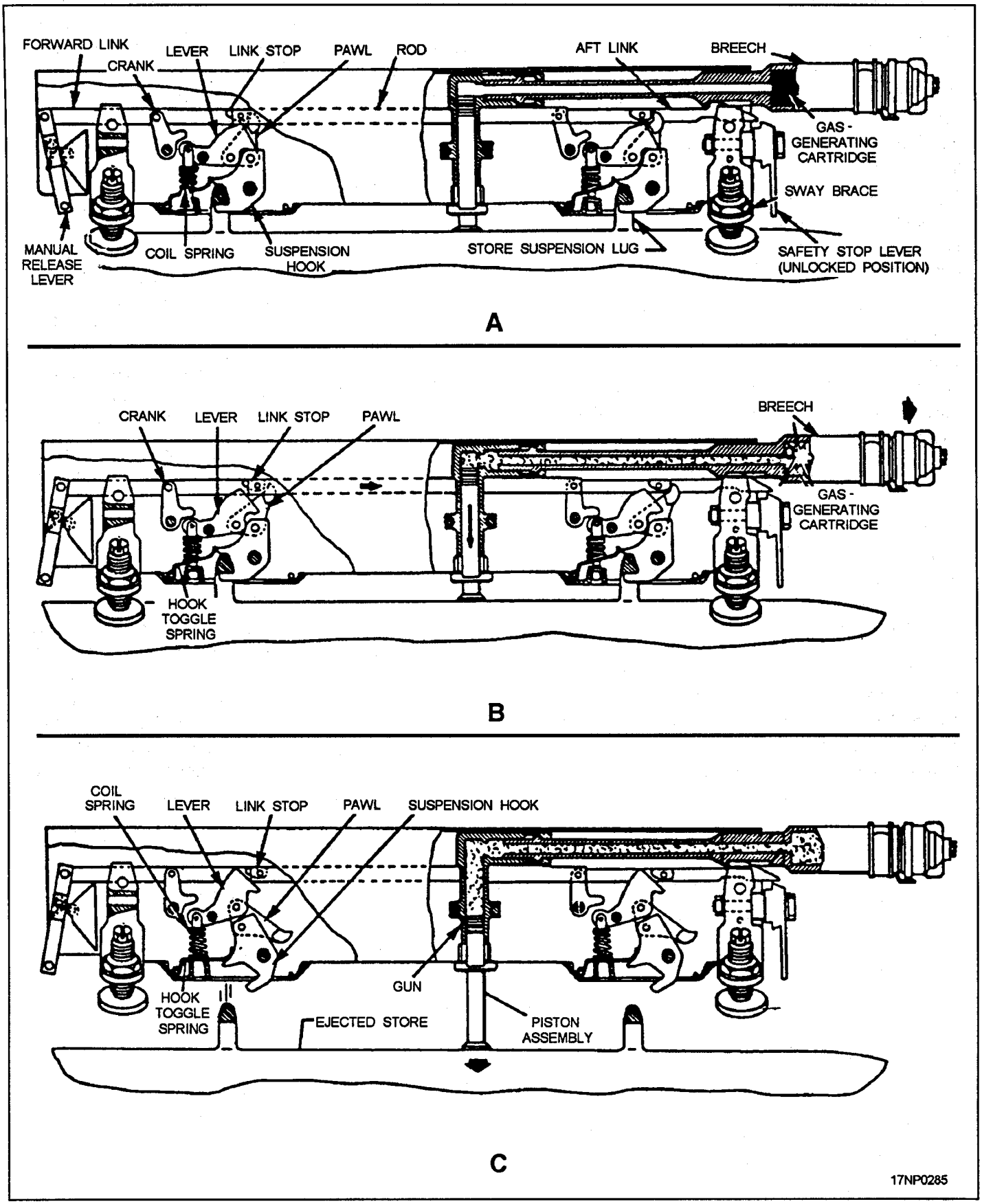


Figure 10-28.—Ejector unit operation.

at figure 10-28. It shows the mechanical operation of the ejector unit.

When a store is loaded onto the ejector unit, the store suspension lugs force the suspension hooks to the closed position. The suspension hooks are locked in the closed position by the overcenter position of the hook toggle levers. The link stops, located over each of the hook toggle levers, prevent the suspension hooks from opening until the cartridge is fired or the manual release lever is pulled, even if the safety stop lever is in the unlocked position (fig. 10-28, view A).

When the gas-generating cartridge is fired, the resulting gas pressure moves the breech aft. The aft movement of the breech also moves the hook release rod aft, lifting the toggle hook levers from the overcenter position. The cranks are forced down. This unlocks the suspension hooks (fig. 10-28, view B).

Gas pressure from the cartridge acting against the gun piston, plus the weight of the store, forces the unlocked suspension hooks to open, releasing the store. The hooks are held in the open position by the hook toggle spring and coil spring. The gun piston continues to act against the store to provide positive separation from the ejector unit (fig. 10-28, view C).

IMER/ITER ELECTRICAL OPERATION.—Before discussing the electrical operation of the IMER/ITER, you must understand the function of several electrical components. These components are briefly discussed in the following paragraphs.

IMER and ITER ejector units are numbered according to their firing sequence (fig. 10-29). For the purpose of discussion, assume that a IMER has stores loaded on stations 1, 2, 4, and 6, and that the release mode selector is set for single release.

When the pilot depresses the cockpit bomb button, a firing pulse is routed from the aircraft through the rack safety switch and the release mode selector switch to energize the necessary rack circuits. With a weapon loaded on station 1, the forward suspension hook is in the closed position, automatically closing the stores sensing switch. The firing voltage is then routed to the firing circuit, firing the cartridge and ejecting the weapon. Ejection of the stores from all remaining loaded stations will occur in sequence each time the pilot presses and releases the bomb button. In this particular load, stations 3 and 5 were not loaded; therefore, make sure the forward hooks are left open. If they are closed, the stores sensing switch signals the rack that a weapon is loaded on that station and will not automatically step to the next station.

Hardware Adapter Kits

Hardware adapter kits are used to adapt the IMER/ITER to various aircraft. The kits include electrical harness assemblies, suspension lugs, sway brace pads and extensions, and attaching hardware required to configure the racks for a desired pylon station on a particular aircraft. Additionally, practice bomb adapters are used to adapt the IMER and ITER for the attachment of practice bombs or externally carried

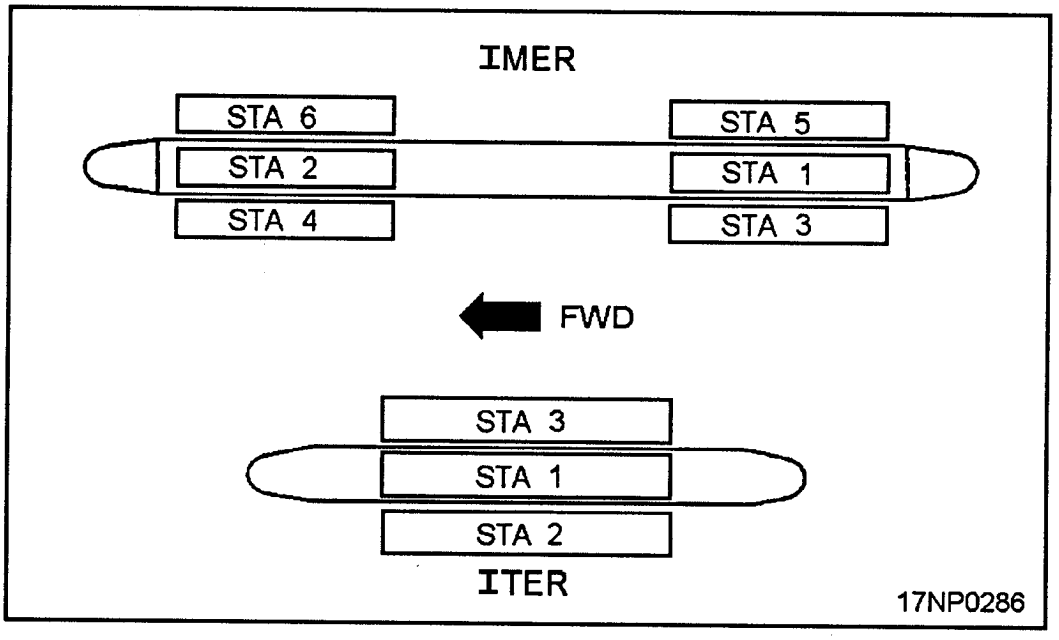


Figure 10-29.—IMER/ITER firing sequence.

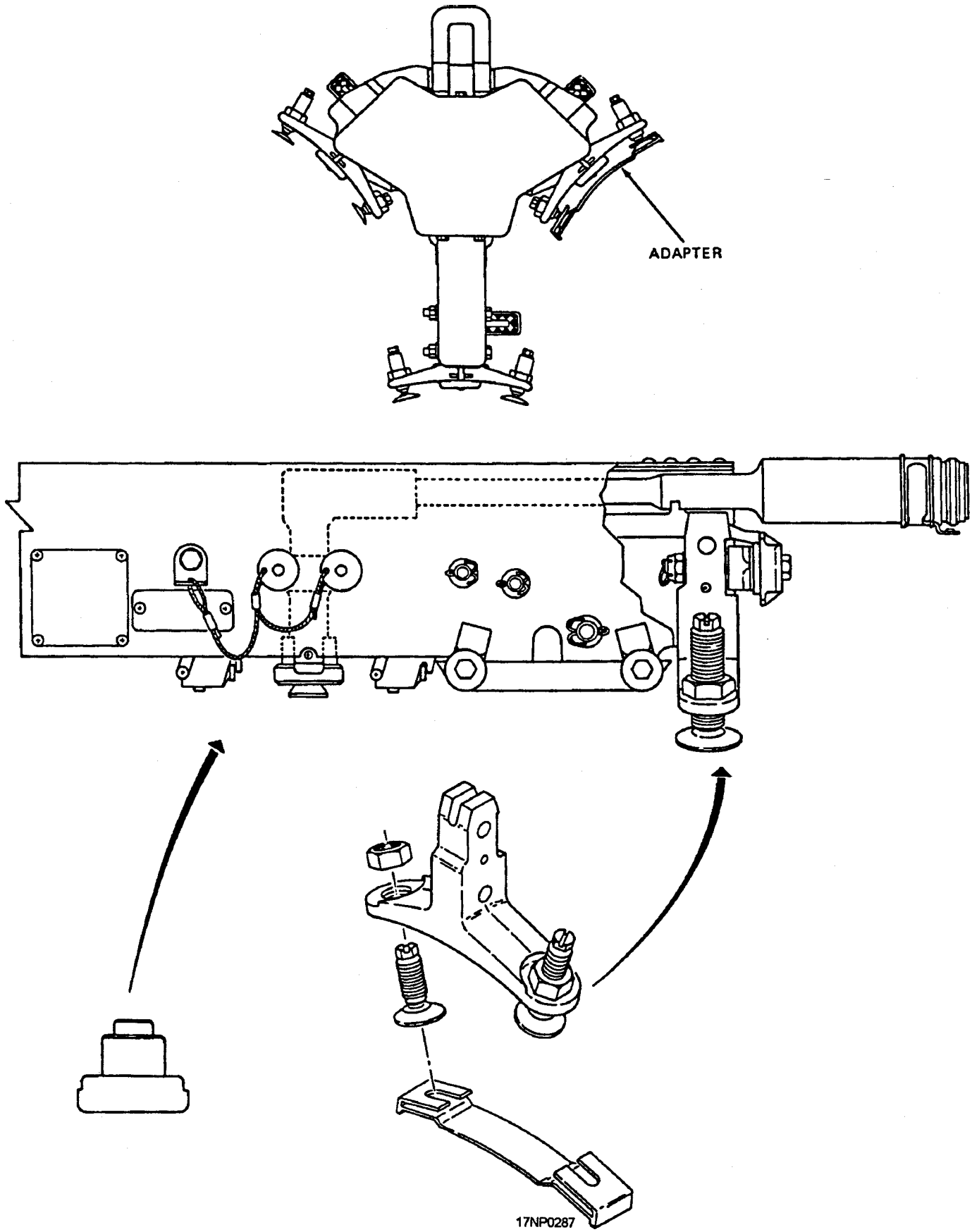


Figure 10-30.—Practice bomb adapter kit.

Mk 45 aircraft parachute flares and Mk 58 marine location markers. The adapter (fig. 10-30) is composed of three separate components-a bracket, an ejector footlock, and a hook actuation spring.

Both the hardware adapter kit and practice bomb adapter are considered to be organizational-level equipment, and are to be maintained in the custody of the organizational unit.

For further information concerning the MER and TER, refer to the publication NAVAIR 11-75A-57, *Multiple Ejector Rack (MER) A/A37B-6E and Triple Ejector Rack (TER) A/A37B-5E* (latest revision). For the improved multiple ejector rack (IMER) and improved triple ejector rack (ITER), refer to the publication NAVAIR 11-5-603.

REVIEW NUMBER 3

Q1. The BRU-32/A bomb ejector rack is installed on the _____ aircraft.

Q2. What is the maximum capacity of the BRU-33 vertical ejector rack?

Q3. List the major subassemblies of the MER and TER.

Q4. The adapter assembly of the IMER houses the wiring support assembly on which you can attach _____ individual ejector units.

Q5. How many individual ejector units can you attach to the adapter assembly of the ITER?

Q6. How are IMER and ITER ejector units numbered?

Q7. What is the purpose of the stores sensing switch located on the forward hook of each station?

Q8. At what level is the custody of the IMER/ITER hardware kit and practice bomb adapter kits maintained?

BOMB SHACKLES

LEARNING OBJECTIVE: *Identify the purpose and use of bomb shackles.*

The Mk 8 Mod 5 bomb shackle is used on helicopters, such as the SH-3. The Mk 8 Mod 5 bomb shackle (fig. 10-31) is used to suspend and release a mine or torpedo that weighs from a minimum of 100 pounds to a maximum of 1,500 pounds. The bomb shackle incorporates suspension hooks spaced 14 inches apart, center to center. It has no integral

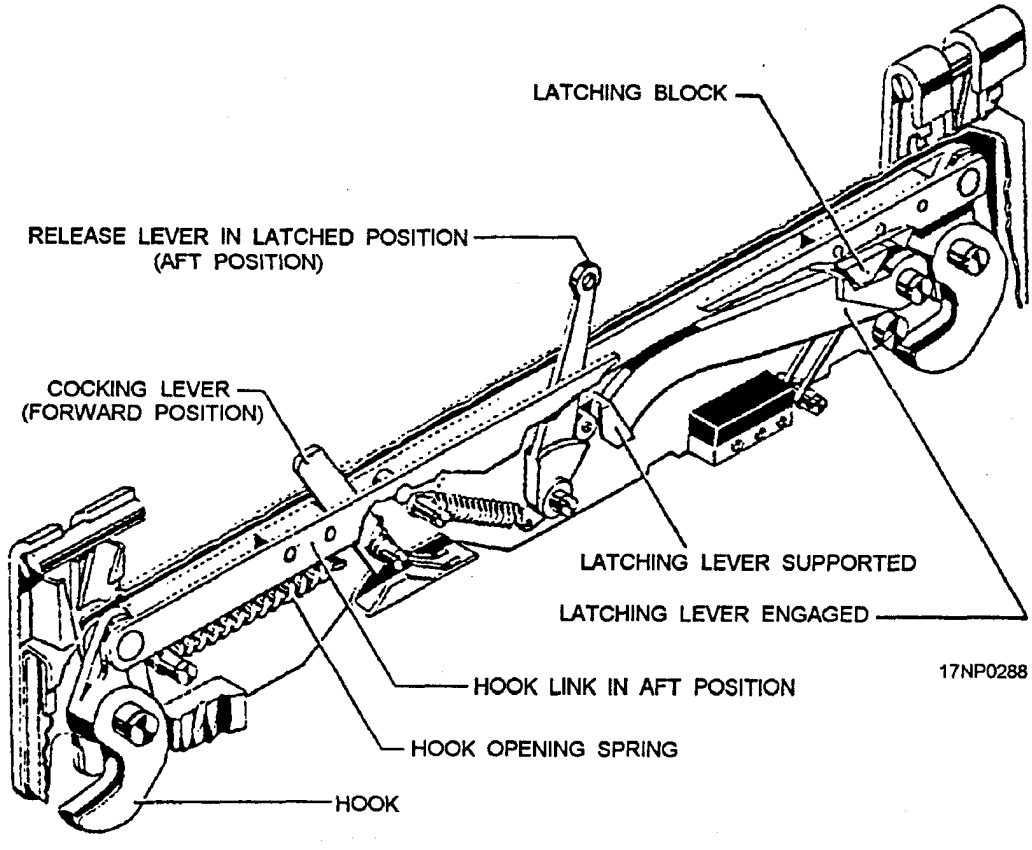


Figure 10-31.—Mk 8 Mod 5 bomb shackle.

provisions for electrical release, electrical arming, or mechanical arming. However, the shackle can be electrically released if you attach an electrical release unit, such as the Aero 7B-1, to the shackle structure. The shackle can be mechanically armed if you attach arming solenoids to the shackle or to the structure on which the shackle is mounted.

The frame of the Mk 8 Mod 5 bomb shackle is an inverted U-shaped member. The frame suspension lugs are also U-shaped. They are attached to the ends of the frame by pivot bolts, which retain the hook link assembly in place within the frame. Inspection holes are located in the frame above each suspension hook so you can visually inspect individual hook latchings. There is also a hole in the frame so you can insert a safety pin that mechanically blocks the linkage to prevent the hooks from releasing. Other components of the Mk 8 Mod 5 bomb shackle are the cocking lever, release lever, latching lever, and associated springs.

When you cock the Mk 8 Mod 5 bomb shackle, you move the cocking lever aft until the latching block on the link assembly engages in the slot of the latching lever. The roller on the latching lever rides up and seats on the top of the release lever cam. When the release lever is moved forward, either electrically by the attached release unit or manually, the latching lever moves down and away from the latching block. This action allows the hook-opening spring and the weight of the store to move the hook link assembly forward, releasing the hooks.

Keep the Mk 8 Mod 5 bomb shackle in the released position except when it is actually carrying stores. The shackle is designed to operate without lubrication. Maintenance is limited to cleaning the assembly with dry-cleaning solvent (P-D-680), inspecting the components for wear and operation, and replacing the shackle.

If you want more information about the Mk 8 Mod 5 bomb shackle, refer to *Bomb Shackle Mark 8 Mod 5,* NAVAIR 11-5-114.

REVIEW NUMBER 4

Q1. The Mk 8 Mod 5 bomb shackle is mounted on what aircraft?

Q2. What is the suspension of the Mk 8 Mod 5 bomb shackle ?

DISPENSERS AND EJECTORS

LEARNING OBJECTIVE: *Identify the purpose and use of dispensers and ejectors.*

REVIEW NUMBER 3 ANSWERS TO QUESTIONS Q1. THROUGH Q8.

A1. The BRU-32/A bomb ejector rack is installed on the F/A-18 aircraft.

A2. The maximum capacity of the BRU-33/A bomb ejector rack is 2,000 pounds.

A3. The major subassemblies of the MER and TER include an adapter assembly, a wiring support assembly, and ejector units.

A4. The adapter assembly of the MER houses the wiring support assembly on which you can attach six individual ejector units.

A5. You can attach three individual ejector units to the adapter assembly of the ITER.

A6. The IMER and ITER ejector units are numbered according to the firing sequence.

A7. The stores sensing switch, located on the forward hook of each station, signals the rack whether a weapon is loaded on a particular station or not. If the forward hook is closed, the switch signals the rack that the station is loaded, and will not automatically step to the next station.

A8. Custody of the IMER/ITER hardware kit and practice bomb adapter kits is maintained at the organizational level.

Dispensers and ejectors are used during tactical situations to provide additional offensive and defensive capabilities to the aircraft. These units are usually detachable. They are suspended from other installed suspension equipment, or they are mounted directly to the aircraft. They are used to suspend and release ordnance items, such as aircraft parachute flares and sonobuoys. In this section of the TRAMAN, you will learn about the basic characteristics of dispensers and ejectors currently in use.

SUU-44 FLARE DISPENSER

The SUU-44 flare dispenser (fig. 10-32) provides the capability for suspending and launching eight Mk 45 aircraft parachute flares equipped with drogue trays. Refer to figure 10-32 as you read this section.

The dispenser has four dispenser tubes. A shear latch (fig. 10-32, view B) is attached to the rear bulkhead to retain the flares in the tube. Each tube holds two flares. After the flares have been inserted into the tubes,

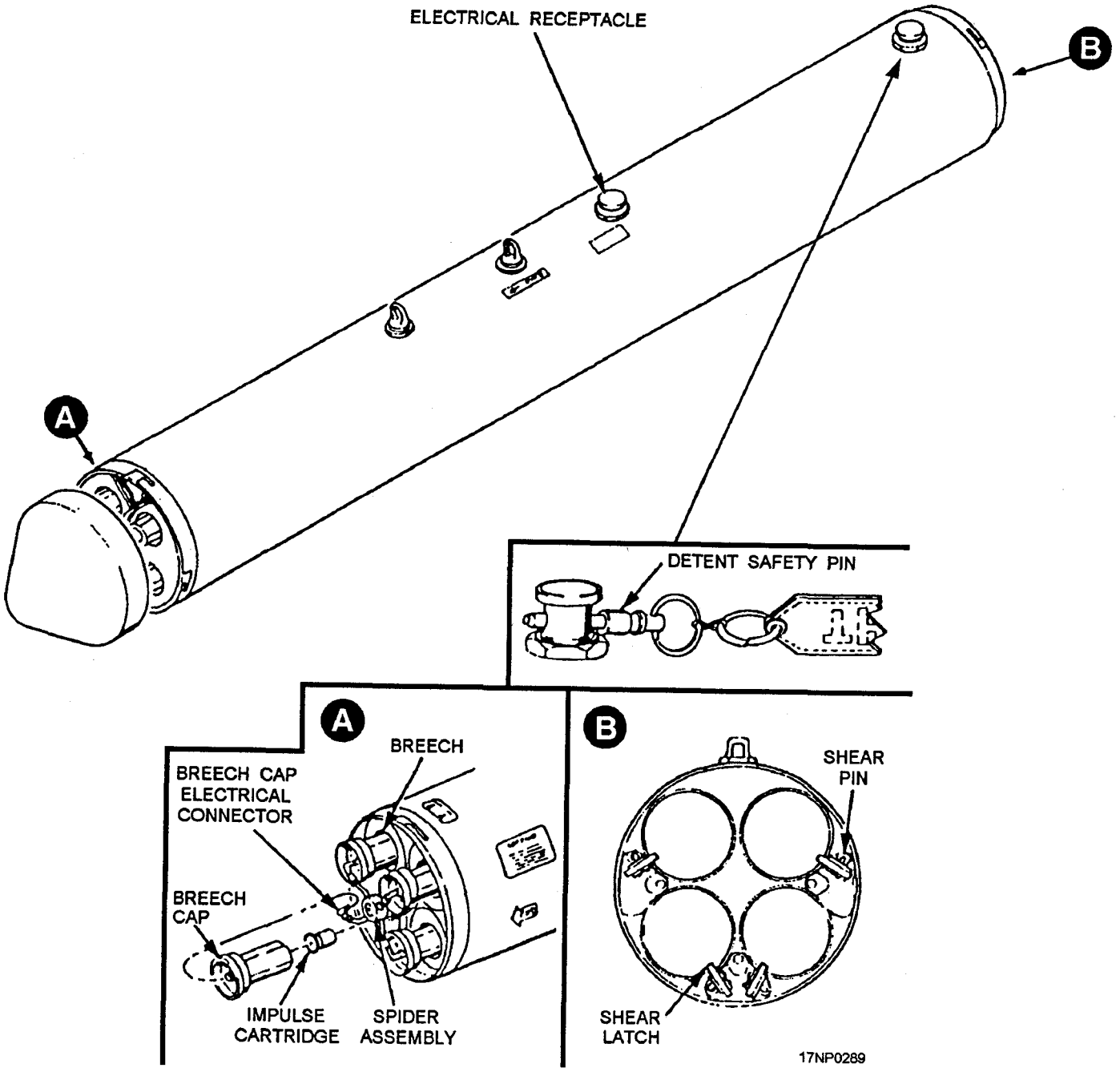


Figure 10-32.—SUU-44 flare dispenser.

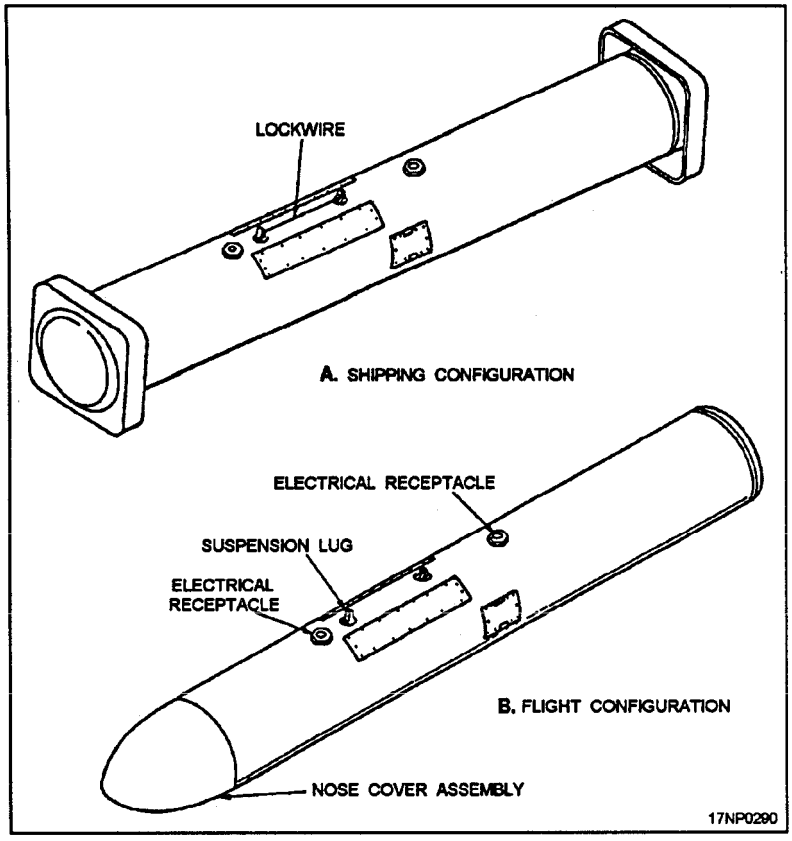


Figure 10-33.—SUU-25F/A dispenser.

rotate the shear latch over the tube opening and fasten it with a shear pin.

Four breeches and breech caps and a spider assembly can be mounted on the forward bulkhead. During dispenser loading and unloading procedures, remove the breech caps and breeches to prevent air pressure buildup when inserting the flares. With the breech caps removed, flares can be pushed rearward during unloading (fig. 10-32, view A). A reusable nose fairing is installed prior to flight to provide protection to the spider assembly and reduce drag. When installed, the detent safety pin electrically safes the dispenser.

During flight operations, the cartridge is fired by an electrical firing pulse routed from the aircraft to the breech of the dispenser. Gas pressure is metered into the forward end of one of the tubes. The expanding gas pressure from the cartridge exerts force against the two flares in the tube. When sufficient force is developed to shear the shear pin off the latch assembly, both flares are ejected into the airstream.

The force of the airstream causes the drogue trays to separate from the flares, pulling the safety pins from the flare fuzes. Further separation pulls the flare lanyard to initiate the flare timing mechanism.

After the cartridge fires, the dispenser intervalometer automatically steps to the next position and is ready for firing the next tube.

Maintenance procedures for the dispenser are concerned with cleaning and inspecting. For further information about the SUU-44 dispenser, refer to *SUU-44 Dispenser,* NAVAIR 11-75AA-44.

SUU-25F/A DISPENSER

The SUU-25F/A dispenser (fig. 10-33) is an airborne, externally mounted, reusable four-tube, rearward ejecting-launching device, The dispenser may

REVIEW NUMBER 4 ANSWERS TO QUESTIONS Q1. AND Q2.

A1. The Mk 8 Mod 5 bomb shackle is mounted on helicopters, such as the SH-3 and SH-60.

A2. The Mk 8 Mod 5 bomb shackle has 14-inch suspension.

be loaded on any aircraft weapons station that has a 14-inch suspension and is authorized to carry the SUU-25F/A dispenser.

The SUU-25F/A dispenser has two main advantages over the SUU-44 dispenser. It can dispense one store at a time, thus doubling its operational capability. It also has the capability of ejecting eight size A sonobuoys.

The SUU-25F/A has a cylindrically shaped, all-metal body. It has four aluminum tubes that will hold either eight LUU-2B/B aircraft parachute flares or eight size A sonobuoys. The tubes are 5 inches in diameter, clustered together inside an outer skin. There is an aluminum die-cast bulkhead at each end. When empty, the dispenser weighs 260 pounds. When loaded with eight LUU-2B/B flares, it weighs 490 pounds. When loaded with eight size A sonobuoys, it weighs from 435 to 572 pounds.

The shipping and flight configuration of the dispenser is shown in figure 10-33. The shipping configuration (view A) has shock pan assemblies at either end of the dispenser so it is easier to handle during shipment and storage. A lockwire is attached to the two suspension lugs to prevent them from becoming lost during shipment or storage. Both the lockwire and shock pan assemblies must be removed before the dispenser is used. When the dispenser is configured for flight (view B), a phenolic or metal cover (nose cone) is mounted on the forward flange. Covers are not shipped with the dispenser, they are ordered as separate components.

As you read the following section on the SUU-25F/A dispenser, look at figure 10-34 for the location and identification of the components.

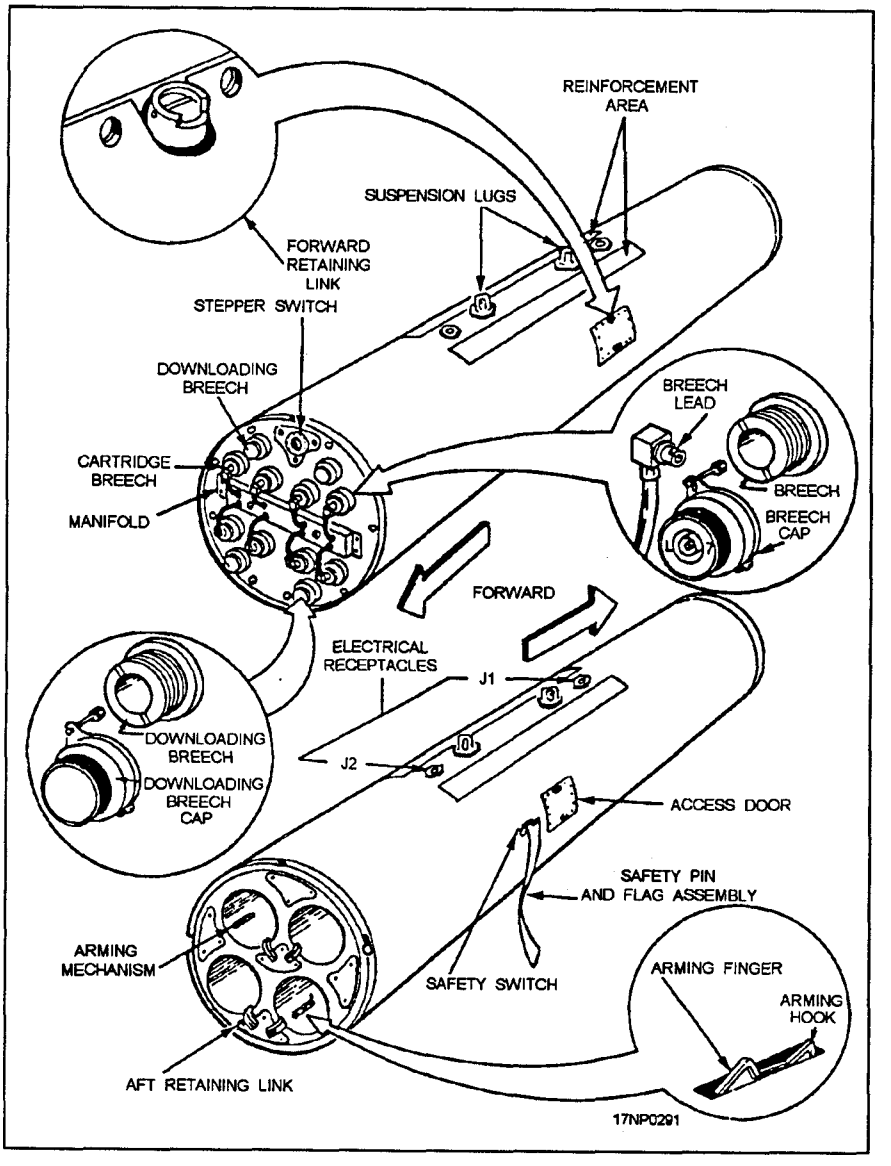


Figure 10-34.—SUU-25F/A dispenser, exploded view.

The breech, breech cap, breech lead, downloading breech, downloading breech cap, the manifold, and the stepper switch are located on the forward bulkhead

Breech, Breech Cap, and Breech Lead

There are two breeches, two breech caps, and two breech leads for each tube of the dispenser. The breech is screwed into the bulkhead so a CUU-44 impulse cartridge can be installed The breech cap, containing the firing pin, screws onto the breech. The breech lead connects to the breech cap and provides a path for the 28-volt dc required to fire the impulse cartridge.

Downloading Breech and Downloading Breech Cap

There is one downloading breech and a downloading breech cap for each tube of the dispenser. The downloading breech mounts to the bulkhead. The downloading breech cap screws onto the downloading breech. With the downloading breech cap removed, the downloading breech lets you insert the loading, unloading, cleaning, pushrod tool so the stores can be easily removed during downloading procedures. It also prevents air pressure buildup in the tubes when uploading stores. Reinstall the downloading breech caps after the loading or unloading procedures have been completed.

Manifold

The manifold has eight manifold breech lead receptacles for connection of the breech leads. It also has two test socket assemblies you can use during dispenser electrical test procedures.

Stepper Switch

The stepper switch provides sequential firing of the impulse cartridges. The switch has 10 functional settings—one safe setting, one arm setting, and eight firing steps. Always place the stepper switch in the safe position during dispenser loading and unloading. Move the switch to the arm position during aircraft arming procedures just before flight.

Forward and Aft Retaining Lock

Each of the four dispenser tubes contains a forward retaining lock, an aft retaining lock, and an arming mechanism.

The forward and aft retaining locks, when in the locked position, protrude into the dispenser tube. This prevents loaded stores from being inadvertently ejected by g forces during aircraft catapult launches.

The forward retaining lock is located between the dispenser outer skin and the tube near the midpoint of the dispenser. You can move the retainer lock from the either the locked or unlocked position through an access door located on either side of the dispenser. Before loading a store, rotate the retaining lock to the unlocked position. This pivots the retainer lock out of the tube. After the store has been loaded, rotate the retaining lock to the locked position, and secure it by installing a shear pin. The forward retaining lock retains the forward loaded store only.

The aft retaining lock is attached to the aft bulkhead and retains the aft loaded store. It is also secured in the locked position by installing a shear pin.

Arming Mechanism

The arming mechanism is located in the aft end of the dispenser tube. The arming mechanism initiates the arming sequence of a store as it is ejected from the tube.

The dispenser is suspended by two screw-type lugs spaced 14 inches apart. The area around the suspension lugs has a hardback reinforcement to permit sway bracing and forced ejection of the dispenser.

Two electrical receptacles, VI and V2, are located forward and aft of the suspension lugs, respectively. Both receptacles give you away to electrically connect the dispenser to the aircraft weapons control system. **Only one receptacle is used at a time.** The electrical configuration of the rack determines the receptacle you will use.

An electrical wiring harness is routed internally from electrical connectors V1 and V2 to the stepper switch. The wiring harness is interrupted by a safety switch that is normally in the closed position. When the safety pin and flag assembly are inserted, the safety switch is held in the open position and the electrical circuits are grounded, making the dispenser electrically safe.

Functional Description

When you load a dispenser tube with munitions, each pair of flares/sonobuoys are configured with an ADU-381/A flare adapter kit. Also, you should enclose sonobuoys in a Mylar sheet (protective sleeve) and install a protective disk.

A yellow-colored sealing ring is pressed on each end of the munition as a seal between the munition and the tube body. This prevents gas pressure from escaping during ejection. A green-colored arming cap is installed on the timer end of a flare or on the rotochute end of a sonobuoy. The green arming cap lanyard is connected to the timer knob of the flare, and then pressed on over the flange of the sealing ring. When you install an arming cap on the sonobuoy, the lanyard is not used. Mount a white cross-shaped plastic spacer on the aft sealing ring of the forward munition. This provides enough space between the forward and aft munition to provide an expansion chamber for ejecting the aft munition.

After you have installed the adapter, install the munitions in the dispenser tube.

When a SUU-25F/A dispenser is fully loaded and uploaded on the aircraft, the pilot may eject flares. The pilot must first select the weapons control system, and then trigger the dispensing switch. A 28-volt dc electrical signal passes through an electrical cable from the aircraft to either receptacle J1 or J2 of the dispenser. The signal is routed from the dispenser receptacle to the stepper switch, causing the stepper switch to step from the preset ARM position to the No. 1 position. This fires the No. 1 impulse cartridge. The gas pressure, generated by the fired cartridge, is ported through a gas tube, internally along the side of the dispenser, into the aft expansion chamber ahead of the aft flare.

As the gas pressure increases, the aft retaining lock shear pin is cut, allowing the aft flare to eject. As the timer end of the flare approaches the rear of the tube, the arming finger of the arming mechanism engages the yellow sealing ring. The sealing ring cams the arming finger down, which, in turn, cams the arming hook up to engage the green arming cap. This action allows the flare to extend the lanyard. The lanyard extracts the timer knob and arms or starts the flare functioning sequence.

When the pilot triggers the system again, the stepper switch steps to the No. 2 position and fires the cartridge. This meters the gas pressure directly into the forward expansion chamber. As the gas pressure increases, the forward retaining lock shear pin is cut. This allows the forward flare to be dispensed in the same manner as the aft flare. If the aft flare failed to eject, the gas pressure generated for ejecting the forward flare produces sufficient gas pressure to purge both flares out of the tube.

The procedure for the remaining three tubes is the same. The firing sequence of the breeches is stamped into the metal of the breech caps, as shown in figure 10-35.

Maintenance Requirements

Organizational-level maintenance is limited to a visual inspection of the dispenser. You need to look for damage, such as cracks or breaks in the aft retaining locks or suspension lugs, unburned pellets or obstructors in the breech sleeve, and frayed or broken breech leads.

For further information concerning the SUU-25F/A dispenser, you should refer to *Dispenser SUU-25F/A,* NAVAIR 11-75AA-48.

REVIEW NUMBER 5

Q1. What is the maximum number of parachute flares you can load in the SUU-44 flare dispenser?

Q2. How many size A sonobuoys can be launched from SUU-25F/A dispensers?

Q3. What impulse cartridge is used to fire the SUU-25F/A impulse cartridge?

Q4. The impulse cartridge is fired by what voltage?

Q5. When performing organizational-level maintenance on the SUU-25F/A, you should look for what types of damage ?

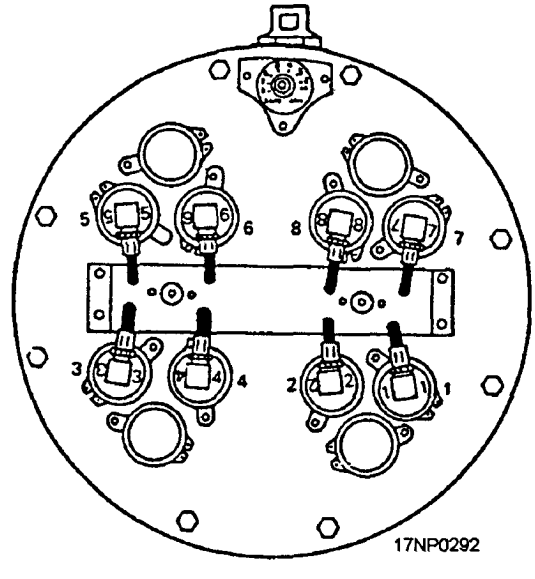


Figure 10-35.—Breech cap identification numbers.

AN/ALE-29A COUNTERMEASURES CHAFF DISPENSING SET

The AN/ALE-29A countermeasure chaff dispensing set, known as the *chaff dispenser,* is an electronic countermeasures device. It maybe installed in almost all Navy combat aircraft. The chaff dispensing set includes two dispenser assemblies, two dispenser housings, two sequencer switches, and a programmer. The cartridge in the chaff dispenser can eject various load configurations of Mk 46 or MJU-8/B decoy flares and RR-129 or RR-144 chaff.

Decoy flares are used during evasive maneuvers against heat-seeking missiles. Chaff rounds consist of fine-shredded metal strips contained in a cylindrical metal container. When ejected from the chaff dispenser, the metal strips are forced from the cylindrical container and dispersed into the atmosphere. This jams ground controlled radar installation or radar-controlled missiles.

Dispenser Assemblies

The dispenser assembly (fig. 10-36) contains two major subassemblies—a glass-reinforced phenolic plastic block and a sandwich-type primed circuit board. The block has 30 holes so you can load the payload units. There are four quick-release, positive-lock studs so you can secure the block in the dispenser housing, and two telescoping handles to make it easier to handle.

The sandwich-type printed circuit board contains the circuitry and jacks so you can install 30 electrically initiated Mk 131 impulse cartridges. You must also install a connector to act as an interface between the dispenser assembly and the dispenser housing.

You load the dispenser by putting the 30 payload units (in plastic sleeves with plastic cartridge retainers installed) into the block. Install an impulse cartridge in each of the 30 jacks on the printed circuit board. Then, attach the board to the block by two captive screws.

NOTE: Installation of the impulse cartridges must be accomplished in a designated RF (radio frequency) free area.

Finally, install the loaded dispenser assembly in the dispenser housing. You need to secure it with the four positive-lock studs of the dispenser block. The payload units are forced from the plastic sleeves by the gas pressure generated when the impulse cartridges are fired. The chaff sleeve extractor, shown in figure 10-36, is used during dispenser download procedures.

Dispenser Housings

There are two different housing configurations available, as shown in figure 10-37. You can identify the housings by the mounting flange configuration, number and arrangement of mounting fasteners, location of the sequence switch, and the cable arrangement. These configurations are supplied so aircraft manufacturers have flexibility in mounting locations.

You **don't** remove the housing assemblies from the aircraft when loading. You **do** remove the dispenser assembly from the housing assembly by unlocking the four positive-lock studs. Move the dispenser assembly to a designated area and load it. Then, return it to the aircraft and reinstall it in the dispenser housing. Safety switches, installed in the aircraft near the dispenser housings, make the dispenser's assemblies electrically safe when the safety pin or flag assemblies are installed.

REVIEW NUMBER 5 ANSWERS TO QUESTIONS Q1. THROUGH Q5.

A1. You can load eight parachute flares in the SUU-44 flare dispenser.

A2. Eight size A sonobuoys can be launched from SUU-25F/A dispensers.

A3. The CUU-44 impulse cartridge is used to fire the SUU-25F/A impulse cartridge.

A4. The impulse cartridge is fired by 28 volts of dc.

A5. When performing organizational-level maintenance on the SUU-25F/A, you should look for cracks or breaks in the aft retaining locks or suspension lugs, unburned pellets or obstructors in the breech sleeve, or frayed or broken breech leads.

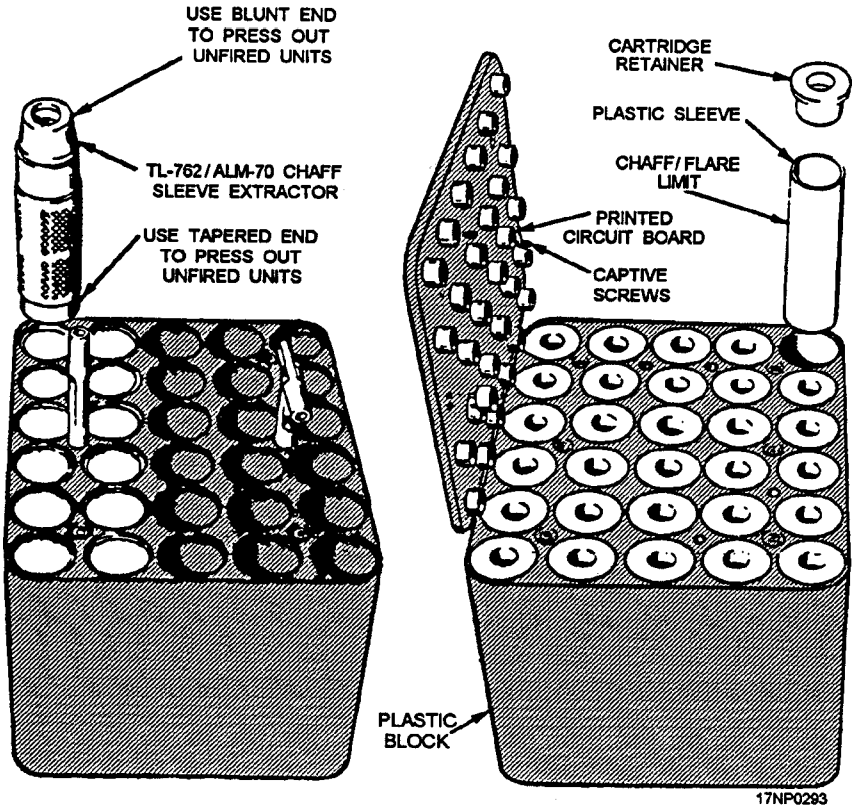


Figure 10-36.—AN/ALE-29A countermeasures chaff dispensing set.

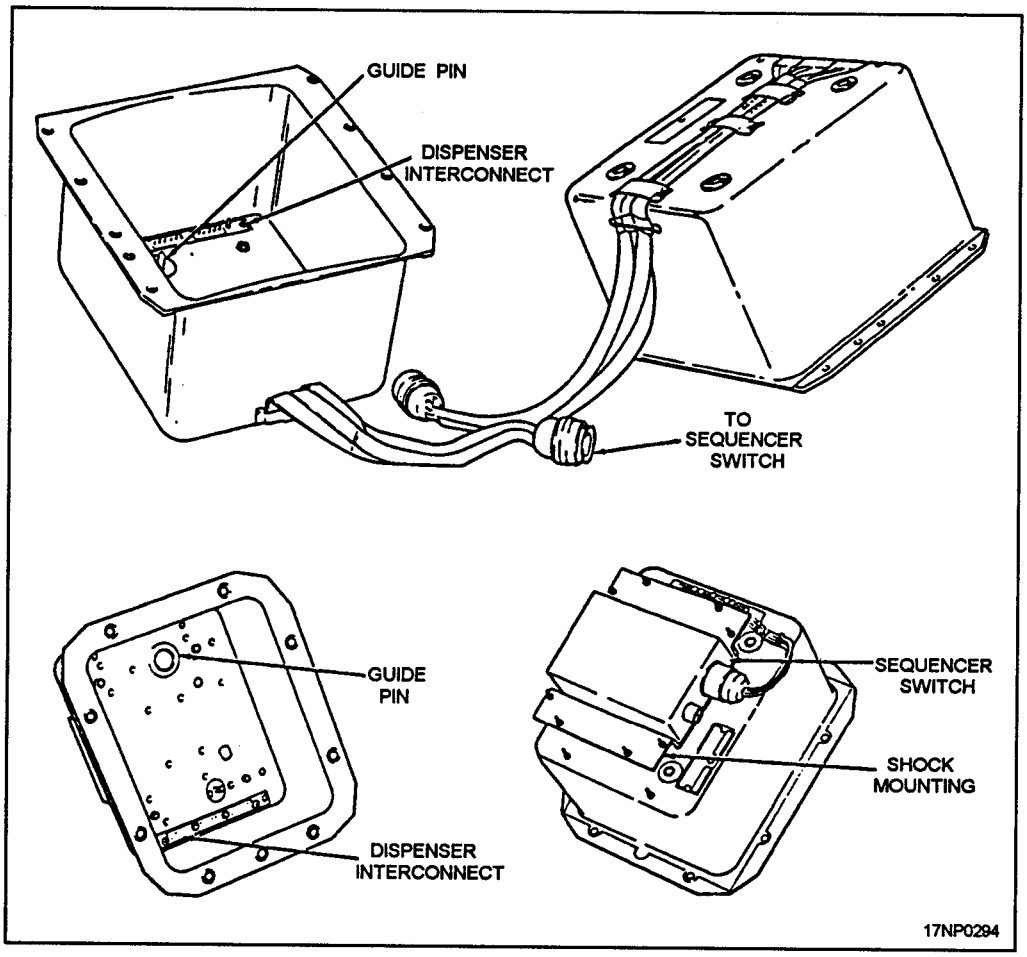


Figure 10-37.—Dispenser housings.

When the dispensers are loaded, the safety pin or flag assemblies must remain installed until just before fight.

The rear of the housing assembly has a dispenser interconnect that electrically connects the dispenser assembly to the system. When you are installing the dispenser assembly into the housing assembly, you should use a guide pin to ensure proper alignment of the electrical connectors.

Sequencer Switch

Two sequencer switches (fig. 10-38) are used in a system—one for the right- and left-dispenser assemblies. The sequencer switch is a solenoid-actuated, multideck, rotary stepping switch contained in a hermetically sealed case.

The sequencer switch is actuated by control signals received nom the programmer. Each control signal from the programmer actuates a relay in the sequencer switch, which applies 28-volt dc to the rotary switch. As the rotary steps, a firing pulse is supplied directly from the aircraft's 28-volt dc power supply. This firing pulse is directed to the applicable impulse cartridge in the dispenser assembly.

Dispensing starts with the selection of one or both dispensers (right or left) from the cockpit and the initiation of the dispensing switch. When only one dispenser has been selected and is emptied, the programmer control pulses are. automatically transferred to the second sequencer switch. When both dispensers are selected by the cockpit control, simultaneous signals are directed to both sequencer switches. The sequencer switches are connected to the dispenser housing by an electrical cable supplied as part of the dispenser housing.

Dispensing Set Programmer

The dispensing set programmer (fig. 10-39) provides electronic control of the dispensing modes. The AN/ALE-39A programmer generates control signals for the programmed payload ejection sequences. It also generates control signals for single ejection of payloads initiated manually. Manual (single) dispensing is performed during a programmed dispensing sequence without disrupting the program.

AN/ALE-37A COUNTERMEASURES CHAFF DISPENSING SET

The AN/ALE-37A countermeasures chaff dispensing set (fig. 10-40) is externally mounted on aircraft MER/TER ejector racks that have 14-inch suspensions. When mounted on the aircraft, the AN/ALE-37A has various patterns of chaff, decoy flares, or expendable jammers. Dispensing is dependent upon control settings and aircraft speed. Several dispensing pods may be employed on a single aircraft to provide maximum countermeasure capabilities.

The dispensing set is of modular construction, making maintenance easier and reducing turnaround time. Each dispensing pod contains two lightweight payload modules. Each payload module has a capacity of 120 rounds, providing a total capacity of 240 rounds. When empty, the pod weighs 180 pounds. When fully loaded, the pod weighs approximately 277 pounds.

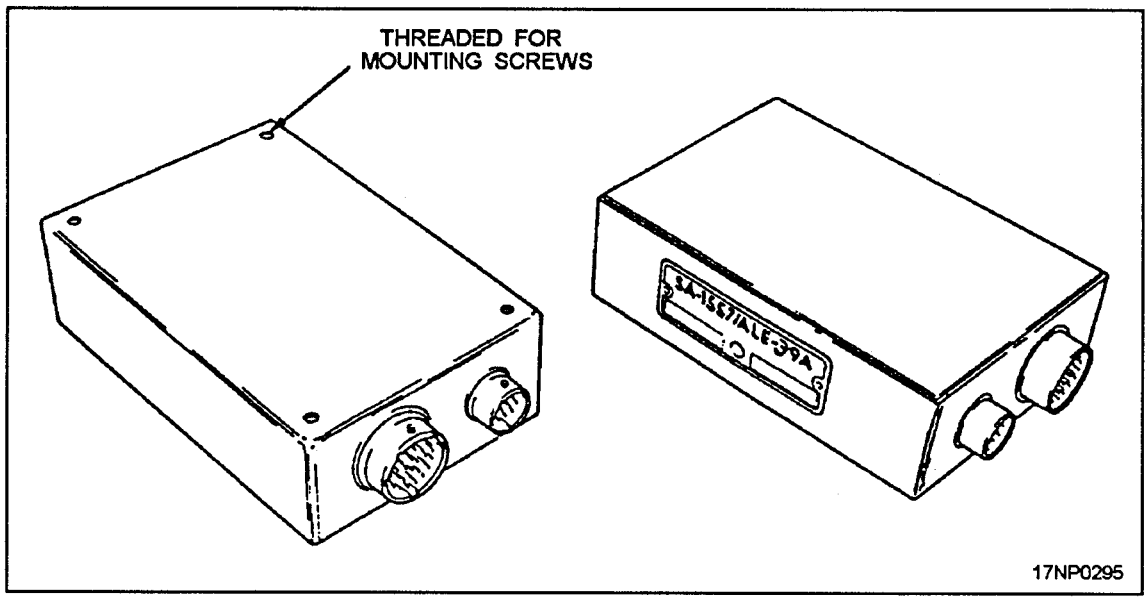


Figure 10-38.—Sequencer switch.

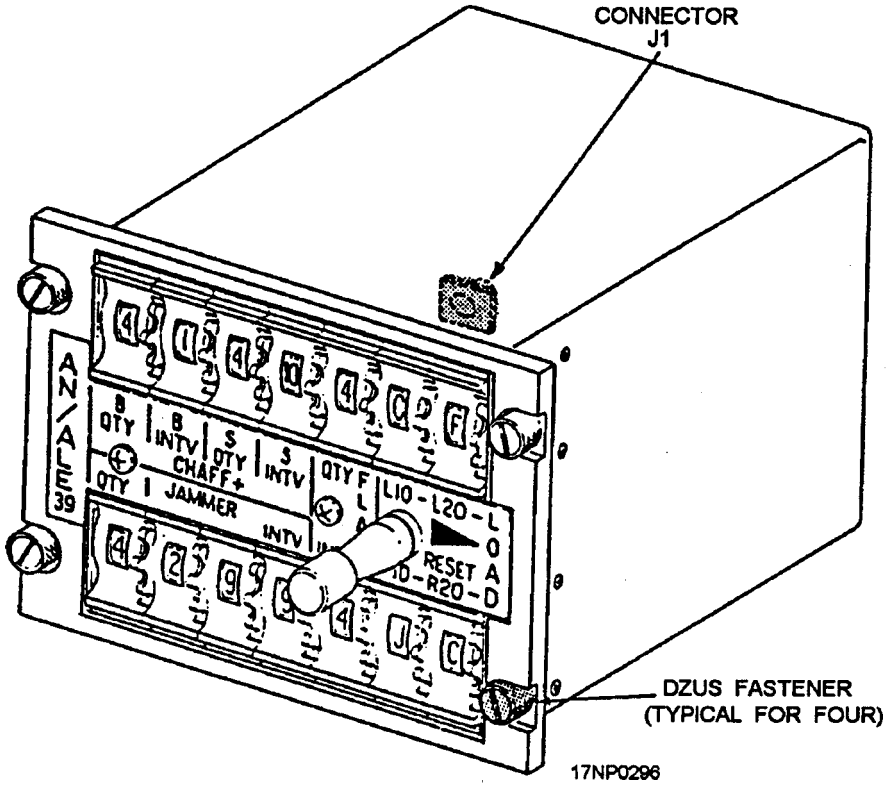


Figure 10-39.—Dispensing set programmer.

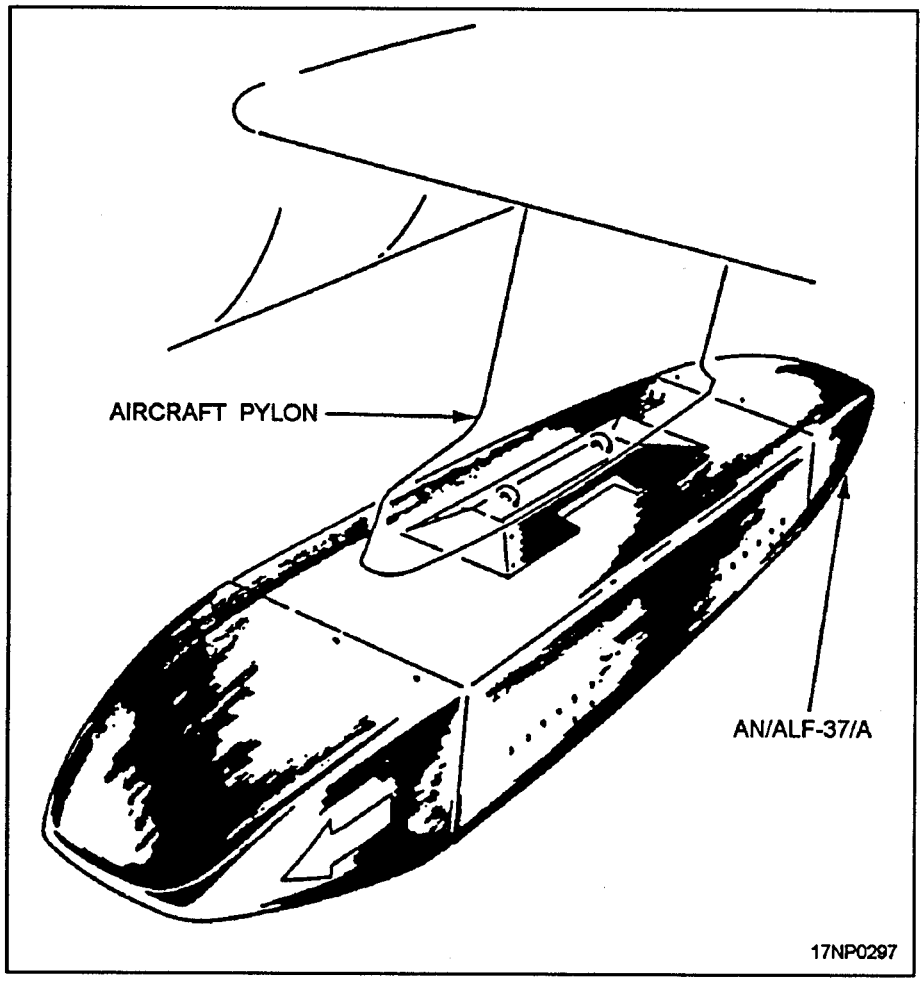


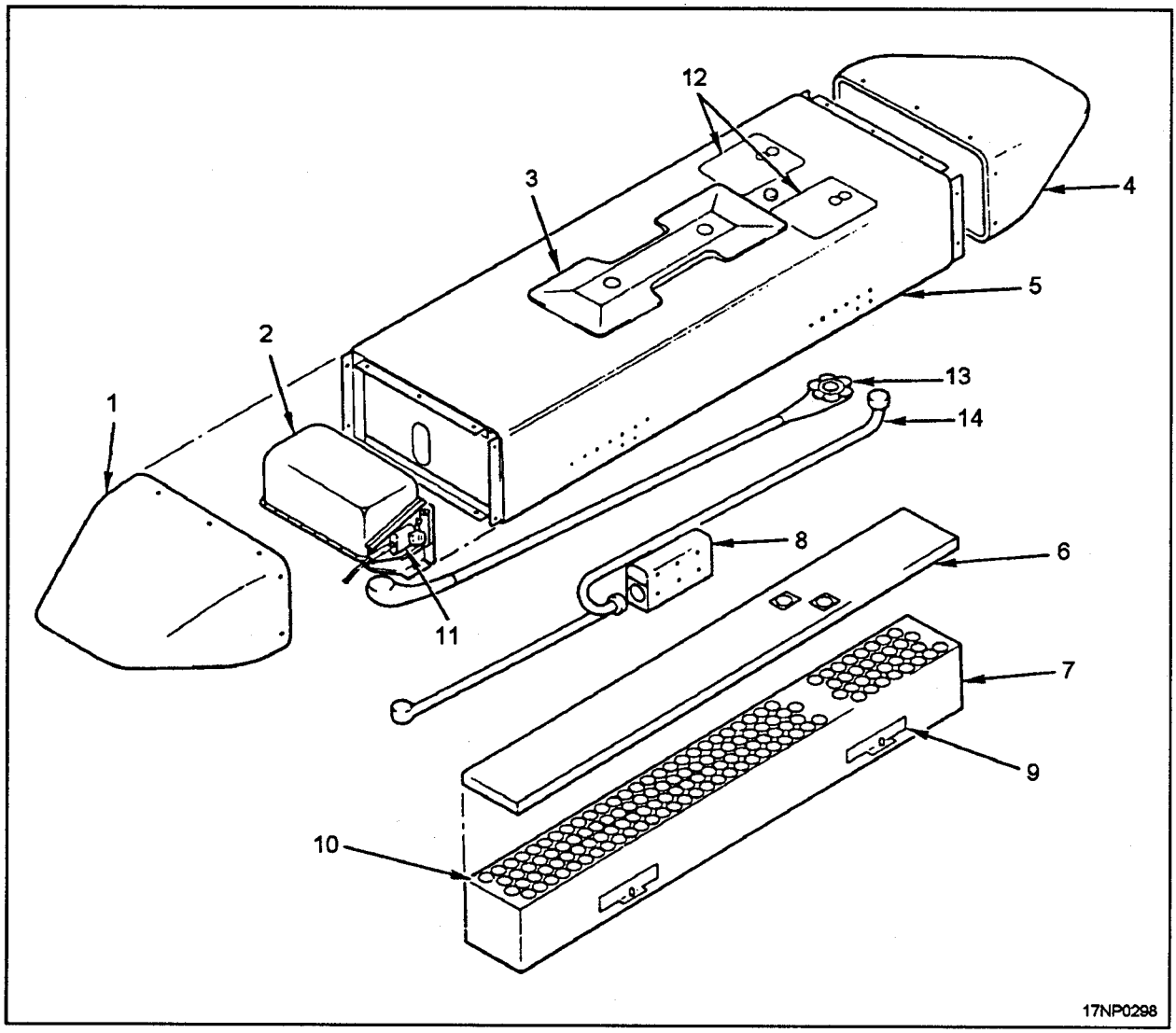
Figure 10-40.—AN/ALE-37A countermeasures chaff dispensing set.

Component Description

The functional theory and a physical description of individual dispensing set components are discussed in the following paragraphs. As you read about the components, look at figure 10-41. It shows their location and identifies them by item number.

Chaff Dispensing Pod

The chaff dispensing pod is constructed of heat-treated aluminum alloy formed sheet metal, extruded shapes, and machined parts. The pod is designed for quick reloading by using the spare loaded modules with squib boards installed. The pod hardback (item 3) has a rigid surface for mounting the pod to the bomb rack. The nose cone (item 1) houses the intervalometer, interlock switch, and provides aerodynamics to the pod. The tail cone (item 4) is identical to the nose cone, except it has extra markings and a hole for the insertion of a lanyard pin. An electrical connector at the aft end of the pod is used to interface with the aircraft's 28-volt dc power supply for pod operation. Power is routed internally, through the electrical wiring (item 14), from the connector to the intervalometer (item 2).



1. Nose cone
2. Intervalometer
3. Hardback
4. Tail cone
5. Module cavity
6. Squib board
7. Chaff module
8. Control indicator
9. Module latch
10. Chaff tube
11. Lanyard disconnect switch
12. Access plate
13. Squib board harness
14. Power wiring

Figure 10-41.—AN/ALE-37A countermeasures dispensing set, exploded view.

Chaff Module

You load the chaff module (item 7) with chaff, decoy flares, jammers, or a mixture of these payloads and a squib board (item 6). Then, insert it into the module cavity (item 5). Secure the chaff module in the cavity by locking the four positive locking latches (item 9). The 120 chaff tubes (item 10) contain the payloads. Each pod houses two separate modules.

Squib Board

The squib board (item 6) has four layers fastened and bonded together. The top layer is a thin sheet metal cover. The second layer is composed of edge spacers to provide a wire cavity for squib circuits. The remaining layers are composed of electrical insulating and fire-retardant materials. Two 61-pin electrical connectors connect the squib board harness (item 13) to the intervalometer circuitry. Place the squib board, with 120 Mk 131 impulse cartridges inserted, on top of the chaff module and secure it with eight captive attachment screws.

Intervalometer

The intervalometer (item 2) is used to control the burst rate. The intervalometer circuitry responds to the settings on the pod control indicator or the cockpit control indicator. The intervalometer contains a solid-state component electronic timing pulser to switch the two automatic stepping switches. The stepping switches will operate individually for singles firing or in parallel for doubles firing.

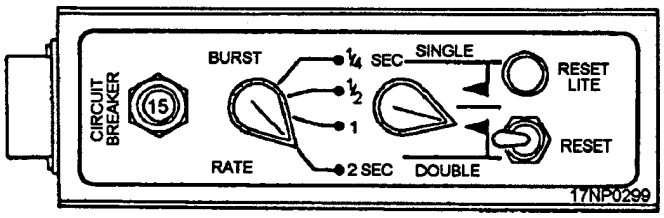


Figure 10-42.—Pod control indicator.

Lanyard Disconnect Switch

The lanyard disconnect switch (item 11) is the main safety feature preventing cartridge detonation during chaff loading and ground maintenance. The switch is normally in the closed position. It is deactivated (opened) by inserting the lanyard pin in the switch socket. With the pin inserted, the lanyard disconnect switch opens the intervalometer circuitry and removes the electrical path to the squib board circuits.

Access Plates

The two access plates (item 12) provide access to the pod electrical connectors.

Pod Control Indicator

The pod control indicator (fig. 10-42) is located on the bottom center of the pod. It provides a means of selecting the burst rate and firing sequence. The controls are preset before flight to meet expected mission requirements. Table 10-1 lists the eight combinations of firing that can be obtained by

Table 10-1.—Firing Time and Sequence

SINGLE-DOUBLE POSITION	BURST RATE POSITION	TOTAL TIME TO EMPTY
SINGLE	1/4 SEC (0.25 Sec)	1 minute
SINGLE	1/2 SEC (0.5 Sec)	2 minutes
SINGLE	1 SEC	4 minutes
SINGLE	2 SEC	8 minutes
DOUBLE	1/4 SEC (0.25 Sec)	30 seconds
DOUBLE	1/2 SEC (0.5 Sec)	1 minute
DOUBLE	1 SEC	2 minutes
DOUBLE	2 SEC	4 minutes

positioning of the two rotary selector switches (BURST RATE and SINGLE/DOUBLE) on the pod control indicator. There is also a reset switch and reset light indicator on the pod control indicator so the intervalometer can be recycled to the starting position.

Cockpit Control Indicator

The cockpit control indicator (fig. 10-43) is an optional feature of the dispensing set. The controls on the cockpit control indicator override those on the pod control indicator, letting the operator select the burst rate and dispensing pattern after the aircraft is airborne.

In addition to the burst rate and single or double rotary switches, the cockpit control indicator has four pod select switches, a power ON switch, and four chaff remaining counters. This gives the pilot individual or simultaneous control of four separate dispensing sets while airborne. The cockpit control indicator has no reset feature. When the aircraft doesn't use the cockpit control indicator, any 28-volt dc power source having a cockpit control switch may be used for operation. When the system is used, the burst rate and dispensing pattern are controlled by the preset controls on the pod control indicator.

For further information on the AN/ALE-37A chaff dispensing set, you should refer to *Countermeasures Chaff Dispensing Set, AN/ALE-37A,* NAVAIR 16-30ALE37-1.

REVIEWER 6

Q1. What chaff dispenser is installed in Navy combat aircraft?

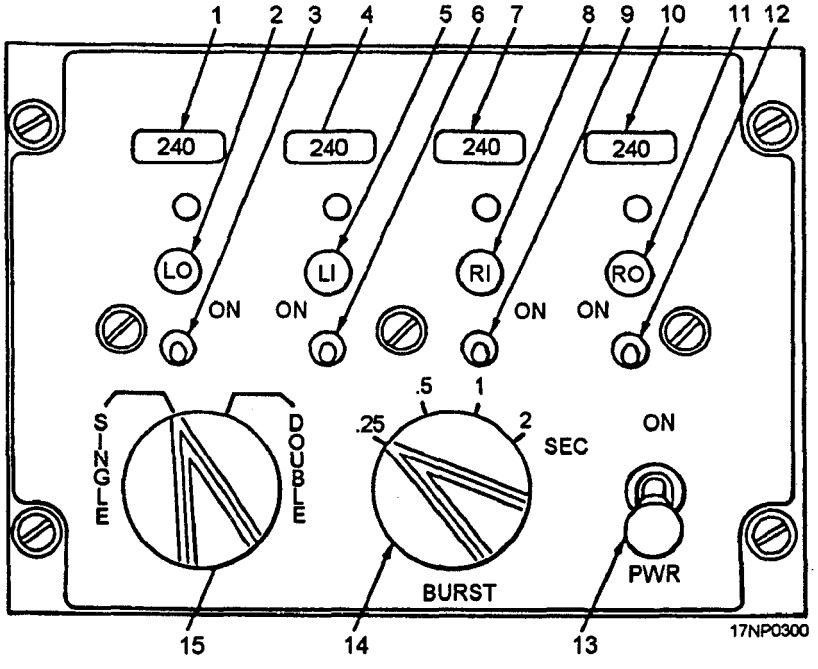
Q2. List the two major subassemblies of the AN/ALE-39A countermeasures chaff dispensing set.

Q3. What is the maximum capacity of the AN/ALE-39A?

Q4. When the AN/ALE-37A is fully loaded, what is its weight?

Q5. The AN/ALE-37A chaff dispenser contains _____ modules.

Q6. There are _____ chaff tubes contained in an AN/ALE-37A chaff module.



1. **Left outboard counter**
2. **Left outboard pod activate indicator**
3. **Left outboard pod activate switch**
4. **Left inboard counter**
5. **Left inboard pod activate indicator**
6. **Left inboard pod activate switch**
7. **Right inboard counter**
8. **Right inboard pod activate indicator**
9. **Right inboard pod activate switch**
10. **Right outboard counter**
11. **Right outboard pod activate indicator**
12. **Right outboard pod activate switch**
13. **Power switch**
14. **Burst rate selector switch**
15. **Single double selector switch**

Figure 10-43.—Cockpit control indicator.

SAFETY PRECAUTIONS

LEARNING OBJECTIVE: *Recognize safety precautions to follow when handling suspension, arming, and releasing equipment.*

As an AO, you need to be concerned with safety when working with suspension, arming, and releasing systems. It is doubtful there is a petty officer in the Navy who has not witnessed a minor mishap with suspension, arming, and releasing equipment. Accidents can be prevented if safety precautions and maintenance instructions are followed. Accidents can be prevented if personnel are trained and educated to work on the equipment. As a petty officer, it is part of your job to follow safety precautions and maintenance instructions and train new personnel. A few safety precautions that you need to follow, and train your subordinates to follow, are shown below.

- Keep all components of the various systems clean, well adjusted, and lubricated as prescribed.

- Make operational checks or periodic inspections of the system under the direct supervision of fully qualified personnel.

- **Never** insert your fingers or tools into a rack when the rack is cocked.

- Check wiring and electrical fittings regularly. Replace frayed or broken wiring. Check plugs for condition and proper installation.

- **Never** bypass safety circuits or devices or make them inoperative.

- **Don't** use any safety pin other than the prescribed one.

- When stores are loaded, install safety pins or other safety devices as prescribed while the aircraft is on the ground.

- **Never** install or arm an ejector rack unless the safety pin(s) and flag(s) are in place.

- **Don't** use an ohmmeter to check electrical continuity of an electrically primed cartridge.

- Remove or electrically disconnect all cartridges from the rack firing circuits before removing any component.

- Install only the prescribed cartridges in ejector devices.

- **Never** allow a dual breech ejector unit to be fired without two cartridges or a cartridge and authorized filler plug in the breeches.

- **Never** allow an ejector unit to be fired without a store latched in place.

- When loading stores, inspect all handling gear carefully. **Don't** use doubtful gear.

- When loading stores, make sure that the store is in position and the rack is securely locked before removing hoists.

- **Don't** place any part of your body under stores being loaded or unloaded if it is possible to accomplish the job without doing so.

- When installing suspension equipment, torque all installation bolts or screws to the prescribed torque value.

- Make sure all final work performed on the armament system is inspected by quality assurance personnel familiar with the system. Operational tests should be made on repaired systems where necessary.

REVIEW NUMBER 6 ANSWERS TO QUESTIONS Q1. THROUGH Q6.

A1. The AN/ALE-39A chaff dispenser is installed in Navy combat aircraft?

A2. The two major subassemblies of the AN/ALE-39A countermeasures chaff dispensing set are the glass-reinforced phenolic plastic block and a sandwich-type primed circuit board.

A3. The maximum capacity of the AN/ALE-39A is 30 payload units.

A4. When the AN/ALE-37A is fully loaded, it weighs 277 pounds.

A5. The AN/ALE-37A chaff dispenser contains two modules.

A6. There are 120 chaff tubes contained in each module of the AN/ALE-37A.

CHAPTER 11

AMMUNITION STORAGE AND HANDLING AFLOAT

The ammunition used by the U.S. Navy must be maintained in a state of readiness at all times. Improper, rough or careless handing, storage, and shipping can result in malfunctioning ammunition and material damage or loss of life.

ORDNANCE CERTIFICATION

LEARNING OBJECTIVE: *Identify the purpose and use of the Explosives Handling Personnel Qualification and Certification Program, OPNAVINST 8023.2.*

The Explosives Handling personnel Qualification and Certification Program was initiated in 1968 to determine the qualifications of personnel who were permitted to participate in ordnance evolutions and any tasks involving aviation ordnance material. In 1973, the Chief of Naval Operations (CNO) revised the concept of the program. The CNO required all personnel (military and civilian) in the Naval Establishment to come under this program if the duties and tasks required them to work with explosive devices. The Explosives Handling Personnel Qualification and Certification Program is governed by OPNAVINST 8023.2.

In the past, mishaps caused injury, loss of life, and damage to equipment. The mishaps were caused by improper handling, loading, processing, and testing of explosive devices. These mishaps reduced the operational effectiveness of fleet and shore activities. The major causes of mishaps were personnel errors induced by inadequate supervision, lack of training, failure to follow standard operating procedures (SOPS), and the assignment of unqualified personnel to perform tasks involving explosive devices. The Navy must rely on properly qualified personnel. If directives (such as technical manuals, checklists, loading manuals, and NAVAIR/NAVSEA directives) are complied with, the number and frequency of personnel errors will be reduced.

DEFINITIONS

Before you read about ordnance certification, you need to know the terminology that will be used in this discussion. The following definitions will help you to select the correct work task code to use on the Record of Certification Form (fig. 11-1).

Arm/dearm. Applies to those procedures in the arming/dearming area section of the applicable loading manual/checklist, which places the explosive device in a ready or safe condition. (Examples: rocket launchers; guided missiles; guns - internal and pods; paraflares - external and SUU-44 dispenser.)

NOTE: The removal/installation of pylon/bomb rack safety pins from a nonordnance loaded station, not requiring a stray voltage check, is not considered a function requiring certification within the purview of this instruction.

Assembly/disassembly. An operation to facilitate the complete buildup/breakdown of explosive devices. (Examples: Mk 82 bomb - attaching fins, inserting electrical fuzes, adapter boosters, etc.; Mk 76/106 practice bombs - inserting signal cartridges; SUU-44 - inserting trayed paraflares).

Board chairman signature. Signature of the commanding officer, officer in charge, or department head designated to act as board chairman. Signature may be collective, if desired.

Certification board observer signature. Signature of the certification board observer who actually observed the individual being certified performing the task under consideration. A signature is required for each line entry.

Certification levels. Only list the highest certification level applicable; e.g., TM, I, TL, and QA are interrelated

Corrections. The use of whiteout/correction tape, or a single line through the entire line entry that required correction; i.e., for upgrading or downgrading certification levels and work task codes.

Decertification. The record of certification form requires a diagonal line made in red ink, and signed by the individual and the board chairman, for revocation of certification for cause.

Delays. Normally, certification occurs within 3 months of the demonstrated proficiency dates.

Explosive device. Applicable explosive device for which the person is being certified.

COMNAVSURFLANTINST 8023.4F/
COMNAVSURFPACINST 8023.5B
03 JUL 1991

RECORD OF CERTIFICATION

CERTIFICATION RECORD
SURFGEN 8023/1 (REV 11/89)

COMNAVSURFLANTINST 8023.4F
COMNAVSURFPACINST 8023.5B

SHIP OR STATION

CERTIFICATION LEVELS		WORK TASK CODES	
TM	TEAM MEMBER	1. STOWAGE	6. MAGAZINE INSP.
I/TL	INDIVIDUAL/TEAM LDR	2. HANDLING	7. EQUIP. OPERATOR
QA	QUALITY ASSURANCE	3. ASSEMBLY/ DISASSEMBLY	8. TESTING
SO	SAFETY OBSERVER	4. LOAD/DOWNLOAD	
		5. ARM/DEARM	

EXPLOSIVE DEVICE	CERT. LEVEL/ WORK TASK	INDIVIDUAL SIGNATURE	CERT BOARD OBSERVER	BOARD CHAIR	VALID DATE

NOTE: All corrections will entail lining out the old line entry and a new line entry made. Line-outs will be initialed by the Board Chairman.

RECERTIFICATION ONLY

Individual Being Recertified (Signature and Date)	Board Chairman (Signature and Date)

NAME	GRADE	BRANCH/CLASS

NOTE: 1. Items not required for recertification shall be lined out and initialed by the individual and Board Chairman.
2. Certification has been reviewed and recertified as per dates and signatures indicated and are effective for 12 months.

17NP0301

Figure 11-1.—Record of Certification.

Family groups. Family groups are explosive devices with similar characteristics.

Handling. Applies to those individuals who engage in the break out, lifting, or repositioning of explosive devices in order to facilitate storage/stowage, assembly/disassembly, load/download, or transporting.

Individual signature. Signature of person being certified. Signing acknowledges certification level and work task code for the explosive device/family; therefore, a signature is required for each line entry.

Load/download. Applies to procedures contained in the load/download section of the loading manual/checklist for that particular explosive device.

Magazine inspections. Applies to the close viewing and critical appraisal of existing conditions within ship/station magazines or ready service magazines/lockers, using standards established by NAVSEA OP 4 and OP 5.

Recertification. Recertification may be accomplished using the space provided. One the individual being recertified and the board chairman signs and dates the form, certification is valid for 1 year.

Storage/stowage. Applies to those individuals whose responsibilities involve storage/stowage of explosive devices. (See OP 2165, volume 1.)

Validation date. Date certification is effective.

EXPLOSIVES HANDLING PERSONNEL QUALIFICATION AND CERTIFICATION PROGRAM

The Explosives Handling Personnel Qualification and Certification Program sets guidelines for weapons certification. **This program is independent from all other maintenance programs.** The Explosives Handling Personnel Qualification and Certification Program is applicable to **all personnel** (both military and civilian, including contractors) in the Naval Establishment whose duties require evolutions or tasks involving explosive devices.

> **NOTE:** All explosives, ammunition, weapons, and devices using conventional explosives, pyrotechnics, or incendiary material for their operation are included in the general term *explosive devices.*

All operators of power-operated handling equipment, such as hoists, winching cranes, or forklifts, that are used in handling explosive devices must be certified and licensed to handle the particular piece of equipment.

Personnel Who Require Individual Certification

If a person's duties (including explosive ordnance disposal [EOD] personnel involved in non-EOD duties) require him/her to individually inspect (including the duty of safety observer), prepare, adjust, arm, or dearm explosive devices, he/she must be qualified and certified for such tasks. Personnel who conduct magazine inspections, maintenance on aircraft safety and survival equipment, or perform any other function that involves explosive devices must be included in this program. The supervisor of explosive operations and members of the command-appointed certification board (except the chairman) must be individually certified for the evolution that they may supervise or observe.

Personnel Who Require Team Qualification and Certification

A person must be team certified and qualified or individually qualified to perform any of the following duties as a team member: packing, unpacking, assembling/disassembling, testing, fuzing, loading/downloading, or arming/dearming. When team operations are involved, the team leader must be designated and must be certified and qualified. Any change in team personnel must be kept to a minimum. Shipboard gun, missile crews, and air wing integrated arm/dearm crews are considered teams for the purpose of qualification and certification. Requalification or recertification of a team after any personnel change is at the discretion of the commanding officer. At times, contractor personnel perform functions within the scope of the Explosives Handling Personnel Qualification and Certification Program at naval activities. The contractor must provide the commanding officer or officer in charge with the documentation to prove that personnel are qualified and certified before performing any duties that come under the program. All contracts that deal with explosives and explosive operations come under the purview of OPNAVINST 8023.2.

Initial Board Member Certification

One major problem of the initial certification of personnel is to ensure that persons who perform qualification evaluations are themselves qualified. Occasionally, it is necessary to initially certify personnel to perform a particular explosive-related job if no certification board is currently established. Commanders should ensure the intent of this program when they select certification board qualifying observers.

The department head (or equivalent supervisor) reviews personnel for initial certification by screening

school records, previous certification, demonstrated ability, and a personal interview. Then he/she makes a recommendation to the commanding officer or officer in charge as to whether a person should or should not be certified. Certification is made at the discretion of the commanding officer or officer in charge. When sufficient personnel have been qualified, a minimum qualification an certification board is established

NOTE: The *Explosives Handling Personnel Qualification and Certification Program,* OPNAVINST 8023.2, is not applicable to the following personnel:

- Personnel, such as a security force, who are required to bear arms in the course of their duties.
- Aircrew personnel whose only contact with explosive devices is during logistic transport by aircraft.
- Lookouts, bridge watches, and man-overboard watches required to handle and launch man-overboard markers in emergency situations.
- Document destruction personnel and aircraft wheel watches should handle explosives only during emergencies.
- Personnel whose sole contact with explosive devices occurs when assigned to a working party for the purpose of replenishment, onloading, or offloading.
- Personnel who conduct tests or inspections of magazine sprinkler systems, provided they have been qualified and certified by other means.

The personnel mentioned above must, however, be carefully instructed in the operation and in the safety precautions applicable to a particular device or explosive material.

Revocation of Certification

The commanding officer or officer in charge is responsible for revoking certification whenever such action is necessary in the interest of safety.

If culpability (responsibility) can be determined during a mishap investigation, a statement on the revocation of individual/team certification must be included in the mishap report.

If an explosive mishap is caused by a person's failure to follow authorized procedures, **revocation of certification is mandatory, and a page 13 entry is required.** If a person flagrantly (openly) disregards safety precautions, operates explosive device handling equipment recklessly, or shows incompetency or unreliability, **revocation of certification for cause is mandatory, and requires a page 13 entry.**

When the commanding officer or officer in charge considers retraining, recertification, and requalifying an appropriate action, the person may be retrained, recertified, and requalified. If, however, the person's behavior indicates that retraining will be ineffective, he/she is assigned to tasks that do not involve explosive devices.

For military personnel, revocation of certification for cause requires a service record entry stating the specific reason(s). For civilian personnel, a letter revoking certification for cause is prepared and filed in his/her civilian personnel record. Revocation of certification means complete removal of an individual from the qualification/certification program. **Onetime recertification for the above infractions is not authorized. There are NO exceptions!**

PROGRAM INITIATION

Commanding officers or officers in charge initiate, monitor, and maintain the Explosives Handling Personnel Qualification and Certification Program.

Personnel

Personnel within the program should be sent to formal schools, if possible, and personnel qualification standards are required, where applicable. However, school attendance and personnel qualification standards do not necessarily qualify an individual for certification.

Certification board members are appointed by name and in writing by the commanding officer/officer in charge. The authority may not be delegated. Certification must be documented by using the format shown in figure 11-1. The original is maintained by the board chairman. A copy is placed in the individual's training records. When the individual is transferred, the original (maintained by the board chairman) is placed on the left side of the individual's service record.

Certification of military personnel is transferable at the discretion of the receiving command. Receiving commands should validate the certification by placing the board chairman's signature in the recertification block. Certification, unless revoked, is valid for a period of 1 year.

Aviation Ordnance Family Types

Training record documentation is by specific explosive device and task. This training will be documented by using an OJT/Professional Training Record Sheet (fig. 11-2). This documentation must support the level of certification listed on the individual's or teams' certification form and must reflect all the individual's or teams' training.

COMNAVSURFLANT/COMNAVSURFPAC
OJT/PROFESSIONAL TRAINING RECORD SHEET

TRAINING LEVELS		WORK TASK CODES	
IT	IN TRAINING	1. STOWAGE	7. EQUIPMENT OPERATOR
TM	TEAM MEMBER	2. HANDLING	8. TESTING
I	INDIVIDUAL	3. ASSEM/DISASSEM	
TL	TEAM LEADER	4. LOAD/DOWNLOAD	
QA	QUALITY ASSURANCE	5. ARM/DEARM	
SO	SAFETY OBSERVER	6. MAGAZINE INSP	

SPECIFIC EXPLOSIVE DEVICE	TRAINING LEVEL/ WORK TASK	LECTURE	INSTRUCTOR	DATE OF TRAINING	ENTERED BY/DATE

NAME: SSN: RANK/RATE

17NP0302

Figure 11-2.—OJT/Professional Training Record Sheet.

NOTE: Supplemental instruction of the Explosives Handling Personnel Qualification and Certification Program by subordinate commands is neither required nor desired.

CERTIFICATION BOARD

The commanding officer or officer in charge of each organization whose duties include handling explosive devices appoints (in writing) an explosives handling personnel qualification and certification board. The following personnel are the minimum personnel included on the board:

- A department head, designated as the board chairman
- No less than one individual, E-6 or above/ civilian supervisor, who is certified to perform the function or tasks under consideration

If seniority requirements cannot be met from within the command, a waiver of personal seniority for the board may be requested from the TYCOM, via the chain of command.

The board chairman is not required to be certified. However, the board chairman certifies other board members. Because of the number of tasks and the number of explosives devices found in some commands, board augmentation with personnel from other commands is authorized and, in some instances, desirable.

CERTIFICATION BOARD RESPONSIBILITIES

Some of the responsibilities of the certification board are discussed below.

- The objective of the board is to ensure that applicable personnel are certified to perform those explosive devices work tasks required for accomplishment of the command mission.
- The board coordinates the unit personnel certification program, It ensures that administrative procedures are established to ensure the establishment and effectiveness of the program.
- The board observes and evaluates the proficiency of the personnel being nominated for certification and makes recommendations concerning certification nomination to the board chairman. If a person nominated for certification requires additional training and/or experience before certification can be made, that person's division officer or supervisor is notified.
- The board reviews proposed formal courses of instruction and makes appropriate recommendations.
- The board reviews safety infractions concerning explosive devices. It makes recommendations to unit commanders concerning corrective actions. If an explosive incident or accident is caused by a person's failure to use or to adhere to the authorized procedures, the person's certification is revoked. **IN SUCH A CASE, REVOCATION OF CERTIFICATION IS MANDATORY!**

If a person exhibits a flagrant disregard of safety precautions, a reckless operation of explosive devices handling equipment, or unreliability, that person's certification must be removed

The certification levels and minimum qualifications are given in OPNAVINST 8023.2.

AMMUNITION STOWAGE

LEARNING OBJECTIVE: Describe *the types of ammunition stowage afloat. Identify the types of stowage spaces afloat to include types of magazines, magazine designations, ammunition stowage requirements, environmental control systems, sprinkler systems and auxiliary equipment, and magazine temperature requirements.*

Stowing ammunition aboard ship presents problems you won't find in other types of storage facilities. When ships are underway, they are subjected to random motion. Ammunition is fastened in place firmly and securely when it isn't being handled. Adequate ventilation is a problem. Most ammunition stowage spaces are located below the main deck. Normally, these areas require extensive piping and venting to maintain proper temperature control and to vent hazardous fumes.

Access to stowage spaces often requires specialized equipment for moving ammunition quickly and efficiently. Stowage spaces are located close to other working spaces, which presents hazards to others on the ship, especially if there were afire or explosion.

AMMUNITION STOWAGE SPACES

NAVSEASYSCOM develops and approves the detailed specifications for construction of Navy ships and individual ship's blueprints. Ammunition stowage spaces (magazines) for various types and classes of ships are designated in these specification. Aircraft or aircraft carriers' ammunition stowage magazines are also approved by NAVAIRSYSCOM.

Magazines are arranged so they are close to supply, have the best available protection, and the most favorable stowage conditions. Figure 11-3 shows the

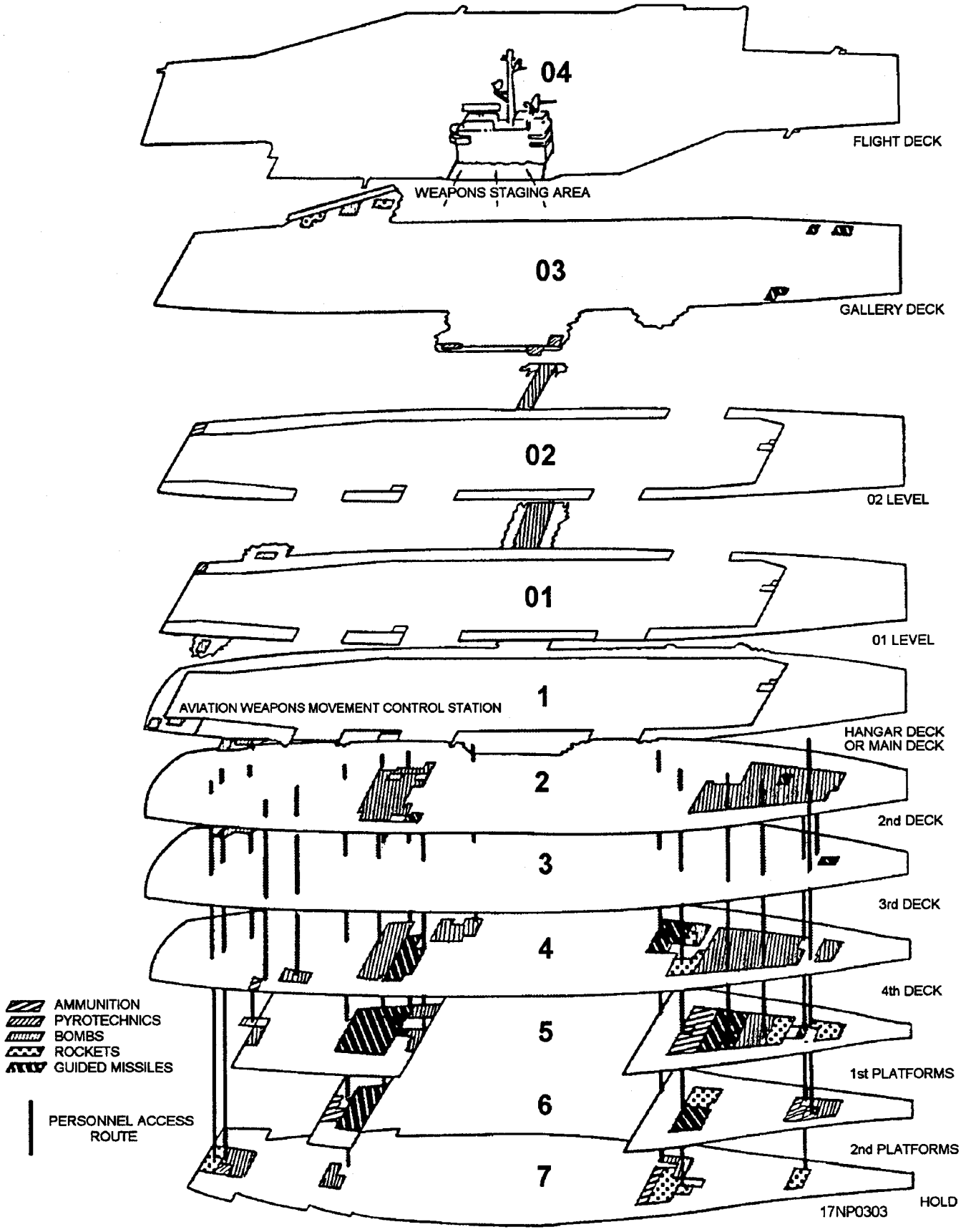


Figure 11-3.—Typical CV magazine locations.

magazine locations of a typical CV (aircraft carrier). For safety reasons, various types of explosives and ammunition are stowed in separate magazines or lockers.

The type of stowage varies with the type of ship, the space available, and the amounts of explosive involved. All magazines are marked by label plates that designate the compartment and the types of ammunition stowed in them. Magazines are marked with warnings that apply to specific special hazardous conditions and operations. Additionally, paint-stenciled labels or painted signs are installed on the outside surfaces of ammunition stowage spaces (except where the outside surfaces are visible from the exterior of the ship). The stenciled markings must be located on the bulkheads, overheads, and decks 12 feet apart. The sign or label (fig. 11-4) is a yellow rectangle, 5 inches high by 9 inches wide. The sign has black slanted lines, 1/8-inch thick and 1 inch long, on 3/4-inch centers along the top and bottom edges, with lines slanting from top right to bottom left. The letters are 1/8-inch thick and 3/4-inch high, with the words AMMUNITION FAR SIDE arranged as shown in figure 11-4. Primary and missile magazines aboard CVs are designed to hold a ship's service allowance and the embarked air wing's service allowance of ammunition.

Ships have several different types of magazines. Each magazine is designed for a specific type of ammunition. The magazine types include primary, missile, ready-service, lockers, and chemical.

Primary Magazines

Primary magazines are stowage spaces that are usually located below deck and, if possible, below the waterline. They are adequately equipped with thermal insulation, temperature control, and ventilation. Primary magazines are equipped with adequate sprinkler systems, and they are closed and locked when unattended.

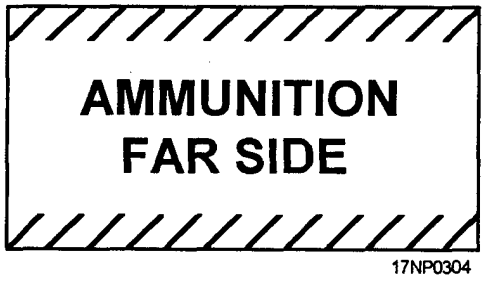


Figure 11-4.—Example of AMMUNITION FAR SIDE sign or label.

Missile Magazines

Because of the nature of guided missiles, requirements for their stowage aboard ship differ from those of conventional ammunition. Air-launched missile magazines in aircraft carriers are usually located below the waterline and within the armor box. Air-launched missile ready-service magazines may be located either above the waterline or within the armor box. Missile magazines contain electrical, hydraulic, and pneumatic power-operated handling equipment. A restraining gear prevents movement of an accidentally ignited motor. Magazines are equipped with specialized detection equipment to make sure that a specific missile hazard isn't present. You must take special care of the ventilation system of missile magazines to ensure pressures don't build up to a dangerous level if a missile motor is ignited.

Additional fire-fighting equipment is often provided for missile magazines. This equipment may consist of carbon dioxide, foam, water injection, or a sprinkler system, or a combination of these systems. NAVSEASYSCOM specifically certifies the magazine for the stowage of hyperbolic-fueled missiles, such as the AQM-37 target drone and fuel-air explosive (FAE) weapons. FAE weapons and the AQM-37 are compatible in stowage. FAE weapons require less stringent certified facilities; therefore, FAE weapons can be stowed in hyperbolic magazines. However, hyperbolic-fueled items cannot be stowed in magazines certified for FAE only.

Ready-Service Magazines

Ready-service magazines (fig. 11-5) are designated spaces located near the weapon or area to be served. Normally, they are equipped with thermal insulation, ventilation, and a sprinkling system. They are securely locked. Certain magazines located within the armor box of aircraft carriers and used for stowage of completely assembled rounds of weapons and deployable targets are also ready-service magazines.

Lockers

Certain compartments or lockers are used to stow special types of ammunition and ammunition components, such as detonators, pyrotechnics, and chemicals. They are frequently located on the weather deck. They are located as conveniently to the weapon or space to be served as possible. They may not be equipped with sprinklers, but they do have locking devices. Special flare ready-service lockers are located

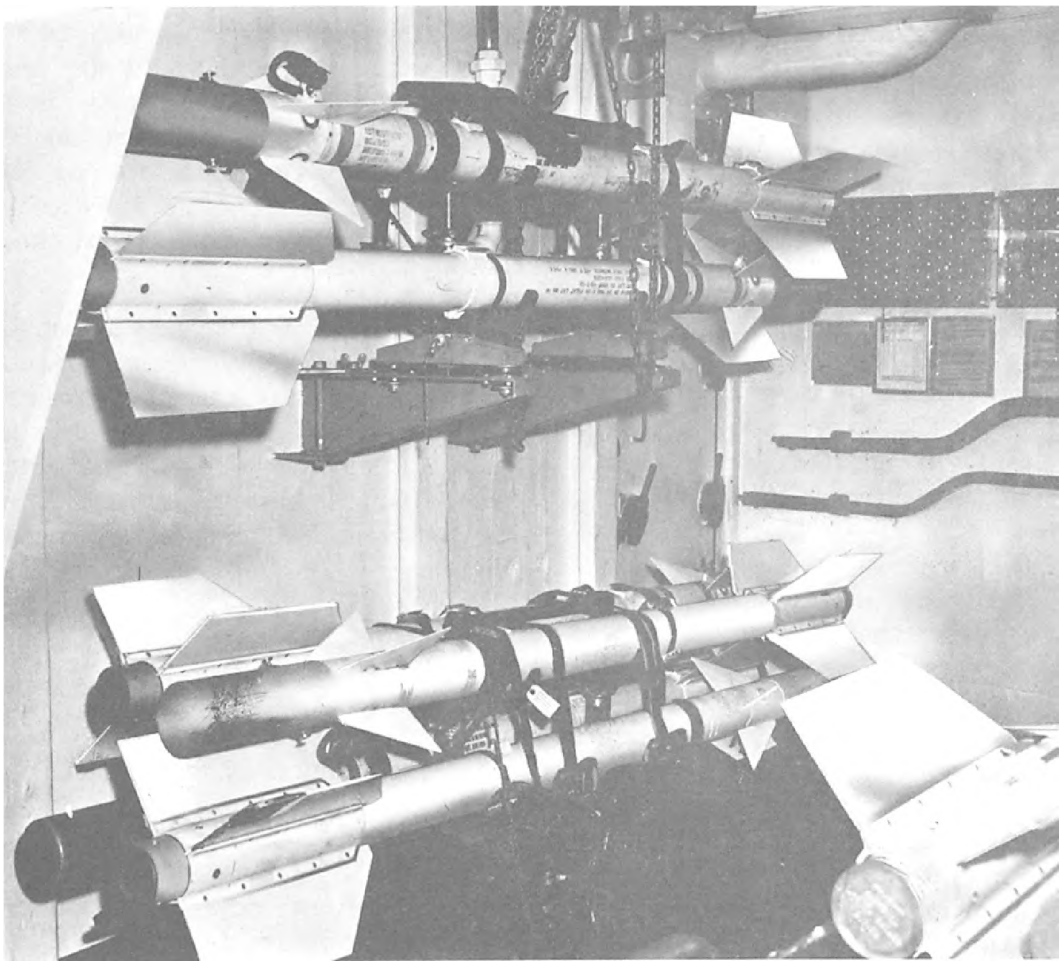


Figure 11-5.—Typical missile ready-service magazine.

at outboard locations on aircraft carriers for short-term stowage of aircraft parachute flares. These flares have either been removed from the primary pyrotechnics magazines and prepared for launching or they have been returned intact after a mission. If necessary, these lockers are manually jettisoned. A label is installed on the locker identifying the type of explosives that are stowed within each locker. Where stowage for ammunition is provided by lockers, chests, or racks that are permanently secured to the ship's structure, don't change their location without prior approval of NAVSEASYSCOM.

Chemical Magazines

Chemical ammunition classified as lethal or incapacitating isn't carried aboard ships unless specifically authorized by NAVSEASYSCOM or higher authority. If authorized, specific stowage instructions are issued by NAVSEASYSCOM, and personnel involved in handling procedures must receive appropriate training. Specific spaces aboard ship may be designated as chemical magazines by NAVSEASYSCOM. The decks and bulkheads of a chemical magazine are coated with an impermeable material, and the magazine contains a provision for sampling its internal atmosphere from an adjacent compartment. Facilities for personnel and gross decontamination are located near the magazine.

IMPROVED REARMING RATE PROGRAM

Modern naval aircraft carriers incorporate a magazine stowage concept called "modular stowage." The modular stowage concept gives greater versatility in magazine stowage arrangement and minimizes ammunition handling. It makes it easier to stow ammunition, such as bombs and missiles, as fleet issue loads. Also, it isn't necessary to depalletize or decan loads before they are stowed. The incorporation of

modular stowage and the addition of larger weapons elevators to service these areas brought about the Improved Rearming Rate Program (IRRP).

The IRRP allows major handling time improvements in two areas-rearming and weapons assembly. Stowing ammunition as received on pallets lets handling crews rearm the ship's mission load in less time than the old system. In turn, handling time is minimized during weapons assembly.

DESIGNATION OF MAGAZINES

Magazines or ammunition spaces afloat are designated with particular reference to the purpose intended. Generally, magazines aboard ship are designated to hold a single type of ammunition.

Single-Purpose Magazine

Magazines are designated as single-purpose stowage magazines whenever practical. The following are single-purpose magazine designations: powder and rocket motor magazine; hyperbolic rocket engine magazine; fixed ammunition magazine; small arms magazine; missile magazine; warhead locker or magazine; aircraft bomb magazine; projectile and rocket head magazine; fuze magazine; detonator locker; pyrotechnic magazine or locker; ready-service ammunition room, box, rack, or locker; and chemical magazine.

Multipurpose Magazine

While stowage of a single type of ammunition in an individual magazine is desirable, it isn't always possible. NAVSEASYSCOM authorizes certain mixed stowages in magazines that retain a single-purpose designation. Where stowage space is limited and the mission requires carrying various types of ammunition, stowage of more than one type of ammunition in a magazine is an acceptable hazard. Authorization for this type of stowage is at the discretion of the operational commander.

AMMUNITION STOWAGE REQUIREMENTS

Generally, there are magazines for each type of ammunition stowed aboard ship. Ammunition, explosives, and explosive components are stowed in specifically designated stowage spaces. Ammunition stowage spaces aboard ships are limited, and in certain classes of ships, extremely limited. Therefore, ammunition stowed aboard ship should stay within authorized ammunition allowances. Its important for shipboard ammunition to be stowed so maximum effectiveness is achieved. For these reasons, strict compliance with ammunition stowage by compatibility groupings aboard ship, while desirable and observed when practical, may not be feasible. When mixed stowage is used, make sure that it conforms to the stowage tables listed in *Ammunition Afloat,* NAVSEA OP 4.

Table 11-1 is an example of the permissible mixed stowage of ammunition types in shipboard magazines. The different types of ammunition are listed in the first column of table 11-1. The types of magazines are listed across the top of the table. The type of ammunition is stowed only in those magazines indicated by a black box intersecting the horizontal line for the ammunition item and the vertical line for the type of magazine.

REVIEW NUMBER 1

Q1. What command develops and approves specifications for construction of Navy ships?

Q2. A ship's primary magazines are usually located _____.

Q3. What type of magazines are located close to the area to be served?

Q4. What is the purpose of modular stowage?

Q5. List the two areas that the IRRP created improved handling.

Q6. Squadron personnel use a _____ *hoist for preloaded IMERS and ITERS.*

Q7. Generally, magazines aboard ship are designated to hold _____.

Q8. Authority for stowing mixed types of ammunition in a magazine rest with _____.

ENVIRONMENTAL CONTROL SYSTEMS

Magazines are fitted with environmental control and safety features to protect ammunition from excessive temperatures and humidity. Most magazines have either mechanical cooling or ventilation systems. However, there are a few magazines that don't have either of these features. If a magazine without controls shows a heat gain in excess of 100°F, use portable ventilation systems to prevent overheating or condensation of moisture.

Table 11-1.—Permissible Stowage of Ammunition and Explosives

TYPE OF AMMUNITION \ TYPE OF MAGAZINE	PROJECTILES & ROCKET HEADS	FIXED AMMO, GUN & ROCKET	PROPELLANT, ROCKET TYPE	PROPELLANT, GUN, BAG	PROPELLANT, GUN, CASED	PROPELLANT, LIQUID FUEL	FUZES	PYROTECHNIC	CHEMICAL	BOMB TYPE	SMALL ARMS	WARHEADS	MISSILES (ASSEMBLED)	GRENADE LOCKERS	DETONATOR LOCKERS	READY-SERVICE	DEMOLITION MATERIAL	SPECIAL LOCKERS	WEAPONS MAGAZINE AS/AD	REMARKS
Destructor, Incendiary																		■		Separate stowage
Detonation Simulators								■		■					■					Separate stowage
Detonators, Detonator Assemblies, Electric Percussion, Stab															■					
Dispensers, Chaffeye, MJU-5B		■					■	■			■									
Dispensers and Bombs, Complete, CBU, Less CBU-15, 22 and 55/B										■		■								
Dispensers and Bombs, Complete, CBU-15, 22 and 55/B	■								■											
Dispensers and Bombs, Practice Weapon, CBU Mk 20		■					■	■			■									
Document Destroyers								■								■				
Dynamite, Military, M1																	■			
Dynamite, 40% Nitro Gel																				Separate stowage ⑥
Exercise Heads, Mk 10 Mod 0 F/GMS										■		■								
Exercise Heads F/GM, Less Mk 10								■				■								
Exercise Sections Assembly, Mk 17, F/GMS										■		■								
Exploder Mechs, Mk 11 and Mods F/Torpedo Mk 27							■									■				
Explosive Blocks, Torpedo							■													
Explosive Drivers		■					■	■			■									
Explosive Fittings, Less Mk 26														■						
Explosive Fitting, Mk 26 F/SUBROC							■													
Explosive Switch, Mk 17 Mods 1 and 2							■													
Explosive Train, F/Torpedo Mk 46, Service and Practice							■													
Extensions, Fuze, Bomb, Tetryl or Comp B Loaded							■													
File Destroyer, Incendiary																		■		Separate stowage
Firing and Arming Mechs. F/U/W Sound Signals							■								■					
Firing Devices, Firing Device Set, Demolitions		■					■	■			■									17NP0306

⑥ May be stowed, if authorized by COMNAVSEASYSCOM, in separate stowage only.

Supply and Exhaust Ventilation

Ventilation ducts and exhaust ventilation outlets to and from magazines provide forced-air ventilation, Air is forced through the ducts by electric fans installed within the duct work. Standard covers maintain watertightness and prevent the entrance of flames from hits on the ship during combat. Always close these covers during combat (general quarters) conditions, unless otherwise directed. If you inhale fumes from some types of ammunition, you might get slightly intoxicated. However, this should not appreciably reduce your work efficiency. Generally, there is sufficient air volume in large, sealed magazines and handling rooms to provide a safe working atmosphere for approximately 5 hours. Magazines that are continuously occupied by personnel are blown through or ventilated a minimum of once every 5 hours.

Magazine Vent Check Valves

Sometimes, it is necessary to operate the sprinkler system in magazines while the ventilation valves are secured When this happens, the magazine must be vented by an air escape to ensure that the pressure within the magazine doesn't build up beyond the allowed pressure limits of its watertight boundaries. Magazine check valves allow air and water to escape from the magazine into one of the ventilation ducts or through an independent air escape.

Exhaust Vents

Aboard ship, most magazines, particularly missile magazines, are vented to the atmosphere. When missile motors burn, they rapidly produce large volumes of smoke and gas. To avoid spreading smoke and gas to other areas of the ship if a missile motor in a magazine accidentally ignites, the exhaust ducts are vented to the atmosphere. The area on the weather deck in the vicinity of an exhaust vent is potentially hazardous, and it is marked to warn personnel not to loiter (hang around) in this area.

SPRINKLER AND ALARM SYSTEMS

Primary and missile magazines, ammunition handling rooms, and most ready-service magazines are fitted with sprinkler systems. Sprinkler systems consist of spray heads or sprinkler-head valves arranged to dash water directly on the munitions and completely cover the magazine's interior. Sprinkler systems for spaces located below the damage control deck (second deck on aircraft carriers) are arranged for local control at the valve and for remote control from the damage control deck (fig. 11-6) On aircraft carriers, the remote controls are normally divided into two groups—forward

REVIEW NUMBER 1 ANSWERS TO QUESTIONS Q1. THROUGH Q8.

A1. NAVSEASYSCOM develops and approves specifications for construction of Navy ships.

A2. A ship's primary magazines are usually located below the waterline.

A3. Ready-service magazines are located close to the area to be served.

A4. The purpose of modular stowage is to give the greatest versatility and to minimize ammunition handling.

A5. The two areas that the IRRP created improved handling are rearming and weapons assembly.

A6. Squadron personnel use a HLU-196B/E hoist for preloaded IMERS and ITERS.

A7. Generally, magazines aboard ship are designated to hold a single type of ammunition.

A8. Authority for stowing mixed types of ammunition in a magazine rest with NAVAIRSYSCOM.

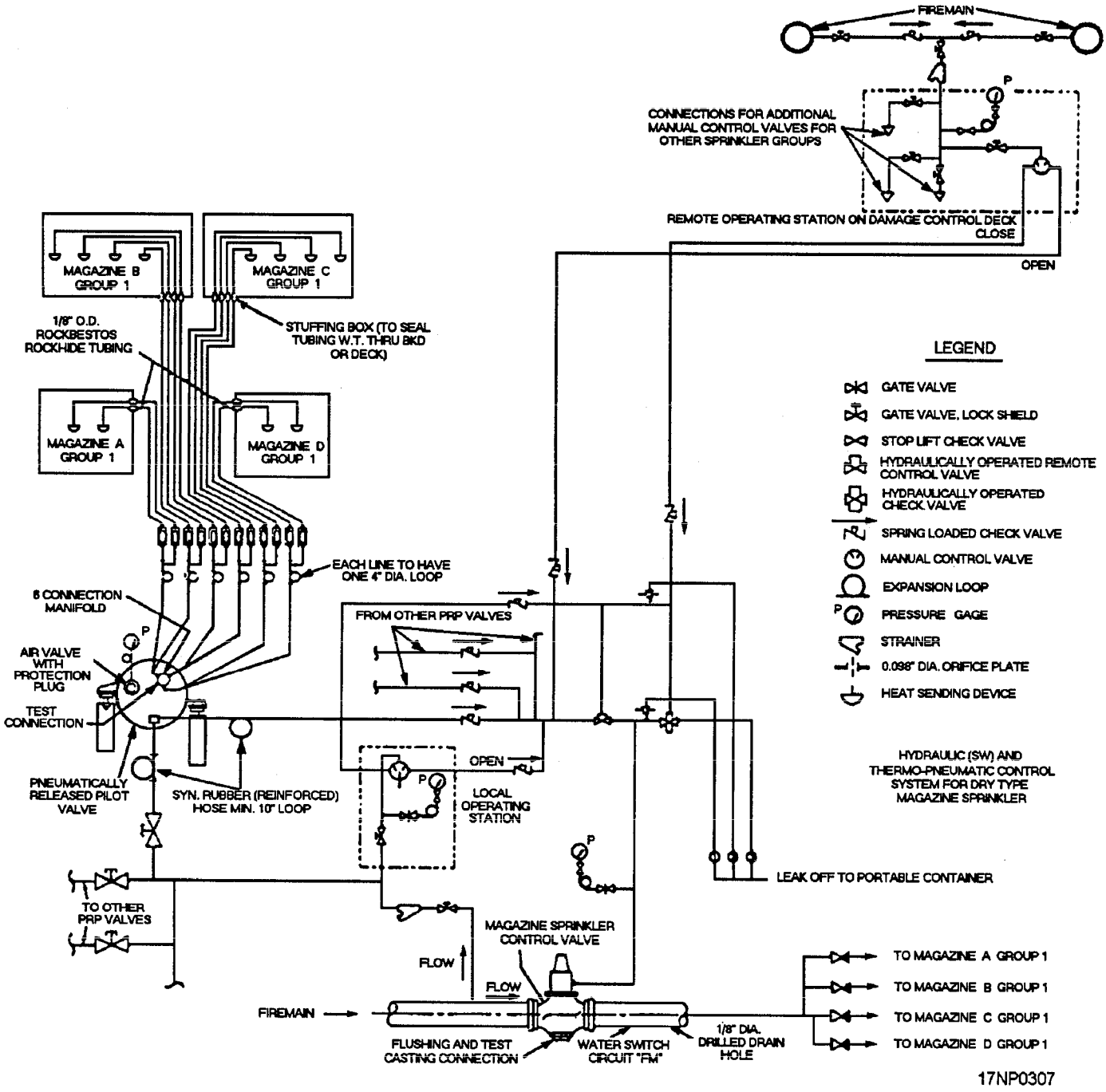


Figure 11-6.—Typical magazine remote and local operating sprinkler stations,

sprinkler control board and aft sprinkler control board. The forward magazine group and the aft magazine group sprinklers can be remotely activated from the two control boards. Sprinkler systems for spaces located on and above the damage control deck are arranged for local control only from a position outside the access entrance to the space.

NOTE: Some magazines are designed without sprinkler systems so water-activated ammunition can be stowed in them. For example, Mk 58 marine location markers cannot be stowed in magazines that can be flooded. Also, weather-deck lockers and 20-mm and 40-mm ready-service rooms do not require sprinkler systems.

Sprinkler Systems

Sprinkler systems are classified by the type or location of the control exercised over the valves that restrain the flow of water. These valves maybe operated

manually (fig. 11-7) or by remote control (manually or automatically). There are three types of remote operation

1. Manual, by operating gears
2. Hydraulic, by means of control cocks and water from the fire system or control cocks and oil pressure supplied by hand pumps
3. Automatic, by means of a *rate of rise* or combined *rate of rise* and fixed temperature thermopneumatic control system

The *rate of rise* is indicated in a magazine when the temperature increases rapidly (such as from a fire). The rapid temperature increase activates the sprinkler-alarm device (FH circuit), which, in turn, automatically activates the sprinkler system control valve.

Alarm Systems

There are three alarms that are commonly associated with all magazine sprinkler systems—a sprinkling (FH circuit) alarm, a flooding (FD circuit) alarm, and a high-temperature (F circuit) alarm.

- High-temperature alarm systems (F circuit) are installed in all of the following magazines or spaces:
- Ammunition and propellant stowage areas
- Ammunition handling spaces
- Ammunition assembly/disassembly/check-out areas
- Cargo ammunition holds to provide a means of determining high temperatures

Don't confuse the F circuit with the FH circuit. The F circuit detects a slow rise in temperature while the FH circuit detects a rapid rise in temperature.

Install a minimum of two thermostats in each space. Install a minimum of one thermostat for each 250 square feet of deck area, or fraction of a deck area. If high temperatures occur in any of the spaces containing

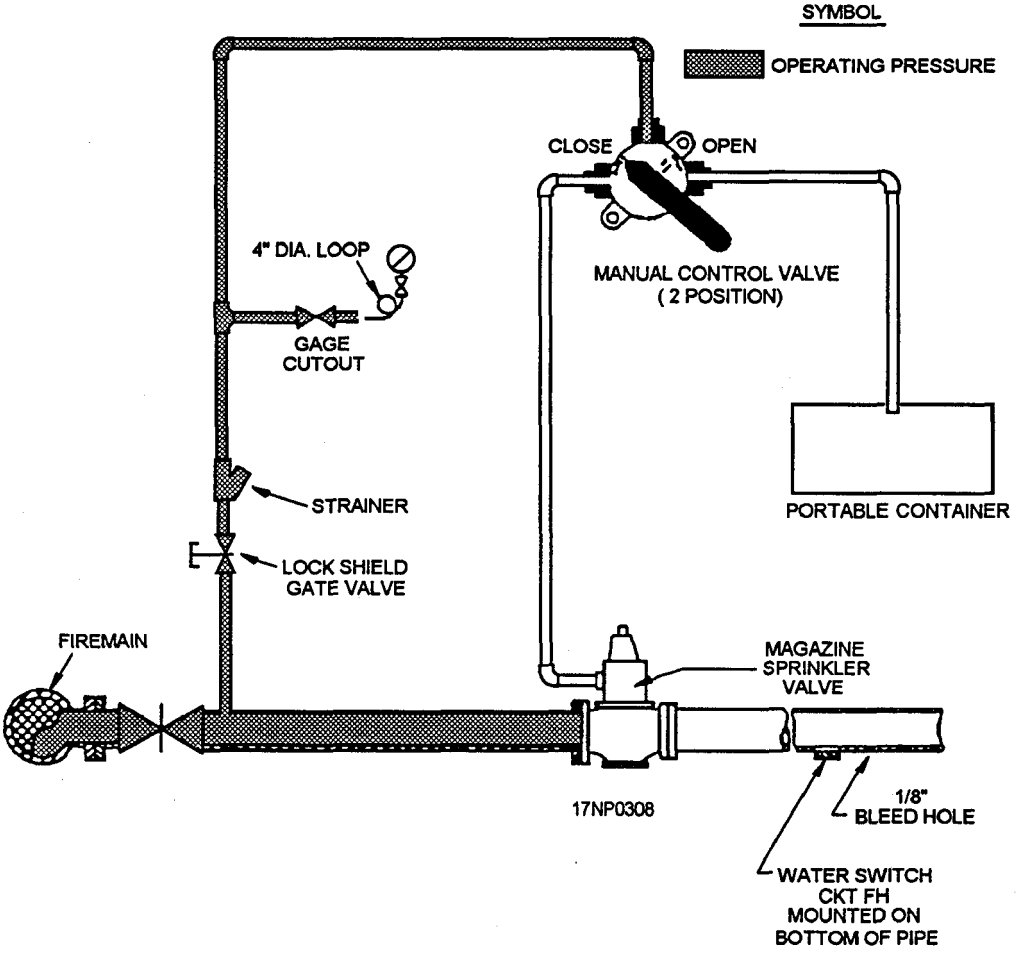


Figure 11-7.—Typical manual control sprinkler system.

thermostats, the high-temperature occurrence is indicated on an alarm switchboard installed in an area continuously manned when the ship is underway. Usually, this is damage control central. Audible alarm systems are also installed in the pilot house, officer-of-the-deck (OOD) area, secondary damage control station, and each interior communications room. The audible alarm systems work in conjunction with the F and FH circuits.

Tests and maintenance of the magazine sprinkler systems are performed periodically according to NAVSEA and applicable preventive maintenance system (PMS) instructions.

MAGAZINE INTERNAL ARRANGEMENT

The internal arrangement of each magazine may vary considerably, The arrangement depends on the stowage space available (fig. 11-8) and the type of

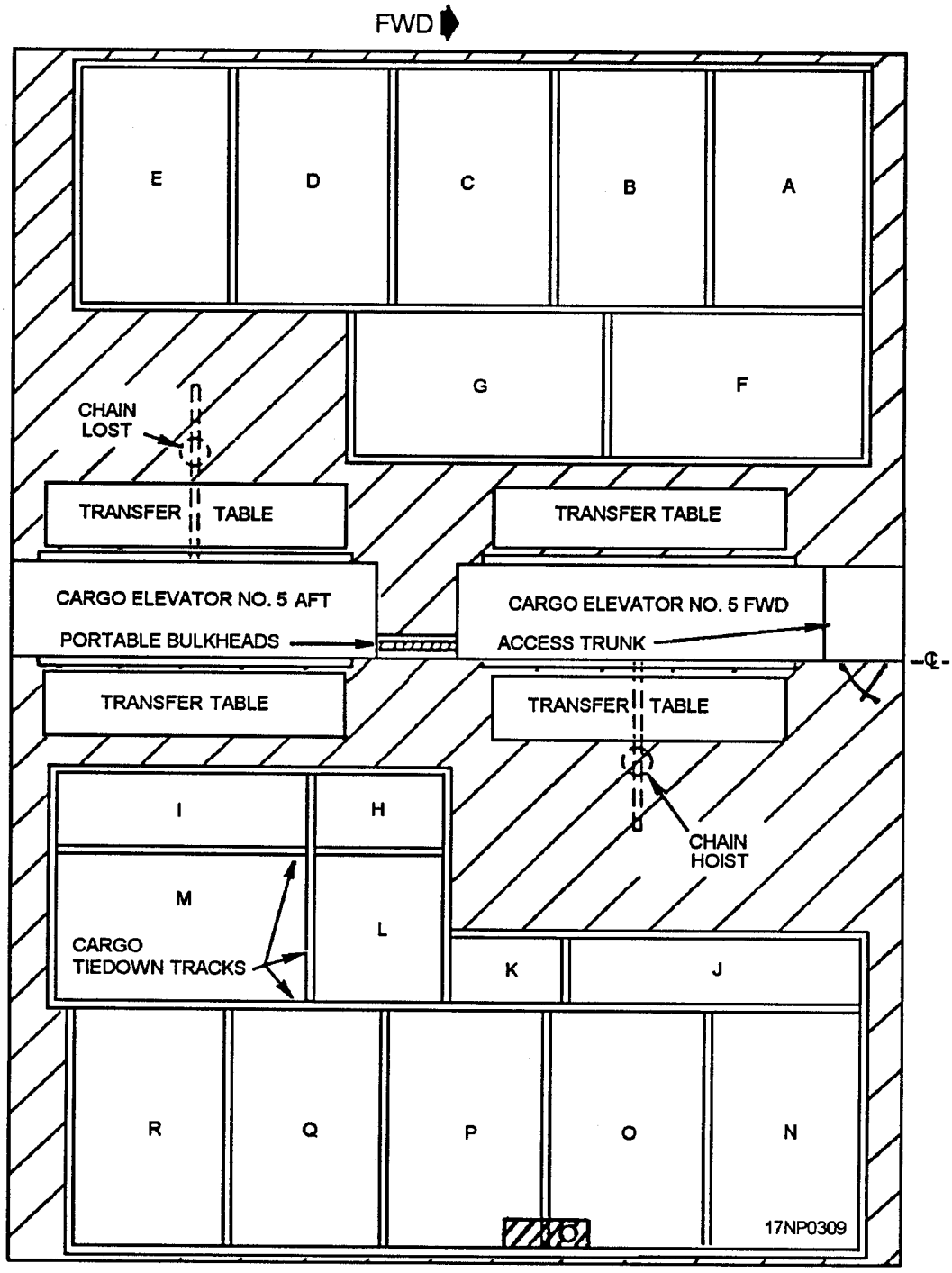


Figure 11-8.—Typical LFORM ammunition stowage plan for an LHA-1.

ammunition stowed. Figure 11-5 shows a ready-service magazine configured for ready-service missiles. Notice some missiles are stowed in cradles attached to the bulkhead. Other missiles are loaded onto handling equipment and ready for immediate issue. In larger magazines, such as primary missile magazines, stanchions may be installed in sockets provided in the deck and overhead. Cradles are attached to the stanchions to stow a large number of decanned, ready-service missiles. Straps are used to secure the missiles in the cradles.

Stanchions are also used to divide a large magazine area into smaller areas or bins (fig. 11-9) to hold various sizes of ammunition with a minimum loss of space. The stanchions are fitted with slots or have other means for receiving battens. The battens (which run horizontally) provide the walls that form the bin.

No matter which stowage method is used, arrange the stowage area so access to as much ammunition and as many containers as possible is provided, and provide adequate space for ventilation and handling operations. Stow ammunition and explosives on dunnage to provide an air space so all parts of the magazine receive maximum ventilation and exposure to the sprinkler system. Mk 3 or Mk 12 metal pallets are used as dunnage aboard aircraft carriers. These have the correct space between the deck and stowed material. They also provide adequate grounding, Additionally, make sure that there is an air space of not less than 2 inches between any ammunition stowage stack and the surface of adjacent plating or sheathing. Stow the stacks of ammunition so sprinkler systems, circuit F sensors, or air escape lines aren't obstructed. When different lots and/or types of ammunition are stored in the same magazine, segregate the ammunition by lot, size, and type. Record this information on magazine cards and post them in the magazine.

Ships at sea move randomly; therefore, securely fasten all hazardous munitions and explosives in place, except when they are actually being handled. In some cases, stanchions and battens provide adequate security. Other types of ammunition stows, such as palletized bombs or missile containers, are secured by tie-down chains especially designed for this purpose. Connect the tie-down chains to the load and the deck tie-down points so even the slightest movement of the ammunition is prevented.

MAGAZINE INSPECTION AND VISUAL SURVEILLANCE OF AMMUNITION

The terms *magazine inspection* and *visual surveillance of ammunition* mean the same thing. They apply to the inspection of magazines and their contents. Aboard ship, these inspections are mandatory according to *The Ships' Maintenance and Material Management (3-M) Manual,* OPNAVINST 4790.4, other Navy regulations, and NAVSEASYSCOM instructions. Magazine inspections are part of the ship's Preventive Maintenance System (PMS), and they should only be conducted by qualified personnel. These personnel use a check sheet (maintenance requirements card) to ensure that a hazard or abnormal condition is not overlooked.

DAILY VISUAL INSPECTION

Generally, the daily visual inspection of magazines consists of checking for the following:

- Improperly secured stowage
- Unsatisfactory protective packaging
- Unusual fumes or odors
- Magazine cleanliness
- Other abnormal conditions

Abnormal conditions in a ship's magazine or ammunition stowage space include evidence of tampering to gain access, evidence of theft, evidence of temperature or humidity fluctuations, and the presence of unauthorized materials. Abnormal conditions also include evidence of localized overheating from adjacent compartments on decks, bulkheads, and overheads; indications of leaks from sprinkler or flood pipes, nozzles, or control valves and regulators; and inoperable or damaged reach-rods, linkages, automatic fire alarm devices, and other similar equipment in the specific hazard stowages. Record the results of all magazine inspections on the appropriate PMS schedule.

An important requirement of the daily magazine inspection is observing, recording, and reporting maximum and minimum temperature conditions in each stowage space. A maximum-minimum thermometer (one or more per magazine) is placed in all magazines when ammunition is stowed in them. The

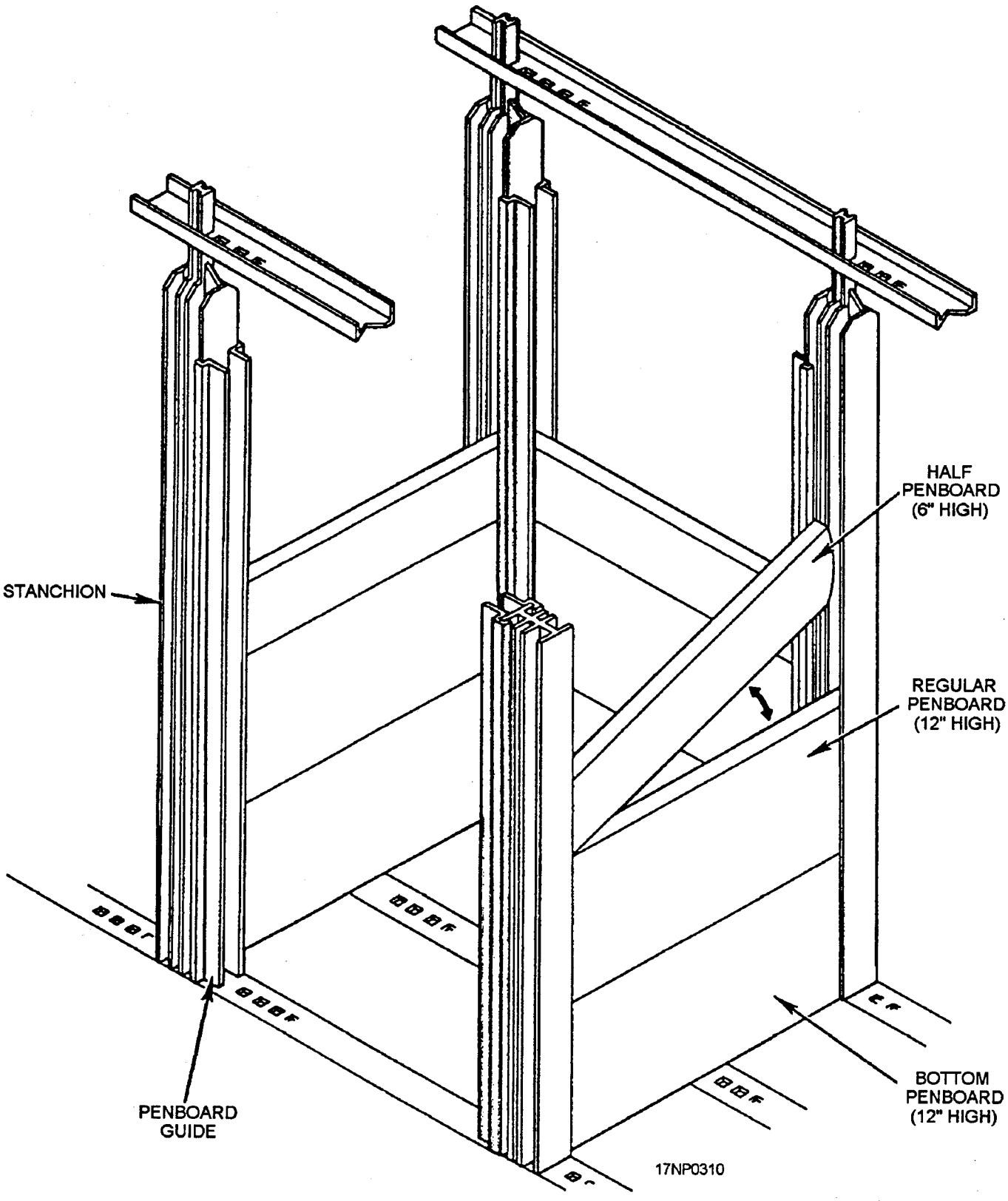


Figure 11-9.—Typical stanchions and bin configuration.

maximum-minimum thermometer (fig. 11-10) is a U-shaped, mercury-filled, glass tube with two bulbs. You determine the current temperature by the level of the mercury in either arm of the tube. The current temperature indicated by the thermometer shown in figure 11-10 is approximately 95°F. The mercury level in each side of the tube should indicate the same temperature reading. If the readings are not the same on both sides of the tube, replace the thermometer.

The maximum and minimum temperatures may be determined by observing the position of the steel index marker located in either side of the glass tube. If the temperature increases, the mercury rises upward in the right-hand scale, forcing the steel index marker upward, while the mercury in the left-hand scale decreases downward and the steel index marker remains stationary. If the temperature decreases, the mercury in the left-hand scale rises, forcing the steel index marker upward, while the mercury in the right-hand scale decreases downward and the steel index marker remains stationary.

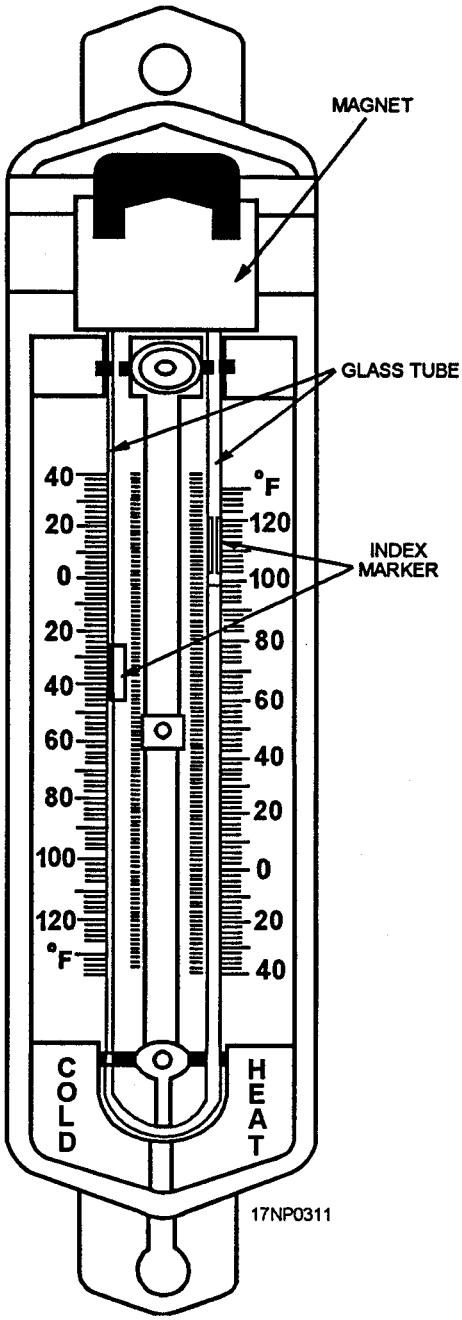


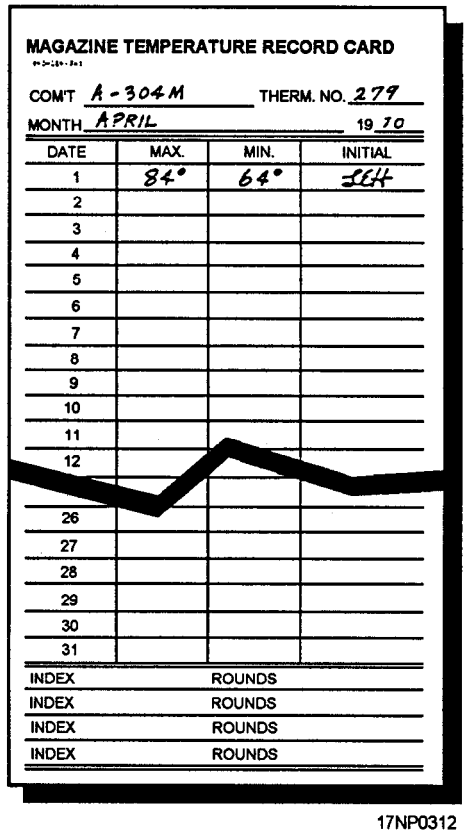
Figure 11-10.—Maximum-minimum thermometer.

The maximum temperature indicated on the thermometer illustrated is approximately 100°F. The reference point for taking all maximum and minimum readings is always from the bottom edge of the steel index marker. The minimum temperature indicated is approximately 45°F.

After recording the temperature readings on the magazine temperature card, zero the thermometer. You use a horseshoe-shaped magnet to zero the thermometer. Place the magnet against the glass and draw it downward so each steel index marker is drawn down to the level of mercury.

MAGAZINE TEMPERATURE LOG

A Magazine Temperature Record Card (fig. 11-11) is located in each magazine. It is posted near the


MAGAZINE TEMPERATURE RECORD CARD

COM'T A-304M THERM. NO. 279

MONTH APRIL 19 70

DATE	MAX.	MIN.	INITIAL
1	84°	64°	SEH
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
26			
27			
28			
29			
30			
31			

INDEX	ROUNDS
INDEX	ROUNDS
INDEX	ROUNDS
INDEX	ROUNDS

17NP0312

Figure 11-11.—Magazine Temperature Record Card.

thermometer for recording daily magazine temperatures. These cards are replaced on the first day of each month. The completed cards are removed from the magazine, and the temperatures for each month are posted in a permanent log. The Magazine Temperature Record Cards are retained on file for a period of 1 year. When recording magazine temperatures in the permanent log, record temperatures in excess of 100°F so they stand out (use red ink). If the temperature exceeds 110°F in smokeless powder, rocket motor, and JATO magazines, check the temperature hourly and record it in a separate notebook. Transfer these recorded temperatures to the permanent log on a daily basis. Any magazine with a temperature consistently above 100°F is reported to NAVSEASYSCOM.

MAGAZINE SECURITY

Unless work is actually being performed within the space, all ammunition stowage spaces containing ammunition or explosives are secured and locked. This action is required by current directives and instructions. Properly securing an ammunition stowage space includes the following actions:

- Properly set all environmental controls.
- Close all hatches, doors, or accesses.
- Properly set all dogs on watertight closures.
- Lock the space with an adequate locking device (fig. 11-12).

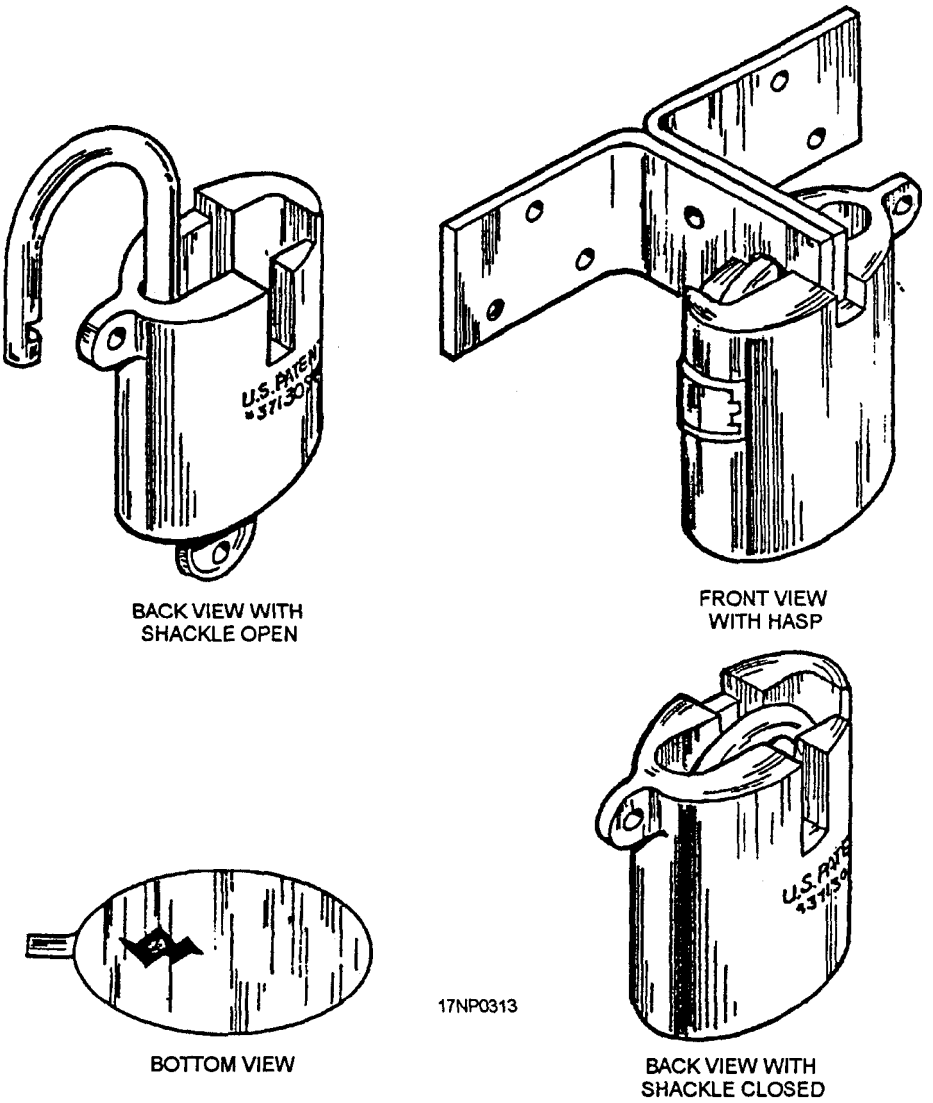


Figure 11-12.—Model 831B high-security shrouded padlock,

Some ammunition and explosive items, such as small arms ammunition, small arms, and pyrotechnics, are highly pilferable. Stow them in high-security stowage spaces. These spaces are equipped with an unauthorized entry alarm system and a specially designed, high-security, locking device (fig. 11-13).

The ship's gunner maintains and controls the magazine keys, including the high-security keys. The keys are logged out to authorized personnel only. During emergencies, such as fire and flooding, the ship's gunner provides access, as necessary, to locked ammunition spaces. If the ship's gunner is absent, the weapons department duty officer performs this function.

REVIEW NUMBER 2

Q1. Missile magazines are vented to _____.

Q2. What item shouldn't be stowed in magazines that are equipped with sprinklers?

Q3. In a shipboard magazine, what alarm circuit indicates a rapid rise in temperature?

Q4. What type of pallets are used as magazine stowage dunnage aboard ship?

Q5. All maximum and minimum readings taken from a magazine thermometer use the _____ *as a reference.*

Q6. NAVAIRSYSCOM should be notified if the temperature in any magazine is consistently above ____.

Q7. What person controls all magazine keys aboard ship?

AMMUNITION HANDLING

LEARNING OBJECTIVE: *Identify ammunition handling equipment used aboard ship and recognize its purpose and use. Identify the purpose and use of weapons elevators.*

Handling ammunition requires detailed planning, precise execution of details, and strict compliance with safety regulations. When handling ammunition aboard a ship, these requirements can't be overemphasized. The working space is limited, and there is a large number of personnel contained within the ship. All personnel (both military and civilian) who handle ammunition

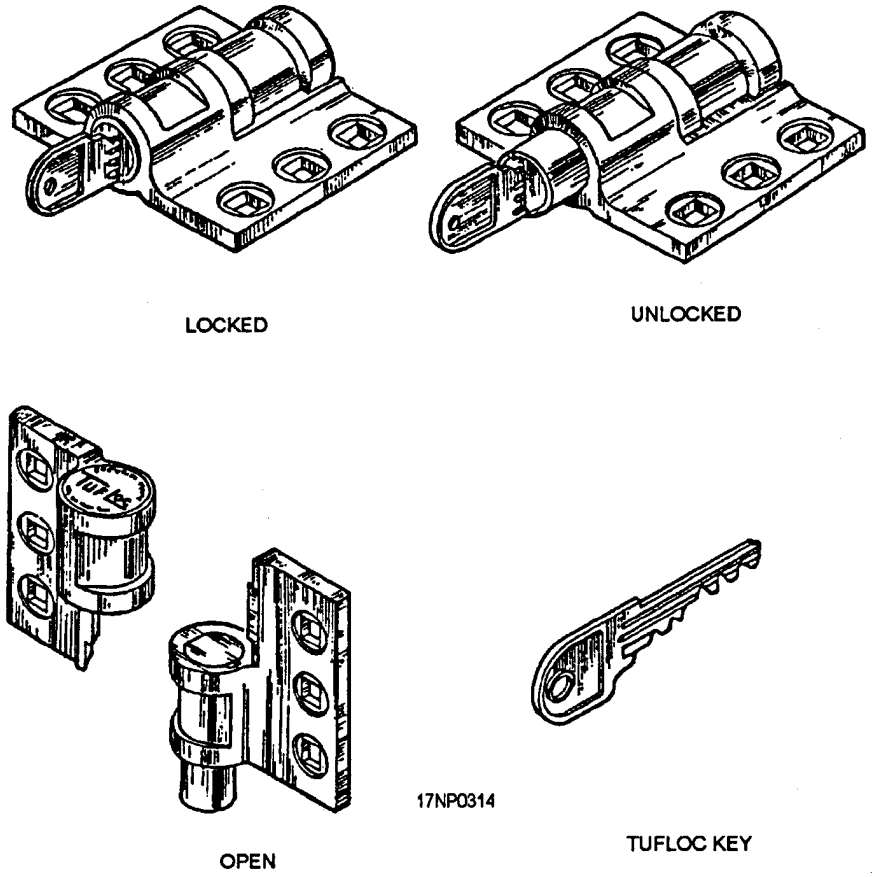
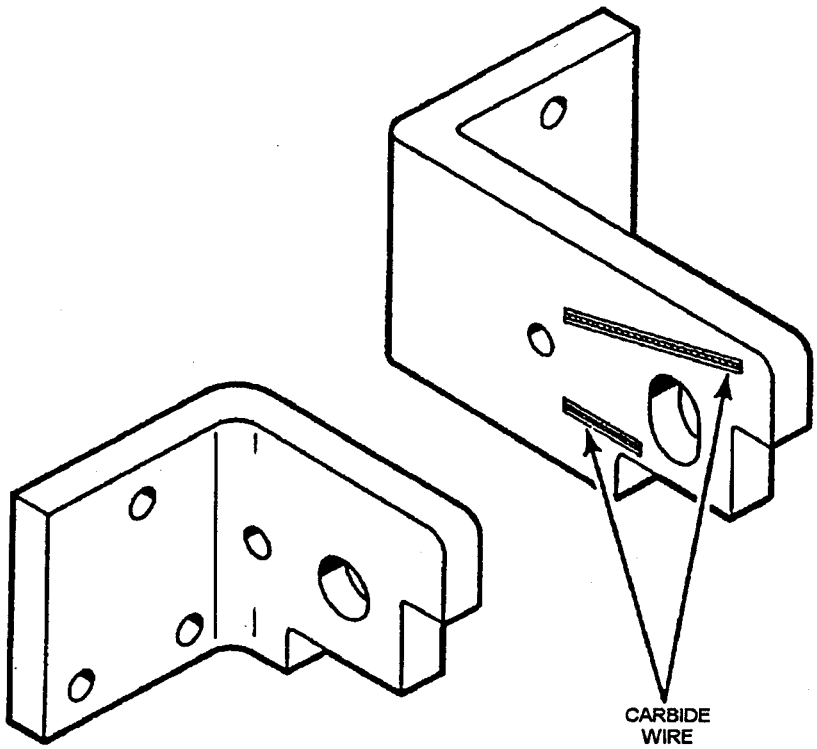
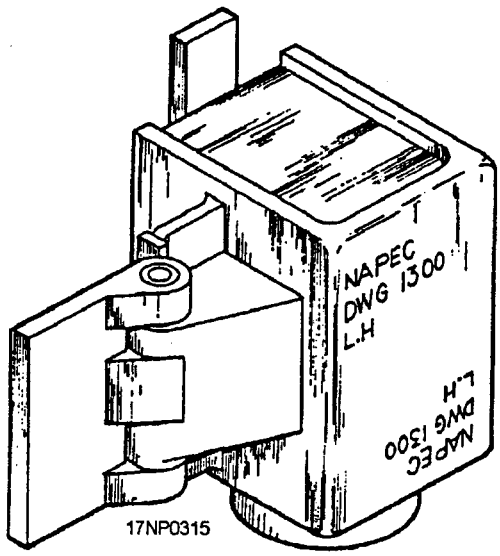


Figure 11-13.—High-security locking devices.



NATICK HIGH-SECURITY HASP



1300 SERIES HIGH-SECURITY HASP

Figure 11-13.—High-security locking devices—Continued

must be qualified and certified in their areas of responsibility.

INSTALLED HANDLING EQUIPMENT

Aboard ship, most large magazine and weapons assembly areas are serviced by weapons elevators. These areas have provisions for the use of hoists. A brief description of handling equipment and its purpose is discussed in the following text.

Hoists

You use hoists in magazine stowage areas to stack or relocate ammunition within the magazine. You also use them to decan weapons. Hoists are used during

weapons assembly to lift a weapon from the handling equipment or pallets to the assembly stands and from the assembly stand to the handling equipment.

There are three basic types of hoists-manually powered, electrically powered, and pneumatically powered (fig. 11-14). A hoist maybe attached to the overhead by a stationary fitting, or it may be mounted onto an overhead monorail to move the load laterally. You must use the correct sling, hoisting beam, and bomb carrier when connecting the hoisting cable to the load. Hoists have an established safe working load (SWL) that you must consider when selecting a hoist for a particular job. Also, consider the SWL of the interfacing equipment (bomb carrier, sling, etc.). For example, you have selected a hoist with an SWL of 4,000 pounds and a bomb carrier with an SWL of 2,000 pounds. The maximum weight this configuration can safely lift is 2,000 pounds.

Inspect hoists before you use them, Hoist must be periodically load tested. Equipment that has satisfactorily passed periodic load tests is marked to indicate its SWL. As a minimum, the marking includes the following information:

- The name of the testing activity and the name of the person performing the test.
- The date the test was performed
- The date of the next required inspection maybe included, if desired

If the test period has expired or if documentation is not available to verify the latest load test status, the equipment is tested before it is used. If the equipment fails the load test specifications, the equipment is destroyed or, if economically feasible, repaired.

Weapons Elevators

There are currently more than 150 weapons elevators, involving over 55 different designs, installed on aircraft carriers. The size, type, and location of these weapons elevators will vary among the different classes of aircraft carriers.

The Forrestal-class carriers, the USS *Kitty Hawk,* and USS *Constellation* have a combination of 5,500-pound, 2,000-pound, and 1,400-pound special armament stowage space (SASS) and improved weapons handling system (IWHS) elevators installed.

The USS *Enterprise* and USS *America* were designed with pneumatically operated doors and hatches. The elevators on the USS *America* include five pneumatically operated elevators and three elevators that have hydraulically operated hatches and pneumatically operated doors.

The USS *John F. Kennedy* was designed with platform conveyors and an athwartship shuttle. The elevators have hydraulically operated doors and hatches served from three power plants. Upper-stage elevators, numbers 2, 3, and 4, are raised and lowered by hydraulic ram instead of cables.

The elevators aboard the USS *Nimitz* have two hydraulic power plants that serve 10 high-speed elevators. All the doors and hatches are hydraulically

REVIEW NUMBER 2 ANSWERS TO QUESTIONS Q1. THROUGH Q7.

A1. Missile magazines are vented to the atmosphere.

A2. Mk 58 marine location markers shouldn't be stowed in magazines that are equipped with sprinklers.

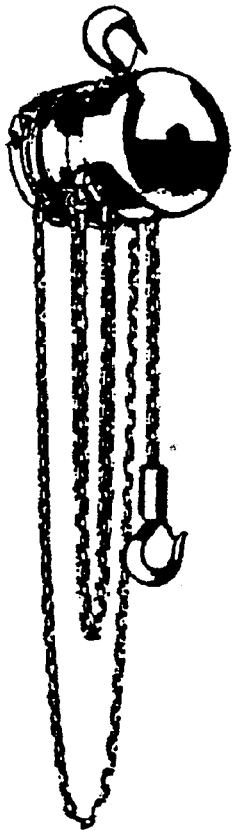
A3. In a shipboard magazine, the FH circuit indicates a rapid rise in temperature.

A4. Mk 3 Mk 12 metal pallets are used as magazine stowage dunnage aboard ship.

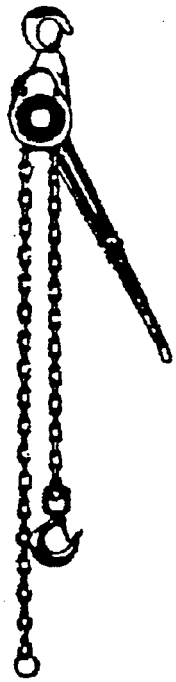
AS. All maximum and minimum readings taken from a magazine thermometer use the bottom edge of the steel index marker as a reference.

A6. NAVAIRSYSCOM should be notified if the temperature in any magazine is consistently above 100°F.

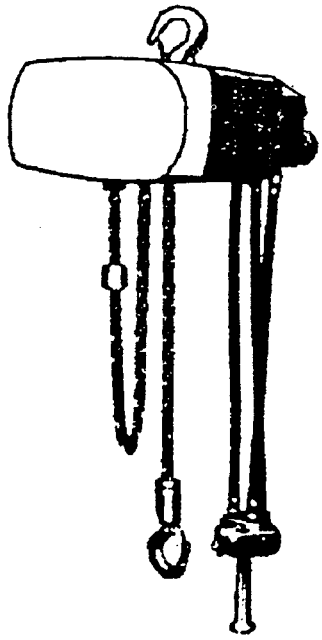
A7. The ship's gunner controls all magazine keys aboard ship.



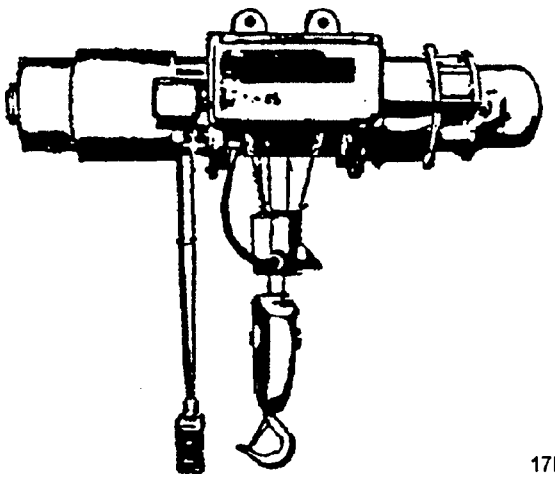
HOOK CHAIN HOIST
MANUALLY OPERATED



HOOK CHAIN HOIST
MANUALLY OPERATED
LEVER TYPE
(COME-A-LONG)



CHAIN HOIST
PNEUMATICALLY
OPERTED



WIRE ROPE HOIST
ELECTRICALLY OPERATED

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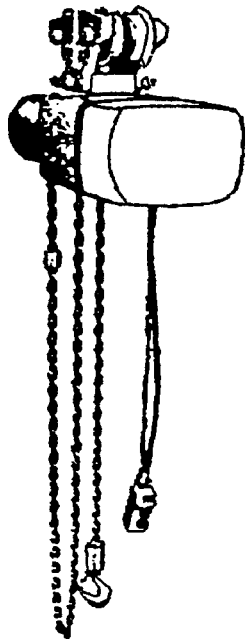


CHAIN HOIST
ELECTRICALLY
OPERATED

Figure 11-14.—Typical ammunition handling hoists.

operated. In addition, all of the elevators are rated for a 9,000-pound load capacity, and the elevator trunks have side-loading capabilities at several magazine levels.

Except for minor differences, the elevators aboard the USS *Eisenhower* and the USS *Carl Vinson are* almost identical to those aboard the USS *Nimitz.*

The foIlowing text contains a brief description of the two major classifications (lower-stage and upper-stage) of weapons elevators. Regardless of the type of installation a weapons elevator provides a safe and efficient means for you to handle weapons and weapons components among the magazines and the various assembly, staging, and arming areas within the ship.

LOWER-STAGE WEAPONS ELEVATORS (5,500 POUNDS).— The 5,500-pound, lower-stage, weapons elevator (fig. 11-15) services magazines and ammunition handling areas from the 7th-deck level up to and including the 2nd-deck level. The components of the elevator include an electrically powered, multiple-drum winch, an elevator platform, an enclosed, watertight, vertical trunk with doors located at the levels and stations serviced, and a semiautomatic control system.

Ramps are used to bridge the gaps in the door opening between the elevator platform and the deck. These allow you to load or unload the elevator platform by using forklift trucks or wheeled skids.

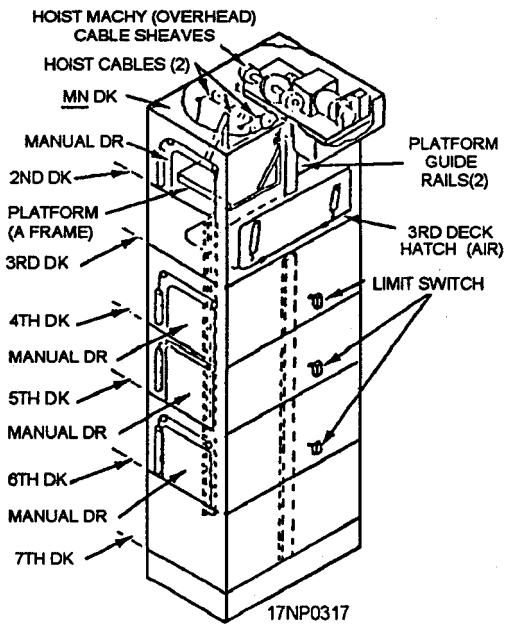


Figure 11-15.—Typical 5,000-pound lower-stage, weapons elevator.

Each lower-stage elevator is equipped with a broken-rope safety device, a down-speed governor device, and slack cable-sensing devices. The broken-rope safety device is mounted on the elevator platform assembly. If any one of the platform suspension ropes break, a roller-wedging mechanism automatically operates to lock the platform to the guide rails.

A counterweight-type governor device for limiting speed of elevator down travel is located in the upper end of the elevator trunk. The governor is operated by a wire rope connected to a lever of the broken-rope safety device on the elevator platform. Then, the rope is passed over the governor sheave and attached to the governor spooling drum on the hoisting winch. Excessive down speed causes the governor limit switch to shutoff the power to the hoist motor and electric brake. Loss of electric power causes the brake to automatically stop the elevator. If the brake fails to stop the elevator, the governor sheave grips the governor rope, causing the broken-rope safety device to stop the elevator.

A slack, cable-sensing, safety device is provided for each suspension rope and the governor rope. Located in the area between the winch drums and the overhead sheaves, these devices function by applying a spring-loaded follower roller to the wire rope. Rope slack causes a proximity switch to shutoff electrical power to the hoisting winch motor and brake, which stops the elevator.

If the elevator overtravels upward beyond the maximum up stop position, an overtravel limit switch is actuated. This stops the elevator by shutting off power to the hoisting winch motor and brake.

If the elevator overtravels downward beyond the hold deck loading station level, the platform is stopped by spring bumpers in the bottom of the elevator trunk. The slack-cable switches are actuated to cut off power to the hoisting winch motor and brake.

An operator-attended control panel is located next to all elevator doors. All operator control panels have a display of selector switches, pushbuttons, and indicator lamps suited for the control functions required at the station served. All control panels have an emergency stop-run switch from which all operations of the elevator can be stopped.

The main operator control panel and electrical power switch are located at the 2d deck-level station. An elevator can be dispatched to another level from any operator control panel. The lower-stage elevator control

system can dispatch the elevator to another level. However, it can't retrieve the elevator from another level.

SPECIAL ARMAMENT STOWAGE SPACE ELEVATORS (SASS) .— The SASS elevators provide service from the special armament stowage spaces to the hangar deck. These elevators are essentially the same as the 5,550-pound, lower-stage elevators with two major differences. The operator of the SASS elevator actually rides the platform from one level to another (personnel are strictly prohibited from riding the platform on all other weapons elevators). The SASS elevator also differs from the 5,500-pound elevator in that the trunk is provided with a hangar-deck hatch. When closed, the hatch becomes part of the hangar deck. The hatch is opened mechanically through the elevator control system. The hatch is lifted up into a horizontal position and moved rearward by rollers that ride on rails in the deck

INPROVED WEAPONS HANDLING SYSTEM (IWHS) LOWER-STAGE WEAPONS ELEVATORS.— The IWHS lower-stage weapons elevator (fig. 11-16) services magazines and ammunition handling areas from the 7th deck level up to and including the main deck (hangar deck). The IWHS is a highly sophisticated system controlled by a PDP-14 programmable controller that continually tracks the location of the platform to within one-twelfth of an inch. Because of the complexity of the IWHS, elevator operators and maintenance personnel are extensively trained in hydraulics, electricity, and electronics.

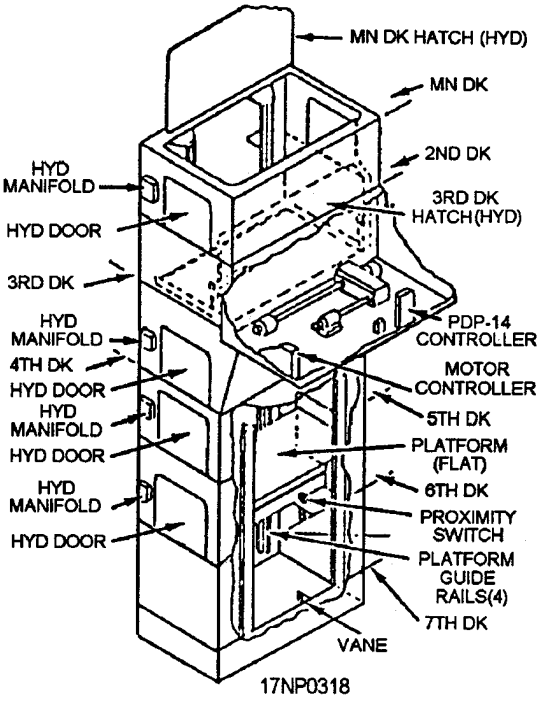


Figure 11-16.—Typical IWHS lower-stage weapons elevator.

The platform is lifted by four cables attached at the corners. The platform machinery is located at the 3rd deck level. The hatches are opened hydraulically. They are designed to automatically undog-open-latch and unlatch-close-dog. The elevator doors are also operated hydraulically.

The IWHS incorporates the following safety features:

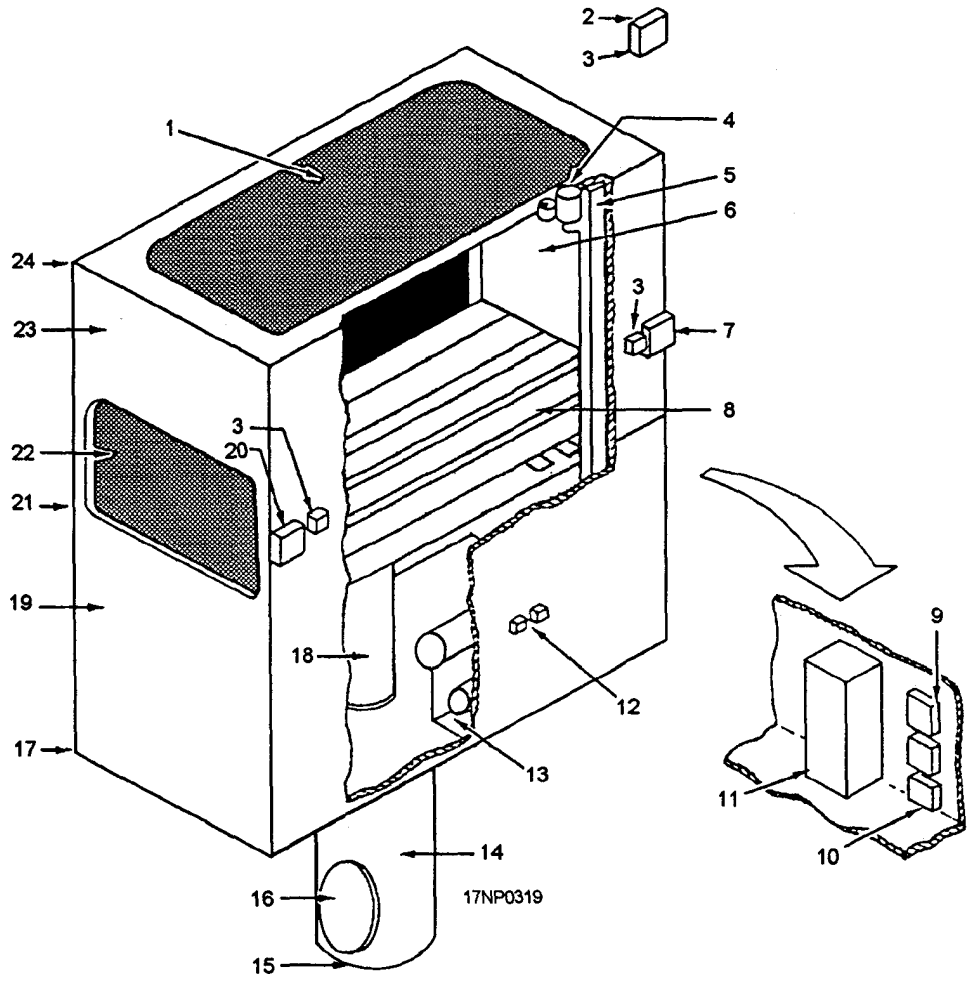
- An overspeed governor slack-cable device
- An overspeed governor device
- A hydraulic interlock to prevent two hatches from being opened at the same time
- A hydraulic interlock to prevent hatches from closing when dogs are in the dogged position
- An electrical interlock to prevent opening a magazine door unless the platform is at that level
- An electrical interlock to prevent opening more than one magazine door at a time
- A pressure switch to prevent operation of the elevator when the hydraulic pressure is below 1,200 psi
- An electrical interlock to prevent platform high-speed travel beyond the sequence-level slowdown switch
- An electrical interlock to prevent platform travel beyond the sequence level until the main deck hatch is opened and latched
- An electrical interlock to prevent movement of the platform until the lockbars are fully retracted

In addition to the operator controllers located at each access door and the 2d deck main controller, a portable main controller may be used at the main deck level. Normally, there is one IWHS installed forward to service the forward-magazine group and one installed aft to service the aft-magazine group. These elevators support the Improved Rearming Rate Program (IRRP).

UPPER-STAGE HYDRAULIC ELEVATORS.—Upper-stage hydraulic elevators (fig. 11-17) are used to transport weapons between the second deck and the main deck only. The major components of each elevator are an enclosed, watertight, vertical trunk, an elevator platform assembly, a hydraulic power plant system, and a semiautomatic elevator control system.

If an excessive elevator downspeed occurs, an overspeed valve closes and stops the elevator. The overspeed valve is mounted on the lower end of the lifting ram hydraulic cylinder assembly.

UPPER-STAGE WIRE-ROPE ELEVATORS.—The upper-stage, wire-rope elevators (fig. 11-18) are the only weapons elevators in the system that provide weapons transportation to the flight deck. The 2d deck is the lowest level served by the upper-stage elevators. The equipment of upper-stage, wire-rope elevators are either similar or identical to those of lower-stage,



1. **Main deck hatch**
2. **Main deck control panel**
3. **Call signal station**
4. **Shock absorbers**
5. **Guide rail**
6. **FWD elevator door**
7. **Master elevator door**
8. **Platform conveyor**
9. **HYD plant motor magnetic controller**
10. **PLATF CONVR motor MAG controller**
11. **Static control panel**
12. **HYD plant motor master switch**
13. **HYD power unit assembly**
14. **Hoisting cylinder enclosure**
15. **4th deck**
16. **Hatch**
17. **3rd deck**
18. **Hoisting cylinder assembly**
19. **Machinery space**
20. **Remote control panel**
21. **2d deck**
22. **Aft elevator door**
23. **Elevator trunk**
24. **Main deck**

Figure 11-17.—Typical upper-stage, hydraulic, weapons elevator.

system can dispatch the elevator to another level. However, it can't retrieve the elevator from another level.

SPECIAL ARMAMENT STOWAGE SPACE ELEVATORS (SASS) .— The SASS elevators provide service from the special armament stowage spaces to the hangar deck. These elevators are essentially the same as the 5,550-pound, lower-stage elevators with two major differences. The operator of the SASS elevator actually rides the platform from one level to another (personnel are strictly prohibited from riding the platform on all other weapons elevators). The SASS elevator also differs from the 5,500-pound elevator in that the trunk is provided with a hangar-deck hatch. When closed, the hatch becomes part of the hangar deck. The hatch is opened mechanically through the elevator control system. The hatch is lifted up into a horizontal position and moved rearward by rollers that ride on rails in the deck

INPROVED WEAPONS HANDLING SYSTEM (IWHS) LOWER-STAGE WEAPONS ELEVATORS.— The IWHS lower-stage weapons elevator (fig. 11-16) services magazines and ammunition handling areas from the 7th deck level up to and including the main deck (hangar deck). The IWHS is a highly sophisticated system controlled by a PDP-14 programmable controller that continually tracks the location of the platform to within one-twelfth of an inch. Because of the complexity of the IWHS, elevator operators and maintenance personnel are extensively trained in hydraulics, electricity, and electronics.

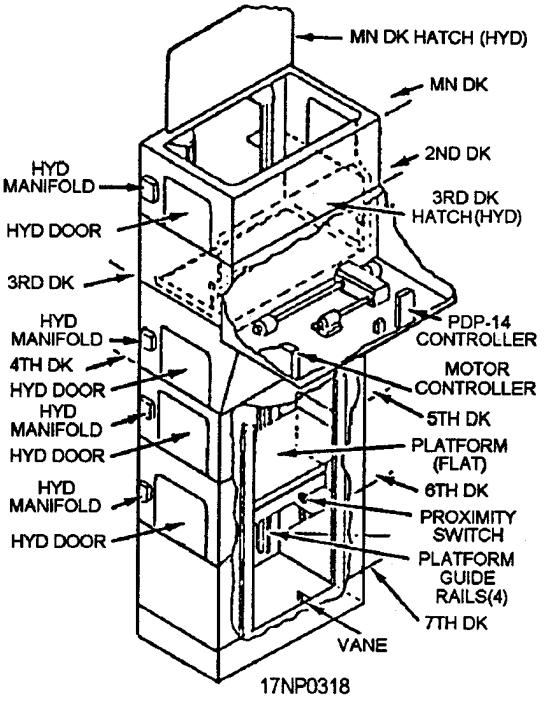


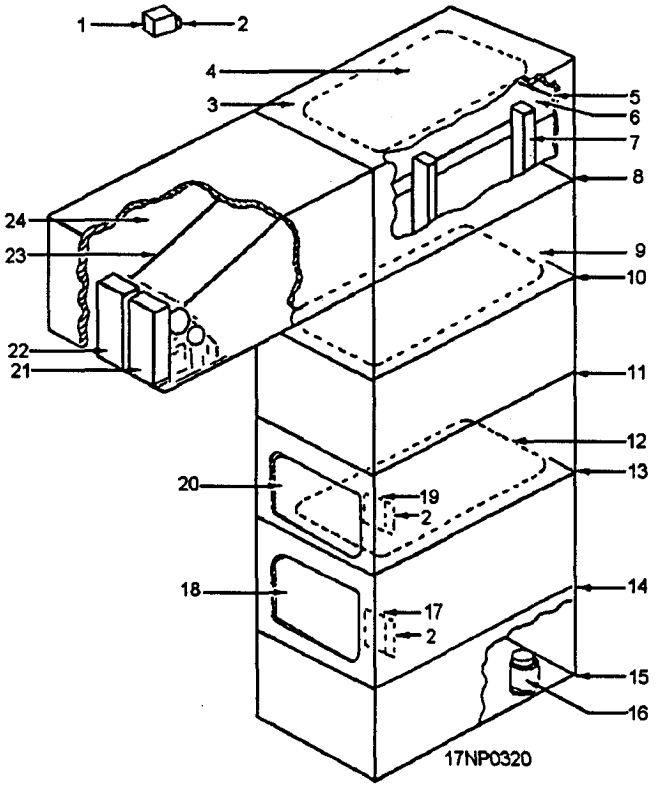
Figure 11-16.—Typical IWHS lower-stage weapons elevator.

The platform is lifted by four cables attached at the corners. The platform machinery is located at the 3rd deck level. The hatches are opened hydraulically. They are designed to automatically undog-open-latch and unlatch-close-dog. The elevator doors are also operated hydraulically.

The IWHS incorporates the following safety features:

- An overspeed governor slack-cable device
- An overspeed governor device
- A hydraulic interlock to prevent two hatches from being opened at the same time
- A hydraulic interlock to prevent hatches from closing when dogs are in the dogged position
- An electrical interlock to prevent opening a magazine door unless the platform is at that level
- An electrical interlock to prevent opening more than one magazine door at a time
- A pressure switch to prevent operation of the elevator when the hydraulic pressure is below 1,200 psi
- An electrical interlock to prevent platform high-speed travel beyond the sequence-level slowdown switch
- An electrical interlock to prevent platform travel beyond the sequence level until the main deck hatch is opened and latched
- An electrical interlock to prevent movement of the platform until the lockbars are fully retracted

In addition to the operator controllers located at each access door and the 2d deck main controller, a portable main controller may be used at the main deck level. Normally, there is one IWHS installed forward to service the forward-magazine group and one installed aft to service the aft-magazine group. These elevators support the Improved Rearming Rate Program (IRRP).



1. FLT DK control panel (gallery walkway)
2. Call signal station
3. Elevator trunk
4. FLT DK hatch
5. Flight deck
6. Elevator platform
7. Guide rail
8. 03 level
9. 02 level
10. 02 level
11. 01 level
12. Main deck hatch
13. Main deck
14. 2d deck
15. 3rd deck
16. Shock absorber
17. 2d deck control panel
18. 2d deck aft elevator door
19. Main deck aft control panel
20. Main deck aft elevator door
21. Elevator hoist motor magnetic controller
22. Elevator static control panel
23. Hoisting machine assembly
24. Machine space

Figure 11-18.—Typical upper-stage, wire-rope, weapons elevator.

wire-rope elevators. The following discussion describes the difference between upper- and lower-stage, wire-rope elevators.

The elevator trunk enclosure extends from the 3rd deck to the underside of the flight deck. Power-operated ballistic hatches in the main deck, 02 level, and flight deck allow passage of the elevator platform, and they maintain ballistic integrity within the trunk. There are power-operated doors in the trunk for elevator loading and unloading.

So the elevator platform can be raised flush with the flight deck, the wire-rope attachment points are on extensions of the platform structure, placing them below the main hoisting sheaves. An arrangement of hoisting and idler sheaves in the upper end of the elevator trunk allows the platform to be raised flush with the flight deck. Safety devices of upper-stage elevators are essentially identical to those for lower-stage elevators.

Control equipment for upper-stage elevators are essentially identical to those for lower-stage elevators. Operator control panels are located at each station served.

Weapons Elevator Maintenance and Safety

The weapons department is responsible for maintaining all weapons elevators aboard aircraft carriers. As an AO, you will perform preventive maintenance and repair elevator systems. The IWHS elevators are located close to the 5,500-pound elevators. Consequently, the same personnel are required to operate, maintain, and troubleshoot both types of elevators, even though they differ significantly in design and level of sophistication.

Although the primary responsibility of elevator maintenance rests with the AO, some maintenance procedures require the assistance of personnel within other ratings, such as Machinist Mate (MM) and Electricians Mate (EM). When this requirement exists, it is noted on the PMS card.

All electrical power requirements for the weapons handling system come from the ship's service 440-volt, three-phase, 60-hertz power supplied throughout the system. Ship's service power is converted to other ac and dc voltages by either the controllers or control panels to meet system equipment requirements.

For the safety of maintenance personnel, the tag-out and tag-in system has been established The steps within this system are standardized throughout the Navy. You should comply with your ship's tag-out procedures to ensure safety.

Ship's service sound-powered telephones are located at each operator control station. They are used to supplement weapons handling system control indicators and coordinate operations between various deck levels. An elevator must not be dispatched from one deck to another until communications between the sending operator and receiving operator have been established.

In addition to OJT, most commands require that all personnel operating elevators possess a valid operators license. The license should reflect the type(s) of elevator(s) the individual is authorized to operate. For example, an operator may be authorized to operate all elevator systems at any control station, or an individual

with less training may only be authorized to operate the 5,500-pound elevator systems at any station except the 2d deck main control station.

REVIEW NUMBER 3

Q1. What decks are serviced by lower-stage elevators?

Q2. What device is used to bridge the gap in the door opening between an elevator platform and the deck?

Q3. If an elevator suspension rope breaks, what mechanism automatically operates to lock the platform to the guide rails?

Q4. If an elevator overtravels upward beyond the maximum up-stage position, what device actuates, stopping the elevator and shutting off power to the hoisting winch?

Q5. Upper-stage elevators are used _____.

Q6. What decks are serviced by IWHS lower-stage elevators?

Q7. The platform machinery for an IWHS lower-stage elevator is located on the____ deck.

Q8. The only weapons elevators that provide access to the flight deck are the _____

Q9. The primary responsibility for maintaining weapons elevators belongs to the _____ rate.

Q10. What electrical power is required to operate the weapons elevators ?

WEAPONS MOVEMENT

The movement of ammunition consists of routine operations such as intramagazine movement (fig. 11-19) and movement of weapons and components in support of flight operations. It may also consist of major evolutions, such as ship rearmament or major loading and off-loading operations. Regardless of the size of the operation, anytime weapons or explosives are removed from their proper stowage environment, the opportunity for the occurrence of an ordnance mishap is much greater. Therefore, one of the most important factors of any ordnance evolution is preplanning. Additionally, a safety-first attitude must be paramount.

Weapons Movement in Support of Flight Operations

To enable squadron personnel to meet the short turnaround time of the flight schedule requirements, weapons must be preassembled and located in staging areas on the hangar deck with sufficient lead time.

The area of the hangar deck that is to be used as a weapons staging area must be coordinated with the hangar-deck control officer. The weapons can't interfere with the movement of aircraft or obstruct fire lanes, but they must be positioned so they are protected by the hangar-bay sprinkler system. This area should be located as close as possible to the aircraft elevator doors to provide a means for jettisoning the weapons overboard in the event of an emergency. Anytime live ordnance is staged on the hangar deck, a security watch must be posted to restrict the area to authorized personnel only and to initiate movement of the weapons in case of an emergency.

The weapons staging area on the flight deck is located outboard of the island structure and inboard of the catwalk or deck edge for aircraft carriers and behind the island on LHA and LND amphibious class ships. This area is commonly called the "bomb farm." Anytime live ordnance is present, this area is manned by the bomb-farm watch. Bomb-farm watch personnel maintain direct communication with the aviation ordnance control station (AOCS). In addition to security of the ordnance, the bomb-farm watch issues ordnance to squadron personnel according to the ship's ordnance load plan.

The bomb-farm staging area also incorporates an emergency jettison ramp. The emergency jettison ramp, when in the rigged position (down), forms a ramp from the flight deck edge to an opening in the outboard bulkhead of the catwalk. This provides a path for jettisoning weapons overboard during an emergency. Additionally, jettison ramps are located fore and aft on the port and starboard sides of the flight deck so weapons can be jettisoned by aircraft loading crews during an emergency. Be careful when the emergency jettison ramps are rigged; they bypass the catwalk and safety net. When the ramps are in the stowed (raised) position, they form part of the catwalk structure.

The bomb farm is routinely replenished with weapons from the hangar deck staging area between the launch and recovery of aircraft. The weapons are transported from the hangar deck to the flight deck by the upper-stage weapons elevators or deck-edge aircraft elevators.

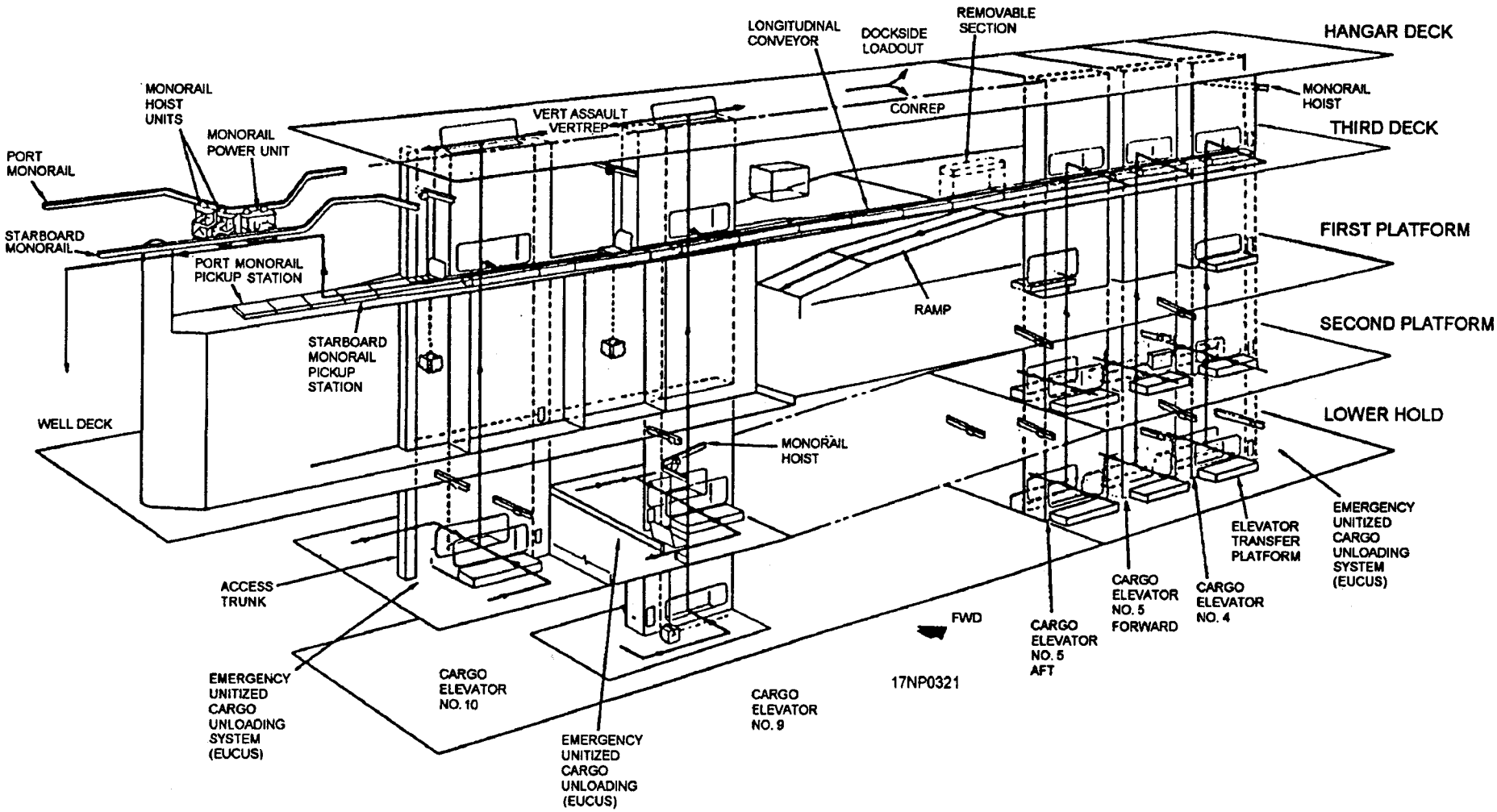


Figure 11-19.—Ammunition flow routes on an amphibious class ship (LHA-1).

Weapons Onload/Offload

There are three situations in which weapons onload or offload operations are normally conducted-pier side, offshore at anchorage, or at sea. The location of the ship during onload or offload operations affects manpower, equipment, time, and the degree of safety requirements.

PIER SIDE.— Handling large quantities of explosive munitions at piers is limited to those designated by NAVSEASYSCOM as "explosive piers." The pier area is restricted during ammunition and explosive loading and offloading operations. Nonessential personnel (visitors) aren't permitted access to the ship or pier area. All privately owned vehicles, ship's vehicles, and assigned government transportation are prohibited on a pier where ammunition is being handled. Before loading or offloading operations, the OOD is notified. The OOD makes sure that a red flag is prominently displayed to indicate that an ordnance evolution is in progress.

Pier-side ammunition handling operations are restricted to daylight hours, except in an emergency. Emergency operations can only be carried out at an adequately lighted pier. An emergency maybe dictated by the ship's sailing schedule or by NAVSEASYSCOM. Therefore, ammunition isn't staged on the pier in large quantities. Close coordination is established between the ship's weapons department and the station's weapons department to ensure that the rate of delivery at the pier doesn't exceed the handling rate of the ship's ordnancemen.

EXPLOSIVE ANCHORAGE.— At times, loading or offloading large quantities of ammunition and explosives at the pier is not practical or feasible. For example, a ship may be located at a pier that has a restricted explosive load limit due to the geographical location of other ships or occupied structures. It could

REVIEW NUMBER 3 ANSWERS TO QUESTIONS Q1. THROUGH Q10.

A1. The *2d through 7th decks are serviced by lower-stage elevators.*

A2. *A movable ramp is used to bridge the gap in the door opening between an elevator platform and the deck.*

A3. *If an elevator suspension rope breaks, a broken-rope safety device automatically operates to lock the platform to the guide rails.*

A4. *If an elevator overtravels upward beyond the maximum up-stage position, an overtravel limit switch actuates, stopping the elevator and shutting off power to the hoisting winch.*

A5. *Upper-stage elevators are used to transport weapons between the 2d and main decks.*

A6. *The 7th through the main decks are serviced by IWHS lower-stage elevators.*

A7. *The platform machinery for an IWHS lower-stage' elevator is located on the 3rd deck.*

A8. *The only weapons elevators that provide access to the flight deck are the upper-stage, wire-rope elevators.*

A9. *The primary responsibility for maintaining weapons elevators belongs to the AO rate.*

A10. *The electrical power required to operate the weapons elevators is 440-volt, three-phase, 60-Hz power.*

also be due to the geographical location of shore-based, ammunition-handling facilities. For example, an aircraft carrier may be docked in Norfolk, Virginia, and the activity receiving or issuing the ammunition maybe located in Charleston, South Carolina. In this situation, the most practical method would be to locate the aircraft carrier at a designated explosive anchorage (commonly called whiskey anchorage) and transport the ordnance by lighters and/or barges. The transfer of ammunition between the ship and the lighters/barges is normally accomplished by the use of a floating crane.

Even though a ship is located at an explosive anchorage, transferring ammunition is restricted to daylight hours. Normally, the ship remains at anchorage until the entire evolution is completed, which may vary from 1 to 5 days.

TRANSFER OF AMMUNITION AT SEA.— The transfer of ammunition at sea (underway) presents problems not met by pier-side or anchorage operations. Normally, replenishment at sea involves the transfer of fuel, supplies, stores, and ammunition simultaneously. Obviously, available deck space, available handling equipment, and manpower are used to the maximum efficiency. Every detail of the entire operation is preplanned and coordinated between the departments involved within the ship and the individuals within the departments.

The transfer of ammunition at sea is accomplished by conventional replenishment (CONREP) and/or vertical replenishment (VERTREP) methods. The CONREP method consists basically of a steel cable rigged between the supply ship and the receiving ship at the hangar-decklevel. These points of contact are called "conning stations," and there may be more than one conning station in operation at the same time. Cargo is attached to the cable by using approved handling equipment and conveyed from one ship to the other. The AO is only responsible for ammunition items. You position each ammunition load at the conning station for transfer. As the ammunition loads are received at the conning station, you move the load to a designated staging area until it is struck below. The operation of conning equipment is normally performed by the ship's deck department.

In the VERTREP method, helicopters using slings and/or cargo nets transfer the ammunition to or from the supply ship. VERTREP operations are conducted on the flight deck. Aviation ordnancemen are responsible for handling all ammunition and preparing and positioning empty slings and ammunition details for transfer to the supply ship. Ammunition is transferred from the flight deck to the hangar deck by a designated aircraft elevator. This elevator is normally on the port side when CONREP and VERTREP operations are being conducted simultaneously.

REVIEW NUMBER 4

Q1. The *weapons staging area on the flight deck, located between the island and the starboard catwalks, is known as the* _____.

Q2. *Under what conditions is a pier-side weapons movement of ammunition loaded onto an aircraft carrier?*

Q3. *List the methods used to transfer ammunition at sea.*

Q4. *When VERTREP is being used to transfer ammunition between ships, transfer is accomplished by* _____.

HAZARDS OF ELECTROMAGNETIC RADIATION TO ORDNANCE (HERO)

LEARNING OBJECTIVE: *Recognize HERO classification standards. Identify HERO hazards. Identify the uses of the emission control (EMCON) bill.*

The functional characteristics of electrically initiated ordnance cause hazards of electromagnetic radiation to ordnance (HERO). Ordnance that presents a HERO problem include cartridges, cartridge-actuated devices, and 20-mm ammunition. The ordnance electroexplosive devices (EEDs) may be accidentally initiated or their performance degraded by exposure to radio frequency (RF) environments. Ordnance is more susceptible to RF environments during assembly, disassembly, handling, loading, and unloading operations.

The term *RADHAZ* (radiation hazards) applies to radio frequency (RF) electromagnetic fields of sufficient intensity to

- produce harmful biological effects in humans, and/or
- cause spark ignition of volatile combustibles or actuate electroexplosive devices.

Although the effects of RADHAZ are important, this chapter limits discussion to HERO hazards.

HERO ORDNANCE CLASSIFICATIONS

The susceptibility of ordnance to RF environments is determined by a testing program sponsored by the Naval Sea Systems Command (NAVSEASYSCOM). Tests are conducted in the maximum RF environment the ammunition or ordnance systems maybe subjected to in its stockpile-to-launch sequence. This data is the basis for the three HERO classifications assigned to ordnance-HERO-safe ordnance, HERO-susceptible ordnance, and HERO-unsafe ordnance.

HERO-Safe Ordnance

An ordnance item is classified as **HERO safe** if it meets the following criteria:

- Percussion initiated
- Sufficiently shield protected so all EEDs contained by the item are immune to adverse effects (safe and/or reliable) when the item is used in its expected RF environments.
- General HERO requirements are observed.

HERO-Susceptible Ordnance

An ordnance item is classified as **HERO susceptible** if proved (by tests) to contain EEDs. HERO-susceptible ordnance can be adversely affected by RF energy. The safety and/or reliability of the system is in jeopardy when the system is used in its expected RF environments.

HERO-Unsafe Ordnance

An ordnance item is classified as **HERO unsafe** if it meets the following criteria:

- Its internal wiring is physically exposed
- Tests are being conducted on the item that result in additional electrical connections to the item.
- EEDs that have exposed wire leads are handled or loaded
- The item is being assembled or disassembled.
- It is disassembled

HERO EMISSION CONTROL (EMCON) BILL

Ordnance items classified as **HERO unsafe** are protected from electromagnetic radiation by putting them in a completely enclosed all-metal container.

NOTE: Ordnance in a wooden or plastic container or on a metal pallet is as exposed as if the container or pallet were not there.

HERO-unsafe ordnance should NEVER be exposed to an RF environment. However, the requirement for assembly, disassembly, handling, loading, and unloading exposes ordnance to some degree. If exposure cannot be avoided, ordnance should be exposed only in essentially RF-free designated regions, such as below deck or in RF-shielded buildings.

The commanding officer is responsible for making sure that **HERO-unsafe** ordnance is not handled in RF environments. Sometimes operational commitments require **HERO-unsafe** ordnance to be exposed to RF

REVIEW NUMBER 4 ANSWERS TO QUESTIONS Q1. THROUGH Q4.

A1. The weapons staging area on the flight deck located between the island and the starboard catwalks is known as the bomb farm.

A2. A pier-side weapons movement of ammunition loaded onto an aircraft carrier is authorized in emergency situations when authorized by NAVSEASYSCOM or to conform to the ship's sailing schedule.

A3. Conventional replenishment (CONREP) and vertical replenishment (VERTREP) are used to transfer ammunition at sea.

A4. When VERTREP is being used to transfer ammunition between ships, transfer is accomplished by helicopters using slings or cargo nets.

environments, such as the flight deck, hangar deck, or weather decks. A degree of relief from HERO RF restrictions is obtained by following the command HERO EMCON bill.

The HERO EMCON bill depends upon two factors—(1) the amount and type of ordnance that is involved, and (2) a knowledge of the RF environment at locations where presence, handling, and loading occur.

The HERO EMCON bill contains a list of all **HERO-susceptible** and **HERO-unsafe** ordnance items on board and their allowable RF environmental levels. It also includes a list of all transmitter-antenna combinations on board and their output power. By reducing or securing certain transmitter-antenna combinations, allowable RF environmental levels can be maintained

Normally, to ensure that proper conditions are met in a given ordnance-handling situation, two actions are taken;

1. All onboard transmitters are listed.
2. The action each operator is to take when a given HERO EMCON condition is set.

For example, in HERO condition 1, a transmitter operator may switch the transmitter to STANDBY. In HERO condition 2, the same operator may restrict transmission to 100 watts, or perhaps there is no transmission restriction at all.

The AO is the most important factor in avoiding a **HERO-unsafe** situation. You determine if an ordnance item is **HERO safe, HERO susceptible,** or **HERO unsafe.** Before moving a HERO-unsafe item from an RF-free environment, you must request, through strike operations or ordnance control, the proper HERO condition. You make sure that the ordnance item remains in an RF-free environment until the word has been passed that the proper HERO condition has been set.

For detailed information concerning all aspects of electromagnetic radiation hazards, refer to *Electromagnetic Radiation Hazards,* NAVSEA OP 3565/NAVAIR 16-1-529, volumes I and II.

REVIEW NUMBER 5

Q1. List the three HERO ordnance classifications.

Q2. Ordnance is HERO safe if it meets what criteria?

Q3. Name the environment to which HERO-susceptible and HERO-unsafe ordnance should not be exposed.

Q4. What is the HERO EMCON bill?

Q5. What information can you find in the local HERO EMCON bill?

SAFETY PRECAUTIONS

LEARNING OBJECTIVE: *Recognize the importance of safety precautions when working with ordnance.*

Accidents caused by explosives are prevented by preplanning, ordnance training, and carefully handling ordnance. The phrase "The life you save may be your own" is a good one, especially when you handle ordnance. It is your responsibility to make sure that safe, approved practices and procedures are used when you handle ordnance.

REVIEW NUMBER 5 ANSWERS TO QUESTIONS Q1. THROUGH Q5.

A1. The three HERO ordnance classifications are HERO safe, HERO susceptible, and HERO unsafe.

A2. HERO-safe ordnance must be percussion initiated and shielded enough so that EDDs are safe when used in RF environments.

A3. HERO-susceptible and HERO-unsafe ordnance should not be exposed to RF environments.

A4. The HERO EMCON Bill contains a degree of relief from HERO RF restrictions.

A5. The HERO EMCON Bill contains a list of all HERO-susceptible and HERO-unsafe ordnance items on board the command.

CHAPTER 12

AMMUNITION STORAGE AND HANDLING ASHORE

Ammunition storage ashore applies to the storage of explosives, ammunition, and ammunition components in two different types of environments and operational conditions. When ammunition is stored at permanently established storage locations, such as naval air stations, naval stations, or other ammunition activities, extensive safety and procedural requirements exist. However, strategic operations may necessitate the establishment of ammunition storage facilities at advanced bases. Although governing regulations exist for the storage of ammunition at advanced bases, they are not as extensive as those governing permanent storage requirements and regulations. The following text covers ammunition storage ashore and ammunition storage ashore for advanced bases.

AMMUNITION STORAGE ASHORE

LEARNING OBJECTIVE: *Identify ammunition magazines used ashore. Recognize the quantity-distance requirements. Recognize the hazards posed by various classes of ammunition. Identify storage capability groups and their use. Identify the facilities used to store ammunition at advanced bases.*

All units of the Naval Shore and Marine Corps Establishments that produce, store, ship, or otherwise handle ammunition, explosives, and other hazardous materials are under the management and control of NAVSEASYSCOM. Also, NAVSEASYSCOM manages and controls the technical aspects of assembling, maintaining, surveilling, storing, issuing, shipping, and handling ammunition, explosives, or other hazardous materials.

AMMUNITION IDENTIFICATION

Ammunition identification is an important part of ordnance handling and administration. Ammunition identification tells you the service/nonservice type of ammunition, class of explosive contained in the round, Mark (Mk) and modification (Mod) numbers, lot numbers, and color codes representing the explosive hazards.

Service Ammunition

Ammunition intended for operational use is classified as service ammunition. The warhead contains explosives, pyrotechnics, or chemical agent filler. If required, the propellant is of service or reduced charge weight. Aircraft service ammunition is identified as either armament (kill stores) or ordnance (search stores).

Nonservice Ammunition

Ammunition used for training personnel is classified as nonservice ammunition. This ammunition may be actual service (tactical) quality or may be specially modified or loaded practice ammunition, inert training, inert dummy/drill, or exercise/recoverable ammunition.

PRACTICE/TRAINING AMMUNITION.— This ammunition is designed for training, practice, or systems testing purposes. It is actually launched, fired, or dropped. It may be a modification of service ammunition designed specifically for practice. Practice ammunition may or may not contain explosive or pyrotechnic materials. Practice ammunition may be either expendable or recoverable, depending upon the device involved.

DUMMY DRILL/INERT AMMUNITION.— This ammunition is completely inert ammunition. It is used to represent the service ammunition for display purposes, testing weapons, and weapons handling operations. It is also used to develop assembly, testing, and handling proficiency of personnel without actually firing or launching the ammunition.

EXERCISE/RECOVERABLE AMMUNITION.— This is service ammunition that is functional in all respects except for the explosive payload. The payload furnishes operational data by the substitution of recoverable exercise components. Pyrotechnics, dye marker, or explosive fittings may be attached to or incorporated in the ammunition.

Table 12-1.—Ammunition Color Codes

COLOR	INTERPRETATION
Yellow	(1) Identifies high explosives. (2) Indicates the presence of explosive, either, (a) sufficient to cause the ammunition to function as a high explosive, or (b) particularly hazardous to the user.
Brown	(1) Identifies rocket motors. (2) Indicates the presence of explosive, either, (a) sufficient to cause the ammunition to function as a low explosive, or (b) particularly hazardous to the user.
*Gray	(1) Identifies ammunition that contains irritant or toxic agents when used as an overall body color except for underwater ordnance.
Gray with Red Band(s)	(1) Indicates the ammunition contains an irritant (harassing) agent.
Gray with Dark Green Band(s)	(1) Indicates the ammunition contains a toxic agent.
*Black	(1) Identifies armor-defeating ammunition, except on underwater ordnance.
Silver/Aluminum	(1) Identifies countermeasures ammunition.
Light Green	(1) Identifies smoke or marker ammunition.
Light Red	(1) Identifies incendiary ammunition or indicates the presence of highly flammable material.
*White	(1) Indicates illuminating ammunition or ammunition producing a colored light; exceptions, underwater ordnance, guided missiles, and rocket motors.
Light Blue	(1) Identifies ammunition used for training or firing practice.
*Orange	(1) Identifies ammunition used for tracking or recovery.
Bronze	(1) Identifies Dummy/Drill/Inert ammunition used for handling and loading training.
Nonsignificant Colors	
Olive Drab	(1) All ammunition items.
Black	(1) For lettering.
White	(1) For lettering. (2) For guided missiles and rocket motors.

*NOTES: The following colors when applied as stated have NO identification color coding significance:

a. The colors GRAY, ORANGE, BLACK, WHITE, BRICK RED OR GREEN on underwater ordnance, such as mines and torpedoes, and the color WHITE on guided missiles or rocket motors.

b. The colors BLACK and WHITE when used for lettering.

c. The color WHITE when used in diamond shaped figures on ammunition.

Painting

Painting (table 12-1) is the application of the final body coating to ammunition, ammunition components, or ammunition containers by authorized activities. Usually, paint color identifies the use or explosive hazards of the ammunition; however, sometimes it has no meaning.

Marking

Marking is the application of colored spots, bands, or symbols on ammunition, ammunition components, or ammunition containers. Markings, by their color or shape, identify ammunition fillers or the presence of specific ammunition components.

Chemical filler ammunition, ammunition components, and ammunition containers are identified by bands that are color coded (table 12-1). Chemical fillers are identified by marking symbols placed on a line parallel to the colored bands.

Lettering

Lettering is the use of letters, words, abbreviations, or numerals on ammunition, ammunition components, or ammunition containers. Lettering is put on ammunition by die stamping, stenciling, decals, etching, or rubber stamping. Lettering identities the type, mark and modification, ammunition lot number, and loading information of the ammunition item. Lettering applied in black or white has no color-code significance.

Mark and Modification Designation

The Mk number is an Arabic numeral and represents a basic design. It is followed by a modification (Mod) number to represent a less than major change in design. For example, the mark/modification number assigned to a general-purpose bomb without a change to the basic design is Mk 82 Mod 0. If a minor change to the basic design is incorporated, it is designated as Mk 82 Mod 1, If further changes are incorporated, the modification designations are assigned in sequence, Mod 2, Mod 3, Mod 4, and so forth.

Some explosive devices and ordnance or armament (such as cluster weapons and bomblets used in cluster weapons) are designated by groups of letters and numbers. An example of this type designation is BLU-99-A-T-1B or BLU-7A/B (table 12-2). Other letter-type designators, such as BRU, SUU, FAE, etc., are discussed in other chapters of this TRAMAN.

Table 12-2.—Item Identification Designations for Cluster Munitions

Item Identification	BL
Unit	U
Model Number	99
Modification	A
Trainer-Dummy	T-1
Installation	B
Bomb or Mine	BLU
Seventh Model and First Modification	7A
Unit Must Be Expended on Mission	/B

U.S. Army ammunition retains the Army identifier that uses a letter, numeral, and letter and numeral system. For example, the model is designated M23. The first modification of this model is designated M23A1, and subsequent modifications are designated by M23A2, M23A3, etc. If an item was jointly developed by the Navy and Army, the model identifying designation is preceded by the letters AN (Army/Navy). For example, a model is designated AN-M173. The first modification of this model is designated AN-M173A1. Later modifications are designated as AN-M173A2, AN-M173A3, etc.

Department of Defense Identification Code (DODIC) and Navy Ammunition Logistic Code (NALC)

The Department of Defense Information Code (DODIC) is a four-digit code assigned by the Defense Logistics Services Center (DLSC). It identifies ammunition and explosive items (nonnuclear) within the supply system applicable to all the armed forces. The Navy Ammunition Logistic Code (NALC) is a four-digit code assigned by Ships Parts Control Center (SPCC). It identifies Navy-unique items of ordnance.

The DODIC and NALC are interchangeable terms and are included as part of the letter identification contained on ammunition and ammunition components. These codes are used specifically for logistic control and ammunition administration.

If an ammunition item or ammunition component has been modified, a DODIC/NALC code is assigned to the modified item. For example, Mk 105 Mod 0 is assigned code A811 and Mk 105 Mod 1 is assigned code A894. A complete listing of DODICs and NALCs is

contained in *Navy Ammunition Logistics Codes,* NAVAIR 11-1-116B/TW010-AA-ORD-030.

Ammunition Lot Number

An *ammunition lot* is a quantity of ammunition assembled from uniform components under similar conditions. A lot is expected to function in a uniform manner. Each ammunition lot (table 12-3) is assigned a code number (ammunition lot number) that identifies all ammunition items assembled as part of that lot. For specific ammunition lot numbers, you should refer to *Identification of Ammunition,* NAVSEA OP 2238/ NAVAIR 11-1-117.

Table 12-3.—Derivation of Lot Number

KEY	DEFINITION
a	Lot sequence number
b	Manufacturer's identification symbol
c	Month of production (two digit)
d	Year of production (two digit)
e	Month of production (single alpha) JAN—A MAY—E SEP—J FEB—B JUN—F OCT—K MAR—C JUL—G NOV—L APR—D AUG—H DEC—M
f	Interfix number
g	Lot suffix (alpha)

Example:

Lot Number,

Method 1:	11	ABC		0588
Key:	(a)	(b)		(c) (d)

(Note that (c) and (d) will be used to compute service life.)

Example:

Lot Number,

Method 2:	XYE	88	E	001-011A
Key:	(b)	(d)	(e)	(f) (a) (g)

(Note that (d) and (e) will be used to compute service life.)

MAGAZINES

Explosives and ammunition are stowed in magazines or areas designated for the specific materials. NAVSEASYSCOM designs and designates all magazines or storage areas. The type and amount of material that may be stowed in any magazine depends on the type of magazine in relation to the quantity-distance requirements.

Types of Magazines

Magazines located at naval air stations and other naval installations are of various sizes, types of construction, and classes, depending upon the nature of the material to be stowed. Magazines are designated as high-explosive magazines, smokeless-powder magazines, and ready-service magazines according to their intended use. Magazines are further classified by type of design—surface, subsurface, arch-type, earth-covered, or barricaded.

Recently designed magazines used to store smokeless powder, pyrotechnics, loaded projectiles, fixed ammunition, small-arms ammunition, and other fire or missile hazard materials are of two general types-the rectangular, earth-covered magazine and the concrete, triple-arch, earth-covered magazine.

1. The rectangular, earth-covered magazine (50 feet by 100 feet) is constructed of reinforced concrete throughout.

2. The concrete, triple-arch, earth-covered magazine has three arches. The combined arches make up a single magazine; however, each arch is separated by a minimum of 10 feet at the door, and the space is filled with dirt. The standard floor size of each arch in the triple-arch construction is 25 feet by 80 feet. Each of the three arches maybe used for a different type of compatible material.

Magazines constructed since 1928 that are used for storing high-explosive, bomb-type ammunition, and other explosive hazard materials are made of reinforced concrete, single-arch, earth-covered type construction, and they are barricaded at the entrance end. These magazines have been constructed in three sizes:

1. The 25 feet by 50 feet and the 25 feet by 40 feet sizes are suitable for the stowage of 250,000 pounds net weight of explosives.

2. The 25 feet by 80 feet size is suitable for the stowage of 500,000 pounds net weight of explosives.

Additionally, the following miscellaneous types of magazines may be found at certain establishments.

KEYPORT. The keyport magazine is earth-covered and arch-shaped with a prefabricated concrete construction. It has interior floor dimensions of 6 feet by 8 feet 8 inches. The height of the arch is approximately 6 feet.

BOX. A box magazine is of concrete construction, rectangular shape, and normally measures 12 feet by 17 feet.

CORBETTA. A corbetta magazine is of concrete construction and is shaped like a beehive or dome.

GALLERY. A gallery magazine is a tunnel or cave, and the dimensions will vary.

MISCELLANEOUS OR NONSTANDARD. The physical dimensions of the miscellaneous or nonstandard magazine depend on the type of stowed material and the location of the magazine.

OPEN STORAGE (REVETTED). The type and amount of explosives stowed in open stowage (revetted) depend on the size and location of the storage area.

Quantity-Distance (Q-D) Requirements

Quantity-distance (Q-D) requirements apply to the concentration of ammunition, explosives, and other hazardous materials at Naval Shore Establishments for development; manufacturing; test and maintenance; storage, loading and off-loading of vehicles, railcars and aircraft; disposal; and all related handling incidents.

Quantity-distance (Q-D) requirements are based on records of actual fires and explosions involving ammunition and explosives. Q-D requirements safeguard personnel against possible serious injury or equipment destruction from possible fires or explosions. These requirements also protect the inhabitants of nearby communities, private and public property, and the Naval Shore Establishment personnel. These requirements keep the loss of valuable ammunition stores (including inert ordnance items) to a minimum if there were a fire or explosion.

The Department of Defense (DOD) Q-D hazard classification system is based on a system recommended for international use by the United Nations Organization (UNO). The UNO system has nine classes of hazardous material; but, DOD only uses three of the nine classes—Class 1, explosives; Class 2, Division 3, poison A, and Class 6, poisonous (toxic) and infectious substances. Table 12-4 identifies each of the nine classes.

Table 12-4.—United Nations Organization Hazard Classes

CLASS	TYPE OF HAZARDOUS MATERIAL
1	Ammunition and explosives, DOT Classes A, B, and C; Blasting Agents
2*	Compressed gases, flammable and nonflammable, Poison gases (Poison A)
3	Flammable liquids
4	Flammable solids or substances
5	Oxidizing materials
6*	Poisonous substances (Poison B); Irritating materials; Etiological agents
7	Radioactive materials
8	Corrosive materials
9	Miscellaneous dangerous substances (other regulated materials)

*Includes ammunition without explosive components which contain toxic chemical agents, and containers of toxic chemical agents in bulk. Formerly Q-D Class 8.

In reviewing table 12-4, you can see that some items are placed in classes other than Class 1. Since DOD uses only Class 1 items for explosives, Class 1 assignments have been made. For example, fuel-air-explosive (FAE) weapons without properly installed explosive componments belong in UNO Class 3, while WP M23 igniters belong in UNO Class 4. However, to maintain identity, DOD places these items in Class 1 for storage only until DOD implements other classes. As an AO, you are involved with the storage of Class 1 material; therefore, the information contained in this section only deals with Class 1 classifications.

DOD Hazard Class 1 is subdivided into divisions 1 through 5, based on the character and predominance of the associated hazards and the potential for causing personnel casualties or property damage. These sub-division are not based upon compatibility groups or

Table 12-5.—Hazard Class 1 Division Designators and Types of Hazards

DIVISION DESIGNATOR	TYPE OF HAZARD
1	MASS DETONATING
2	NON-MASS DETONATING, FRAGMENT PRODUCING
3	MASS FIRE
4	MODERATE FIRE, NO BLAST
5	MASS FIRE

intended use. The divisions within Class 1 and the expected hazard for each division is listed in table 12-5.

MASS-DETONATING HAZARD MATERIALS (CLASS 1, DIVISION 1).— Damage from mass-detonating hazard materials is caused by concussion or blast or by sympathetic detonation. Prescribed distances between piles of these materials and between magazines containing these materials must be maintained to minimize the possibility of sympathetic detonation or propagation. Ammunition and explosives that are considered mass-detonating hazards are Hazard Class 1, Division 1.

NON-MASS-DETONATING HAZARD, FRAGMENT-PRODUCING MATERIALS (CLASS 1, DIVISION 2).— The principal hazards for items within this division are fragment and blast, either individually or in combination, depending on such factors as storage configuration, type of packing, and quantity. The designated minimum distances are based upon the limited range of fragments. These are the distances that must be used for protection of inhabited buildings and public traffic routes. Since fragment-producing materials can be grouped according to the range of the fragments produced, four fragment distance categories have been established. This permits flexibility of storage. Most fragments produced by incidents in this division will fall within one of four specified minimum distances—400, 800, 1,200, and 1,800 feet.

MASS FIRE HAZARD MATERIALS (CLASS 1, DIVISION 3).— Items in this division burn vigorously. There is little or no possibility for extinguishing them in a storage situation. Normally, explosions will be confined to pressure ruptures of containers and will not produce propagating shock waves or damaging blast overpressure beyond specified distances. A severe fire may result from the tossing about of burning container materials, propellant, or other flaming debris. Toxic effects, such as burning pyrotechnic items, will not normally extend beyond the inhabited building distances specified for this division.

MODERATE FIRE HAZARD, NO BLAST MATERIALS (CLASS 1, DIVISION 4).— Items in this division present a fire hazard with no blast hazard and virtually no fragmentation or toxic hazard beyond the fire hazard clearance specified for high-risk materials. However, separate facilities for storage and handling of this division should not be less than 100 feet from other facilities. However, if the facilities are of fire-resistive construction, they may be 50 feet from each other. If devices containing explosives are such that accidental ignition during storage or transport will not cause external damage to the devices, either by fire, smoke, heat, loud noise, or by visible damage to the outer packaging, they are not considered Class 1 items. These devices may be considered inert for storage purposes and marked AMMUNITION NON-EXPLOSIVE for transport purposes.

Certain articles within the division that contain one ounce or less of explosives have (based on test results) been classified as Class 1, Division 4S. These articles may be considered inert for storage purposes, and they are not subject to explosive transportation regulations. Articles containing larger quantities of explosives, also classified as Class 1, Division 4S, may be considered inert for storage purposes. However, they must be reviewed on an individual basis to determine whether explosive transportation regulations are applicable.

VERY INSENSITIVE EXPLOSIVE ITEM MATERIALS (CLASS 1, DIVISION 5).— Items in this division are considered very insensitive when not stored or transported with other Class 1 materials. DOD considers these items to be the same as Class 1, Division 1, Compatibility Group D. There is very little probability of accidental explosion or transition from deflagration to detonation. The materials within this division are shipped as Q-D Hazard Class 1, Division 5. They are stored as Class 1, Division 1, Compatibility Group D.

Normally, technical manuals do not present the hazard class, division, and compatibility group as they are written in previous paragraphs. For example, an item classified as Class 1, Division 5, Compatibility Group D, is written as Class 1.5D; or for an item in Class 1, Division 4, Compatibility Group S is written as Class 1.4S.

Figure 12-1 shows Q-D information about Class 1.1 items. As you read this paragraph, refer to figure 12-1. Col 1 and Col 2 list the minimum and maximum

NEW		Distance in Feet to Inhabited Building From			Distance in Feet to Public Traffic Route From		
Over	Not Over	Standard Earth-Covered Magazine[4]		Other PES	Standard Earth-Covered Magazine[4]		Other PES
		Front or Side	Rear		Front or Side	Rear	
Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7	Col 8
0	1	35	25	40	21	15	24
1	2	44	32	50	26	19	30
2	5	60	43	69	36	26	40
5	10	75	54	87	45	32	52
10	20	95	68	110	57	41	65
20	30	110	78	125	65	47	75
30	40	120	86	140	72	51	83
40	50[3]	130	92	150	77	55	89
50	100	160	115	190	97	70	115
100	200	205	145	235	125	88	140
200	300	235	165	270	140	100	160
300	400	260	185	295	155	110	175
400	500	280	200	320	165	120	190
500	600	295	210	340	175	125	205
600	700	310	220	355	185	135	215
700	800	325	230	375	195	140	225
800	900	340	240	390	205	145	235
900	1,000	350	250	400	210	150	240
1,000	1,500	400	285	460	240	170	275
1,500	2,000	440	315	505	265	190	305
2,000	3,000	505	360	580	305	215	350
3,000	4,000	555	395	635	335	240	380
4,000	5,000	600	430	685	360	255	410
5,000	6,000	635	455	730	380	275	440
6,000	7,000	670	480	770	400	285	460
7,000	8,000	700	500	800	420	300	480
8,000	9,000	730	520	835	435	310	500
9,000	10,000	755	540	865	450	325	520
10,000	15,000	865	615	990	520	370	595
15,000	20,000	950	680	1,090	570	405	655
20,000	25,000	1,025	730	1,170	615	440	700
25,000	30,000	1,085	775	1,250	650	465	745
30,000	35,000	1,145	820	1,310	685	490	785
35,000	40,000	1,195	855	1,370	720	515	820
40,000	45,000	1,245	890	1,425	745	535	855
45,000	50,000	1,290	920	1,475	775	555	885
50,000	55,000	1,330	950	1,520	800	570	910
55,000	60,000	1,370	980	1,565	820	585	940
60,000	65,000	1,405	1,005	1,610	845	605	965

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Figure 12-1.—Quantity-distance requirements for Class 1, division 1 items (example).

(respectively) net explosive weight to be stowed. For example, if you are stowing Class 1 Division 1 explosives with a net explosive weight of 13,000 pounds, you find the minimum net explosive weight in Col 1 (10,000 pounds) and the maximum net explosive weight in Col 2 (15,000 pounds); then, read horizontally across the page to obtain the distance requirements. Columns 3, 4, and 5 list the minimum distance, in feet, from the storage site (in this case a standard earth-covered magazine) to an inhabited building. If the net explosive weight is 13,000 pounds, the minimum distance from the front or side of the magazine to the closest inhabited building is 865 feet (Col 3). The minimum distance from the rear of the magazine to an inhabited building is 615 feet (Col 4). The minimum distance from the magazine to other potential explosive sites (PES) is 900 feet. Columns 6, 7, and 8 list the minimum distance, in feet, from the magazine to public traffic routes. It is read in the same manner as Columns 3, 4, and 5.

The Q-D hazard requirements do not apply to ammunition and explosives while in transit. Ammunition and explosives in transit are regulated by the Department of Transportation (DOT). The Q-D hazard classifications do not necessarily mean that all ammunition and explosives within a classification can be stowed in the same magazine. All ammunition and explosives listed as Class 1, Division 1 explosives may not be compatible when stowed together. For example, assembled HE rockets and GP bombs are classified as Class 1, Division 1 explosives, but they aren't

compatible when stored together. NAVSEA OP 5, volume 2, contains a listing, by DOD Q-D hazard class, of naval ammunition and explosives.

Storage Compatibility Groups

Ammunition and explosives are assigned to one of twelve storage compatibility groups (A through H, J, K, L, and S).

GROUP A. Group A items are initiating explosives. These are bulk initiating explosives that have the necessary sensitivity to heat, friction, or percussion to make them suitable for use as initiating elements in an explosive train. Wet lead oxide, wet lead styphnate, wet mercury fulminate, wet tetracene, dry RDX, and dry PETN are examples of initiating explosives.

GROUP B. Group B items are detonators and similar initiating devices. These are items containing explosives that are designed to initiate or continue the functioning of an explosive train. Detonators, blasting caps, small arms primers, and fuzes without two or more safing features are examples of Group B items.

GROUP C. Group C items are bulk solid propellants, propelling charges, devices containing propellant with or without a means of ignition, and items that will deflagrate, explode or detonate upon initiation. Examples of Group C items are single-, double-, and triple-base propellants, composite propellants, rocket motors (solid propellant), and ammunition with inert projectiles.

GROUP D. Group D items are black powder, high explosives (HE), ammunition containing HE without its own means of initiation and without propelling charges, and fuzes with two or more safing features. This group includes ammunition and explosives that may explode or detonate when any given item or component is initiated. Also included in this group is ammunition with an initiating device that is packaged to eliminate the risk of ammunition detonation if accidental functioning of the initiating device occurs. The initiating function is confined within the package unless the package has been degraded by fire. In this case, all blast or projection effects are limited to the extent that they will not significantly hinder fire fighting. Examples of these items are thermal batteries, explosive switches or valves, and other ammunition items packaged to meet the criteria established for this group.

GROUP E. Group E items are ammunition that contains HE without its own means of initiation with a propulsive charge (other than one containing a flammable or hyperbolic liquid). Examples of these items are artillery ammunition, rockets, and guided missiles.

GROUP F. Group F items are HE ammunition with means of initiation other than described in Group D, with a propelling charge (other than one containing a flammable or hyperbolic liquid) or without a propelling charge. This group includes HE ammunition or devices (fuzed) with or without propelling charges. Examples are items initiated by means of a bouchon firing device, grenades, sounding devices, and similar items that have an in-line explosive train in the initiator.

GROUP G. Group G items are fireworks, and illuminating, incendiary, smoke (including HC) or tear-producing munitions other than those munitions that are water activated or contain white phosphorus, flammable liquid or gel. This group includes ammunition that, upon functioning, results in an incendiary, illumination, lachrymatory, smoke, or sound effect. Examples of these items are flares, signals, incendiary or illuminating ammunition, and other smoke or tear-producing devices.

GROUP H. Group H items contain explosives and white phosphorus or other pyrophoric material. Ammunition in this group contains a filler, which is spontaneously flammable when exposed to the atmosphere. Examples of these items are white phosphorus (WP), white phosphorus plasticized (PWP), or other ammunition containing pyrophoric material.

GROUP J. Ammunition in this group contains both explosives and flammable liquids or gels. This ammunition contains flammable liquids or gels other than those that are spontaneously flammable when exposed to water or to the atmosphere. Examples of these items are liquid- or gel-filled incendiary ammunition, fuel air explosive (FAE) devices, flammable-fueled missiles and torpedoes.

GROUP K. Ammunition in group K contains both explosives and toxic chemical agents. Ammunition in this group contains chemicals specifically designed for incapacitating effects that are more severe than lachrymation. Examples of these items are artillery or mortar ammunition (fuzed or unfuzed), grenades, and rockets or bombs filled with a lethal or incapacitating chemical agent.

GROUP L. Ammunition in Group L is not included in other compatibility groups. Ammunition in this group has characteristics that don't permit storage with other types of ammunition, explosives, or dissimilar ammunition within this group. Examples of these items are water-activated devices, prepackaged hyperbolic liquid-fueled rocket engines, certain fuel-air-explosive (FAE) devices, TPA (thickened TEA), and damaged or

suspect ammunition of any other group. Types of ammunition having similar hazards can be stored together but cannot be mixed with other groups.

GROUP S. Ammunition in this group presents no significant hazard. It is designed or packed so all the accidental functioning hazards are confined within the package, unless the package has been degraded by fire. In this case, all blast or projection effects are limited to the extent they will not significantly hinder fire-fighting operations. Examples of these items are thermal batteries, explosive switches or valves, and other ammunition items that are packaged to meet the criteria established for this group.

Ammunition and explosives are assigned to compatibility groups. When stored within their assigned group, ammunition and explosives can be stored together without significantly increasing either the probability of an accident or, for a given quantity, the magnitude of the effects of such an accident. The mixing of storage compatibility groups is permitted by NAVSEASYSCOM, as shown in figure 12-2. The mixing of storage compatibility groups other than those

GROUPS	A	B	C	D	E	F	G	H	J	K	L	S
A	X	Z										Z
B	Z	X										X
C			X	Z	Z		Z					X
D			Z	X	X							X
E			Z	X	X							X
F						X						X
G			Z				X					X
H								X				X
J									X			X
K										Z		
L												
S	Z	X	X	X	X	X	X	X	X			X

NOTES:

1. The marking "X" at an intersection of the above chart indicates that these groups may be combined in storage. Otherwise, mixing is either prohibited or restricted per note 2 below.
2. The marking "Z" at an intersection of the above chart indicates that, when warranted by operational considerations or magazine non-availability, and when safety is not sacrificed, logical mixed storage of limited quantities of some items of different groups may be combined in storage as approved by NAVSEASYSCOM. Approval is not to be considered a waiver. Combinations that violate the principles of paragraph 2-3.3 require justification by a waiver or exemption. Examples of acceptable combinations of Class 1 are:
   a. Division 1, Group C bulk propellants with Division 1 bulk HE
   b. Division 1, Group C rocket motors with Division 1, Group D bombs (HE) without their own means of initiation.
   c. Group C rocket motors with Group E complete rocket systems having the same rocket motor.
   d. Division 3 Group C bulk propellants or bagged propelling charges with Division 3, Group G pyrotechnics without their own means of initiation.
3. Equal numbers of separately packaged components of complete rounds of any single type of ammunition may be stored together. When so stored, compatibility is that of the assembled round, i.e., WP filler in Group H, HE filler in groups D, E, or F, as appropriate.
4. Ammunition designated "Practice" by NSN and nomenclature may be stored with the fully loaded ammunition it simulates.
5. Mixing of compatibility groups (except items in groups A, B, & L) in limited quantities is authorized by NAVSEASYSCOM. Such mixed storage is not to exceed a total of 1,000 pounds net explosive weight and will be considered as the highest hazard division included.
6. Group K requires not only separate storage from other groups, but may also require separate storage within the group. NAVSEASYSCOM shall determine which items in group K may be stored together and those which may be stored separately.
7. Ammunition items without explosives which contain substances properly belonging to another hazard class may be assigned to the same compatibility group as items containing explosives and the same substance, and be stored with them.

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Figure 12-2.—Storage compatibility mixture chart.

shown in figure 12-2 must be approved by NAVSEASYSCOM.

IDENTIFICATION OF FACILITIES

Buildings and magazines, including open storage sites that contain ammunition, explosives, or chemical and inert components, are marked according to a standard system of identification so you can rapidly identify the hazards associated with their contents. This identification and numbering system is used in addition to any other numbers on the buildings. These standard identification markings are stamped out over other markings, if present. The standard identification system consists of the magazine designator and the symbol indicator.

The magazine designator is a three-group symbol, composed of numbers and letters. It identifies a magazine by location of the magazine group, the number of the magazine within the group, and the type of magazine construction. The magazine group number, the type of magazine and capacity letter(s), and the magazine sequence number form the three-group symbol that makes up the magazine designator.

Magazine Group Number

The magazine group number is the first number of the magazine designator symbol. It shows the magazine group in which the magazine is located Each physically separated group of magazines or, at smaller stations, each noncontiguous magazine area is assigned a number, making it easy to rapidly and easily identify the group. The group numbers begin with 1 and continue in ascending numerical order. If only one magazine group exists, the number 1 is used. For example, the numeral 4 in the first position of the magazine designator 4XTX4 indicates that this magazine is located within magazine group 4.

Magazine Type and Capacity Letter(s)

The magazine type and capacity letter(s) shows the type and capacity of the magazine. For this reason, magazines of certain sizes are assigned a letter

Table 12-6.—Magazine Designators for Mass Detonating Hazard of High Explosives (Bulk, Depth Charges, Mines, Warheads, Bombs, etc.), Fuzes, Detonators, Exploders, and Black Powder

DIMENSIONS (nominal)	NORMAL USE	NORMAL EXPLOSIVE LIMIT	LETTER DESIGNATOR
25′ × 80′ arch type (igloo)	High explosives	500,000 lb	A
25′ × 50′ arch type (igloo)	High explosives	250,000 lb	B
25′ × 40′ arch type (igloo)	High explosives	250,000 lb	B
39′ × 44′ or 32′ × 44′ (warhead type)	High explosives	500,000 lb	W
12′ × 17′ (box type)	Black powder	20,000 lb	E
Miscellaneous or nonstandard size	High explosives	Dependent upon size, location, construction	X
Open storage (revetted)	High explosives	Dependent upon size, location	R
25′ × 20′ arch type (igloo)	Fuze and detonator	70,000 lb	F
52′ dome (Corbetta type)	High explosives	500,000 lb	D
Dimensions vary (gallery or tunnel type)	High explosives	250,000 lb	G
10′ × 14′	Fuze and detonator	15,000 lb	H
10′ × 7′	Fuze and detonator	7,500 lb	H
6′ × 8′8″ (Keyport type)	High explosives	4,000 lb	K

Table 12-7.—Magazine Designators for Fire Hazard of Powder (Bulk or Semifixed Ammunition), Pyrotechnics, Ignition Fuzes and Primers, Small Arms, Smoke Drums, and Explosive-Loaded Chemical Ammunition

DIMENSIONS (nominal)	NORMAL EXPLOSIVE LIMIT	LETTER DESIGNATOR
50′ × 100′	1,000,000 lb	L
25′ × 80′ triple-arch	1,000,000 lb	L
52′ dome (Corbetta type)	1,000,000 lb	D
50′ × 60′	300,000 lb	M
30′ × 50′	125,000 lb	N
25′ × 48′	125,000 lb	N
25′ × 40′	125,000 lb	N
Miscellaneous or nonstandard size	Dependent upon location, size, and construction	Y

Table 12-8.—Magazine Designators for Fragment Hazard of Projectile and Fixed Ammunition

DIMENSIONS (nominal)	MAXIMUM EXPLOSIVE LIMIT	LETTER DESIGNATOR
50′ × 100′	500,000 lb	P
25′ × 80′ triple-arch	500,000 lb (total for three arches)	P
25′ dome (Corbetta type)	500,000 lb	D
Miscellaneous or nonstandard size	150,000 lb	Z

designation as indicated in tables 12-6, 12-7, 12-8, and 12-9. To show the type of magazine, for example, the letter T is added if the magazine is earth-covered and barricaded If the magazine is earth-covered but not barricaded, the letter C is added. If the magazine is not earth-covered but is barricaded, the letter S is added. Therefore, in the magazine designator 4XTX4, the letter *X* in the second position indicates that the magazine size is miscellaneous or nonstandard, and it is normally used for storing high explosives. Also, the normal explosive storage limit depends on the magazine's size, location, and type of construction.

The explosive limits contained in tables 12-4 through 12-7 are maximum capacities, They are based on magazine design and construction characteristics. These limits are further subject to the Q-D considerations discussed previously. Additional limitations are shown in the magazine designator. When the Q-D relationship, as indicated in the tables, doesn't permit using the explosive capacity design of a standard magazine because of insufficient separating distances, the letter X, Y, or Z is added to the designator. These letters indicate the magazine contains mass detonation hazards, mass fire hazards, or fragment-producing hazards, respectively. For example, in the magazine

Table 12-9.—Magazine Designators for Miscellaneous Magazines

DIMENSIONS (nominal)	TYPE	LETTER DESIGNATOR
	All inert storehouses	SH

designator 4XTX4, the letter *X* in the fourth position tells you that the magazine doesn't have a sufficient separating distance from other structures or magazines,

Before 1985, naval facilities used to store or maintain ammunition or explosives used a standard two-part system of identification-a color-hazard indicator and a magazine designator. **The color hazard indicator has been replaced by a system of fire, chemical hazard, and fire-fighting direction symbols.** When possible, mount placards at locations that are visible for a minimum distance of 500 feet in the daytime. Placards are placed on the road at distances of not less than 500 feet to indicate the magazine contents. This is required when visibility is obstructed by vegetation or curves in the road, When the contents of the magazine are changed or removed, the placards are also changed or removed. These placards are displayed to help fire fighters identify, from a safe distance, the type of hazards involved so they can determine the types of equipment and procedures to use.

REVIEW NUMBER 1

Q1. Mandatory regulations governing the storage of ammunition ashore are found in _____.

Q2. What prefabricated, concrete-constructed magazine is earth-covered and arch-shaped?

Q3. What is the normal size of a box-type magazine?

Q4. What concrete-constructed magazine is shaped like a beehive or dome?

Q5. What magazine type consists of a tunnel or cave that has varied dimensions?

Q6. WP-M23 igniters belong is what ordnance class?

Q7. How many subdivisions are contained in DOD Hazard Class 1?

Q8. What type of items are contained in storage compatibility Group B?

Q9. Black powder belongs in compatibility storage group____.

Q10. What type of ammunition is found in compatibility Group S?

Q11. The first number in a magazine designator symbol shows the _____.

Q12. The letter T in the third position of a magazine designator indicates that the _____.

AMMUNITION STORAGE ASHORE FOR ADVANCED BASES

LEARNING OBJECTIVE: *Identify ammunition storage ashore for advanced bases to include facilities, magazines, and handling requirements,*

Advanced base is the general term for a temporary base that is in or near a forward area outside the zone of the interior. The primary mission of an advanced base is to support wartime operations of the armed forces. Advanced bases are established to perform one or more of the following functions: to hold threatened strategic areas; to protect, or be part of, a line of communications and supply; to serve as a base for direct offensive operations; or to serve as a base for mounting or supporting further offensives.

If a valid reason for not complying with storage and handling regulations/instructions at advanced bases is not contained in NAVSEA OP 5, volumes 1 and 2, you need to refer to *Ammunition Ashore,* NAVSEA OP 5, volume 3.

AMMUNITION STORING AND HANDLING FACILITIES

When you establish an advanced base, divide the storing and handling facilities into areas. These areas should correspond to the functions required by the mission of the base, to make ordnance handling operations easier and smoother, and to isolate hazards. Areas at advanced bases are designated as magazine, renovation, disposal, pier, enemy ammunition, and administration and personnel areas. These areas are discussed briefly in the following paragraphs.

Magazine Areas. Provide two or more magazine or storage areas for each advanced base. This allows you to disperse ammunition stows, and makes it easier to receive and issue ammunition. The primary objective in dispersing ammunition is to prevent the complete loss of a single type of ammunition because of fire, accidental explosion, or hostile action. Ample provision should be made for expansion during the initial planning of magazine areas.

Renovation Areas. Some ammunition received at advanced bases would become unserviceable if it were improperly handled or exposed to the elements. This would make it require renovation. Since renovation operations may be performed at advanced bases, a suitable area must be provided for segregation, exterior maintenance, and modification operations.

Disposal Areas. Normally, an area unusable for other purposes is chosen for an ammunition disposal area. The disposal site should beat least 800 yards from the nearest ammunition storage site and any inhabited area of the base. The site should be cleared of all vegetation. A powder burning area, detonation pits, and a component popping pit should be included in the site. Provide a splinterproof or other suitable shelter to protect personnel during demolition operations. Where facilities are available, ammunition may be destroyed by dumping at sea. Existing directives should be consulted for disposal procedures.

Pier Areas. In the initial stages of construction of an ammunition storage area at an advanced base, an isolated and separate ammunition pier should be provided. Such a facility eliminates congestion, delay, and unnecessary hazards when loading and unloading general cargo, fuels, and ammunition.

Enemy Ammunition Areas. A separate area should be provided for storing captured enemy ammunition. This area should be at least 800 yards from the other storage areas.

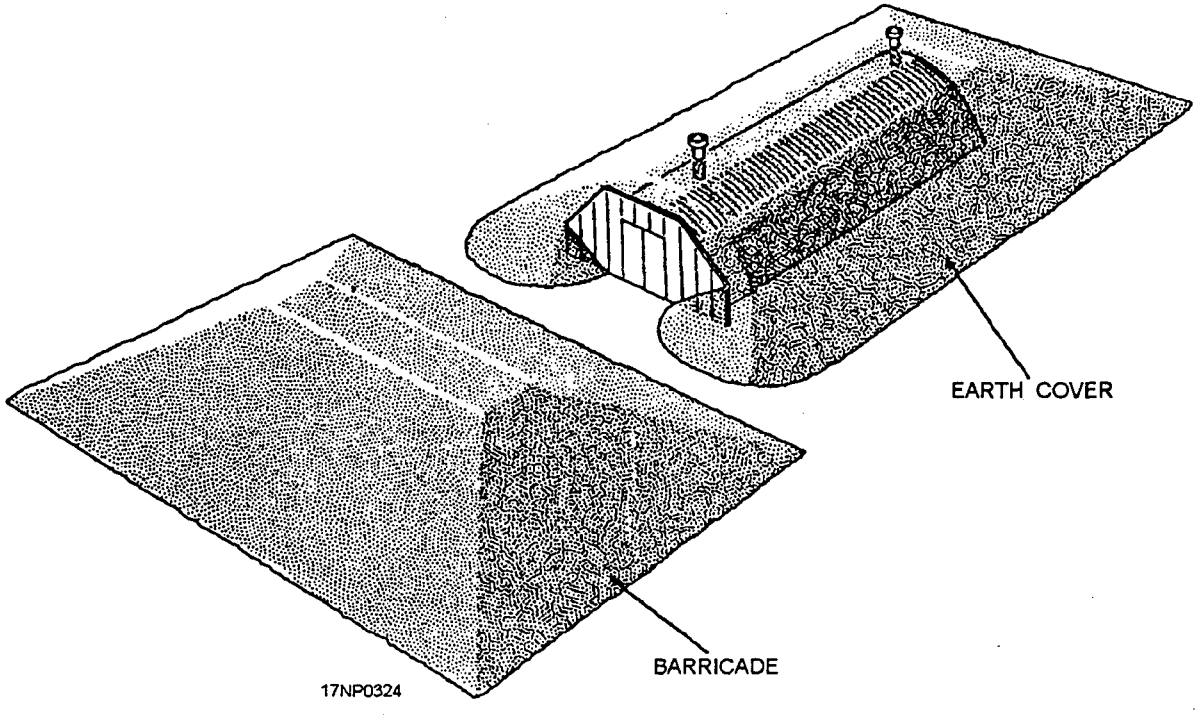
Administration and Personnel Areas. Administration and personnel areas must be at least 800 yards from the ammunition storage and handling areas.

Ammunition Storage Facilities

Ammunition is stored at advanced bases in approved magazines, existing buildings, and in dry caves and tunnels. Ammunition may also be stored in the open, in quarries, pits, and similar areas. Don't put ammunition in caves, tunnels, quarries, or pits if there isn't adequate drainage. When possible, assign available magazines and buildings for storing the more fragile and perishable ammunition, such as pyrotechnics, ammunition containing smokeless powder, fuzes, and similar components. Store the more durable ammunition, such as aircraft bombs and depth charges, in the open, provided it affords maximum protection against corrosion and deterioration.

PREFABRICATED MAGAZINES.— Advanced base magazines (fig. 12-3) are prefabricated, earth-covered, arch-type structures that are used to provide weatherproof storage for ammunition of all types.

The barrel of each advanced base magazine is an arch made of sheets of corrugated sheet metal bolted together to form a semicircular-arch roof. Two screened, sheet metal ventilators are mounted on top of the arch, one at the front of the magazine and one at the rear. The rear wall is constructed of corrugated sheet metal. The front wall is constructed of wide, heavy-gauge metal plates, which are reinforced with angles and channels. The front wall extends above and to each side of the outer limits of the magazine, providing a retaining wall for the earth fill. The ends of the plates that extend beyond the limits of the magazine



Figur-e 12-3.—Typical advanced base magazine.

are secured to the structure by turnbuckle rods. The magazine floor is a concrete slab placed on compacted gravel or broken stone fall. A pair of 8-foot, double-leaf doors are placed in the front wall of the magazine. Screened louvers are placed in each door for ventilation, Table 12-10 lists the available magazine sizes, maximum storage capacities, and the recommended separation distances between the magazines.

Table 12-10.—Prefabricated Advanced Base Magazines

MAGAZINE SIZE	MAXIMUM CAPACITY	QUANTITY-DISTANCE UNBARRICADED	QUANTITY-DISTANCE BARRICADED
16 × 36	50,000	200 feet	115 feet
25 × 48	150,000	290 feet	165 feet

A barricade is placed opposite the front wall of each magazine used for the storage of high explosives or fuzes and detonators. The barricade extends to the height of the inside crown of the magazine arch. The barricade must be at least 3 feet wide at the crest and slope to a grade on the natural slope of the earth used as fill.

TEMPORARY SHELTERS AND COVERINGS.— If magazines or existing buildings aren't available at advanced bases for the storage of ammunition, temporary shelters or coverings are erected to protect ammunition that is stored in the open.

When tents are used, ventilate them during the heat of the day by raising the sides at the top. Be careful to prevent the direct rays of the sun from shining through the peaks onto the piles of ammunition. When tents are ventilated properly, air circulates freely around the piles

REVIEW NUMBER 1 ANSWERS TO QUESTIONS Q1. THROUGH Q12.

A1. Mandatory regulations governing the storage of ammunition ashore are found in OP 5, volumes 1 and 2.

A2. The keyport magazine is a prefabricated, concrete-constructed magazine that is earth-covered and arch-shaped.

A3. The normal size of a box-type magazine is 12 feet by 17 feet.

A4. The Corbetta magazine is a concrete-constructed magazine shaped like a beehive or dome.

A5. The Gallery magazine consists of a tunnel or cave that has varied dimensions.

A6. WP-M23 igniters belong to Class 4 ordnance.

A7. There are five subdivisions contained in DOD hazard Class 1.

A8. Detonators and similar initiating devices are contained in storage compatibility Group B.

A9. Black powder belongs in compatibility storage group D.

A10. Ammunition that doesn't present any signifiicant hazard is found in compatibility Group S.

A11. The first number in a magazine designator symbol shows the magazine group number.

A12. The letter T in the third position of a magazine designator indicates that the magazine is earth-covered and barricaded.

Figure 12-4.—Ammunition protected by a thatched-roof hut.

of ammunition in the tents. During the night, and during rainy weather, lace the tents tightly, and keep the sides staked down to prevent moisture from condensing on the ammunition.

In tropical areas where vegetation grows very thick, thatched-roof huts (fig. 12-4) or shelters made of woven mats can be erected to protect the ammunition.

Piles of ammunition stored in the open and unprotected by temporary shelters, such as tents or thatched-roof huts, should be covered with a double thickness of serviceable tarpaulin (fig. 12-5). If

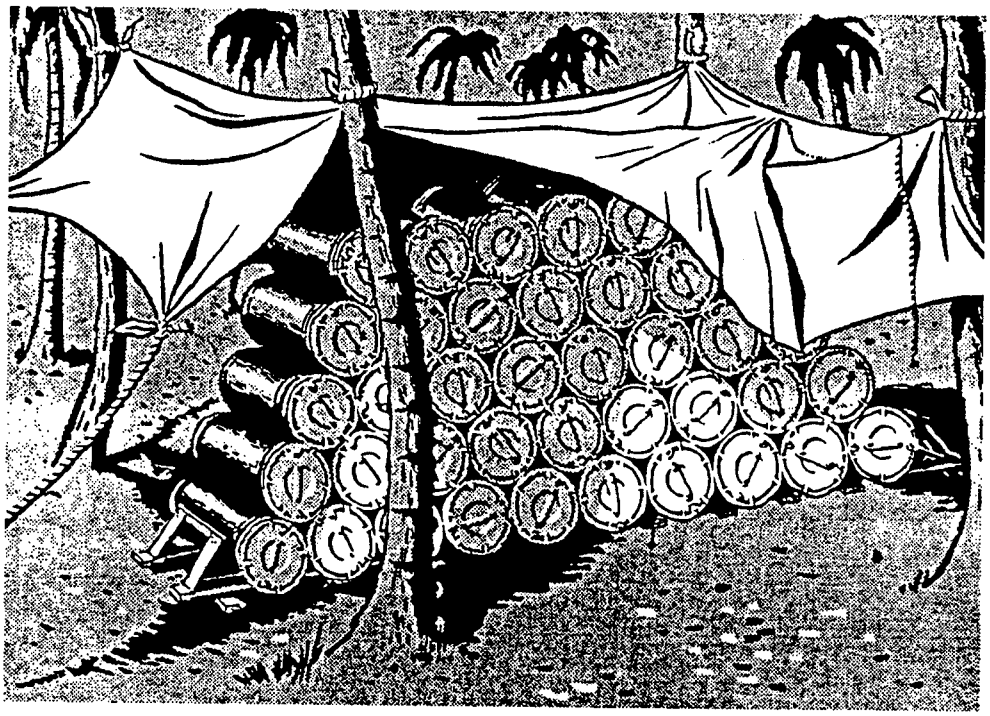


Figure 12-5.—Ammunition protected by a tarpaulin cover.

materials are available, fabricate a wooden roof-type cover like the one shown in figure 12-6, and placed it on the top layer of the ammunition pile.

BARRICADES AND REVETMENTS.— Earth barricades or revetments around individual piles of ammunition, similar to that shown in figure 12-7, are easily erected and protect ammunition from fire and explosion. Each barricade should beat least 3 feet wide at the top and 1 foot higher than the ammunition that it protects.

EXISTING BUILDINGS.— Occasionally, existing buildings are used to store ammunition. Each building should be of fire-resistant construction, and it should protect ammunition against moisture and dampness. It should have adequate ventilation and have substantial flooring to support the ammunition. An existing building should afford adequate protection to the ammunition and adjacent areas.

CAVES AND TUNNELS.— Caves and tunnels are used to store ammunition if they are reasonably dry and free of moisture seepage. Most types of ammunition may be stored in caves and tunnels. In very hot climates, however, don't store ammunition that contains smokeless powder in caves and tunnels unless they are ventilated, either by natural or artificial means, to prevent the accumulation of ether fumes.

OPEN STORAGE.— Ammunition is stored in the open at advanced bases to supplement magazine space. However, when ammunition is stored outdoors, special consideration must be given to protecting it from the elements.

Identification of Magazines and Open Storage Sites

When practicable, magazines, buildings used as magazines, and piles of ammunition stored in the open are marked according to the system of identification you have already read about. At advanced bases, the identification system consists of two parts-a group construction symbol and a symbol hazard indicator.

The group construction symbol is a three-group symbol that consists of the following:

1. A number indicating the group in which the magazine or open storage site is located,

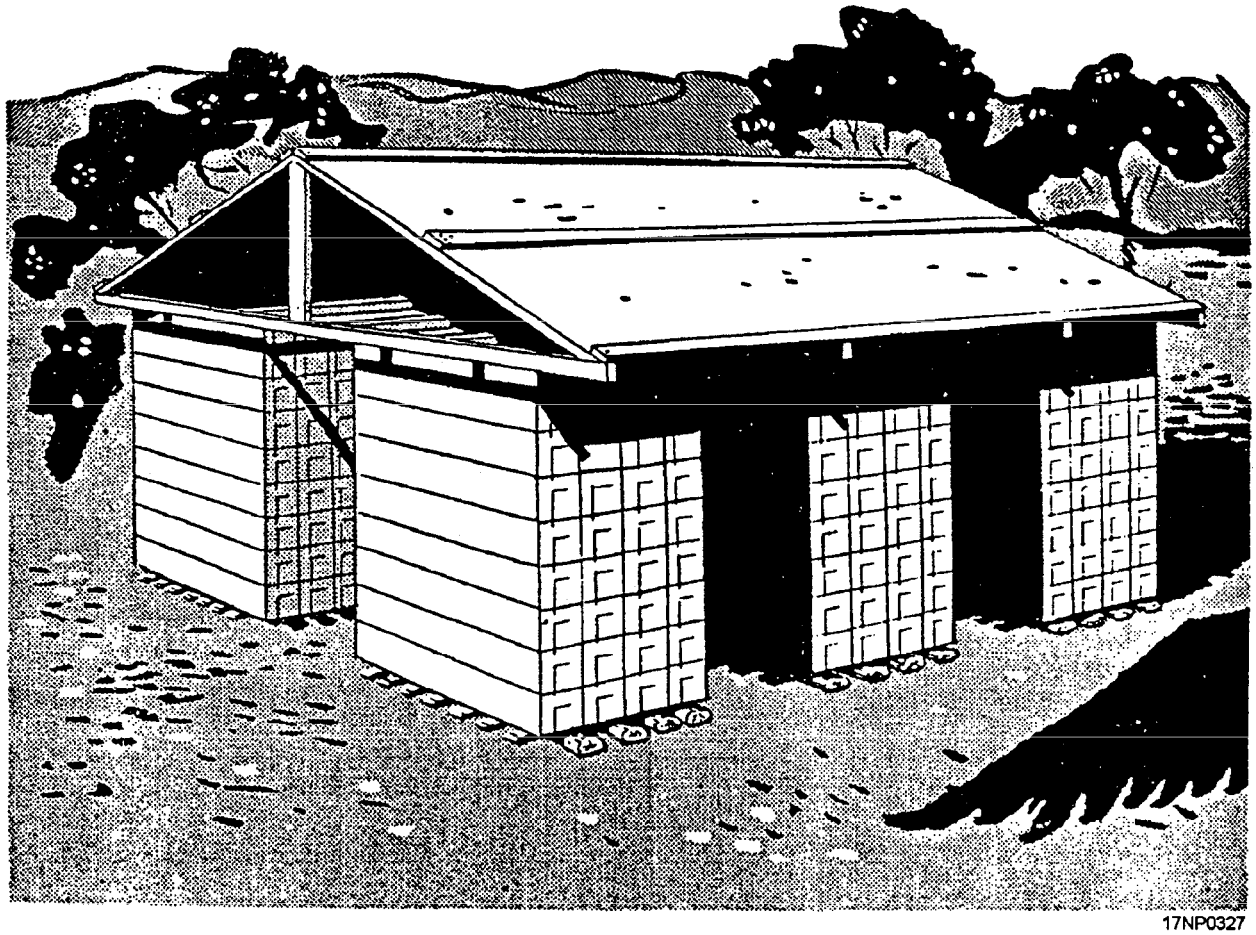


Figure 12-6.—Ammmnition protected by a wooden, roof-type cover.

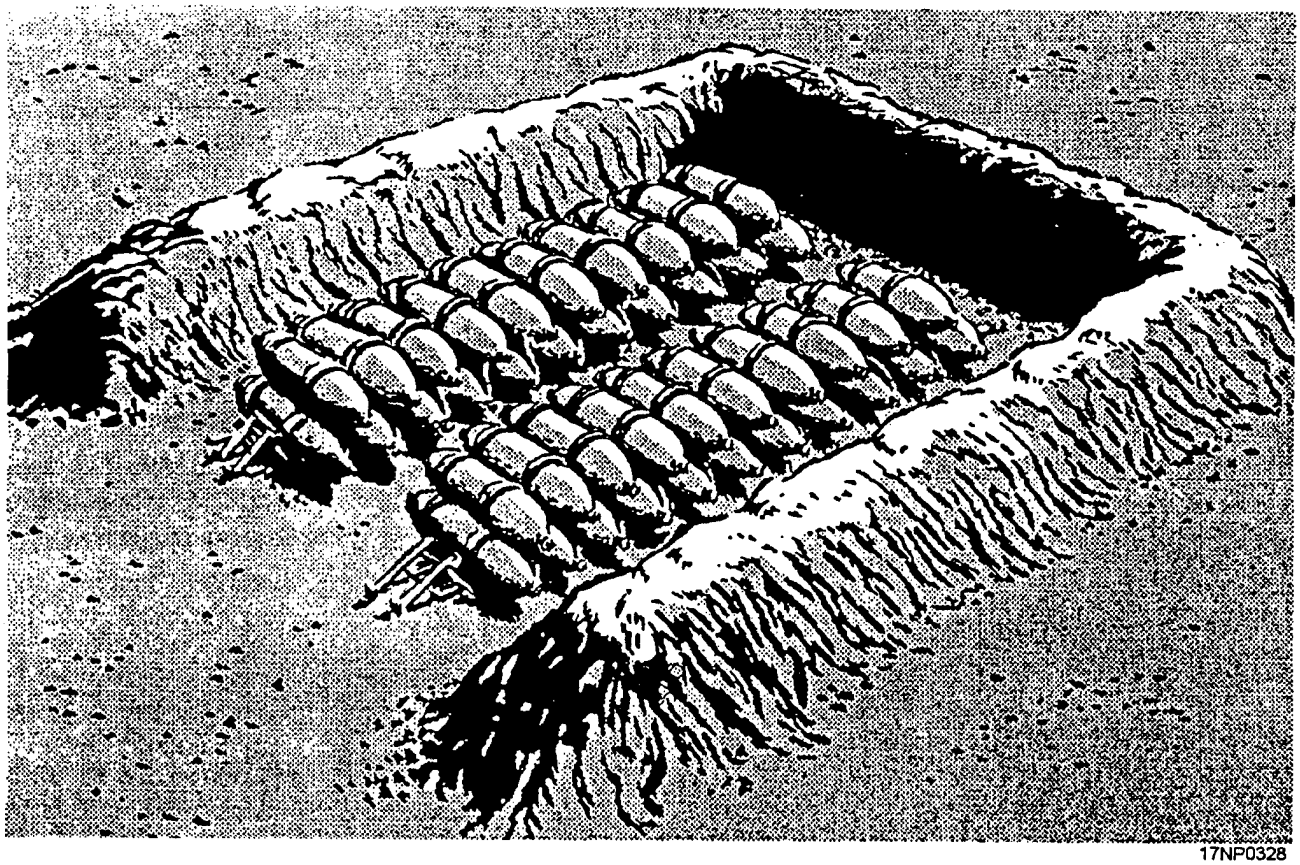


Figure 12-7.—Revetted stowage of aircraft bombs.

2. A letter or group of letters designating the type and capacity of the magazine, and
3. A number designating the sequence of the magazine within the magazine group or area.

Letter designators for advanced base storage are indicated in table 12-11. To indicate the nature of the construction of the magazine, the letter *T* is added if the magazine is earth-covered and barricaded; the letter C is added if the magazine is earth-covered, but the door isn't barricaded. The letter *T* is also used to designate revetted storages. Advanced base magazines, buildings used as magazines, caves, tunnels, and open storage sites do not conform to the standard magazine sizes prescribed in NAVSEA OP 5, volume 1. Therefore, the letters X, Y, or Z that identify explosion hazard, fire hazard, or fragment hazard, respectively, are used in place of the standard letter designators. Accordingly, XT is applied to an earth-covered, barricaded, advanced base magazine that is used for storing high explosives. Also, RZT is part of a designator for fragment-hazard material in a revetted storage.

In addition, the following information must be conspicuously posted on one door in each magazine or building that contains ammunition

1. The hazard classification of ammunition (explosion, fire, or fragment) stored there.
2. The maximum quantities of ammunition in each hazard classification as determined from the quantity-distance (Q-D) tables.

Table 12-11.—Letter Designators for Advanced Base Storage

STORAGE	DESIGNATOR
Advanced base magazine:	
Explosion hazard	X
Fire hazard	Y
Fragment hazard	Z
Open storage (revetted)	R
Caves and tunnels	G

3. Safety precautions and regulations that pertain to the specific material presently stored in the magazine or building.

Post this information at each outside (open) ammunition storage site. Print the information on a card so it is protected from the weather. Then, put the card in a locally manufactured ammunition site sign and card holder, as shown in figure 12-8.

Advanced base magazines are built in the most suitable location for storing one of the three hazard classifications-explosion, fire, or fragment. Since all advanced base magazines are of the same type of construction, all three hazard classifications may be stored in them if they are within Q-D limitations. However, the group construction symbol designates the type of storage for which the magazine is most suitable. Don't change this symbol to show the magazine's present or new use, unless the change is permanent.

DISPERSION OF AMMUNITION

Ammunition dispersement is a main consideration inlaying out an ammunition storage area at an advanced base. Each type of ammunition is stored in two widely separated areas. This prevents losing an entire supply of an ammunition item if there is a fire or explosion. Explosive stores are separated from other stores, as specified in the Q-D tables.

Group piles of ammunition stored in the open by categories. These groups are discussed in the following paragraphs. These groupings aren't compatibility groups; they are only used to ensure safe distances are maintained between piles and stacks of ammunition.

CATEGORY A. This category of material presents a fire hazard. It includes propelling charges, bag charges, rocket motors, pyrotechnics, and small arms ammunition. Category A material should be separated from materials in the other categories (B through E) by at least 350 feet.

CATEGORY B. This category of material presents fire and fragment or fragment and explosion hazards. It includes fixed ammunition, separate loading projectiles, complete rockets (assembled or unassembled), grenades, and mortars. Category B material should be separated from materials in the other categories by at least 300 feet.

CATEGORY C. This category of material presents an explosion hazard This category includes bombs, warheads, depth charges, mines, demolition material, and bulk explosives. Category C material should be separated from materials in the other categories by at least 695 feet.

CATEGORY D. This category of material includes fuzes and detonators. Category D material should be separated from materials in the other categories by at least 200 feet.

CATEGORY E. This category of material includes chemical ammunition. Category E material should be separated from materials in the other categories by at least 400 feet.

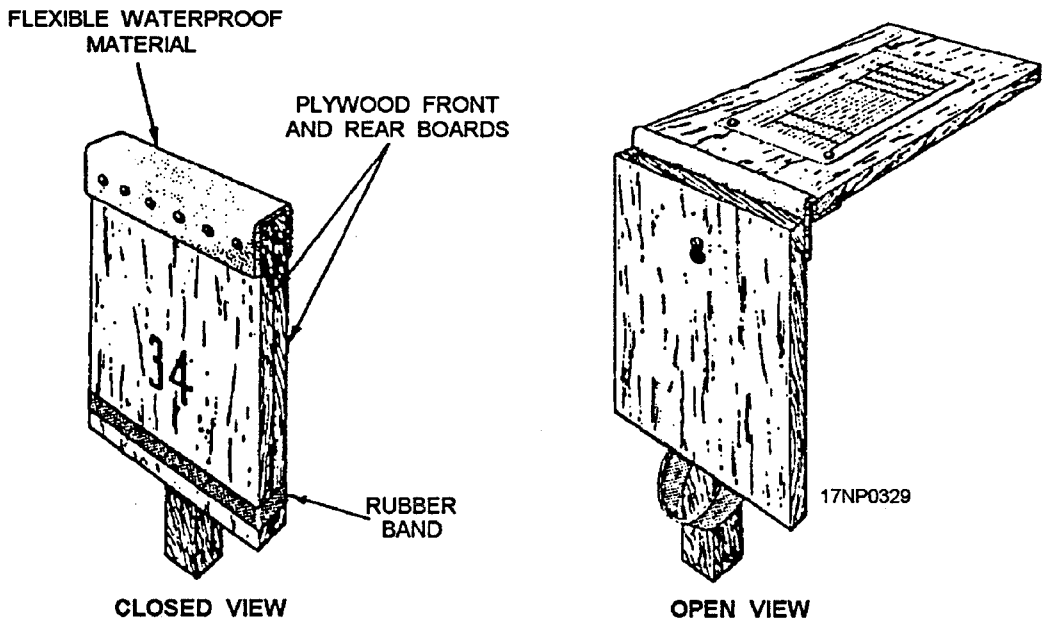


Figure 12-8.—Ammunition site sign and card holder.

REVIEW NUMBER 2

Q1. Describe the purpose of an advanced base.

Q2. What publication governs ammunition storage at advanced bases?

Q3. What is the purpose of having at least two storage areas for each type of ammunition at an advanced base?

Q4. The disposal area at an advanced base should be a minimum of what distance from ammunition storage sites and inhabited areas?

Q5. List the characteristics of a prefabricated magazine at an advanced base.

Q6. At an advanced base, ammunition in Category A poses what sort of hazard?

MAGAZINE MAINTENANCE, STORAGE, AND HANDLING REQUIREMENTS

LEARNING OBJECTIVE: *Identify the types of procedures used for magazine maintenance, storage, and handling to include personnel requirements, lightning protection systems, magazine security, and ammunition handling and shipping.*

Proper explosives and ammunition storage facilities are only apart of the overall storage system. Among the most important aspects of the storage of ammunition is the proper maintenance of magazines and magazine areas.

PERSONNEL REQUIREMENTS

Normally, all personnel engaged in operations that involve ammunition, explosives, and other hazardous materials are trained and qualified to perform their assigned duties. In addition to being qualified and certified, personnel involved with hazardous explosive operations are certified by a physician as physically qualified. Personnel aren't knowingly permitted or required to work when their ability or alertness is impaired because of fatigue, illness, or other reasons. This would expose them and other personnel to injury.

Occasionally, manpower shortages cause a need for assistance by personnel from other Navy ratings to join working parties to handle or transport ammunition and explosives. These working parties are referred to as augmentation crews. Before using augmentation crews, try to make sure that personnel in the working party are trained so mistakes aren't made or safety factors violated Furthermore, make sure enough qualified representatives, preferably officers or petty officers that are senior in rank to any member of the working party, are present to detect or prevent violations of safety orders and other unsafe practices. They should take whatever action is required to correct the situation.

LIGHTNING PROTECTION SYSTEMS

Lightning protection is required for all ordnance handling buildings, storage facilities, and handling areas that have more than 5 days per year when thunderstorms occur.

There are two types of lightning protection systems—primary and secondary. The primary system prevents damage from direct lightning strikes by diverting the strike and providing a low-impedance path to ground. The secondary system maintains all metal objects within its system at the same electrical potential. This prevents the possibility of sparking between the objects.

Primary Systems

There are two types of primary lightning protection systems acceptable to NAVSEASYSCOM—the separately mounted lightning mast system and the separately mounted overhead ground (aerial shield) wire system.

LIGHTNING MAST SYSTEM.— This type of primary system consists of lightning masts (freestanding air terminals) placed around a facility and connected to a buried primary girdle. A sufficient number of masts are used to protect the entire structure within the combined cones of the masts. The number and height of masts required to adequately protect a structure is determined by the dimensions of the structure.

OVERHEAD GROUND (AERIAL SHIELD) WIRE SYSTEM.— This system consists of overhead lightning protection conductors spanned between lightning masts above a facility. The conductors are connected to a buried ground girdle or to ground rods only, depending upon the type of installation.

Secondary System

The secondary lightning protection system consists of a buried girdle to which all metal parts are connected at the lowest point. This implies that electrical access to all reinforced steel must be provided during

construction. The normal wire ties are considered sufficient to provide electrical connection between the sections of reinforced steel that are in contact with each other.

MAGAZINE AND MAGAZINE AREA SECURITY

Magazine areas are protected by nonclimbable fences. All the entrances are locked unless guards are posted. Post a sign at all the entrances to restricted areas. The sign indicates that every vehicle must stop, that each person must present proper credentials to the guard, and that all articles prohibited within the area must be given to the guard. The exact wording of the signs are left to the discretion of the commanding officer. However, the word *explosive* doesn't appear on the sign, and the sign isn't attached to the magazines.

Special precautions are taken to guard or patrol the areas that not protected by suitable fencing. Magazine and explosives areas where ammunition, explosives, and other items of high-security classification are stored must be adequately guarded at all times.

Don't let unauthorized personnel enter or remain in any magazine or explosives area. Personnel involved in ammunition handling operations are authorized in magazines or buildings that contain explosives only as required, and they must enter and leave explosives areas at designated points.

Additional information on the requirements for posting, fencing, unguarded facilities and vehicles, emergency events, and security alarm systems is found in *Department of the Navy Physical Security Instruction for Sensitive Conventional Arms, Ammunitions and Explosives (AA&E),* OPNAVINST 5530.13.

MAGAZINE/MAGAZINE AREA INSPECTIONS

The commanding officer, or duly authorized representative, requires regular and frequent magazine inspections. These inspections include ready-service lockers, ready-service magazines, and magazine areas. Magazine inspections are conducted to make sure the following conditions are met:

- Ensure magazine repairs are made, if needed.
- Ensure that safety regulations, particularly those that involve cleanliness and elimination of fire hazards, are observed.
- Ensure that magazine contents are not deteriorating into an unsafe condition, and they are stored in an orderly, compatible, and approved manner.

The magazine area inspections are designed to make sure the following actions are being maintained

- Firebreaks are being maintained.
- Fire protection equipment, when required, is available and serviceable.
- Roads are good and in usable condition.
- Fences are secure.

REVIEW NUMBER 2 ANSWERS TO QUESTIONS Q1. THROUGH Q6.

A1. An advanced base is a temporary base that is in or near a forward area outside the zone of the interior Its primary mission is to support a wartime operation.

A2. NAVSEA OP 5, Volume 3, governs ammunition storage at advanced bases.

A3. At least two storage areas for each type of ammunition is needed at an advanced base to prevent loss of a particular type of ammunition if there were a fire or explosion.

A4. The disposal area at an advanced base should be a minimum of 800 yards from ammunition storage sites and inhabited areas ?

A5. A prefabricated magazine at an advanced base is an earth-covered, arch-type structure.

A6. At an advanced base, ammunition in Category A poses a fire hazard.

At times area inspections are performed more often than magazine inspections, particularly during seasons when grass or brush fires are most likely to occur.

General Inspection Requirements

Some of the types of things you look for when conducting general magazine inspections are security, safety, cleanliness, atmosphere (temperature and humidity), identification of contents, and posting. A checklist covering all safety regulations and requirements of magazine operations is used when you conduct magazine inspections. This helps you make sure you don't overlook violations or hazards. The checklist provides an adequate and full description of any condition that is unsatisfactory and in violation of requirements. Make sure the checklist is properly authenticated and made a part of the magazine log.

Frequency of Inspections

The inspection frequency is determined by the commanding officer or duly authorized representative. The frequency varies, depending on the number of magazines to be inspected, weather conditions, season of the year, number of magazines requiring special attention (for example, environmentally controlled), and security requirements of magazines/magazine areas. Inspections are conducted during daylight hours. Make sure there is enough light to see that any substandard condition that exists is seen and reported to the inspector. The exception to this procedure is security inspections; they are conducted during the day and at night.

Temperature Control Considerations

The majority of the ordnance items in the Navy inventory are designed to withstand temperatures in the range of 130° to 160° Fahrenheit. Temperatures within conventional ordnance storage magazines seldom exceed 105° Fahrenheit. Therefore, you don't have to closely monitor the temperatures within these magazines. However, in the case of *special magazines,* such as certain missile/missile components, torpedoes, and mine magazines that require environmental control, control-system monitoring is still required

Report of Inspections

You must record the date and hour of each inspection in a magazine inspection log above the signature of the person who made the inspection. Promptly report substandard or abnormal conditions to the officer or supervisor in charge of correcting it. Then annotate the observed conditions in the log. Note satisfactory and normal conditions in the log by the entry *normal.* Magazine inspection logs may be destroyed 1 year from the date of last entry.

REVIEW NUMBER 3

Q1. Describe the two types of primary lightning protection systems acceptable to NAVSEASYSCOM.

Q2. Lightning masts are connected to a _____.

Q3. To what instruction should you refer for specific requirements about the physical security of naval magazines?

Q4. When are magazine inspections conducted?

Q5. Describe the information recorded on the magazine inspection log above the signature of the person conducting the inspection.

AMMUNITION HANDLING

The AO must be familiar with handling ammunition. It is a repetitious task, whether at a shore station or aboard ship. Repetitious work, no matter how dangerous, often becomes routine and leads to carelessness. Therefore, pay attention to what you are doing to prevent accidents in operations dealing with ammunition and explosives.

Whenever ammunition or explosives are received, transferred, or stowed, an officer or petty officer that knows the rules governing the care and handling of ammunition supervises the work. The supervisor makes sure that all work personnel are aware of the need to be careful when they handle ammunition and explosives.

Handling equipment is properly maintained and frequently inspected to make sure it is in safe working condition. Also, the handling equipment must be the right equipment for the purpose. Inspections are made before and during loading/unloading operations.

AMMUNITION SHIPPING

Ammunition shipping is a phase of ammunition handling. Instructions for the preparation and shipment of naval ordnance material are contained in *Navy Transportation Safety Handbook for Hazardous Materials,* NAVSEA OP 2165, volumes 1 and 2. The

instructions in NAVSEA OP 2165 cover the preparation, flow, and use of all the documents required to ship, receive, and report shipments. Instructions for the use of ordnance transport equipment, materials to be transported, division of responsibility for carrying out inspections, and criteria for accepting or rejecting equipment are also contained in this publication. NAVSEA OP 2165 contains the general information needed for you to efficiently, safely, and economically perform the duties required when shipping ordnance materials.

Department of Transportation Explosive Hazard Classifications

The Department of Transportation (DOT) has established explosive hazard classifications for ammunition and explosives in shipment. DOT defines explosives as *any chemical compound, mixture, or device whose primary or common purpose is to function by explosion.* Explosives includes, but are not limited to, individual land mines, demolition charges, blocks of explosives (dynamite, TNT, C-4, and other high explosives), and other explosives (gun powder, nitroguanidine) that have a total weight of 10 pounds or more. All naval explosives fall within three explosive hazard classifications-Class A, Class B, and Class C. These classifications are discussed in the following paragraphs.

CLASS A.— Class A explosives are chemical compounds, mixtures, or devices (mass detonating, spark initiated, or shock sensitive) that constitute a maximum shipping hazard; for example, black powder, explosive warheads, nitroguanidine, and nitrosoguanidine.

CLASS B.— Class B explosives function by rapid combustion rather than by detonation for example, rocket ammunition without projectiles, special fireworks, and starter cartridges for jet engines.

CLASS C.— Class C explosive devices contain Class A or Class B explosives, or both, but in restricted quantities. They also have certain types of fireworks. Examples of Class C devices are electric squibs, explosive bolts, common fireworks, and small arms ammunition.

> **NOTE:** Remember, these explosive hazard classifications apply to ammunition and explosives during shipment only. They do not apply to the storage classifications discussed earlier in this chapter.

Explosives Driver

An explosive driver is often an AO with an excellent safe driving record, and a person fully qualified according to *Motor Vehicle's Driver's Handbook Ammunition, Explosives, and Hazardous Materials,* NAVSEA OP 2239. To become a qualified explosives driver, you must meet the qualifications described below. If you meet these qualifications, you are certified to drive motor vehicles that transport hazardous materials (HM).

STATE OPERATOR'S LICENSE.— An explosives driver must hold a valid state operator's license, not necessarily issued by the state in which the activity is located. This applies to operation of vehicles both on- and off-station. This requirement is permanently waived for those personnel stationed

REVIEW NUMBER 3 ANSWERS TO QUESTIONS Q1. THROUGH Q5.

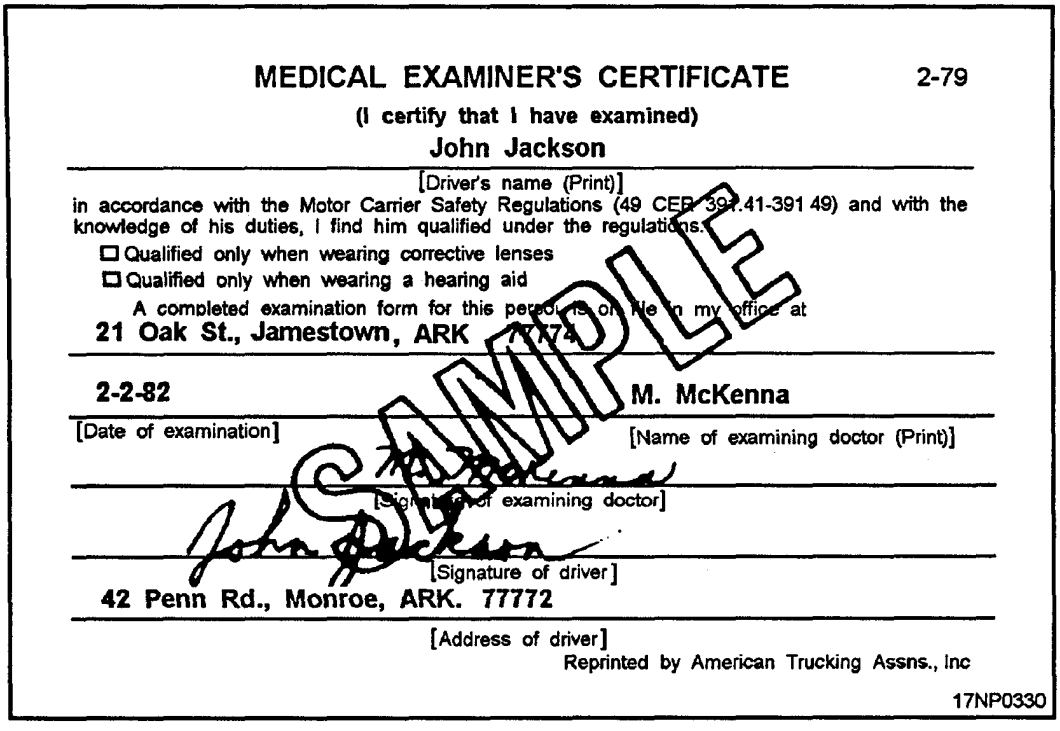
A1. The two types of primary lightning protection systems acceptable to NAVSEASYSCOM are the sequentially mounted lightning system and the separately mounted overhead ground (aerial shield) wire system.

A2. Lightning masts are connected to a buried primary girdle.

A3. For specific requirements about the physical security of naval magazines, you should refer to 0PNAVINST 5530.13.

A4. Magazine inspections are conducted only during daylight hours.

A5. The information recorded on the magazine inspection log above the signature of the person conducting the inspection includes the date and hour of each inspection as well as abnormal or substandard conditions of the magazines, or the word "Normal" if conditions were satisfactory.



MEDICAL EXAMINER'S CERTIFICATE 2-79

(I certify that I have examined)

John Jackson

[Driver's name (Print)]

in accordance with the Motor Carrier Safety Regulations (49 CFR 391.41-391.49) and with the knowledge of his duties, I find him qualified under the regulations.

☐ Qualified only when wearing corrective lenses

☐ Qualified only when wearing a hearing aid

A completed examination form for this person is on file in my office at

21 Oak St., Jamestown, ARK 77774

2-2-82

[Date of examination]

M. McKenna

[Name of examining doctor (Print)]

[Signature of examining doctor]

John Jackson

[Signature of driver]

42 Penn Rd., Monroe, ARK. 77772

[Address of driver]

Reprinted by American Trucking Assns., Inc

17NP0330

SAMPLE

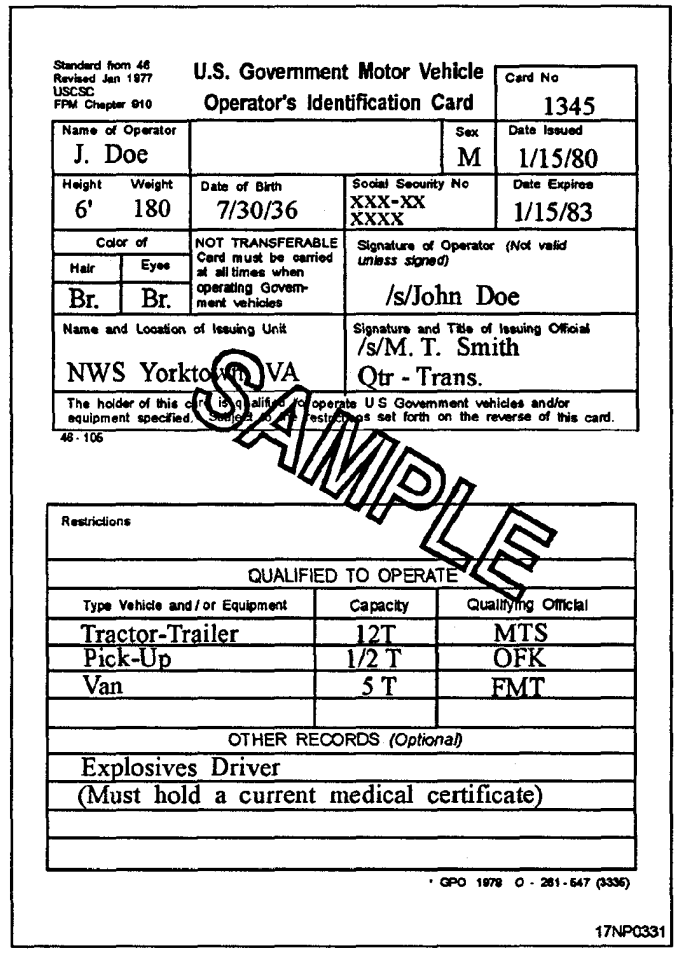
Figure 12-9.—Medical Examiner's Certificate, ATA Form C0750.

outside the 50 states who would otherwise be eligible to obtain an explosives driver's permit.

MEDICAL EXAMINER'S CERTIFICATE.— An explosives driver must undergo an annual physical examination and, on the basis of such an examination, be certified by a licensed doctor of medicine or osteopathy to ensure that he/she meets applicable requirements as stated in the *Federal Motor Carrier Safety Regulations.* Applicants who pass the prescribed annual physical examination are issued a Medical Examiner's Certificate, ATA (American Trucking Association) Form C0750. (See fig. 12-9.) This certificate, in addition to the explosives driver's permit, must be on the operator's person while driving any vehicle transporting HM.

EXPLOSIVES DRIVER PERMIT.— An explosives driver must hold a U.S. Government Motor Vehicle Operator's Identification Card, Standard Form 46 (SF 46). (See fig. 12-10.) The card will be noted: "Explosives Driver (Must hold a current medical certificate)." The SF 46 is valid for 3 years and must be renewed prior to expiration. A yearly endorsement is not required. An individual's safety record and physical requirements will be considered prior to recertification as an explosives driver.

AGE AND EXPERIENCE.— An explosives driver must be 18 years of age or older to operate motor vehicles transporting HM on-station and 21 years of age



Standard form 46 Revised Jan 1977 USCSC FPM Chapter 910

U.S. Government Motor Vehicle Operator's Identification Card

Card No 1345

Name of Operator		Sex	Date Issued
J. Doe		M	1/15/80

Height	Weight	Date of Birth	Social Security No	Date Expires
6'	180	7/30/36	XXX-XX XXXX	1/15/83

Color of Hair	Color of Eyes	NOT TRANSFERABLE Card must be carried at all times when operating Government vehicles	Signature of Operator (Not valid unless signed)
Br.	Br.		/s/John Doe

Name and Location of Issuing Unit: NWS Yorktown, VA

Signature and Title of Issuing Official: /s/M. T. Smith, Qtr - Trans.

The holder of this card is qualified to operate U S Government vehicles and/or equipment specified. Subject to the restrictions set forth on the reverse of this card.

46-106

Restrictions

QUALIFIED TO OPERATE

Type Vehicle and/or Equipment	Capacity	Qualifying Official
Tractor-Trailer	12T	MTS
Pick-Up	1/2 T	OFK
Van	5 T	FMT

OTHER RECORDS (Optional)

Explosives Driver

(Must hold a current medical certificate)

* GPO 1978 O - 261-647 (3336)

17NP0331

SAMPLE

Figure 12-10.—U.S. Government Motor Vehicle Operator's Identification Card, SF 46.

or over for off-station motor vehicle HM operations. The explosives driver must also have had considerable and varied driving experience with the type of equipment to be operated and have a safe driving record.

MENTAL REQUIREMENTS.— Applicants, military and civilian, are required to pass a mental examination that is administered by the local command before they can be considered eligible to be explosives drivers.

ALCOHOL AND DRUGS.— An applicant for explosives driver certification found to be addicted to alcohol or drugs is rejected Certification is revoked for an explosives driver found to be under the influence of alcohol or drugs while on duty or when showing evidence of addiction. Temporary revocation of HM certification may become necessary when the use of physician-prescribed drugs are likely to interfere with the driver's ability to operate a motor vehicle safely.

ABILITY TO READ AND UNDERSTAND REGULATIONS.— An explosives driver must be able to read, write, and understand the English language, and to complete the various forms for which a driver is responsible. The driver is required to read and understand the regulations that pertain to the duties as prescribed in NAVSEA OP 2239.

In addition to these qualifications, if you apply for certification as an explosives driver, you are required to complete an explosives driver's training course and pass the tests given at the conclusion of the course. All explosives drivers receive at least 12 hours of instruction in the following activities:

- Driving trucks, truck-tractors with semitrailers, and other vehicles of appropriate types
- Handling and transporting hazardous materials
- Interpreting regulations and procedures pertaining to the transporting of hazardous materials
- Training and use of fire extinguishers
- Completing and filing required reports

When operating Navy-owned vehicles, you, as an operator, must comply with DOD regulations and all state and local traffic laws. You are also subject to fine or imprisonment when you violate these regulations and traffic laws.

REVIEW NUMBER 4

Q1. To what publication should you refer for information about transporting hazardous materials?

Q2. List the three Department of Transportation (DOT) explosives classifications.

Q3. In what DOT explosives class does black powder fall?

Q4. In what DOT explosives class does small arms ammunition fall?

Q5. Explosives drivers must have an _____ physical examination.

Q6. What is the minimum age requirement for an explosives driver to transport explosives off-station?

SAFETY PRECAUTIONS

Safety precautions prescribe the minimum requirements and regulations you should observe when handling ammunition. These regulations may be general in nature or step-by-step procedures. Regardless of the situation, safety precautions must NEVER be ignored or bypassed, even during the simplest ammunition-handling evolutions.

The general safety precautions listed below show some of the regulations contained in publications referred to in this chapter.

1. Properly stow all materials within a magazine and keep them in a safe condition. Never let trash resulting from decanning, depalletizing, or unpacking accumulate in a magazine. It presents a fire hazard and unsafe working conditions for personnel.

2. Don't use improvised tools, platforms, or ladders.

3. Before ammunition loading, explosives loading, or offloading operations, either at a shore activity or a ship underway, inspect all fire mains to make sure they operate properly and efficiently. Fire hoses must be laid out ready for use in the immediate area of operations. The hoses must be laid out so that damage control and fire boundaries are not crossed, using all risers available. Additionally, keep the valves controlling these fire hoses open so that water is readily available.

4. Flame, heat, or spark-producing devices aren't permitted where explosives or flammable materials, batteries, or battery charging lockers are located. Cigarette lighters, heaters, fires, welding tools,

soldering irons, cutting torches, and uncovered lights are included in this category. When work requiring the use of flame, heat, or spark-producing devices is urgently required in or adjacent to an ammunition stowage space, follow the procedures outlined in OPNAVINST 8023.2 (series) and OPNAVINST 8023.21 (series).

5. Emphasize safety precautions applicable to in-service ammunition items or equipment by using applicable signs throughout the ship. Signs may be obtained as Cog I material. They are indexed in Section 13 of Navy *Stock List of Forms and Publications—Cognizance Symbol I,* NAVSUP Publication 2002, or when not listed in NAVSUP 2002, you may obtained them from a tender-type ship by submission of a work order.

6. Emergency drills requiring the use of the general alarm system, ship's bell or whistle aren't conducted aboard ship while moored to an ammunition-activity pier, unless specific approval for such drills has been granted by the commanding officer of the ammunition activity.

Similarly, such emergency drills aren't conducted by ships nested together or at a pier where ammunition-handling operations are in progress, or by a ship underway during an ammunition handling evolution.

7. Ammunition evolutions involving direct contact with ammunition components are curtailed during local atmospheric disturbances, such as thunderstorms or high winds. Operations aren't resumed until nonhazardous conditions prevail.

8. Stowage of privately owned ammunition and small arms is permitted aboard ship if approved by the commanding officer. This type of stowage is subject to the security requirements of chapter 700 of the Naval Ships Technical Manual, *Ammunition Handling and Stowage,* NAVSEA S9086-XG-STM-000.

9. Ships and craft entering commercial or naval shipyards for periods longer than 6 weeks are completely offloaded of all ammunition, except the small arms ammunition that the commanding officer considers necessary for the maintenance of security aboard ship and inert ordnance items such as bomb fins.

If a ship is expected to remain in the yard for less than 6 weeks, the ship offloads, as a minimum, all ammunition or explosives that can't be stowed in sprinkler-protected or floodable spaces.

10. The number of personnel engaged in ammunition and explosive handling operations is limited to the minimum necessary for safe and efficient performance of the work. Unauthorized personnel aren't permitted in a magazine, missile handling or testing area, or at any handlng operation involving explosives or ammunition. Visiting personnel are accompanied by a responsible escort.

11. As a general rule, any pyrotechnic device that is armed and otherwise prepared for launching or activating but hasn't been used may be dearmed, restored to its original packing, and returned to stowage. The exceptions to this rule are Mk 25 and Mk 58 marine location markers, Mk 48 decoy flares, and aircraft parachute flares. If such devices can't be made safe beyond question, they must be stowed in lockers or disposed of according to current directives.

12. When the temperature in a magazine containing gas generators, propelling charges, or fixed ammunition reaches 110°F or above, certain actions must be taken to preserve safety and stability of the explosives.

When the magazine temperature is between 110°F and 120°F, the magazine should be artificially cooled, as practical. The number of hours and the maximum temperature reached during each hour of exposure above 110°F, but less than 120°F, must be recorded. When the cumulative total number of hours of exposure to these temperatures reaches 500 hours, the ammunition must be expended or turned into an ammunition activity, stating the reason for return, If the ammunition was subjected to these temperatures for less than 500 hours, it should be expended during subsequent firings.

When the magazine temperature is between 120°F and 130°F, the magazine should be artificially cooled, as practical. A special record of the number of hours of exposure and the maximum temperature reached each hour should be made. When a cumulative total of 100 hours of exposure above 120°F is reached, prior to a cumulative total of 500 hours of exposure between 110°F and 130°F, the ammunition must have priority for expenditure or be turned in to an ammunition storage activity at the first opportunity.

At temperatures above 130°F, the ammunition should be removed from the magazine and turned in to the nearest ammunition activity. When there is no storage activity immediately available and the ship is in port, the ammunition may be retained on board in a segregated magazine or in a ready-service room or locker. All possible methods should be used to lower the temperature of the ammunition until the ship is able to turn it in to the nearest ammunition activity.

REVIEW NUMBER 4 ANSWERS TO QUESTIONS Q1. THROUGH Q6.

A1. For information about transporting hazardous materials, you should refer to NAVSEA OP 2165, Volumes 1 and 2.

A2. The three Department of Transportation (DOT) explosives classifications are Class A, Class B, and Class C.

A3. Black powder is included in Class A of the DOT explosives classes.

A4. Small arms ammunition is include in Class C of the DOT explosives classes.

A5. Explosives drivers must have an annual physical examination.

A6. To transport explosives off-station, the driver must be 21 years of age.

CHAPTER 13

WEAPONS ASSEMBLY

Weapons assembly must be done with care and safety; the procedures in this chapter are typical assembly requirements. These procedures do not include authorization for flight or tactical doctrine.

WEAPONS ASSEMBLY PROCEDURES

LEARNING OBJECTIVE: *Identify the purpose of conventional weapons assembly to include a description of general-purpose bombs and support equipment configurations. Identify common procedures to follow when assembling conventional weapons. Recognize the bomb assembly area arrangement.*

In the following paragraphs, you will read about the assembly procedures for some of the most commonly used weapons. This TRAMAN doesn't include assembly procedures for every available weapon in the Navy. However, the following procedures give you basic information about assembly procedures. Remember, regardless of how well trained an assembly crew may be, there must always be a crew leader and a quality assurance/ safety observer (QA/SO). The crew leader is required to use a weapons assembly checklist or manual during all phases of the weapon assembly process. The QA/SO inspects each completed round to ensure it is correctly assembled and installed on the handling equipment.

NOTE: For detailed information on Mk 80 (series) bomb assembly/disassembly, support equipment requirements, and procedures for preloading/downloading accessory suspension equipment, you should refer to the *Airborne Weapons Assembly Manual,* NAVAIR 11-140-5.

AIRCRAFT GENERAL-PURPOSE BOMBS

Aircraft general-purpose bombs are assembled in a variety of configurations. Mission requirements dictate the way a weapon is to be configured. This information is found in the ordnance load plan. A few of these configurations are discussed in the following paragraphs.

Bomb Assembly Tools and Equipment Requirements

Tools and equipment listed in table 13-1 are required for weapons assembly evolutions. The list is provided to assist personnel in proper assembly procedures.

Bomb Assembly Crew

Bomb assembly is usually done on the fourth or fifth deck of an aircraft carrier or flight deck or hangar deck on LFORM class ships. They can also be built on the second deck (mess deck) or other designated areas of aircraft carriers. The reference to positions used with the bomb assembly crew as used here are for ease of understanding only. Many personnel operate the bomb assembly stand (fig. 13-1) and support the assembly evolution. The crew positions are:

- Supervisor
- QA/SO
- Hoist operators
- Nose fuze/TDD installer
- Tail fuze installer
- Tail fin installer
- Skid and hoist operator
- Forklift operator
- Dunnage personnel
- Elevator operators

Preparation For Use

When you use GP bombs, the following preparations must be carried out. As you read this section, refer to figures 13-2 through 13-5.

Table 13-1.—Bomb Assembly Tool Requirements

BOMB ASSEMBLY TOOL/EQUIPMENT REQUIREMENTS	
Spanner wrenches (spreader type)	2 each
Apex tip holders (with setscrew) 3/8" drive	4 each
Apex tip for 500 lb bomb conical fins	2 each
Apex tip for 1000 lb bomb conical fins	2 each
Apex tip for 500 lb retarding fin	2 each
Apex tip for nose setscrew 3/16"	2 each
Apex tip for butt plate removal	2 each
1/2" drive speed handle	2 each
3/8" drive speed handle	3 each
Needle nose pliers	2 each
6" Straight slot screwdriver, 1/4" blade	2 each
8" Straight slot screwdriver, 3/8" blade	2 each
Phillips screwdriver 8" No. 2	2 each
Band cutters	1 each
Full face shields	2 each
Heavy duty work gloves	2 pair
Wire cutters (diagonal wire cutting)	2 each
Wooden dowel	2 each
Nonsparking wire brush	2 each
Local manufactured bar for rolling bombs	1 each
Allen wrench sets	2 each
1/8" Allen wrench	2 each
Explosionproof flashlight	3 each
Sway brace/lug gauge GMU-74/E	2 each
Nutdriver 3/8" for fuze restraining clip (nutdrivers are enclosed with case of clips)	2 each
Closure ring wrench P/N 1379AS503 3/8" drive ratchet	2 each
IMER/ITER RACKING - STATIONS TOOL REQUIREMENTS	
15/16" open end wrench	3 each
7/16" open end wrench	3 each
5/8" open end wrench	3 each
7/16" socket 3/8" drive	3 each
3/8" drive ratchet	3 each
Needle nose pliers	3 each
Wire cutters (dykes)	2 each
6" straight slot screwdriver	3 each
Sway brace/lug gauge GMU-74/E	2 each
IMER/ITER rack unlocking tool (manufactured locally)	3 each
Tool pouches	As required

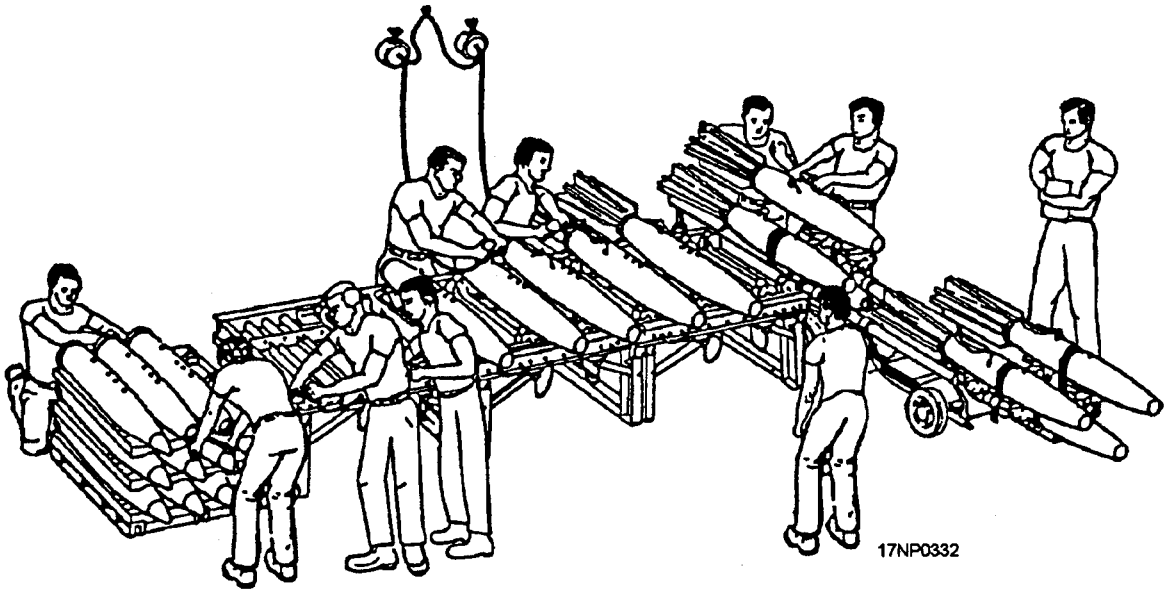


Figure 13-1.—Typical bomb assembly crew positions.

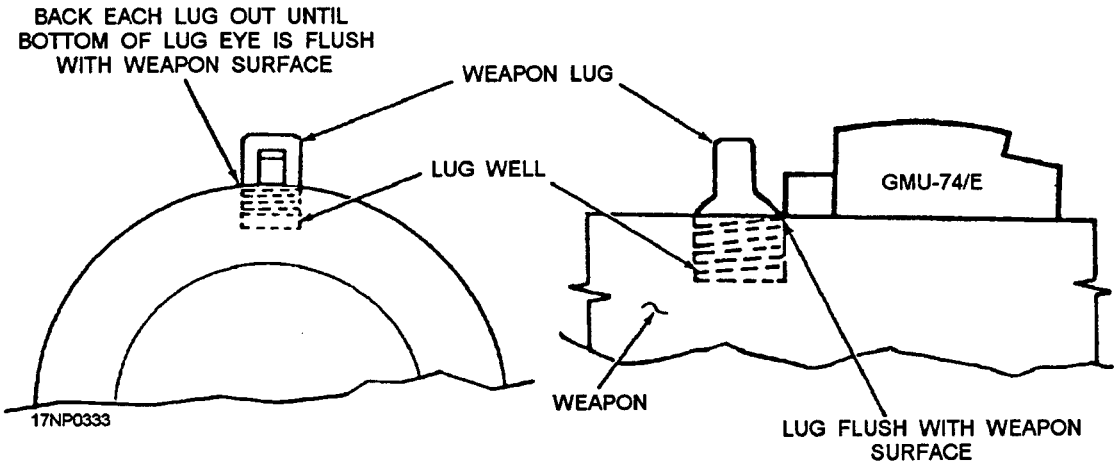


Figure 13-2.—Weapon lug thread engagement.

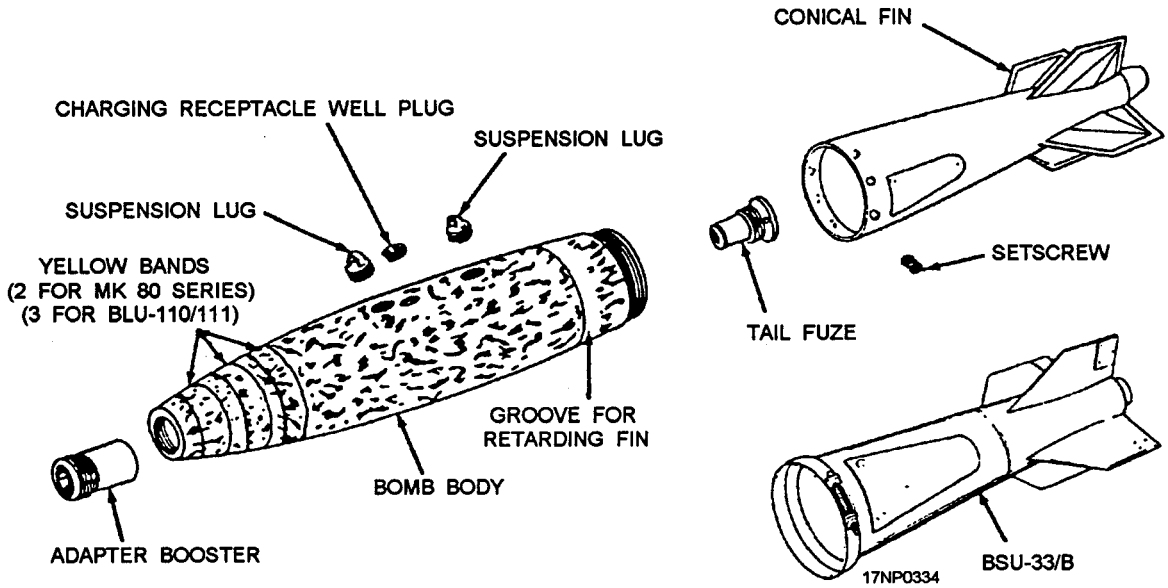


Figure 13-3.—General-purpose bomb components.

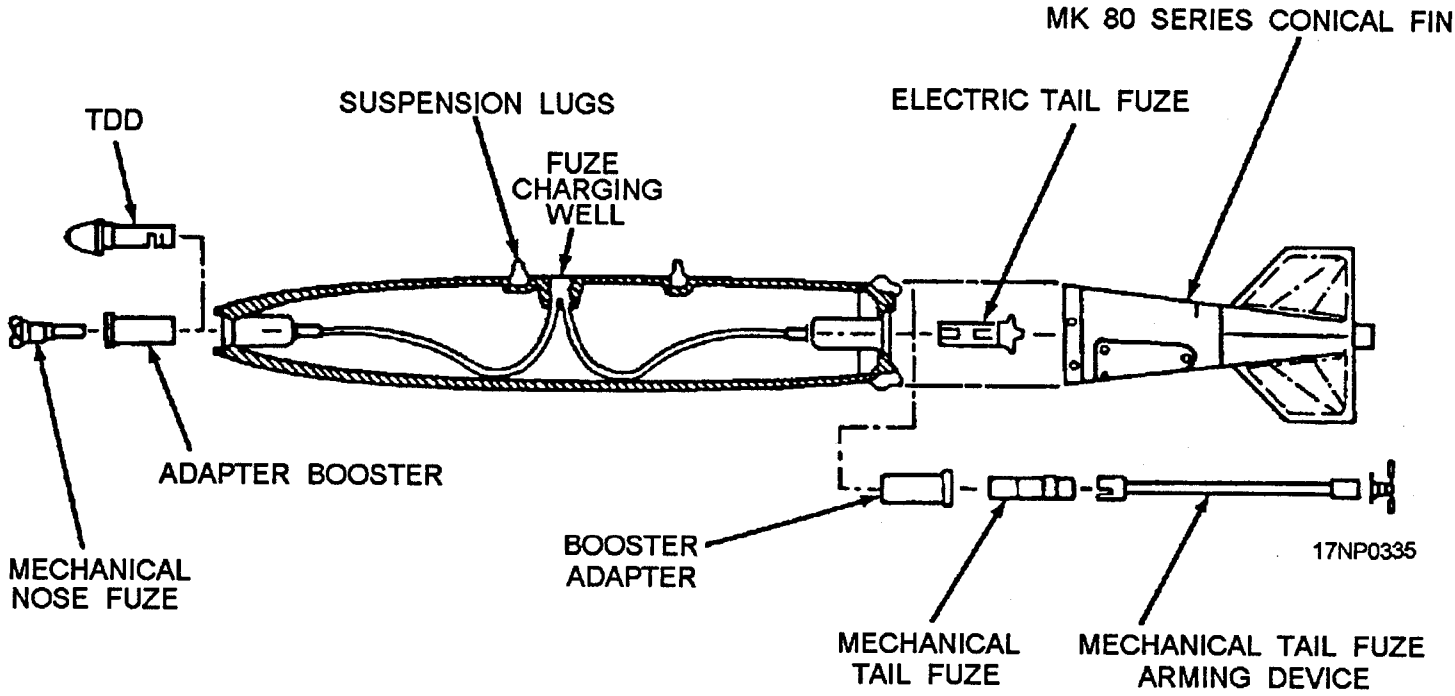


Figure 13-4.—Bomb breakdown.

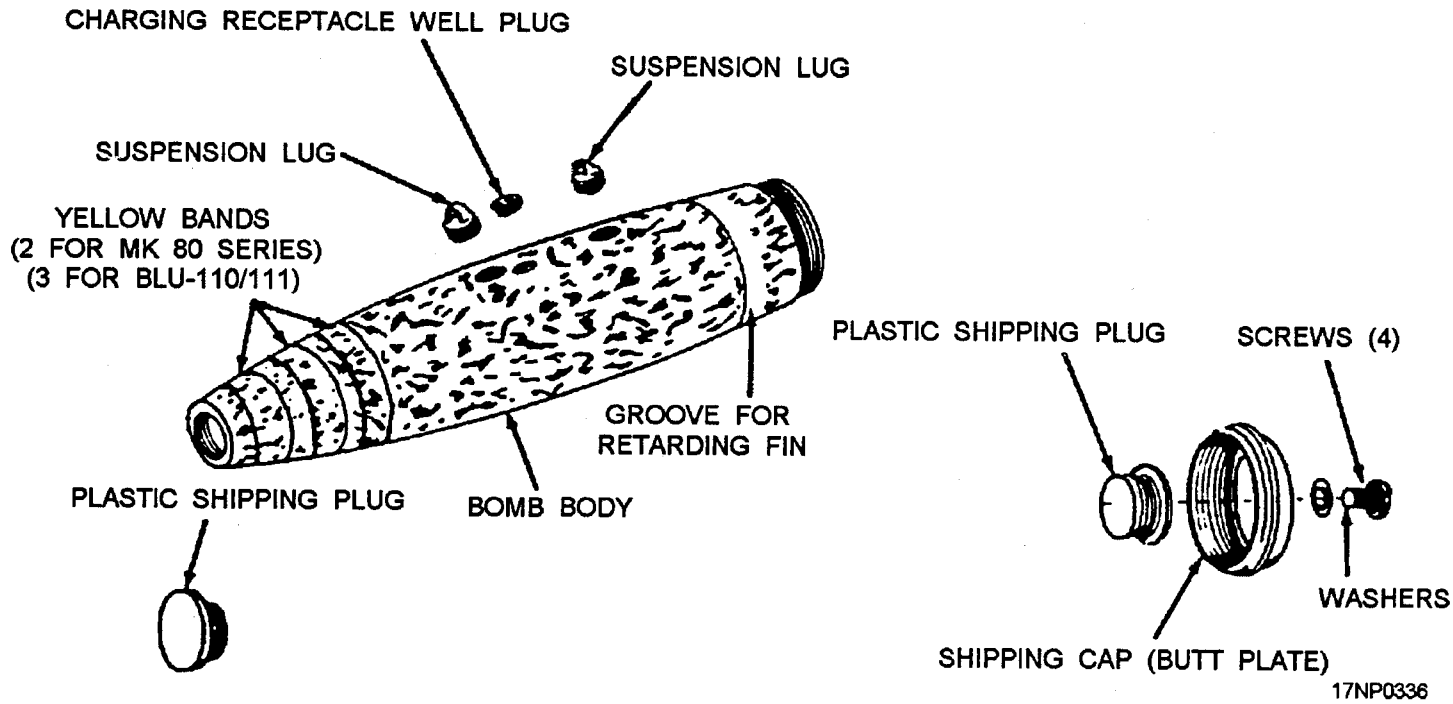


Figure 13-5.—General-purpose bomb shipping configuration.

BREAKOUT.— *Breakout* is the term used to define the physical removal of ammunition from the magazine. Weapons are broken out, by direction of the ordnance handling officer (OHO), in accordance with the load plan. When ordnance breakout is directed by the OHO, the breakout crew records the type, lot number, and quantity of ordnance broken out. Then, the crew passes this information back to ordnance control so that an accurate account and location of weapons and related material on board can be kept up to date.

UNPACKING.— You must depalletize the bomb body and place it on the appropriate bomb skid or assembly stand. Prior to depalletizing, ensure that gloves, steel toe shoes, and face shields are worn. When depalletizing a bomb body, you need to remove the banding straps and the top section of the metal pallet, the shipping cap on the rear of the bomb body, and all plastic shipping plugs from the fuze cavities. Then, install hoisting bars, as necessary, for manual handling of the bombs. Other suitable hoisting equipment may be used when available. Finally, place the bomb on the appropriate bomb skid or assembly stand.

INSPECTION.— You need to inspect the bomb for damage, stripped threads, cracks, or broken welds. Make sure the bottoms of the suspension lug eyes are flush with the weapon surface. Check to see that the bomb's V-groove is clean and undamaged. Check the fuze wells to ensure they are clean and dry. If nose elements and/or electric tail fuzes are to be used, check the electrical connectors to ensure they are not bent or corroded. Press gently with a wooden dowel on the connectors to ensure that they are firmly seated. Inspect thermally protected bombs for loose or chipped coating. Bombs that are missing more than 15 square inches of thermal coating in one spot are not considered thermally protected and are restricted from issue to aircraft carriers. Damaged or otherwise unserviceable bombs should be disposed of by following current directives.

Adapter Boosters

Install adapter boosters by using the procedures discussed in the following text.

WARNING

Fuzing for the thermally protected GP/TP bomb to obtain cook-off protection is limited to Fuze M904E4 with thermally protected adapter-booster M148E1, electric fuzes FMU-139, Mk 376, and Mk 346 with thermal shield. Any other fuzing greatly increases the probability of early detonation of a bomb engulfed in a fire.

INSTALLATION OF ADAPTER BOOSTERS.— Remove the adapter booster from the shipping container. If a mechanical nose fuzing is used, install an M148 adapter booster. If you use a mechanical tail fuze, install the M150/T46 adapter booster with the booster cup.

NOTE: In addition to the booster cup, the M150 and T46 adapter booster consists of two separate explosive components. The primary adapter booster contains a 2.0-inch diameter tail fuze. The T46 (series) contains a fuze adapter sleeve for use with 1.5-inch diameter fuzes.

MECHANICAL NOSE FUZING.— When you use mechanical nose fuzing, an M148 adapter booster is installed as follows:

1. Unpack the adapter booster and remove the closing plug.
2. Inspect the adapter booster internally and externally to ensure all parts, including threads, are clean and undamaged
3. Inspect the bomb nose fuze cavity.
4. Loosen the setscrew in the bomb body.
5. Screw the adapter booster into the bomb, and tighten it with a spanner wrench until it is firmly seated
6. Tighten the setscrew in the bomb body against the adapter-booster threads.

Installation of Electric and Electronic Tail Fuzes

The Mk 376/FMU-139 series electric and electronic tail fuzes are currently being used in the Navy. The following are general procedures you should

follow when working with these fuzes. Refer to figure 13-6 for arming wire installation.

MK 376 ELECTRIC TAIL FUZE.— Prepare, inspect, and install the fuze as follows:

1. Ensure that the safety pin is installed in the pop-out pin.

2. Remove shipping cap.

3. Ensure moisture or foreign material is not present in the electrical connector at base of fuze.

4. With thumb, push in on pop-out pin, remove safety pin from pop-out pin.

5. Ascertain if resistance from pop-out pin against thumb is present.

6. Reinstall safety pin into pop-out pin.

7. Loosely install fuze restraining clip on the flange of the fuze.

8. Install fuze into tail fuze well, and tighten with spanner wrench until flange is seated.

9. Align pop-out vertical with bomb lugs; tighten fuze restraining clip.

FMU-139 ELECTRONIC TAIL FUZE.— Prepare, inspect, and install the fuze as follows:

1. Ensure that gagrod is secured by safety pin.

2. Verify that red and black striping is not visible on gagrod sleeve.

3. Check fuze for exterior damage, moisture, and corrosion.

4. Remove plastic shipping plug and flag from connector on the end of the fuze.

5. Set the fuze switches as follows:

a. Check that the low-drag arm/delay fire switch is set to X-position.

b. Rotate high drag arm/delay time switch as required. It must be in a 2.6 sec position for Navy/Marine aircraft.

6. Align faceplate with bomb lugs. Insert fuze into tail fuze well.

7. Install and tighten closure ring. The fuze may spin slightly.

Mk 122 Arming Safety Switch

Remove, inspect, and install the Mk 122 arming safety switch as follows:

1. Remove the Mk 122 arming safety switch from its package.

2. Inspect the Mk 122 arming safety switch for deformation, corrosion, and damage to the case. Check the contact assembly for cleanliness. Check the coaxial cable for cracks and breaks in the insulation, and be careful not to stress the coaxial cable.

3. Install the Mk 122 safety arming switch as follows:

WARNING

The Mk 122 arming safety switch must be installed in a RADHAZ-free environment Do not pull the lanyard during handling and loading. If the lanyard breaks away from the switch, discard the entire arming safety switch so it will not be used on a bomb. Do not attempt to replace the lanyard.

CAUTION

When installing or removing the weapons carrier and while handling the weapon, be particularly careful to avoid damaging the safety switch. When using a Mk 49 Mod 1 weapons carrier, do not install the safety switch until the weapon has been positioned on the skid adapter. Failure to orient the switching unit retaining nut can result in damage to the arming safety switch.

a. Plug the male connector of the switching unit firmly into the bomb charging receptacle, piercing the diaphragm. Then, slide the switching unit retaining nut, threads down, over the cable and lanyard.

b. Secure the arming safety switch in the bomb charging receptacle by screwing the switching unit retaining nut into the bomb and tightening it with the wrench supplied. When the nut is seated on the top of the switching unit, back it off until the flattened sides of the switching unit retaining nut are at right angles to the length of the bomb and the coaxial cable is aft of the lanyard.

c. Insert the free end of the cable through the nearest bomb suspension lug to safeguard the cable.

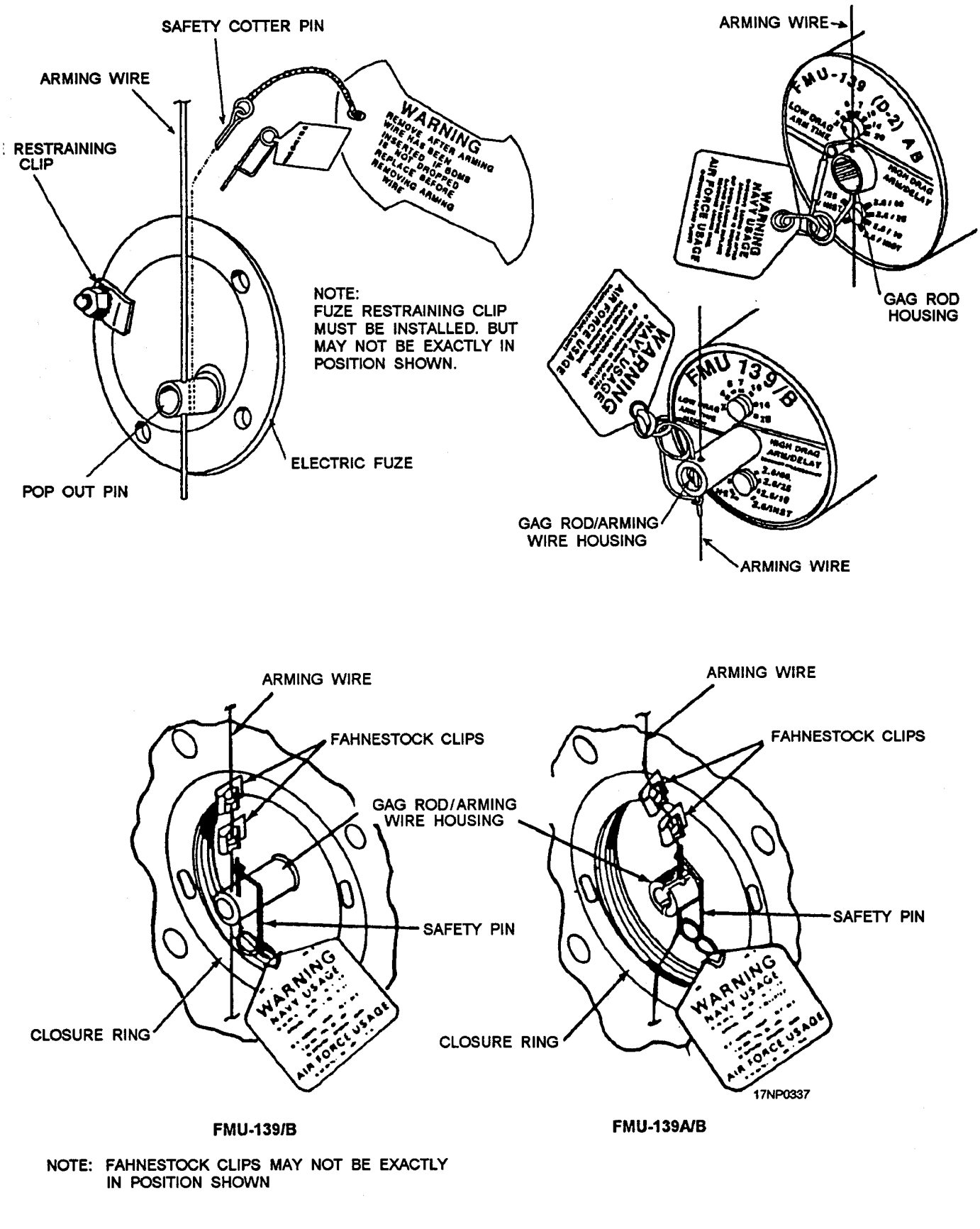


Figure 13-6.—Mk 376 and FMU-139 series electric/electronic fuze arming wire installation.

Assembly of Conical Fin to the Bomb Body

Prepare, inspect, and install a conical fin as follows (fig. 13-7):

1. Inspect fin for damage.

2. Ensure excess paint is removed from fin flange.

3. Ensure access cover is secure.

4. For a conical fin, retract all fin mounting setserews until screws are flush with the inside of the fin flange (all setscrews must be installed).

5. For a BSU-33 fin, ensure the clamp bolt on the band is retracted.

6. Ensure index pin in fin flange is not damaged.

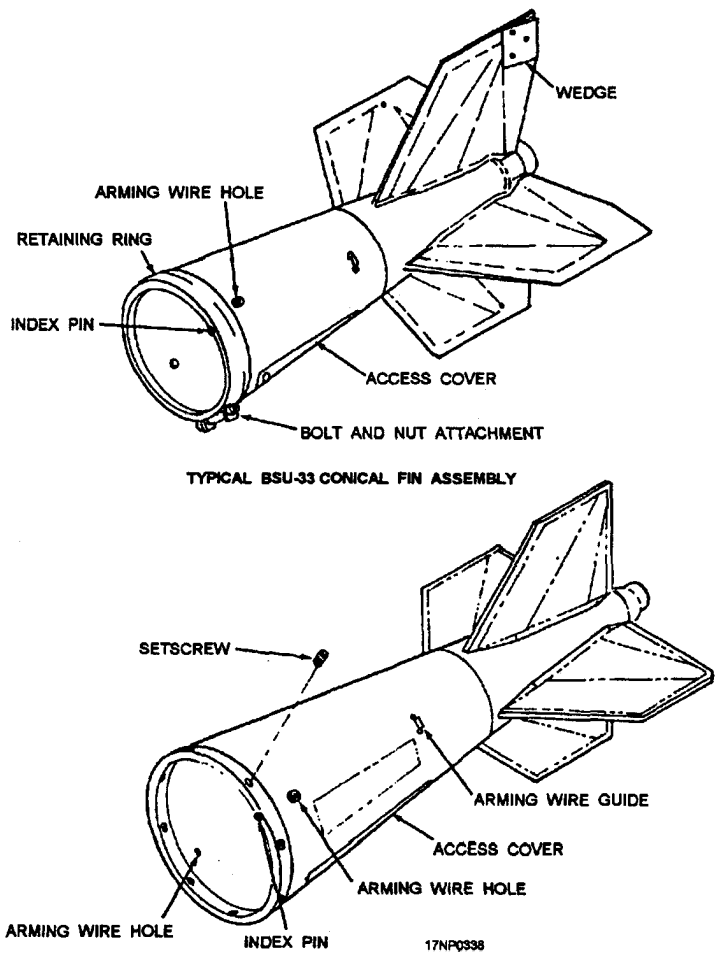


Figure 13-7.—BSU-33 series and MAU-93/B conical fins.

7. Attach the arming wire to the aft lug (fig. 13-8). Thread the free end of Mk 3 arming wire from aft bomb lug through MAU-182 swivel ring and arming wire hole in top of fin.

8. Align fin behind bomb body with fin in the X-configuration.

9. Align pop-out pin with arming wire hole in top of fin.

10. Thread arming wire through the hole in top of the fin, and then through the fuze pop-out pin (fig. 13-6) and through the hole in bottom of fin (Mk 376).

11. Remove safety pin from pop-out pin (Mk 376).

12. Thread arming wire through two Fahnstock clips, gagrod, (fig. 13-6) and through the bottom of the fin (FMU-139/B).

13. Thread arming wire through two Fahnstock clips and the bottom of the fin, vertically align arming wire with arming wire slots located on gagrod arming wire housing (FMU-139A/B, B/B).

14. Push arming wire into arming wire housing.

15. Remove safety pin from gagrod.

Assembly of BSU-86 and BSU-85 Fins to GP Bombs

Inspect the BSU-86 fin (fig. 13-9) as follows:

1. Inspect fin for damage and improperly installed or missing parts and corrosion.

2. Ensure that the restraining band is free of corrosion. If damage is found or suspected, complete steps 3 through 7; if no damage, proceed to step 8.

3. Remove cotter pin from fin latch; ensure latch opens freely.

NOTE: If fins extend automatically at least 1/2 inch when the cotter pin is removed, and can be extended to contact the shock absorber by hand, the fin is operative.

4. Check that link pins and link pin retainers are present, not damaged, and properly positioned in the drag links.

5. Close fins and clamp together with vise grip pliers.

6. Relatch the release band, and insert warning tag assembly.

7. Remove vise grip pliers.

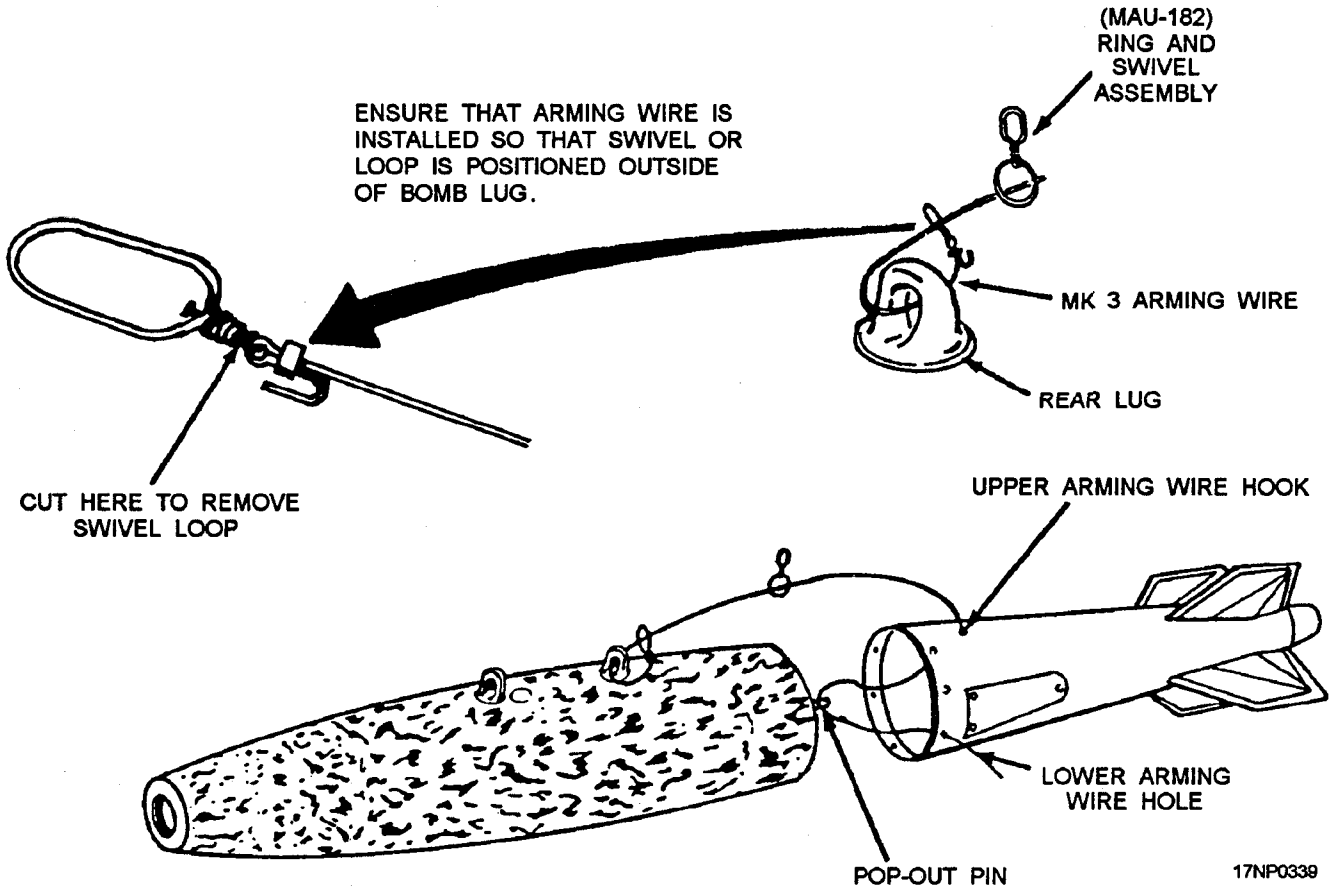


Figure 13-8.—Conical and BSU-33 series fin installation.

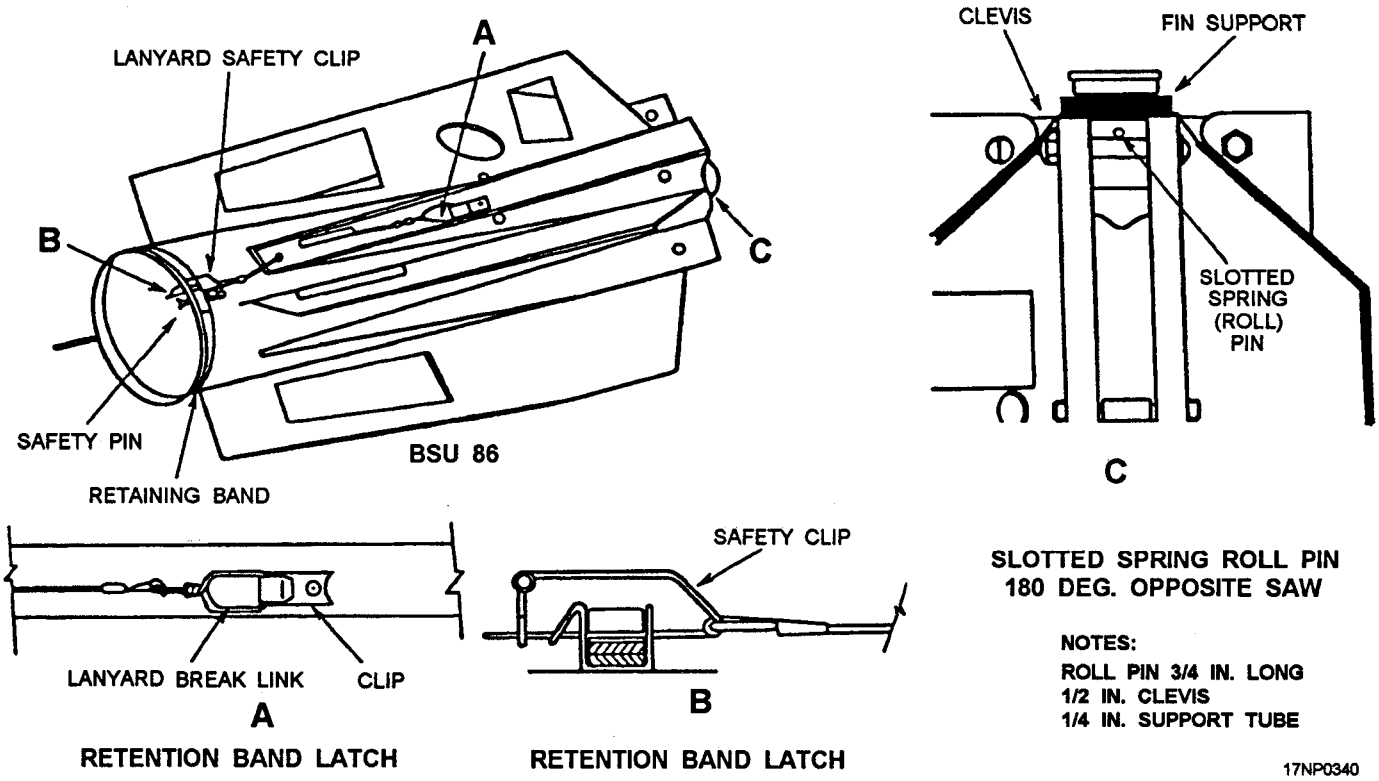


Figure 13-9.—BSU-86 bomb fin.

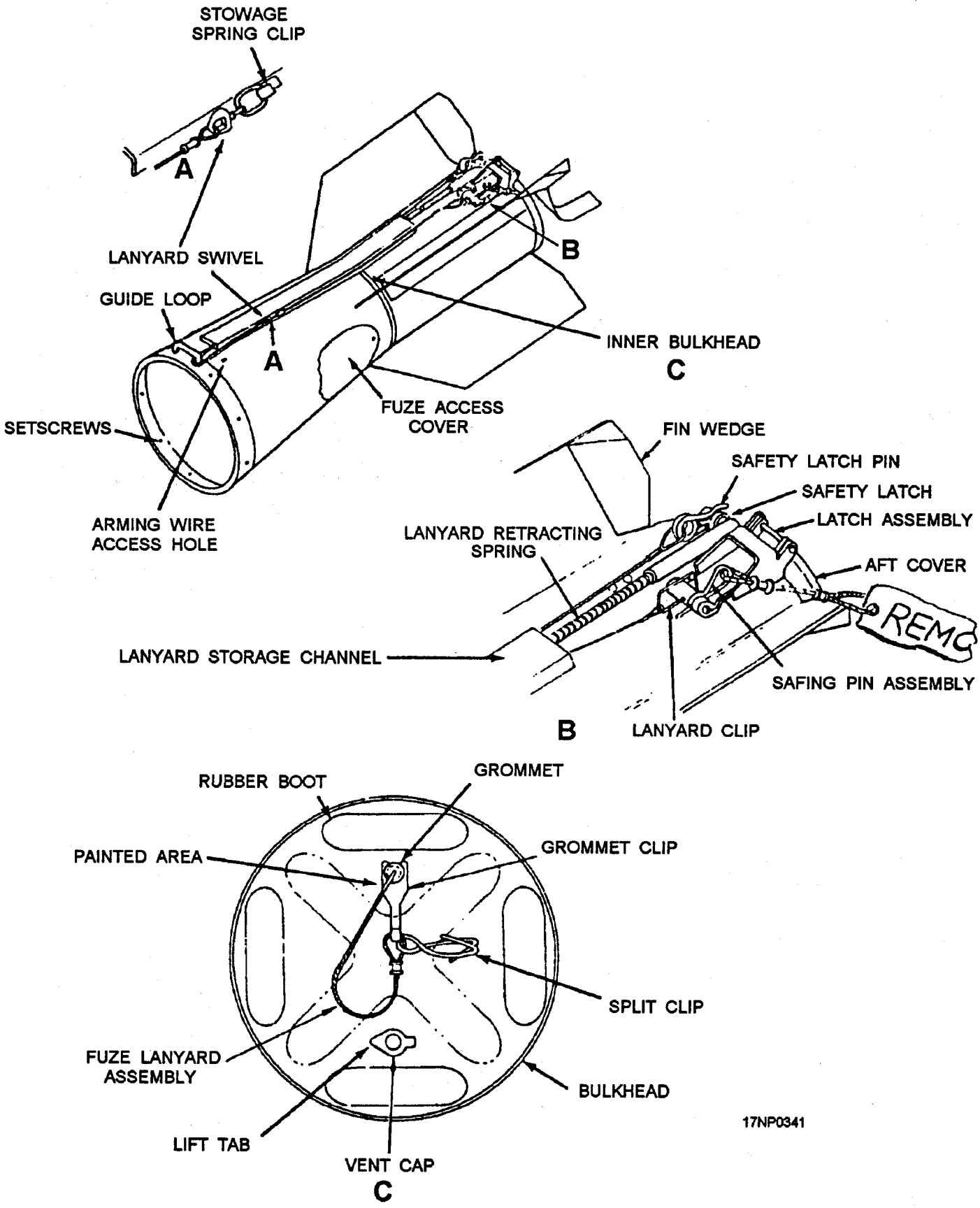


Figure 13-10.—BSU-85/B air-inflatable, retardable fin.

8. Ensure band, retainer, and release assembly are not damaged.

9. Ensure the lanyard swivel is installed on stowage.

10. Ensure the release lanyard and housing and the safety clip are not damaged.

11. Ensure the slotted spring (roll pin) is installed and is properly seated and not protruding from the clevis.

Inspect the BSU-85/B fin (fig. 13-10) as follows:

1. Ensure safing pin assembly, safety latch pin, and lanyard clip are properly installed

2. Ensure all setscrews are installed and flush with inside surface of the forward ring.

3. Viewing the retarder from the open attachment end, check that the rubber boots are secure and not damaged (fig. 13-10).

4. Open the pressure vent cap, ensure the nose fuze lanyard assembly is not damaged, and that the lanyard swivel assembly is attached to the stowage spring clip (fig. 13-10).

5. Ensure the safety latch is installed over the aft cover tang, the release latch pivot pin is not damaged, and the cotter pin is installed (fig. 13-10).

6. Ensure access cover is installed.

Installation of BSU-86 and BSU-85/B Fins

Install the BSU-86 and BSU-85/B fin assemblies to GP bombs as follows:

1. Attach arming wire to aft lug (fig. 13-11). Thread free end of Mk 3 arming wire from aft bomb lug through MAU-182 swivel ring and arming wire hole in top of fin.

2. Align fin behind bomb body with fin in the X-configuration.

3. Align pop-out pin or gagrod housing with arming wire holes in top of fin.

4. Align index pin with hole in bomb body, and press fin against bomb body.

5. Tighten all setscrews into groove in bomb.

6. On the BSU-85/B, remove access cover, and inspect arming wire. Alternately pull wire from top and bottom of retarder.

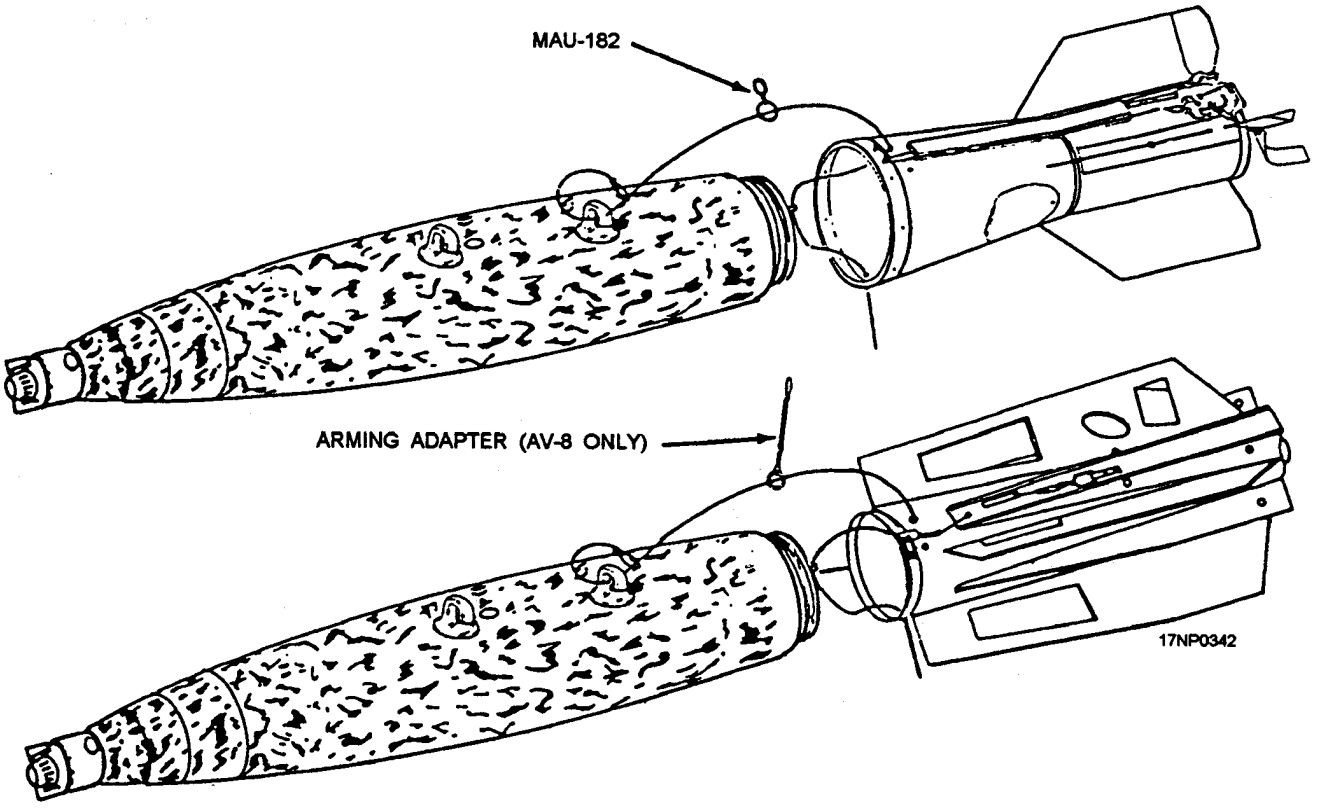


Figure 13-11.—Mk 3 arming wire and swivel loop installation.

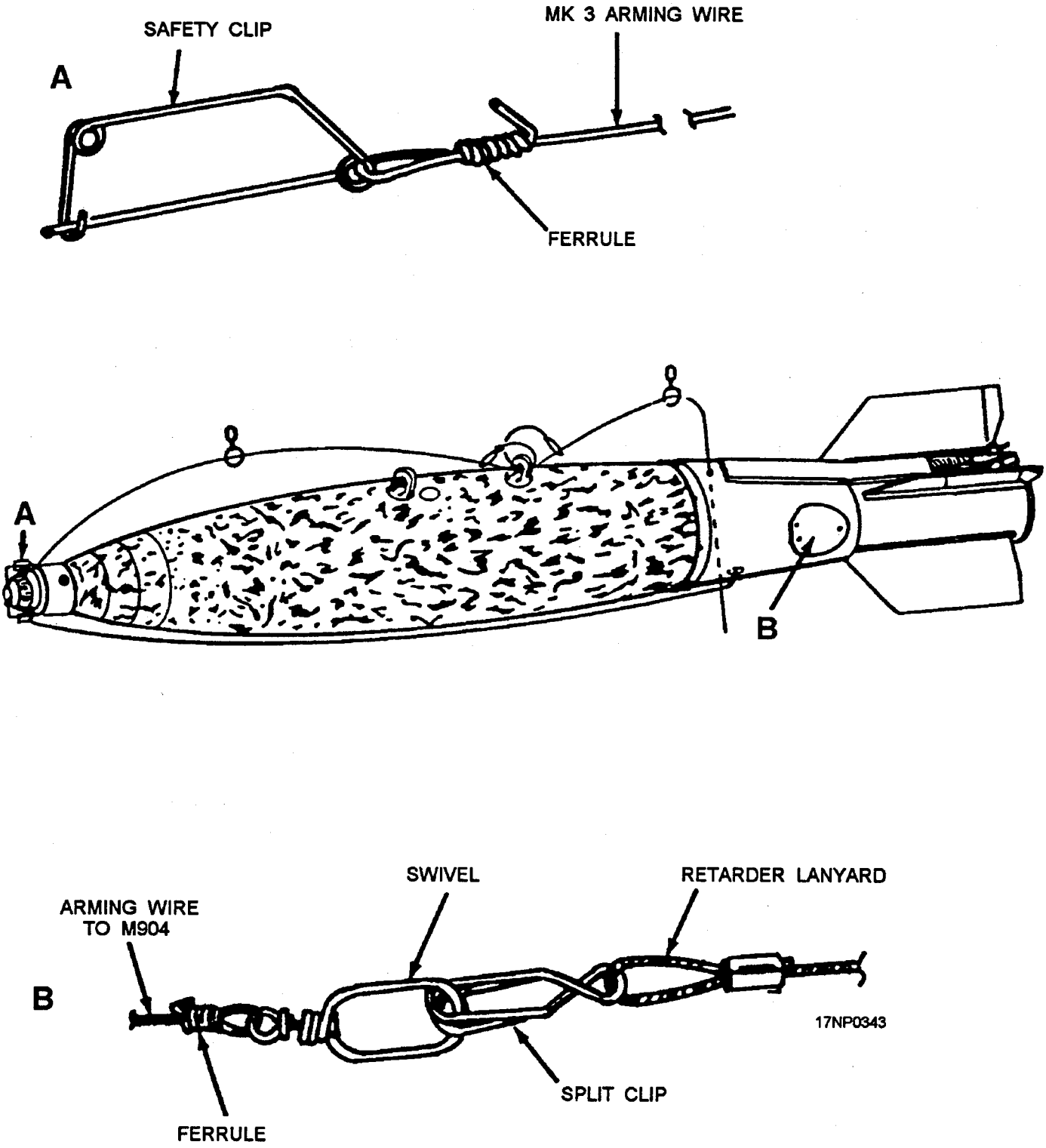


Figure 13-12.—Arming wire and split clip installation.

7. Attach the split clip to the arming wire swivel, route the arming wire through the bottom arming wire hole, and then route forward (fig. 13-12).

8. Fabricate composite arming wire after it is routed through bottom arming wire hole in fin.

9. Attach swivel end of the composite arming wire to the split clip on the fuze lanyard assembly.

10. Tape the arming wire to the bomb body.

11. (BSU-85/B) Re-install access cover.

12. (BSU-86/B) Ensure the lanyard clip and safety latch pin are installed and the safety pin assembly is removed.

13. (BSU-86) Install fin release safety clip into retaining band latch.

14. On the BSU-86, remove fin safing pin assembly.

15. Wrap uncut Mk 3 arming wire around the fin, and feed excess wire into appropriate hole in fin.

If you want more information about the configuration and assembly procedures for the GP bombs, you should refer to *Aircraft General Purpose Bombs, Fire Bombs, Practice Bombs, Fuzes, and Associated Components,* NAVAIR 11-5A-17, and *Airborne Weapons Assembly Manual,* NAVAIR 11-140-5.

REVIEW NUMBER 1

Q1. For information about the GP bomb assembly, you should refer to_____.

Q2. A maximum of _____of thermal coating can be missing,from a GP bomb and it is still considered thermally protected.

Q3. What mechanical nose fuze is used with the thermally protected Mk 80 bomb?

Q4. What electric tail fuzes can you use in live GP retarded bombs ?

Q5. Mk 122 arming safety switches are installed in GP bombs in a _____ .

SUBCALIBER PRACTICE BOMBS

The practice bombs normally used on a routine basis are the Mk 76 Mod 5 and the BDU-48. These practice bombs are discussed briefly in the following paragraphs.

Mk 76 Mod 5 Practice Bomb

The Mk 76 Mod 5 practice bomb (fig. 13-13) is prepared for aircraft loading as discussed in the following steps:

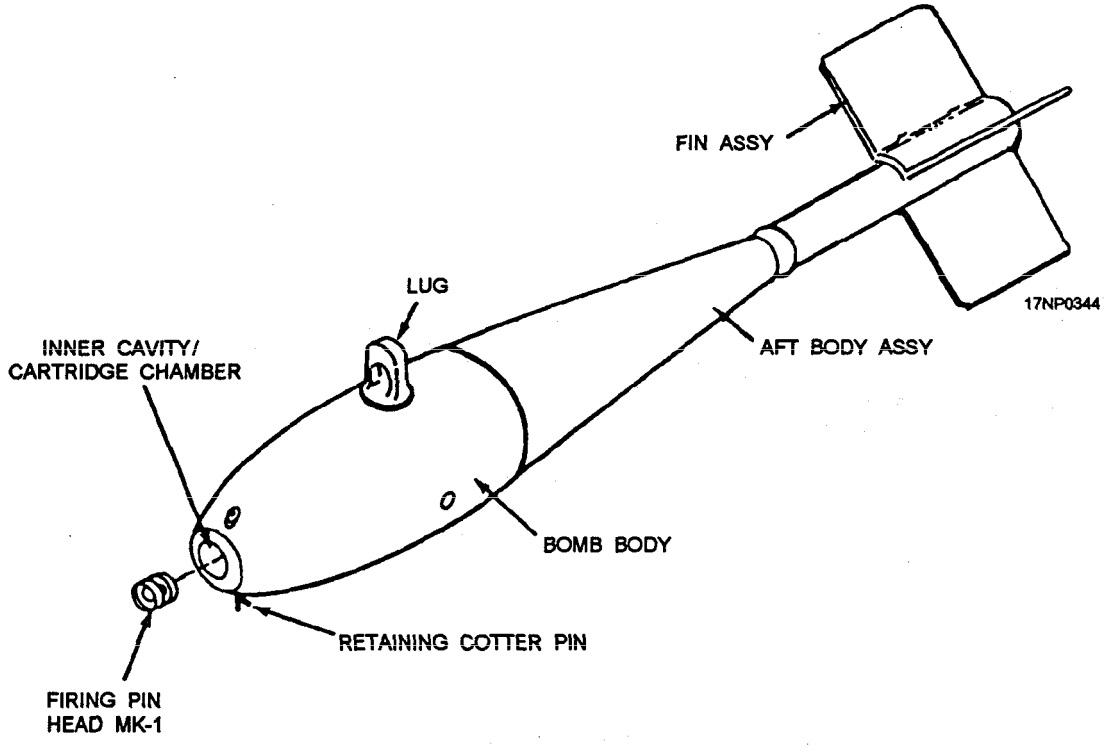


Figure 13-13.—Mk 76 Mod 5 practice bomb.

WARNING

Be extremely careful when handling a practice bomb loaded with a signal. Jarring or dropping the bomb may detonate the signal. Do not, under any circumstances, point either end of the bomb toward another person. Loading personnel must not place their bodies in line with the nose or tail end of a bomb.

1. Remove the bomb from the cardboard container.

2. Remove the cotter pin and Mk 1 firing-pin assembly from the nose. Inspect it for rust and deformation. Ensure the firing-pin cup is not deformed and the firing-pin point is below the lip of its cup.

3. Inspect the blast tube for rust and obstructions. Clean as required. When any obstructions are noted, proceed as follows: Insert a plug gauge SK923AS503 into the center cavity. The gauge should slide into place until the shoulder rests flush against the bomb. When the gauge shoulder does not rest against the bomb, the cavity is not clear. When the obstruction cannot be removed, reject the bomb as unserviceable, and dispose of it by following current instructions.

WARNING

A signal cartridge must not be swollen or deformed in any manner. The primer must be flush with or slightly below the base of the cartridge. If you attempt to install a deformed signal, it can cause detonation. Use extreme care when you handle a signal cartridge. When a practice bomb is not used after the signal has been installed, the signal must be gently removed and replaced in the original shipping container. The cartridge can be reloaded and used later. Do not apply pressure to force the signal cartridge or firing-pin assembly into the bomb because the assembly could become deformed and fire the signal.

4. With the firing-pin assembly removed, elevate the nose of the bomb. Insert the Mk 4 Mod 3 or CXU-3A/B practice bomb signal, primer end up, into the nose of the practice bomb. Slide it gently into place. Do not use force. The base flange of the signal cartridge must rest on the bore shoulder, which is about 1 1/4 inches inward from the nose of the bomb.

5. Carefully insert the firing-pin assembly with the firing-pin end toward the signal.

6. Rotate the firing-pin assembly so that the two notches in the lip of the forward cup line up with the cotter pin holes in the nose end of the bomb. Do not apply pressure to the firing pin during this procedure.

7. Insert the cotter pin through the pinholes in the bomb body. Pass it through the notches in the firing-pin assembly. Spread the ends of the cotter pin just enough to retain it in place.

BDU-48 Practice Bomb

The BDU-48 practice bomb is prepared for aircraft loading as discussed in the following steps:

NOTE: The warnings discussed for the Mk 76 Mod 5 also apply to the BDU-48.

REVIEW NUMBER 1 ANSWERS TO QUESTIONS Q1. THROUGH Q5.

A1. For information about the GP bomb assembly you should refer to Airborne Weapons Assembly Manual, NAVAIR *11-140-5.*

A2. A maximum of 56 square inches of thermal coating can be missing from a GP bomb, and it is still considered thermally protected.

A3. An M904E4 mechanical nose fuze with an M148E1 adapter booster is used with the thermally protected Mk 80 bomb.

A4. Only the Mk 376 and FMU-139 electrical tail fuzes are used in live GP retarded bombs.

A5. Mk 122 arming safety switches are instilled in GP bombs in a RADHAZ-free environment.

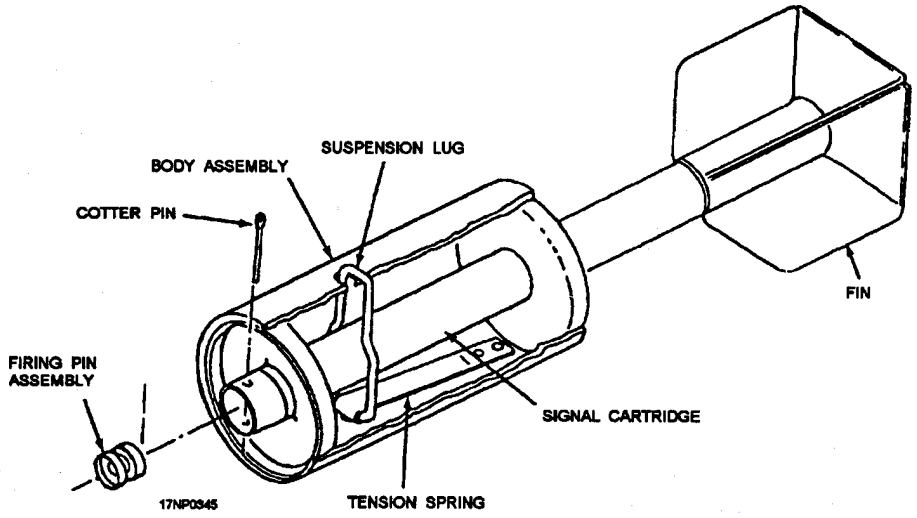


Figure 13-14.—BDU-48/B practice bomb.

1. Remove the bomb assembly from the container.

2. Remove the firing device and inspect for rust or deformation. Refer to figure 13-14 for identification of the components.

3. Inspect the blast tube for rust and deformation. Clean as required.

4. Insert the signal into the sleeve. With the firing device removed, elevate the nose of the bomb. Insert the Mk 4 or CXU-3A/B practice bomb signal, primer end up, and slide it gently into place. Do not use force. The base flange of the signal cartridge must rest on the bore shoulder.

5. Carefully insert firing pin assembly into the nose of the bomb.

6. Align firing pin assembly notches with the two holes in the nose end of the bomb. Insert cotter pin through holes in bomb body, and spread end of cotter pin just enough to remain in place.

For detailed information concerning the preparation of practice bombs for aircraft loading, refer to the publication NAVAIR 11-140-5.

FULL-SCALE PRACTICE BOMBS (BDU-45)

Preparation and inspection of BDU-45 (fig. 13-15) full-scale practice bombs are the same as the GP bombs

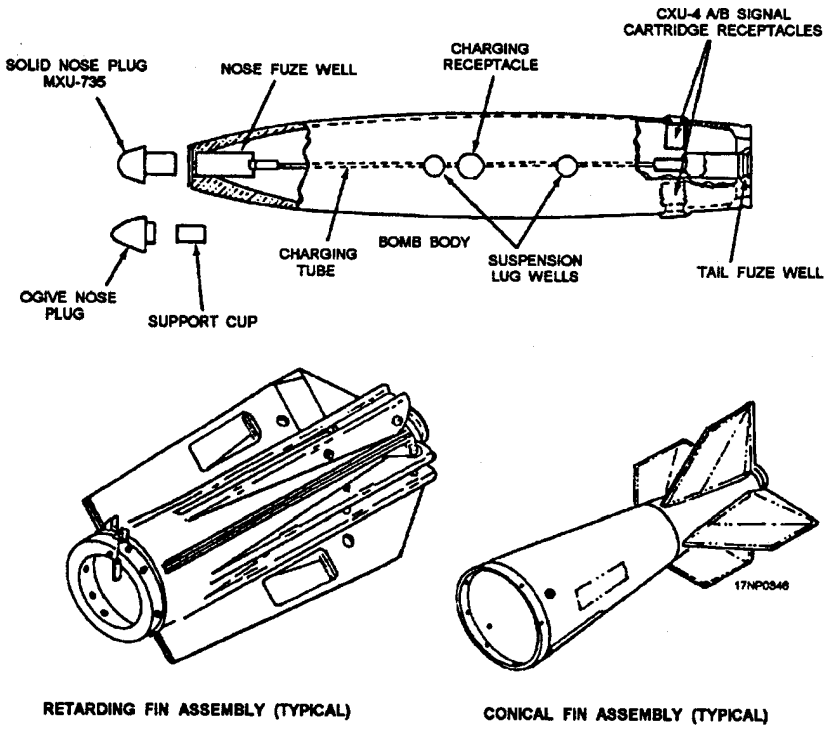


Figure 13-15.—BDU-45/B (typical) practice bomb.

discussed earlier in this chapter with the following exceptions. The spotting charge receptacles must be checked to ensure they are clean, free of foreign material and moisture, and not deformed.

CXU-4/B Spotting Charge

Prepare, inspect, and install the CXU-4/B spotting charge as follows:

1. Check spotting charge for damage or leakage.

2. Ensure retaining ring and spring washer are present.

3. Install spring washer at base of spotting charge receptacle.

4. Slide spotting charge into receptacle and secure with retaining ring (pliers may be required).

MXU-735 Nose Plug

Inspect and install nose plug as follows:

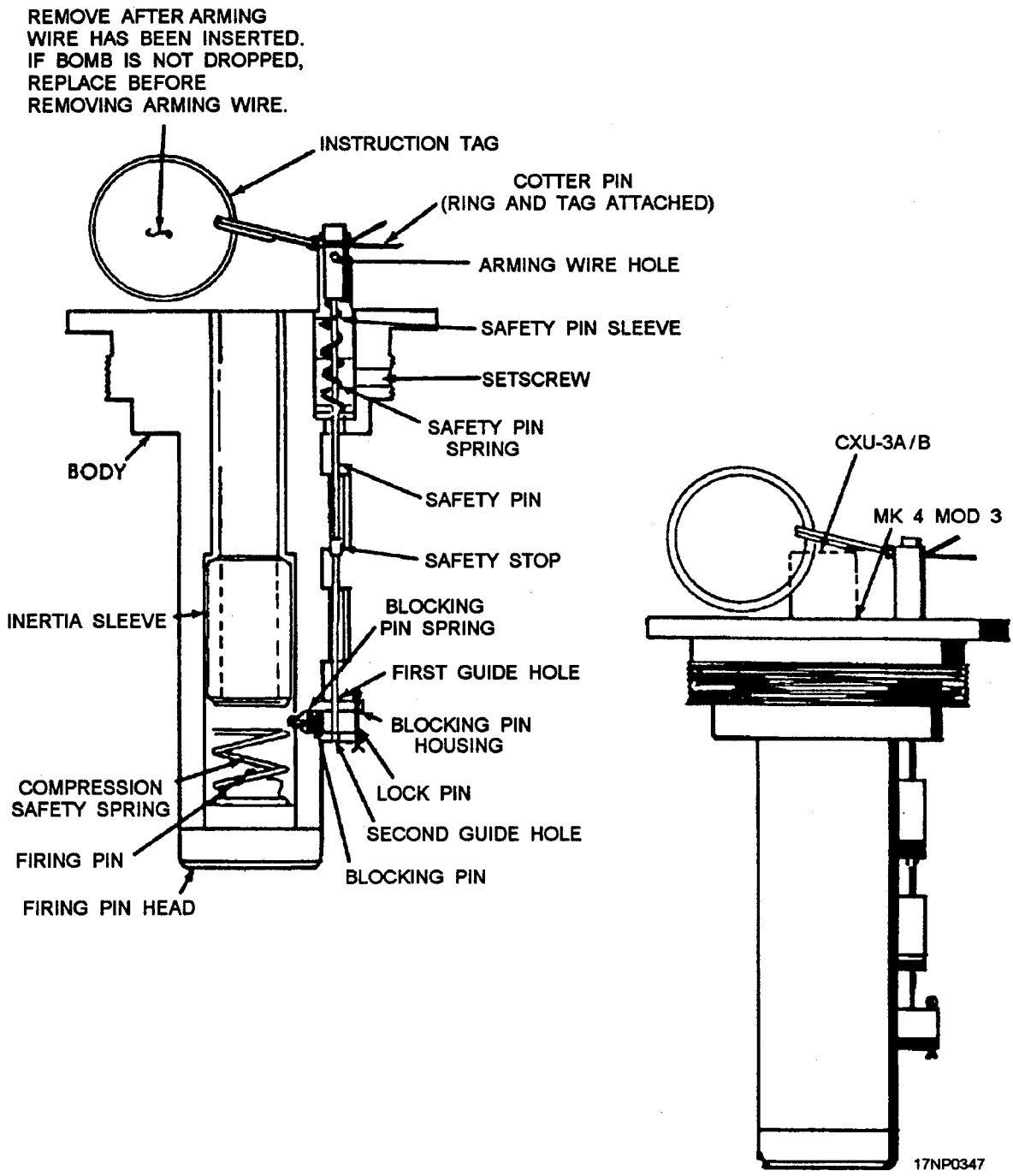


Figure 13-16.—Mk 89 Mod 0 bomb spotting charge adapter.

1. Ensure threads are not damaged

2. Install nose plug, tighten with spanner wrench or rachet, and tighten nose setscrew.

Electric/Electronic TaiI Fuzes

Procedures for inspection and installation of tail fuzes FMU-139 and Mk 376 are the same as for GP bombs, as outlined previously in this chapter.

Mk 89 Mod 0 Spotting Charge Adapter

Prepare and inspect the Mk 89 spotting charge adapter (fig. 13-16) as follows:

1. Remove tape holding cotter pin with instruction tag attached

2. Remove inertia sleeve and compression safety spring by unscrewing firing pinhead from adapter body.

3. Inspect all components, and reject adapter if any components are damaged.

Mk 4 and CXU-3 Cartridge Installation

Install signal cartridge in spotting charge adapter as follows:

1. Insert inertia sleeve into cavity body.

2. Slide cartridge through inertia sleeve with cartridge rim against forward end of sleeve.

3. Press blocking pin inward until safety pin presses through the second guide hole, locking blocking pin in place.

4. Insert cotter pin through outer set of holes in head of safety pin and safety pin sleeve. Bend leg of cotter pin slightly to hold in place.

5. Place compression safety spring over firing pin head into adapter body and hand tighten.

Mk 89 Spotting Charge Installation

Install Mk 89 spotting charge adapter with signal cartridge as follows:

1. Verify bomb tail well is clean.

2. Insert adapter in the same manner as electric fuzes.

NOTE: The procedures for inspection and installation of nose fuzes and bomb fins are the same as those discussed previously in this chapter for GP bombs.

GUIDED-BOMB UNIT (GBU) ASSEMBLY

GBUs are general-purpose bombs configured with a wing assembly and a computer control group. Preparation and inspection of the GBUs are the same as the GP bombs, discussed earlier in this chapter,

Wing Assembly Installation

Install the wing assembly on the bomb as follows:

1. Ensure safety pins are securely installed in latch release lever and collar assembly (fig. 13-17).

2. Remove access covers.

NOTE: Refer to figure 13-18 for steps 3 through 8.

3. Attach Mk 3 arming wire to aft suspension lug.

4. Insert arming wire through MAU-166 swivel loop.

5. Orient wings as follows:

a. Position GBU-12 and GBU-16 wings in X configuration with the wing release latch mechanism at 9 o'clock, with the bomb lugs at 12 o'clock when viewed from the rear.

b. Position GBU-10 wings so that latch mechanism is at 12 o'clock in line with the bomb lugs.

NOTE: Mk 3 arming wire installation for the GBU-12 and GBU-16 is the same as for GP bombs, discussed earlier in this chapter. For the GBU-10, install arming wire through hole at the 3 o'clock position of wing and route through pull-out pin/gagrod and pass wire out through hole at 9 o'clock position of wing assembly.

6. Remove safety cotter pin from pull-out pin/gagrod.

7. Keep arming wire taut while pressing the wing against the bomb body. Hand tighten setscrews.

8. Torque setscrews to the required torque.

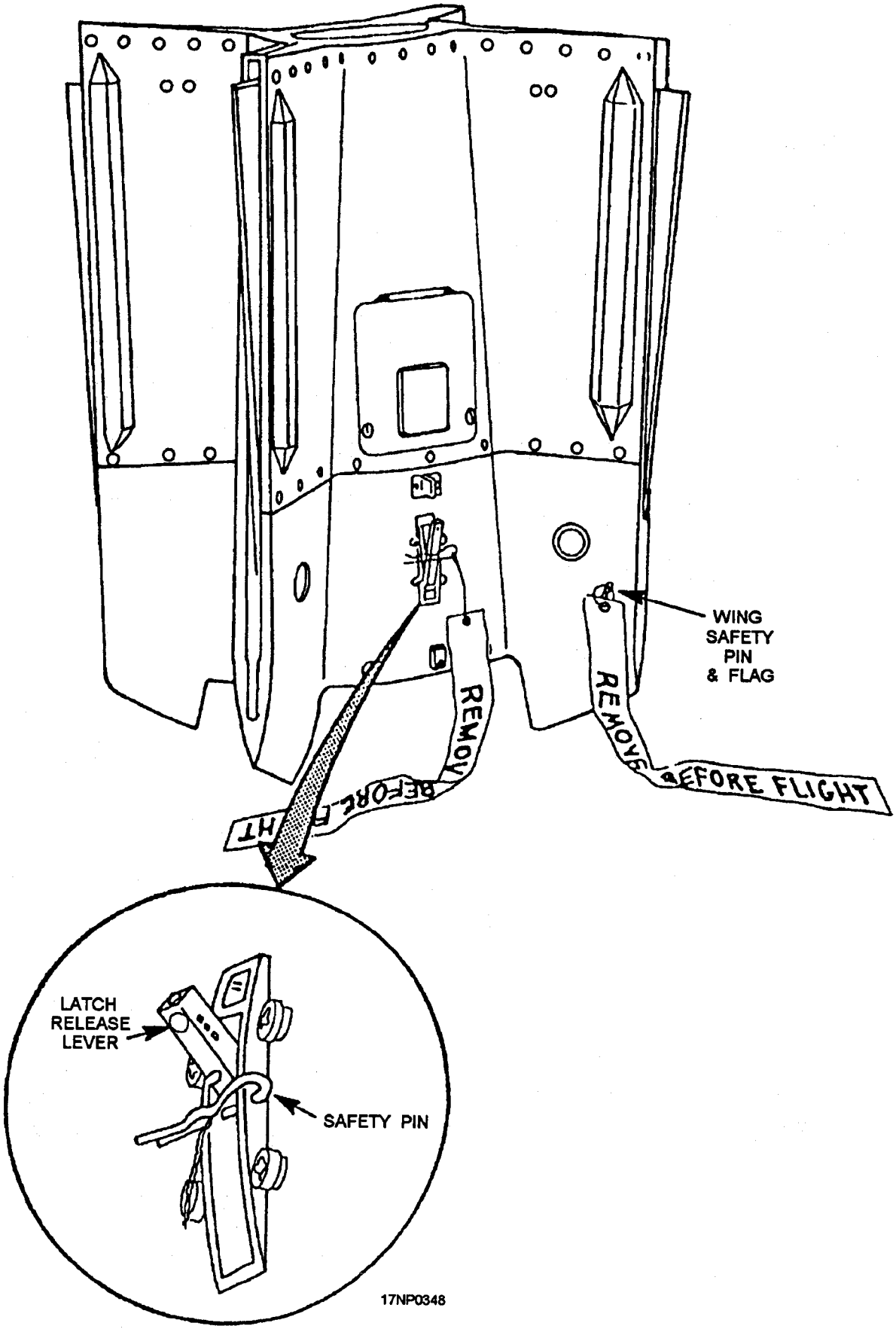
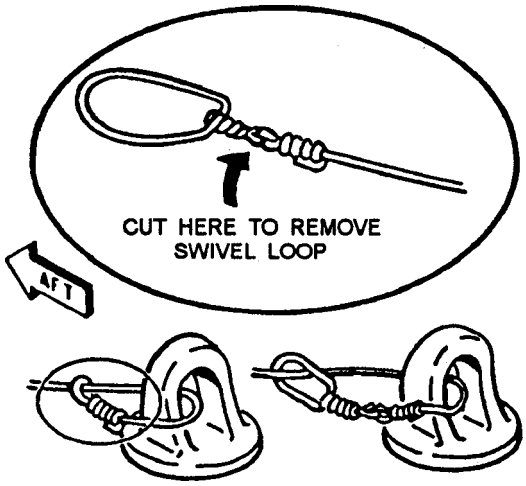


Figure 13-17.—Wing assembly.

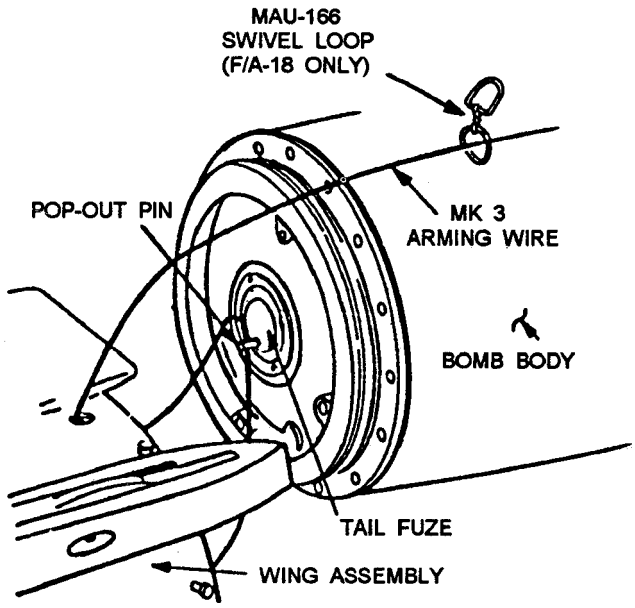


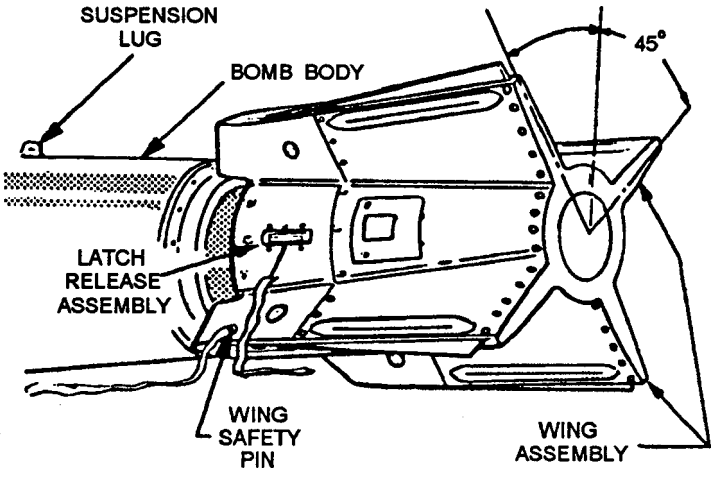
PREFERRED ATTACHMENT

PRIOR TO ATTACHING ARMING WIRE REMOVE SWIVEL LOOP AS SHOWN IN INSET.

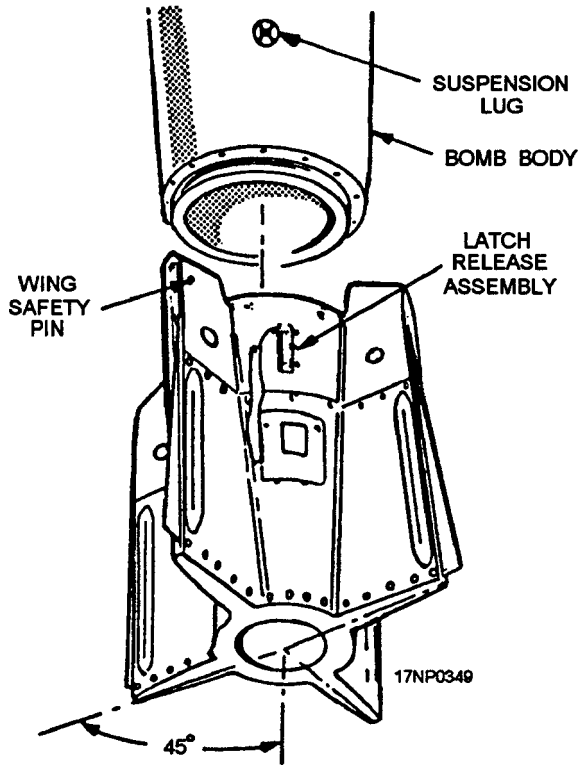
ALTERNATE ATTACHMENT

IF SWIVEL LOOP IS NOT REMOVED ENSURE THAT ARMING WIRE IS INSTALLED SO THAT SWIVEL LOOP IS POSITIONED OUTSIDE OF BOMB LUG.





SIDE VIEW



TOP VIEW

Figure 13-18.—GBU-12/16/10 wing assembly installation.

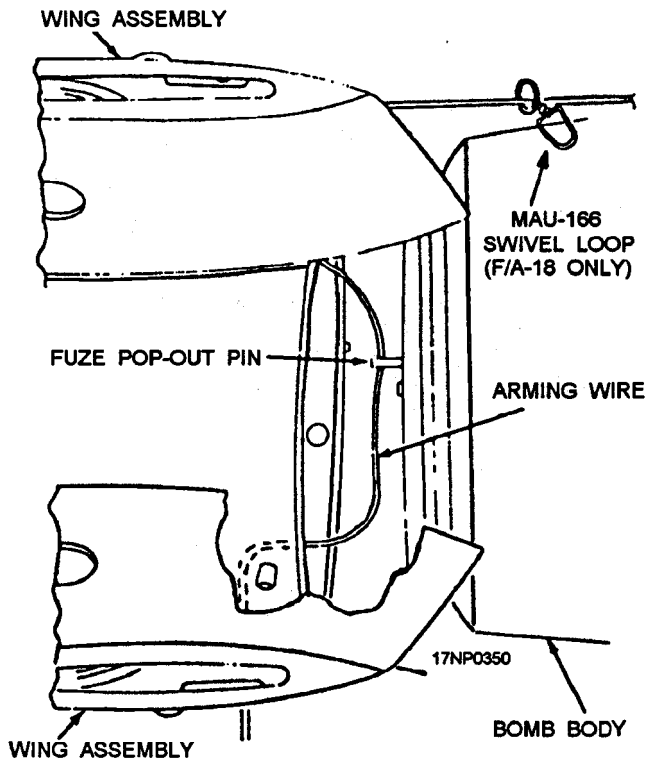


Figure 12-19.—Arming wire installation.

9. Remove the access cover, ensure that no kinks are in the arming wire, and that the wire is not looped around pull-out pin (fig. 13-19).

10. Secure access cover.

11. Wrap arming wire around wing assembly.

12. Mark wing assembly with type of fuze and date installed, fuze safety pin removed, and current date and QA initials.

Forward Adapter Assembly Installation

Install forward adapter assembly (fig. 13-20) on nose of bomb as follows:

1. Place O-ring on external threads of retainer bolt.

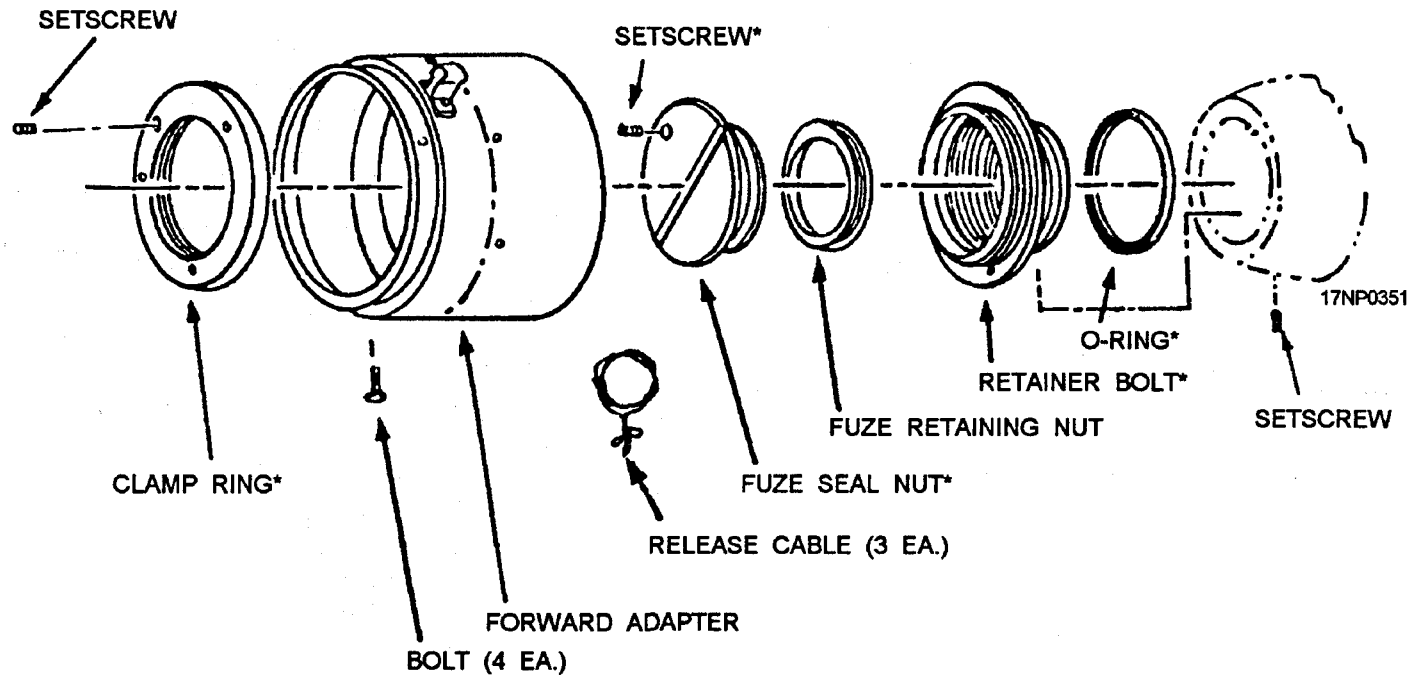
2. Install retainer bolt into nose fuze well (fig. 13-21).

3. Torque retainer bolt to specified torque by using wrench adapter (fig. 13-21).

4. Apply specified torque to setscrew in nose fuze well (fig. 13-21).

5. Install fuze seal nut in retainer bolt and tighten (fig. 13-21) setscrew.

6. Place open end of forward adapter over nose bomb body. Align arming wire guide with suspension lugs on bomb body.



*FUZE RETAINER AND BOLT ASSEMBLY 310021-1

Figure 13-20.—Forward adapter assembly with fuze retaining bolt.

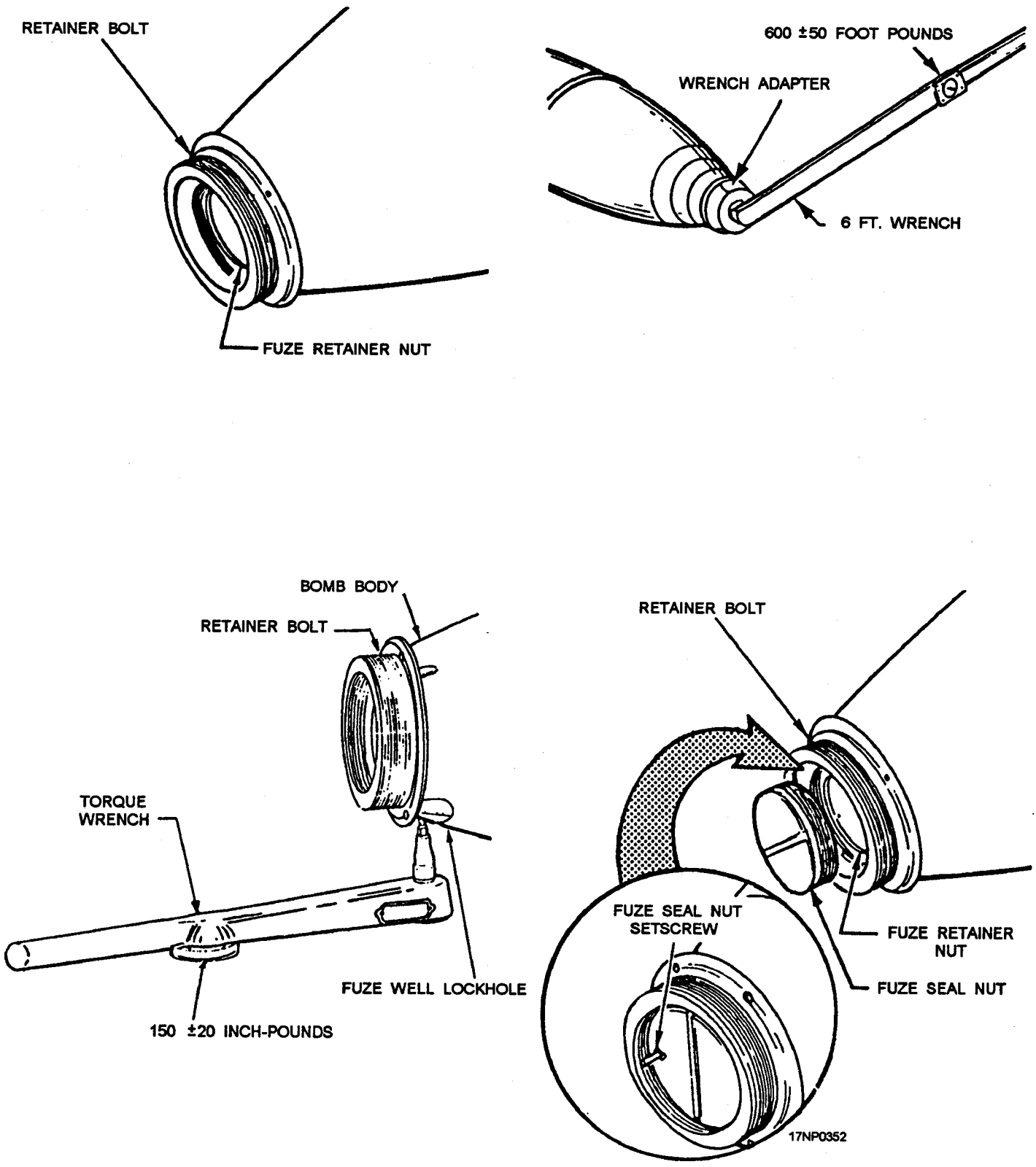


Figure 13-21.—Retainer bolt and sealing nut installation.

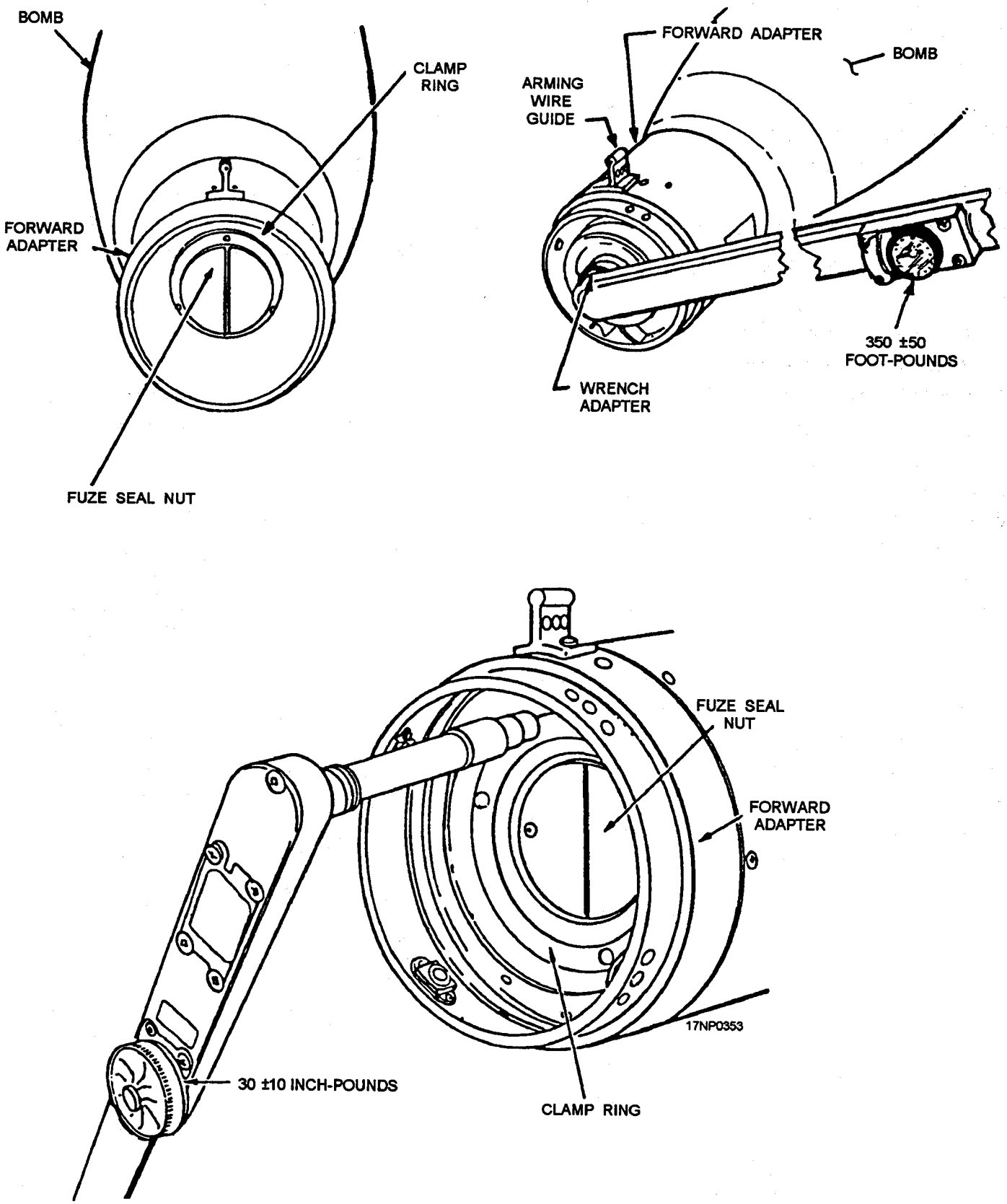


Figure 13-22.—Clamp ring installation.

7. Install clamp ring onto retainer bolt (fig. 13-22). Back out setscrew to prevent assembly interference.

8. Torque clamp ring to specified torque.

9. Verify arming wire guide is aligned with suspension lugs of bomb body.

10. Apply specified torque to clamp ring setscrew (fig. 13-22).

Computer Control Group Installation

Install the computer control group (CCG) as follows:

1. Visually inspect CCG for physical damage.

2. Ensure thermal battery firing pin assembly safety wire and pull-out pin are installed (fig. 13-23).

3. Ensure control section seal is installed.

4. Remove detector dome protective cover and packing, inspect detector for cracks through the dome thickness, portions of the dome missing, or abrasion that prevents you from visually seeing the internal parts.

5. Inspect humidity detector ring inside of the detector optic assembly for indication of moisture.

6. Ensure detector moves freely on gimbals.

7. Replace detector dome protective cover and packing.

8. Position CCG on forward adapter (fig. 13-23), and align thermal battery firing pin assembly with arming wire guide on forward adapter.

9. Install four bolts through CCG mounting hole and forward adapter. Apply specified torque to bolts.

5.0-INCH AIRBORNE ROCKET ASSEMBLY PROCEDURES

The following 5.0-inch airborne rocket assembly procedures are used when you load the LAU-10 airborne rocket launcher. The LAU-10 airborne rocket launcher is discussed in chapter 2 of this TRAMAN. If the rocket launcher is being reused, it must be sent to AIMD for electrical checkout prior to loading.

The 5.0-inch rocket components maybe received as follows: The rocket motors are preloaded in the 4-round LAU-10 launcher, and the fuze and warhead are shipped in separate shipping containers, or all rocket components are shipped in separate authorized shipping containers.

Unpacking Rocket Components

Rocket motors and other rocket components are unpacked as discussed in the following steps:

WARNING

Banding straps are under tension. You must use care in cutting them to prevent injury.

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

2. Keep all containers in a horizontal position while opening them. During the assembly procedure, keep the rocket warheads and motors in a horizontal position. This decreases the possibility of accidents.

3. All retrograde items, such as metal boxes, wooden boxes, spacers, and thread protectors, are

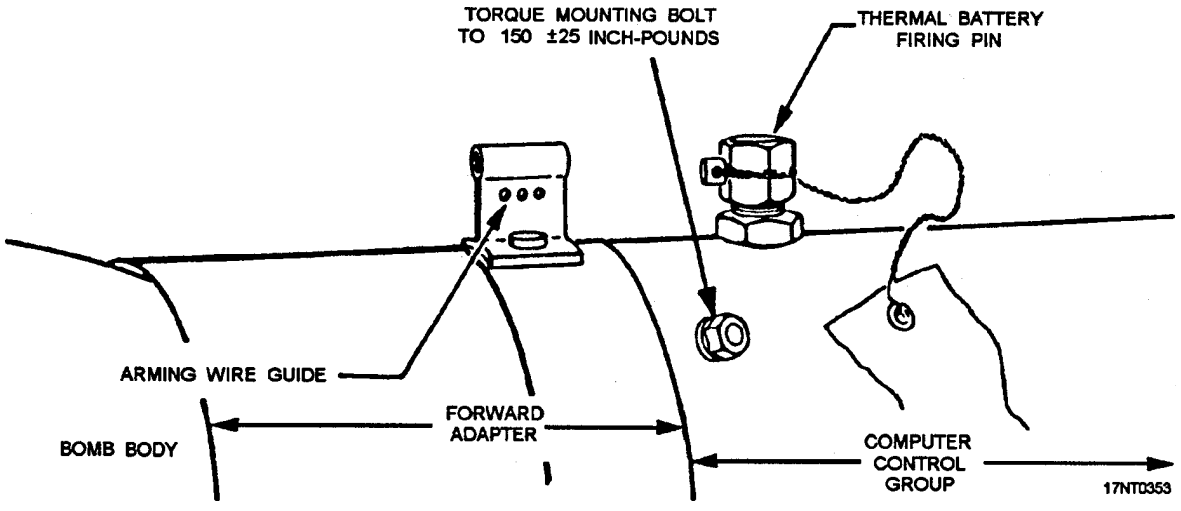


Figure 13-23.—Computer control group installation.

removed from the components in preparation for assembly. These retrograde items must be retained and disposed of according to current directives.

Inspecting Rocket Components

As the rocket components are removed from their shipping containers, inspect them by performing the steps listed below. Dispose of defective items according to current directives. The components you inspect include launchers, warheads, fuzes, and rocket motors, to include their fins.

WARNING

To avoid personal injury and equipment damage in an operation involving assembly, disassembly, fuzing, defuzing, or cleaning, you must do the work in a designated area. This area must be safely located away from other explosives and vital installations. Only the smallest number of rockets practicable should be exposed. Only authorized personnel essential to the work should be permitted in the vicinity. Refer to the publications NAVAIR 16-1-529 and NAVORD OP 3565 for RADHAZ procedures and precautions.

WARHEADS.— Inspect the warheads as follows:

WARNING

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

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

2. On the Mk 32 warhead, verify that the fuze is staked

3. Verify that the base and fuze cavity threads are not damaged 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 l/16 inch. Detonation could occur during handlng or firing.

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

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

FUZES.— Inspect the fuze as follows:

WARNING

Fuzes that are damaged are hazardous. Detonation may occur.

CAUTION

Do not use Mk 93 or M414 fuzes with nose cones that are completely penetrated by scratches, cracks, or abrasions. Minor scratches or abrasions do not affect their performance or safety.

1. Verify that the fuze body is not damaged.

2. Check the fuze threads for damage or corrosion.

ROCKET MOTORS.— Inspect the motor as follows:

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

WARNING

Use an authorized metal shielding band assembly only. Do not substitute the Mk 71 motor plastic fin retainer band because it offers no RADHAZ protection.

NOTE: Rocket motors packaged in individual wooden containers may be received with the old, narrow, metal shielding band (P/N 1516140) installed. This band is obsolete and must be replaced with shielding band assembly P/N 4902192 when unloaded from the launchers.

2. Verify that the shielding band and the RADHAZ barrier are in place.

3. Verify that the nozzle plug is in place.

4. For rocket motor Mk 71, verify that the fin retainer is in place, the fins are not bent or broken and the fin pin is clean and free of foreign matter. The spring-loaded fins must be exercised four to six times.

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

6. Check threads for damage or corrosion.

Assembly of Rocket Components

Rocket components are assembled as discussed in the following steps:

WARNING

Shielding bands must be in place whenever the rocket motor is out of or protrudes from the launcher. Ensure the shielding band covers the contact band but does not touch it.

1. Place detent lift arm in load position.

2. Push forward on aft end of rocket motor until forward end of rocket emerges from launcher.

3. Slide shielding band (fig. 13-24) over motor and hold against forward part of launcher; push motor foward until locking tabs seat in the motor detent grooves and not in the contact band groove.

NOTE: A standard rocket assembly tool kit containing crowfoot wrenches, a torque wrench, detent locking wrenches, chain wrenches, and strap wrenches is available for the assembly of 2.75-inch and 5.0-inch rockets.

4. Hold motor with strap wrench. Screw warhead into motor and tighten securely with chain wrench until the warhead seats 360 degrees.

5. Attach appropriate nose fuze and tighten.

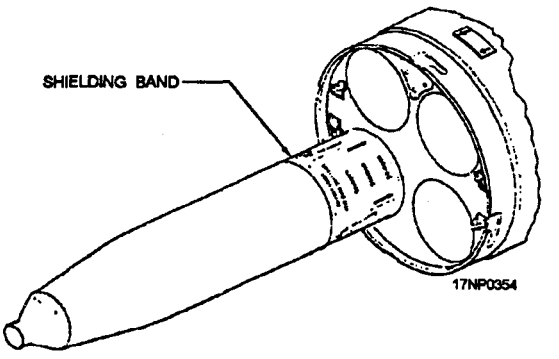


Figure 13-24.—5.0-inch rocket RADHAZ and electrostatic protection.

6. Push rocket motor slowly into the tube until aft end contacts aft stop.

7. Rotate detent lift arm to flare position.

8. Push the motor forward hard; pawl will engage groove with audible click indicating positive engagement.

2.75-INCH AIRBORNE ROCKET ASSEMBLY PROCEDURES

Unpacking and inspection of the warhead, fuzes, and motor are essentially the same as for the 5.0-inch rocket components discussed earlier in this chapter. Assemble rocket components as follows:

1. Place rocket motor body in holding fixture (fig. 13-25).

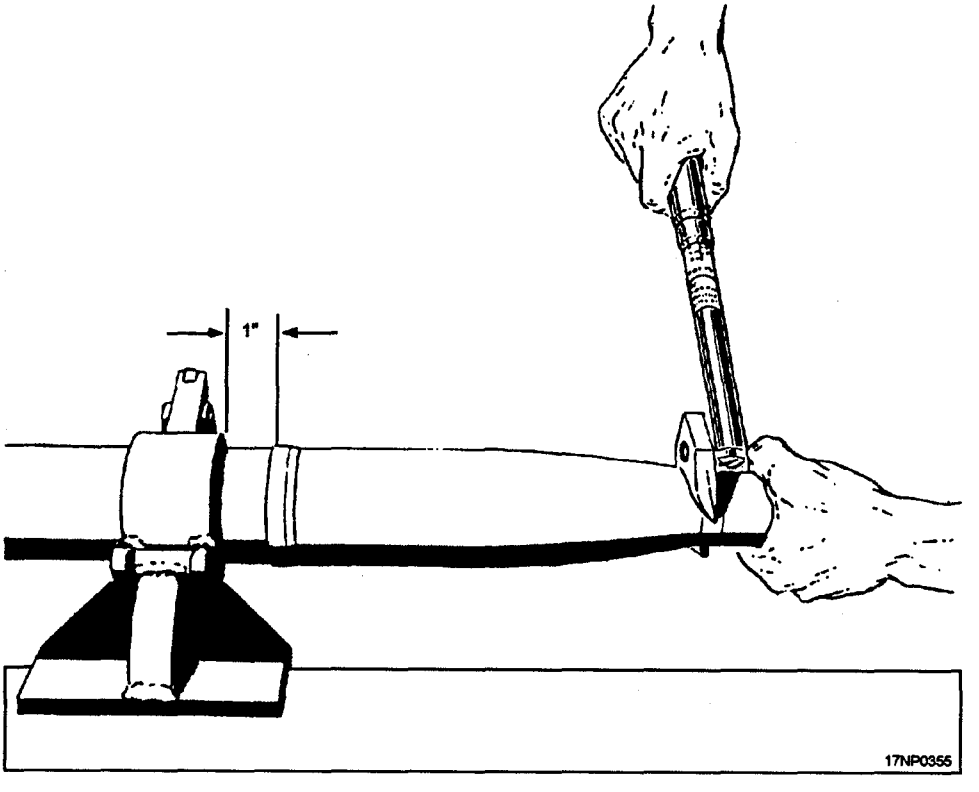


Figure 13-25.—Holding fixture assembly.

2. Hand tighten warhead to motor.

3. Apply the specified torque to the warhead by using a crowfoot adapter and torque wrench (fig. 13-25).

NOTE: Some warheads only require tightening until the warhead seats on the motor 360 degrees.

4. Install fuze hand-tight in the warhead.

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

6. Remove assembled rocket from holding fixture.

7. Remove and retain fin protector just before inserting rocket into launcher.

8. Slowly push the rocket into the tube by using rocket loading and release tool (fig. 13-26) until detent snaps into position in detent groove.

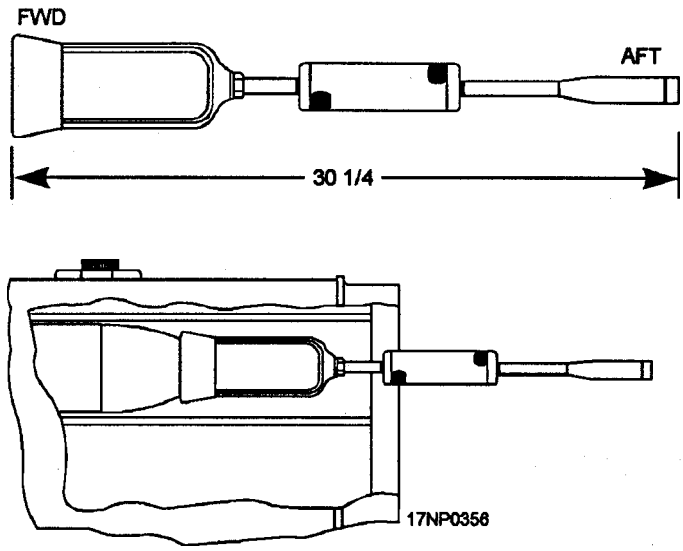
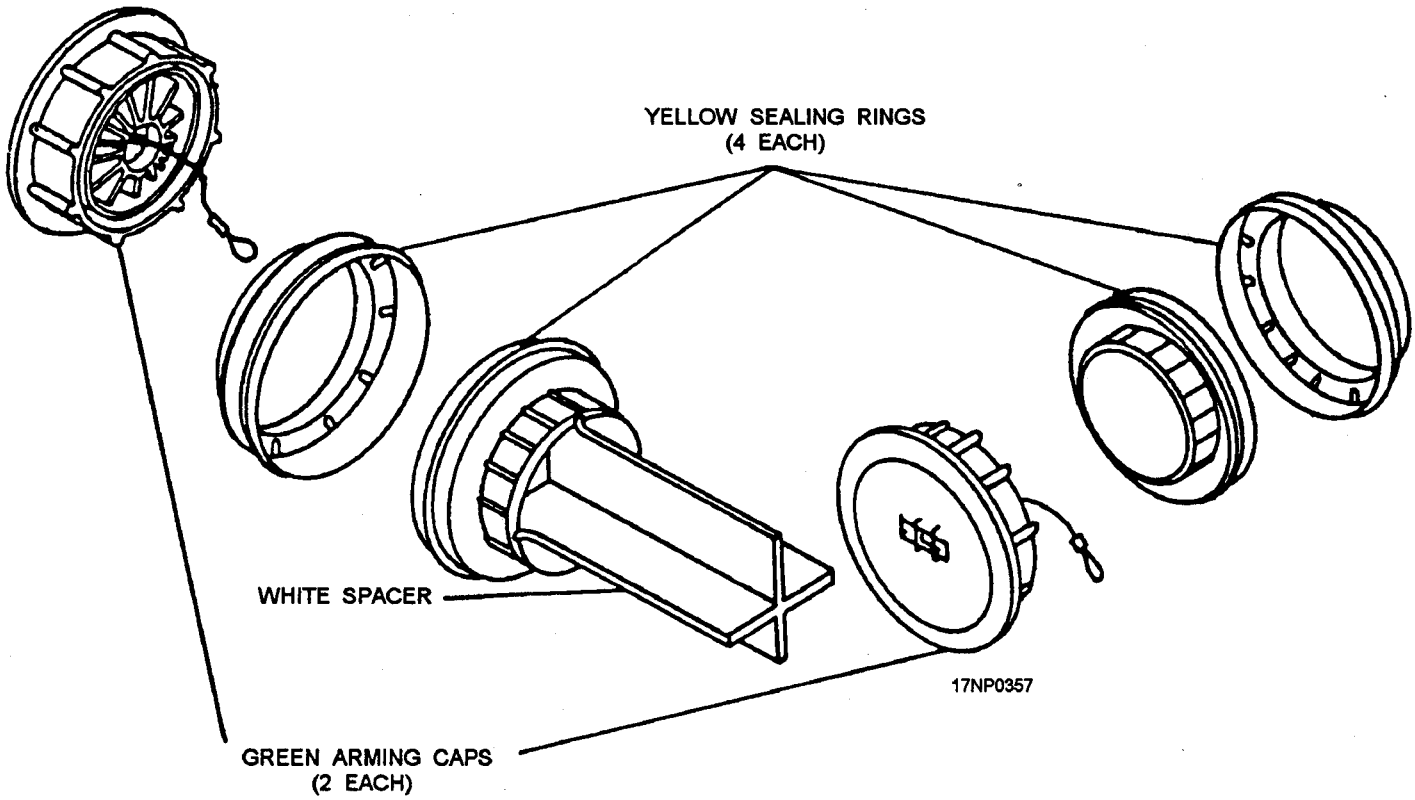


Figure 13-26.—Rocket loading and release tool.



FLARE ADAPTER KIT ADU-381/A PLASTIC PARTS
DODIC/NALC LY15

Figure 13-27.—Flare adapter kit.

CAUTION

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

NOTE: A groove may be cut in one nylon insert only of the practice warheads Mk 6 Mod 7 and Mk 32 Mod 0. This facilitates assembly of the warhead to the motor.

For detailed information concerning the assembly procedures of airborne rockets, you should refer to *Airborne Rockets,* NAVAIR 11-85-5; *5.0-Inch Airborne Rocket Launchers LAU-10 Series,* NAVAIR 11-75A-63; and *2.75-Inch Airborne Rocket Launchers,* NAVAIR 11-75A-61.

REVIEW NUMBER 2

Q1. List the two subcaliber practice bombs normally used.

Q2. List the two practice bomb signals used with the Mk 76 practice bomb.

Q3. To what publication should you refer for detailed information about practice bombs?

SUU-25 FLARE DISPENSER

Perform loading and unloading of the dispenser in authorized areas only.

Adapter Kits

Install adapter kits on flares as follows:

1. Make sure the timer knob is on safe.

2. Make sure there is no external damage.

3. Check the adapter kit (fig. 13-27) for two green arming caps with serviceable arming lanyards, one white two-piece spacer, and four yellow sealing rings.

4. Rotate the time knob (fig. 13-28) to required setting.

5. Install yellow sealing ring on each end of flare.

6. Connect green arming cap lanyard (fig. 13-29) to timer knob.

7. Install green capon yellow sealing ring.

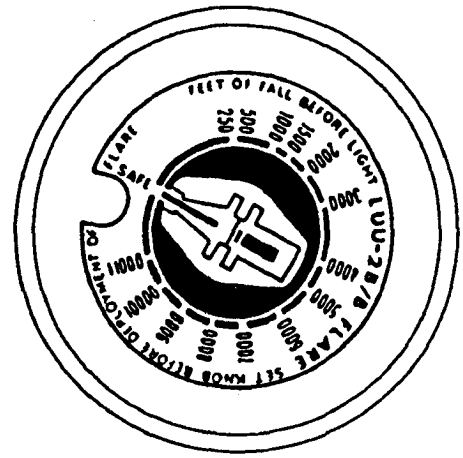


Figure 13-28.—Timer knob settings.

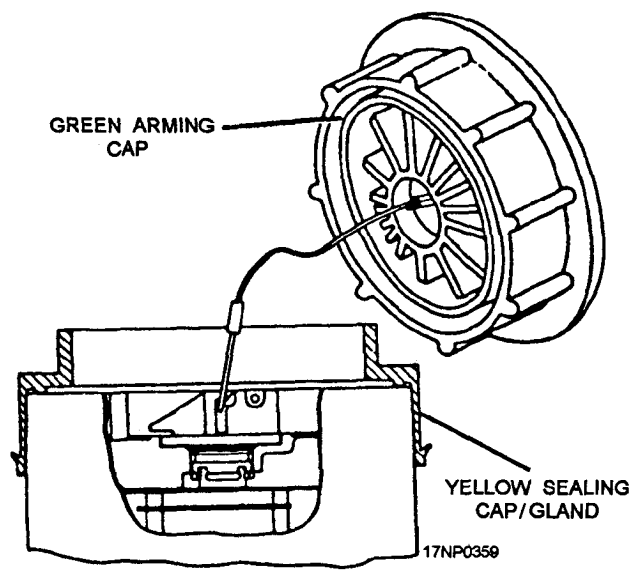


Figure 13-29.—Lanyard configuration.

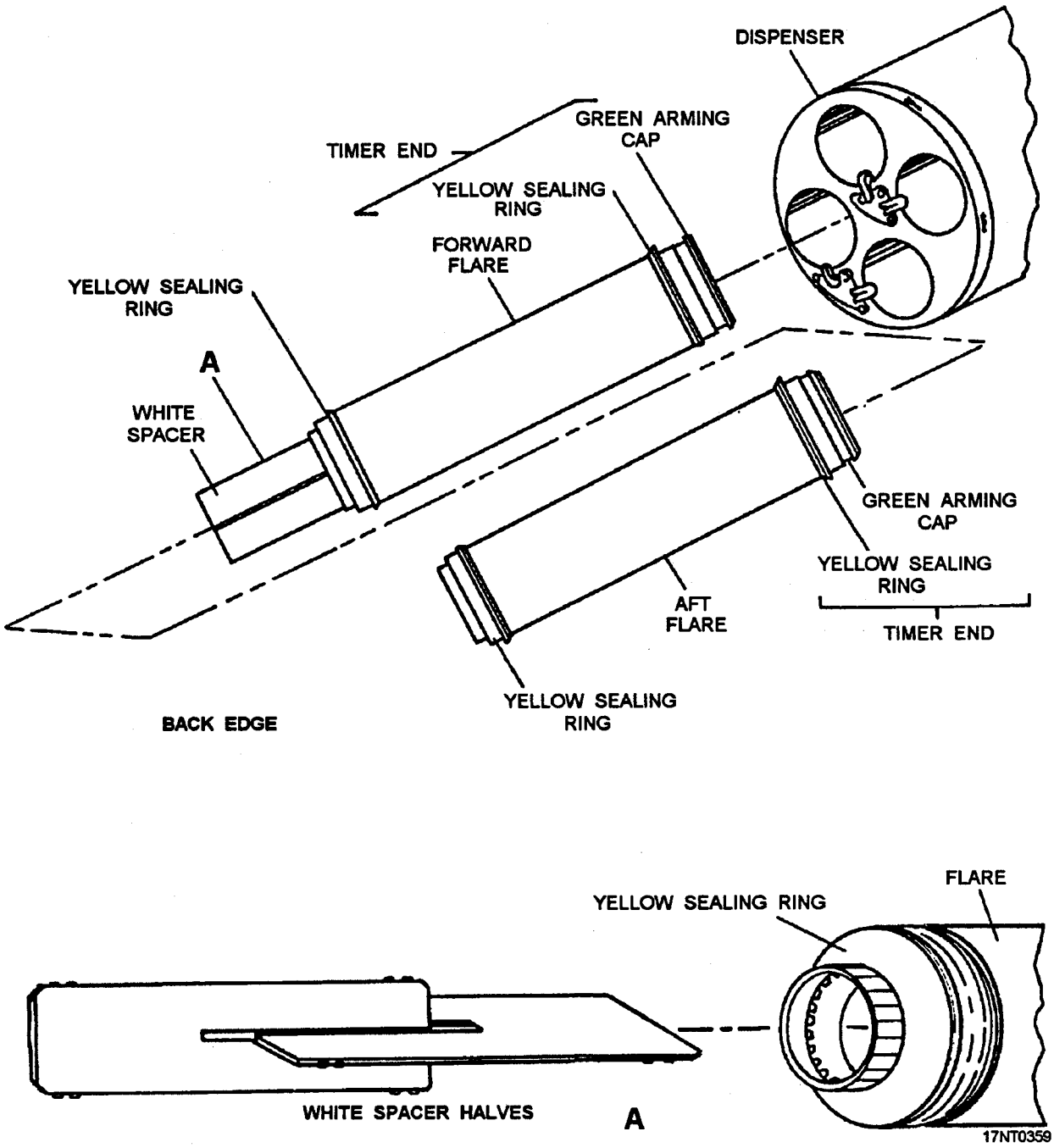


Figure 13-30.—Installation of spacer assemblies on flares.

REVIEW NUMBER 2 ANSWERS TO QUESTIONS Q1. THROUGH Q3.

A1. Mk 76 and Mods and BDU-48/B are the two subcaliber practice bombs normally used.

A2. The CXU-3A/B day use and the Mk 4 night use are the two practice bomb signals used with the Mk 76 practice bomb.

A3. You should refer to NAVAIR 11-5A-17 for detailed information about practice bombs and signal cartridges.

8. Place the two halves of the white spacer together and install on the aft end of the forward flare (fig. 13-30).

Dispenser Preparation

Prepare dispenser for flare loading as follows:

1. Safety pin and flag installed in safety switch (fig. 13-31).

2. Stepper switch set on safe.

3. Ensure dispenser has been electrically checked.

4. Open breech caps, ensure sleeves are clean.

5. Open four downloading breech caps (fig. 13-32).

Flare Loading Procedures

Load flares into dispenser as follows:

1. Insert forward flare into tube with green arming cap forward, and ensure white spacer is properly seated on yellow sealing ring and centered. Continue to push flare forward, and insert aft flare with green arming cap forward until forward flare is stopped against the expansion chamber.

2. Close aft retaining link and insert shear pin, with head of shear pin in the upward position. Spread shear pin tangs 30 to 40 degrees.

3. Rotate applicable forward retaining lock to locked position.

4. Install shear pin into lock with pinhead forward and spread tangs to 30 to 40 degrees.

5. Install four downloading breech caps and tighten.

6. Mark dispenser with the date loaded, munitions, lot number, timer setting, and electrical test date.

SAFETY PRECAUTIONS

Safety precautions prescribe the minimum requirements and regulations you should observe when

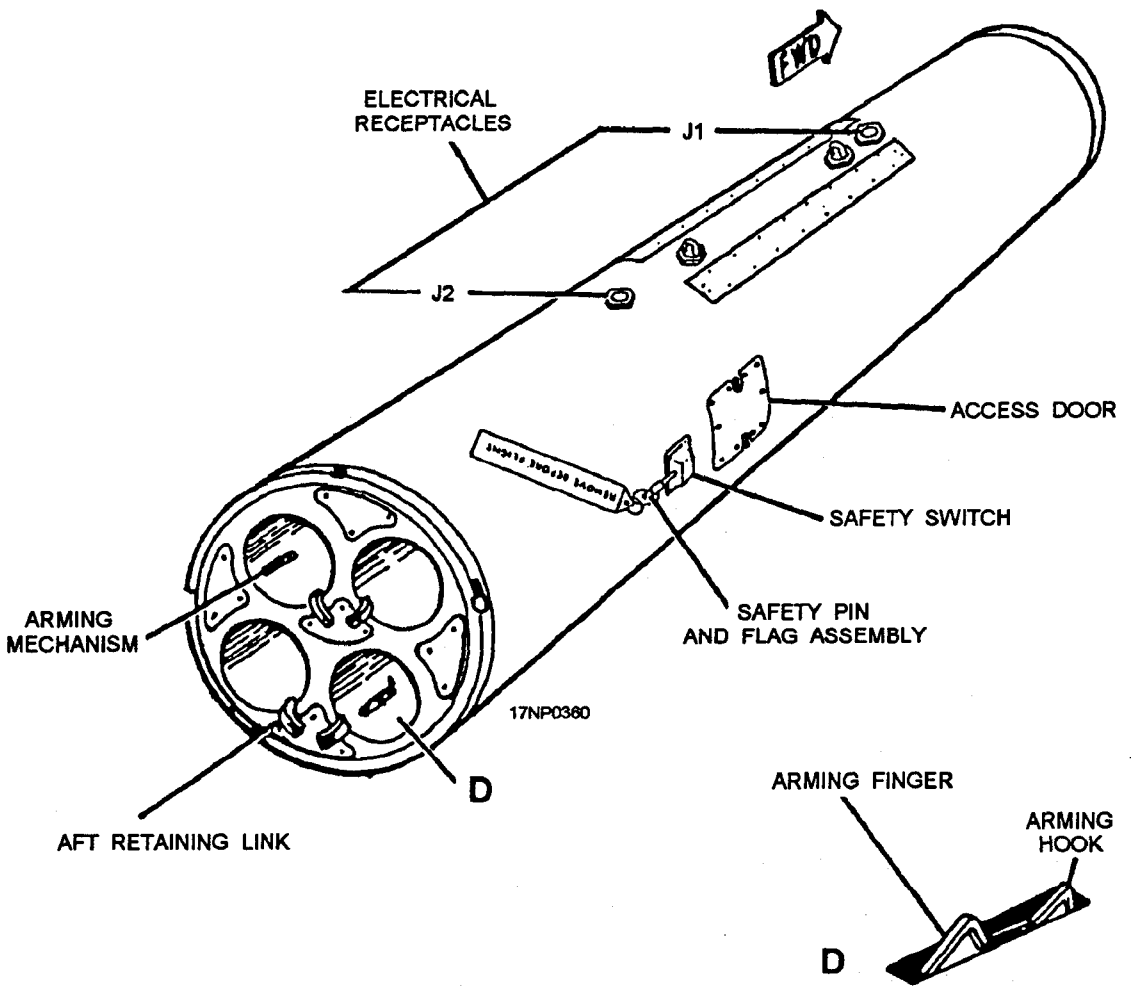


Figure 13-31.—SUU-25F/A.

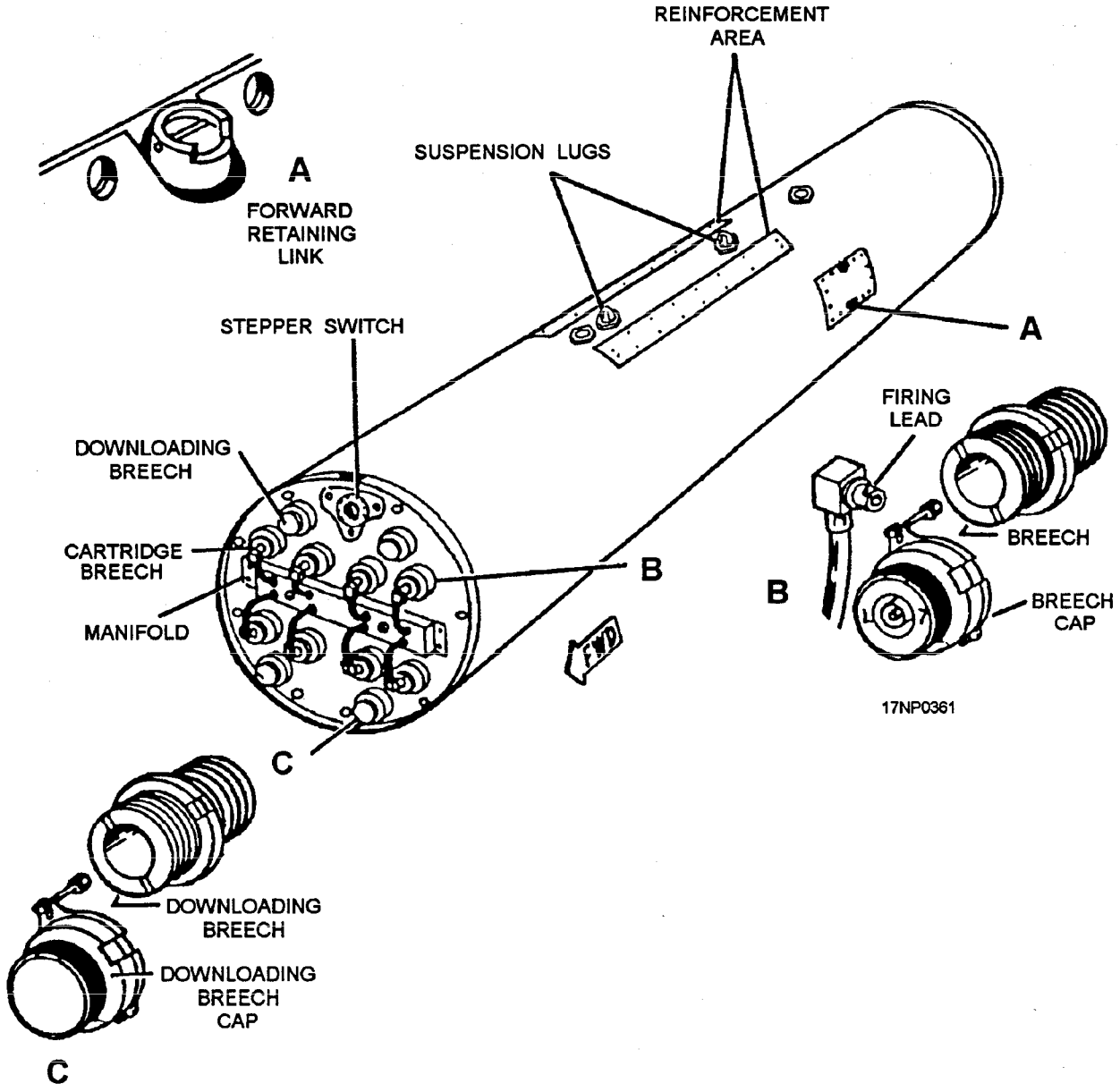


Figure 13-32.—SUU-25F/A downloading breeches.

handling ammunition. These regulations may be general in nature or step-by-step procedures. Regardless of the situation, safety precautions must NEVER be ignored or bypassed, even during the simplest ammunition-handling evolutions.

If you are involved in weapons assembly, always review the applicable safety precautions before beginning the evolution. A few of these general safety precautions are as follows:

1. Fuze or defuze (electric fuzes only) bombs in handling rooms or spaces specifically designed for such purposes.

2. Normally, mechanical nose-fuzed, high-explosive bombs are fuzed after the weapon is loaded on the aircraft. When the aircraft is carrier based, it must be spotted on the flight deck. Exceptions to this rule are authorized when loading bombs that require special fuzing RADHAZ susceptible units, integral fuzing, and all-up-rounds.

3. Detonators, boosters, primers or other firing devices aren't assembled in or removed from bombs unless specifically prescribed for the weapon.

4. Fuzes aren't allowed to accumulate at the fuzing stations. Never stockpile fuzes. They must be withdrawn from stowage on an as needed basis.

5. Never, under any circumstance, try to disassemble or repair a fuze. Also, never try to render inert a live, loaded item of ordnance.

6. Except as authorized by current directives, no attempt should be made to disarm a fuze.

7. Move assembled rocket ammunition to the designated storage area as soon as practicable after completion of assembly operations.

8. Don't make changes or additions to any ordnance or ordnance components without explicit authority from the Naval Air Systems Command.

9. Exercise particular caution when handling rocket motors to avoid propellant grain damage or fracture.

10. Don't connect electrical power or test equipment to a rocket launcher when rockets are installed.

11. Assemble and fuze airborne rockets in a designated assembly area and as close to the time of aircraft rearming as possible.

CHAPTER 14

AIRCRAFT LOADING AND UNLOADING PROCEDURES

After aircraft ordnance and ordnance accessories have been tested, they are approved for carriage and for release by a particular model aircraft. Information about ordnance and ordnance accessories can be found in the aircraft's Naval Air Training and Operating Procedures Standardization (NATOPS) flight/tactical manual. This manual is the basic authority for the types of ordnance and ordnance load combinations on each model aircraft. Deviation (change) from the basic authority must be approved before it can be made. The authority that approves deviations is the Naval Air Systems Command (NAVAIR).

The types of aircraft ammunition and armament equipment were covered in previous chapters. In this chapter, you will learn about loading and unloading ammunition and other armament equipment onto the aircraft.

AIRBORNE WEAPONS/STORES LOADING MANUAL

LEARNING OBJECTIVE: *Identify requirements in airborne weapon/stores loading manuals as they pertain to loading and unloading aircraft ashore and afloat.*

The Airborne Weapons/Stores Loading Manual, known as the *Loading Manual,* standardizes loading procedures used throughout the Navy and Marine Corps. It improves safety and reliability in the loading of conventional weapons and airborne stores. You must follow the loading procedures in the *Loading Manual.* If there is a conflict between the *Loading Manual* and another publication, follow the procedures in the *Loading Manual* until NAVAIRSYSCOM solves the conflict.

The procedures in the *Loading Manual are* followed during aircraft loading. However, the physical size of the manual makes it impractical for use on the flight line. Therefore, the actual aircraft loading procedures for a weapon/store are condensed into an airborne weapons/stores checklist. An individual checklist is provided for each type of weapon/store to be loaded. This includes release and control system checks, retarded/nonretarded bombs, fire bombs, pyrotechnics, and laser-guided bombs. Each member of the loading crew does not need a copy of a checklist during loading operations. However, crew leaders **MUST** use a checklist for the particular weapon/store being loaded. **Checklists are not complete guides. They must be used only by experienced crew leaders that have thorough knowledge and understanding of the loading manual.** Each checklist contains a required reading section that each member of the loading crew must understand before starting loading operations. To keep these loading manuals and checklists current, you should use the *Airborne Weapons/Stores Publication Index,* NAVAIR 01-700. This index provides activities with a guide that lists all existing changes or revisions for aircraft conventional weapons loading, release and control, airborne weapons support equipment (AWSE), chemical, and weapon assembly or disassembly checklists and manuals on hand. This publication index is updated quarterly.

ASHORE, LPH, LHA, LHD, AND CV NATOPS MANUALS

LEARNING OBJECTIVE: *Identify the requirements in airborne weapons/stores loading manuals and the NATOPS manuals.*

The NATOPS manuals are issued by the authority of the Chief of Naval Operations (CNO) in conjunction with the Naval Air Training and Operating Procedures Standardization (NATOPS) program. The NATOPS manuals contain the best available operating instructions for most circumstances. The NATOPS is regulatory in nature; however, operational necessity may require modification of the procedures contained in it.

TERMS

When you are involved in weapons loading and flight deck or flight line operations, there are certain weapons terms that you must know. Some of the more common terms are contained in Appendix I of this training manual.

WEAPONS HANDLING PROCEDURES

Airborne weapons handling evolutions (loading/unloading) introduce a degree of risk into shore based and carrier based operations. They require careful planning and preparation. The necessity to train for and conduct combat operations creates risks that cannot be avoided when explosive weapons are handled.

Weapons Loading and Downloading

The flight deck of an aircraft carrier is the preferred area to load or download an aircraft. Normally, the rearming area is adjacent to and aft of the island structure on the flight deck. When operationally necessary, however, the ship's commanding officer (CO) may authorize loading or downloading on the ship's bow while cyclic flight operations are in progress. Only a minimum quantity of weapons should be moved toward the ship's bow.

Loading limited amounts of weapons on the hangar deck may be authorized by the CO when operationally necessary. However, this adds an additional risk of fire because there is both fuel and explosives in a confined area. Only aircraft scheduled for the next launch or an alert condition are authorized for loading on the hangar deck. Authorization is also restricted to the particular weapons shown in table 14-1.

According to the *CV NATOPS Manual,* fueling, loading and downloading weapons, and installing fuzes and arming wires simultaneously are authorized. However, you can't load forward-firing ordnance that requires simultaneous and/or prior electrical connections for loading while aircraft fueling is in progress. Don't make other electrical connections to weapons or remove/install impulse cartridges while aircraft are being fueled. Don't position the fuel hoses under the weapons/stores being loaded/downloaded.

When required, you may apply electrical power to the aircraft during a loading/downloading evolution. However, it should be held to a minimum, and it should be consistent with operational requirements. Don't apply electrical power to the armament or weapon release-and-control circuitry while weapons are being loaded/downloaded. Conduct loading/downloading weapons and oxygen servicing (other than the converter replacement at the aircraft) as separate evolutions.

Arming and Dearming

Arm airborne weapons in the designated rearming area or the arming area. Generally, all weapons (except for forward-firing ordnance) are armed in the rearming area. This is done after engine turnup but before the aircraft is taxied. Weapons that are armed in the rearming area include retard/nonretard bombs, CBUs, and fire bombs. These arming functions are normally performed by the squadron's ordnance loading crew.

Aircraft loaded with forward-firing ordnance, such as aircraft guns, rockets, and missiles, are positioned in the arming area to arm the weapons. When the aircraft is located in the arming area, optimum safety is provided because the area directly in front of the aircraft is unobstructed by structures or personnel.

Arming functions are normally performed by the carrier air wing (CVW) arm and dearm crew (or MAG personnel on LFORM class ships) in the arming area under the supervision of the CVW ordnance officer. The crew is composed of ordnancemen from each squadron within the CVW. They are cross-trained and certified to arm and dearm all types of aircraft aboard the ship. The crew members work in their respective squadrons except during actual aircraft launch and recovery operations.

Airborne weapons are dearmed in the designated dearming area before or immediately after engine shutdown. All forward-firing ordnance is dearmed by the CVW arm and dearm crew before engine shutdown. All other ordnance is safed or dearmed by squadron ordnancemen in the dearming or rearming area after engine shutdown.

When arming or dearming an aircraft, aircraft arming and safing signals (tables 14-2 and 14-3) are used when crew members perform the arm and dearm procedures. These signals are used by both the squadron and CVW arm and dearm crews. Arming or dearming aircraft is conducted only when the aircraft is at a complete stop, and control of the aircraft has been turned over to the arming crew supervisor.

Hung or Unexpended Weapons

The CVW aircraft dearming supervisor is always on the flight deck during recovery operations. By being there, he makes sure that the aircraft directors and the dearming crew coordinate their actions. The dearming supervisor tells the aircraft director which aircraft requires safing before it is taxied to the recovery spot.

Table 14-1.—Weapons Loading, Strikedown, Downloading, and Recovery Guide

WEAPON	HANGAR DECK		RECOVERY	
	LOAD	STRIKEDOWN/ DOWNLOAD	UNEXPENDED	HUNG
General Purpose Bombs/LGB (all)	YES (1) (5)	YES (6)	YES (2)	YES (2)
2.75/5.00-inch Rocket Launchers (all)	NO	NO (3)	YES	YES
Aircraft Parachute Flare (LUU-2B/B)	YES (11)	YES (11)	YES (11)	YES (11)
Tube Loaded Flare dispenser (loaded with LUU-2 flare)	YES (11)	YES (11)	YES (11)	YES (11)
20-MM Guns/GPU-2 Gun Pod (7)	YES	YES (7)	YES	YES
25-MM Gun/GAU-12 Gun Pod (7)	YES	YES (7) (12)	YES	YES
30-MM ADEN Gun (10)	NO	NO	NO	NO
Rockeye II	YES (5)	YES (6)	YES	YES
SIDEWINDER (all)	NO (4)	YES	YES	YES
AMRAAM	NO (4)	YES	YES	YES
SIDEARM	NO (4)	YES	YES	YES
HARM	NO (4)	YES	YES	YES
MAVERICK (all)	NO (4)	YES	YES	YES
HARPOON (all)	NO (4)	YES	YES	YES
Decoy Flare (all)	NO	NO	YES	YES
Torpedoes (all)	YES (5)	YES (6)	YES	YES
SUS (Mk 64)	YES	YES	YES	YES
Marine Marker (all)	YES	YES	YES	YES
Practice Bombs (all)	YES (5)	YES (6)	YES	YES
JAU-22/B Cartridge	YES	YES (9)	YES	YES
TOW Missile	NO(4)	YES	YES	YES
7.62-MM Guns	NO	NO	YES	YES
.50 Caliber Guns	NO	NO	YES	YES
M118 Smoke Grenade Dispenser	NO	NO	YES	YES
Chaff with Cartridges	YES	YES	YES	YES

Notes

1. No mechanical nose fuzes shall be installed on the hangar deck.

2. Arming wires/safety clips intact.

3. Authorization to perform a maintenance action is listed on this figure.

4. LHAs with centerline elevators may lower aircraft to hangar deck only if downloading on the flight deck will delay the launch. Hangar deck downloading shall be performed immediately after the aircraft is in spot and tied down.

5. Air launched missiles shall not normally be loaded on the hangar deck except when operational commitments so dictate. Commanding officers may authorize loading of missiles on the hangar deck only up to the point of mechanical attachment of the weapon to the launcher/rack in accordance with the procedures prescribed in the appropriate NAVAIRSYSCOM weapons and stores loading checklists/scheduled removal components.

6. Ejector cartridges shall not be installed on the hangar deck.

7. In the event of strikedown of a loaded aircraft to the hangar deck, the nose fuzes (as applicable) and ejector/jettison cartridges shall be removed immediately after the aircraft is in spot and tied down.

8. The GPU-2/GAU-12 gun pod is exempt from downloading requirements for up aircraft temporarily spotted in the hangar decks and aircraft undergoing limited maintenance, i.e., turnaround maintenance, providing compliance with all gun dearming procedures of the airborne weapons and stores loading manual, associated checklists, and stores reliability cards have been accomplished.

9. Guidance provided in this figure is subject to individual aircraft tactical manual limitations.

10. Maintenance on-loaded aircraft.

11. The 30-MM Aden gun is prohibited from use aboard ship until authorized by appropriate authority.

12. Impulse cartridges must be removed from stations loaded with LUU-2 and dispenser with LUU-2.

13. Strikedown/download of aircraft jammed 20-MM/25-MM gun pods is prohibited.

Table 14-2.—Aircraft Arming Signals

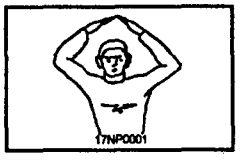
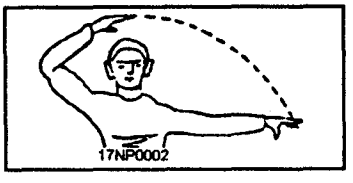
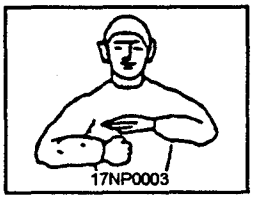
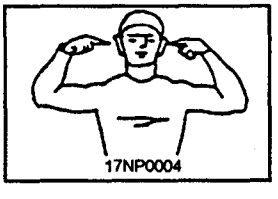
SIGNAL		MEANING	RESPONSE
DAY	NIGHT		
(1) ARMING SUPERVISOR: HANDS OVER HEAD WITH FINGER TIPS TOUCHING. 	RED BANDED WANDS OVERHEAD WITH TIPS TOUCHING.	PILOT/COPILOT/NFO: CHECK ALL ARMAMENT SWITCHES OFF OR SAFE.	PILOT/COPILOT/NFO: RAISE BOTH HANDS INTO VIEW OF ARMING SUPERVISOR AFTER CHECKING SWITCH POSITIONS. (HANDS REMAIN IN VIEW DURING CHECK AND HOOKUP).
(2) ARMING SUPERVISOR: ONE HAND OVER HEAD; POINT TO ARMING CREWMEMBERS WITH OTHER HAND. 	SAME AS DAY BUT WITH RED BANDED WANDS.	ARMING CREW: PERFORM STRAY VOLTAGE CHECKS.	ARMING CREW: GIVE "THUMBS UP" TO ARMING SUPERVISOR IF NO STRAY VOLTAGE EXISTS. "THUMBS DOWN" INDICATES STRAY VOLTAGE PROBLEMS. NIGHT: VERTICAL SWEEP WITH FLASHLIGHT INDICATES NO STRAY VOLTAGE. HORIZONTAL SWEEP INDICATES STRAY VOLTAGE.
(3) ARMING SUPERVISOR: RAISE FIST, EXTENDED UPWARD TO MEET HORIZONTAL PALM OF OTHER HAND. 	FORM A TEE RED BANDED WANDS.	ARMING CREW: ARM WEAPONS (AS APPLICABLE).	ARMING CREW: GIVE ARMING SUPERVISOR "THUMBS UP" WHEN ARMING COMPLETED AND CLEAR IMMEDIATE AREA. "THUMBS DOWN" IF MALFUNCTION EXISTS. NIGHT: VERTICAL SWEEP WITH FLASHLIGHT INDICATES ARMING COMPLETED. HORIZONTAL SWEEP INDICATES MALFUNCTION.
(4) ARMING SUPERVISOR: RAISE BOTH HANDS WITH FINGERS POINTING TO SOUND ATTENUATORS. 	SAME AS DAY. TIPS OF RED BANDED WANDS TOUCHING SOUND ATTENUATORS.	ARMING CREW: PERFORM MISSILE CHECK.	PILOT: GIVE ARMING SUPERVISOR "THUMBS UP" IF TONE IS HEARD. "THUMBS DOWN" IF NO TONE. NIGHT: SAME AS SIGNAL 3 ABOVE.

Table 14-2.—Aircraft Arming Signals.—Continued

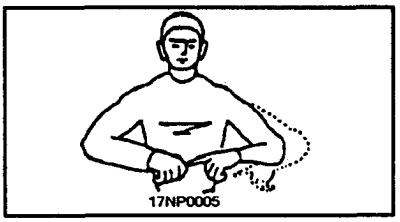
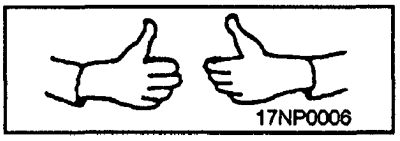
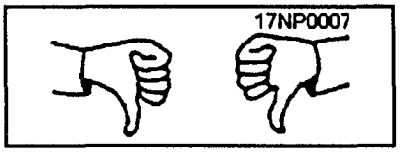
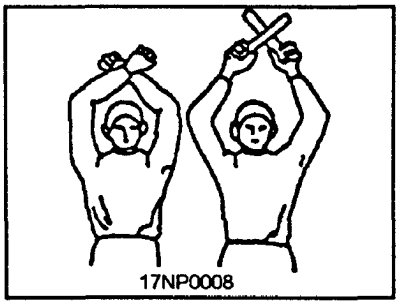
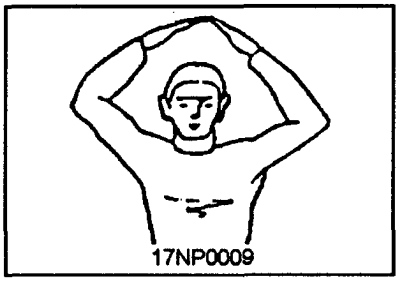
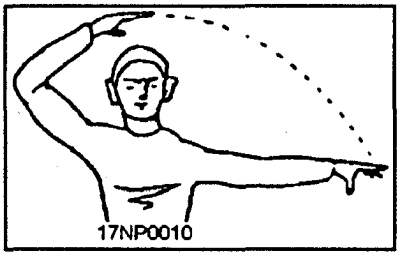
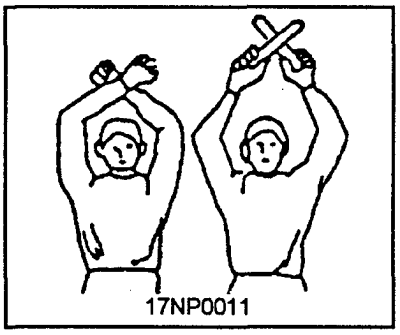
SIGNAL		MEANING	RESPONSE
DAY	NIGHT		
(5) ARMING SUPERVISOR: INSERT FINGER OF ONE HAND INTO CLENCHED FIST OF OTHER HAND AND GIVE EXTRACTING MOTION.  17NP0005	TOUCH TIPS OF RED BANDED WANDS IN FRONT OF BODY. THEN MOVE ONE WAND LATERALLY IN A SWEEPING MOTION.	ARMING CREW: REMOVE BOMB RACK/PYLON SAFETY PINS.	ARMING CREW: SHOWS PINS TO ARMING SUPERVISOR AND CLEAR IMMEDIATE AREA. NIGHT: SAME AS SIGNAL 3 ABOVE.
(6) ARMING SUPERVISOR: GIVE PILOT (A) THUMBS UP.  17NP0006	(A) VERTICAL SWEEP WITH RED BANDED WAND.	PILOT: (A) AIRCRAFT ARMED AND ALL PERSONNEL AND EQUIPMENT CLEAR.	PILOT: (A) ACKNOWLEDGE WITH SIMILAR SIGNAL.
(B) THUMBS DOWN.  17NP0007	(B) HORIZONTAL SWEEP WITH RED BANDED WAND.	(B) AIRCRAFT DOWN FOR WEAPONS.	(B) ACKNOWLEDGE WITH SIMILAR SIGNAL.
(7) ARMING SUPERVISOR/ OBSERVER: CROSSED ARMS OVERHEAD, FISTS CLENCHED.  17NP0008	CROSSED STANDARD RED WANDS HELD OVERHEAD.	SUSPEND ALL ARMING/ SAFETY OPERATIONS ON AIRCRAFT.	SUSPEND ARMING AND AWAIT FURTHER INSTRUCTIONS.

Table 14-3.—Aircraft Safing Signals

SIGNAL		MEANING	RESPONSE
DAY	NIGHT		
(1) SAFING SUPERVISOR: HANDS OVER HEAD WITH FINGER TIPS TOUCHING.  17NP0009	RED BANDED WANDS OVERHEAD WITH TIPS TOUCHING.	PILOT/COPILOT/NFO: CHECK ALL ARMAMENT SWITCHES OFF OR SAFE.	PILOT/COPILOT/NFO: RAISE BOTH HANDS INTO VIEW OF SAFING SUPERVISOR AFTER CHECKING SWITCH POSITION. (HANDS REMAIN IN VIEW DURING SAFING.)
(2) SAFING SUPERVISOR: ONE HAND OVER HEAD, POINT TO SAFING CREWMEMBER WITH OTHER HAND.  17NP0010	SAME AS DAY BUT WITH RED BANDED WANDS.	SAFING CREW: SAFE WEAPONS (AS APPLICABLE).	SAFING CREW: AFTER SAFING, GIVE SAFING SUPERVISOR "THUMBS UP" AND MOVE CLEAR OF AIRCRAFT. NIGHT: VERTICAL SWEEP WITH FLASHLIGHT WHEN SAFING IS COMPLETE.
(3) SAFING SUPERVISOR/ OBSERVER: CROSSED ARMS OVERHEAD, FISTS CLENCHED.  17NP0011	CROSSED STANDARD RED WANDS HELD OVERHEAD.	SUSPEND ALL ARMING/ SAFETY OPERATIONS ON AIRCRAFT.	SUSPEND SAFING AND AWAIT FURTHER INSTRUCTIONS.

At times, aircraft return to the ship with hung or unexpended weapons. When this happens, the flight leader advises cognizant personnel aboard ship of the total quantity and type of hung or unexpended weapons on aircraft in that flight. As each of these aircraft approaches the ship, the air officer (air boss) announces the model and type of weapon problem over the flight deck announcing system.

After landing with hung weapons and/or forward-firing weapons, the aircraft is normally safed after taxiing clear of the landing area. However, at the discretion of the air officer, it may be safed in the landing area. Aircraft returning with unexpended weapons should be safed according to normal procedures.

REVIEW NUMBER 1

Q1. If you want to find information on aircraft ordnance and ordnance accessories, you should refer to _____.

Q2. To what authority should you submit a change to or request a deviation from a NATOPS flight or tactical manual?

Q3. What command resolves conflicts between weapons/stores loading manuals and other publications?

Q4. NATOPS manuals are issued by the _____.

Q5. At sea, the responsibility for dearming forward-firing ordnance belongs to the _____.

BOMB LOADING AND UNLOADING PROCEDURES

LEARNING OBJECTIVE: *Identify the procedures used to load and unload bombs.*

As an AO, you will load ammunition on many different models of aircraft. However, the general loading and unloading procedures for most aircraft are similar. The procedures contained in this chapter don't cover every step of weapon preparation and loading. These procedures will give you basic information about representative types of ordnance that you might load in an operating squadron. The aircraft loading and unloading procedures covered in this section are general, and they are limited to aircraft bombs. When loading practice bombs, you should handle them just like live ordnance, and you must use the appropriate checklist.

Before loading bombs onto an aircraft, you must prepare and inspect the aircraft. Step-by-step procedures must be carefully followed. These procedures are found in the applicable manuals.

AIRCRAFT PREPARATION AND INSPECTION

The first step you should take when loading bombs onto parent racks and improved multiple ejector racks/improved triple ejector racks (IMERS/ITERS) is to make sure that the preloading release and control checks have been performed. Then make sure the aircraft is in the rearming area, and stations you are to load are accessible. You need to make sure that the aircraft is properly grounded.

> **NOTE:** Electrical power may be applied to the aircraft during loading/unloading evolutions, but power is to be held to a minimum. The step "if applicable, power removed may be omitted when operational requirements dictate that a power requirement is necessary. However, unless a step procedure in the checklist calls for power, don't energize the armament circuits. Remove power from the aircraft if the step "power removed" is not preceded by "if applicable."

If applicable, make sure that electrical power is removed from the aircraft. Also, make sure the aircraft is properly grounded. Ground the aircraft by using an authorized ground cable (fig. 14-1) connected to a

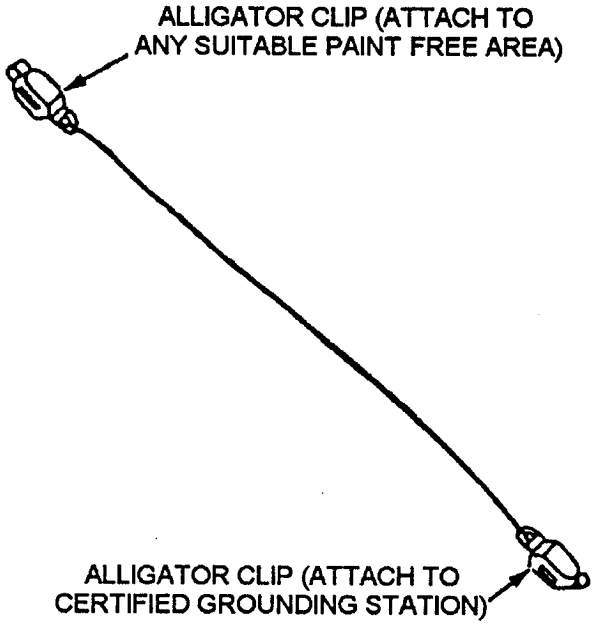


Figure 14-1.—Typical aircraft ground strap.

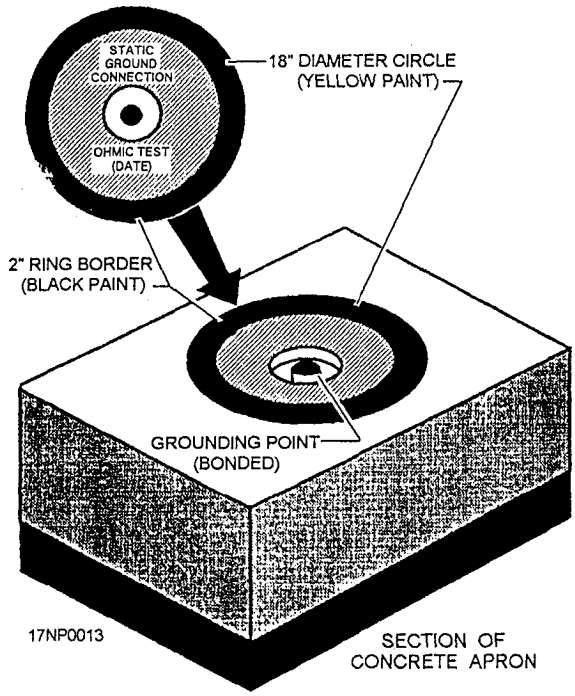


Figure 14-2.—Typical aircraft grounding point ashore.

certified ground eyelet (fig. 14-2) or a common static ground. Next, connect the cable to an authorized ground receptacle or unpainted surface of the aircraft. You should refer to *Electrical Grounding for Aircraft Safety,* MIL-HDBK-247(AS), for further information on aircraft grounding.

Ensure, if applicable, that safety pins are installed in all loaded parent racks, and verify that all cockpit armament selectors are in the OFF or SAFE position.

Next, open the pylon access doors on all parent stations to be loaded. Verify that the cartridges are removed from the breech chambers and the auxiliary release unit. Retract the sway braces to the full up position, retract the ejector foot to the full up position, and open all suspension hooks.

If you are going to load an IMER/ITER, verify that an adapter connector and an electric fuze adapter harness (if applicable) are installed. Also, make sure the pullout bails are attached to the bail bar.

The following information will give you some idea of the steps you would follow to prepare or inspect an IMER/ITER for loading. Visually inspect the parent rack to ensure a safety pin is installed and the rack is locked. Make sure the parent rack breech caps are removed, the cartridges are not installed, and the parent rack sway braces and ejector foot are properly adjusted and positioned. Also, there should be an adapter connector installed in the aircraft and connected to the IMER/ITER with the pullout bail attached to the bail bar (fig. 14-3).

If electric fuzing is used, you need to check that an electric fuze adapter harness is installed and connected to the IMER/ITER. If applicable, make sure the pullout bail is attached to the bail bar, as shown in figure 14-3. Then, disconnect the breech caps and verify that the cartridges are removed from all ejector units. Make sure the breech caps are positioned to prevent damage during weapons loading. Then, open all suspension hooks. Adjust the inboard sway braces to the diameter of the weapon, as shown in

REVIEW NUMBER 1 ANSWERS TO QUESTIONS Q1. THROUGH Q5.

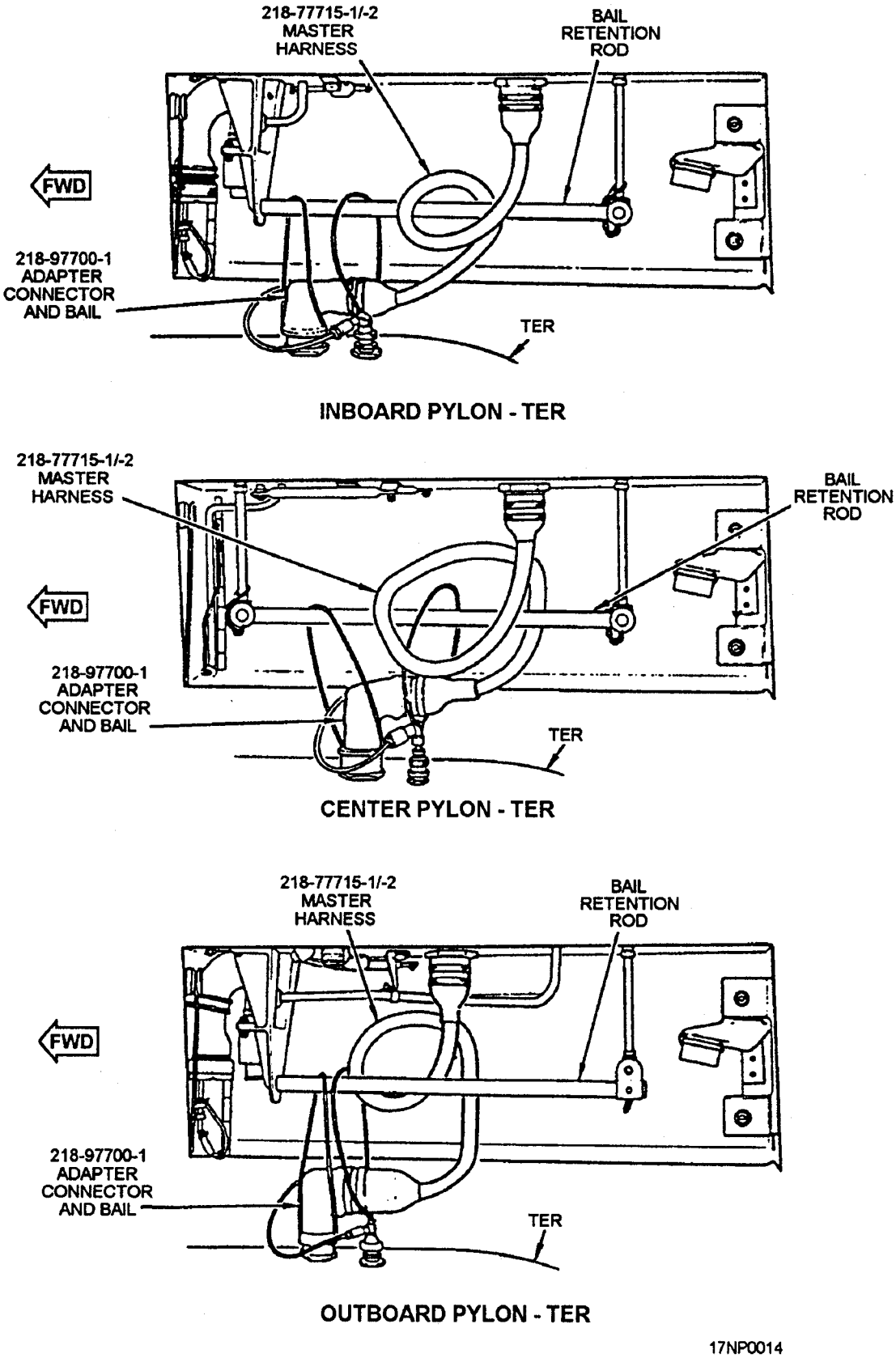
A1. To find information on aircraft ordnance and ordnance accessories, you should refer to the applicable NATOPS flight/tactical manuals.

A2. A change to or request for a deviationfiom a NATOPS flight or tactical manual should be submitted to the Naval Air Systems Command (NAVAIR).

A3. NAVAIRSYSCOM resolves conflicts between weapons/stores loading manuals and other publications.

A4. NATOPS manuals are issued by the Chief of Naval Operations (CNO).

A5. At sea, the responsibility for dearming forward-firing ordnance belongs to the CVW arm/dearm crew.



NOTE

HARNESS AND ADAPTER CONNECTOR ARE PART OF 218-99020 KIT .

Figure 14-3.—Typical IMER/ITER harness configuration.

figure 14-4. Adjust all other sway braces to the full up position. Finally, retract the ejector feet to the full up position

WEAPON INSPECTION

All weapons must be inspected before you can load them. If they don't meet the inspection criteria, you must reject them and notify the proper authority,

WEAPONS LOADING

The method you use to load retard or nonretard bombs depends on the weight and configuration of the bombs and the operational commitments. For example, you can load a 500-pound bomb onto the parent rack of an IMER/ITER by using the HLU-196/E bomb hoisting unit. But remember, you are authorized to manually load most weapons or stores weighing 1,000 pounds or less with manual hoisting bars. To meet rearming requirements of high-tempo cyclic operations, you would normally use manual hoisting bars to load individual retard or nonretard bombs that weigh 1,000 pounds or less. Weapons weighing over 1,000 pounds are normally loaded with the HLU-196/E bomb hoisting unit.

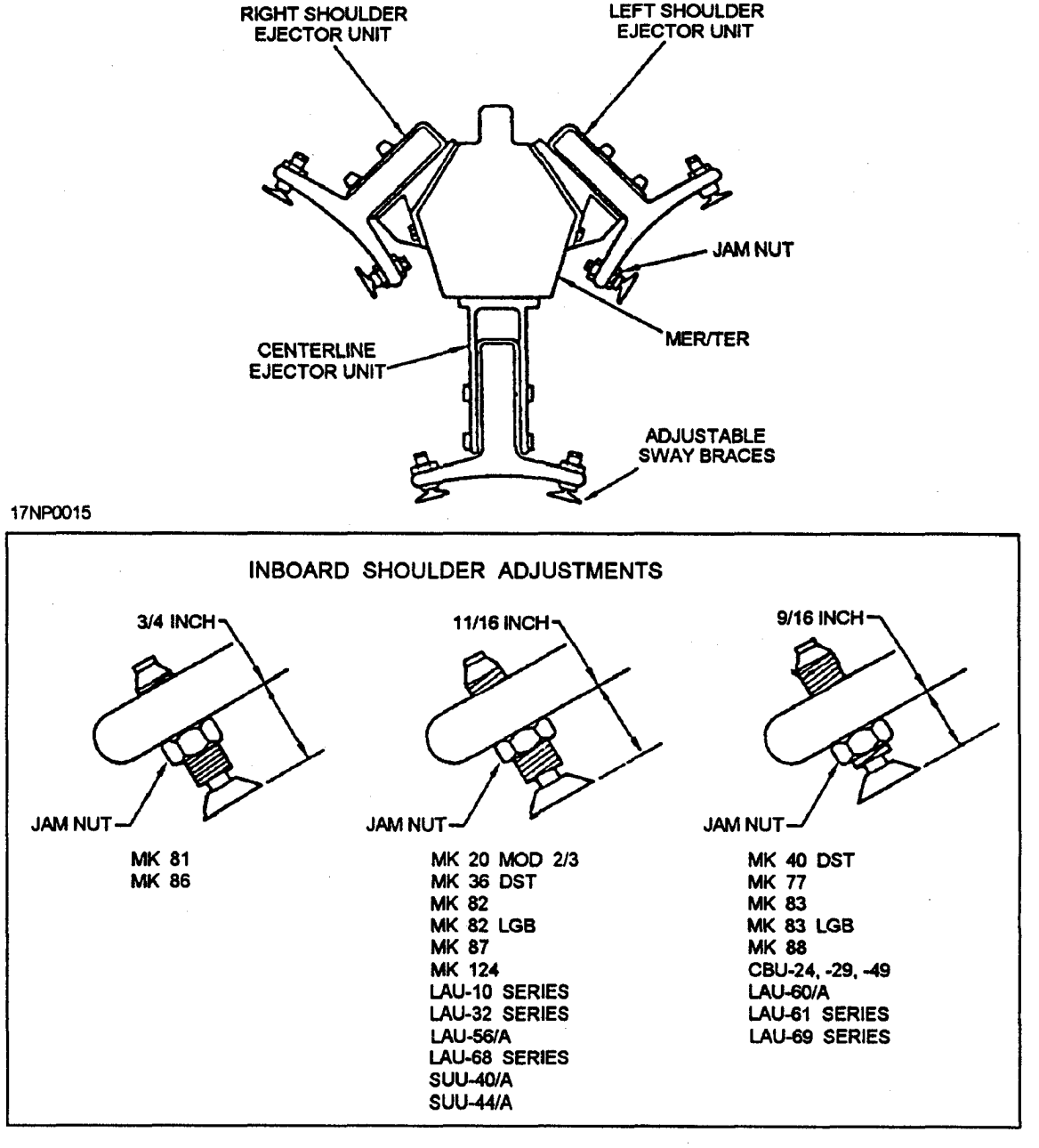


Figure 14-4.—IMER/ITER sway brace preset adjustment.

When the parent rack is ready to be loaded, position the weapon and the handling and loading equipment under the loading station. If applicable, prepare the weapon for bomb hoist loading by installing a hoisting sling on the bomb for single store hoisting. Then, you can install the bomb hoist on the parent rack and attach the hoist cable to the hoisting sling. Remove slack from the cable by operating the hoist. (Remember, one person is positioned at the front and one at the tail of the weapon to steady it while it is being hoisted.) Remove the tie-down straps that secure the weapon to the handling equipment.

If applicable, install a manual hoisting bar for manual loading by installing the HLU-256/E manual hoisting bar in the fuze well. Then, remove the weapon tie-down straps that secure the weapon to the handling equipment.

Now, the bomb hoist can be used to load the weapon,

If you use an electric fuze, hoist the weapon to about 10 inches below the rack connect the Mk 122 arming safety switch quick-disconnect connector (fig. 14-5) to the parent rack arming receptacle. Then, continue to hoist the weapon until both suspension lugs enter the suspension hooks, and the hooks latch. Visually inspect the hook lock indicators on parent racks for a hook locked indication on each set of hooks being used. Slack the hoist cable and shake the weapon gently to make sure it is supported by the suspension hooks on the IMER/ITERs lock safety stop levers.

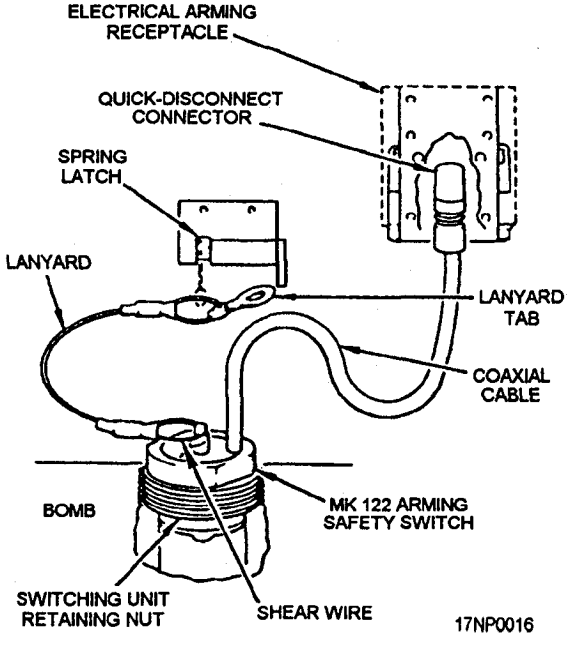


Figure 14-5.—Mk 122 arming safety switch.

When you have finished loading the weapon on the parent rack, remove the manual hoisting bar or the bomb hoisting unit. Then you can adjust the sway braces by taking the following actions:

NOTE: Unused sway braces should remain in the full up position with the jam nuts tightened.

- Adjust the sway brace adjusting screws until the sway brace pads contact the weapon.

- Simultaneously tighten the forward right and aft left sway brace screws one-quarter turn with a suitable wrench.

- Simultaneously tighten the forward left and aft right sway brace screws one-quarter turn.

NOTE: If all sway brace screws cannot be tightened one-quarter turn on final tightening, ensure the same amount of turn is applied to each sway brace screw. The total tightening of each sway brace screw should not exceed one-half turn.

- Tighten the jam nuts with a suitable wrench.

Next, you should adjust the ejector foot down until it makes contact with the weapon. Then back off to the first detent.

Then, if applicable, install the nose fuze or TDD.

Once fuzes are installed, you can install cartridges in all loaded IMER/ITER breech chambers. Screw the breech caps on all IMER/ITER breech chambers and hand tighten the breech caps. Then, install cartridges and tighten breech caps on parent rack. Verify that unloaded IMER/ITER suspension hooks are open. Place a WEAPON LOADED sign in the cockpit. Remove tools and handling or loading equipment from the area.

Weapons are loaded on an IMER/ITER in much the same way as on a parent station. The major differences are as follows:

- After the weapon lugs have engaged the rack suspension hooks, the safety stop lever must be locked.

- The ejector foot must be positioned down against the weapon.

POSTLOADING QUALITY ASSURANCE INSPECTION

A certified quality assurance inspector (QAR) performs the postloading quality assurance inspection after loading and fuzing is complete. A postloading quality assurance inspection makes sure that weapons are properly loaded and no procedural steps were omitted.

REARMING AREA (BEFORE ENGINE TURNUP)

There aren't many procedures for you to carry out in the rearming area (before engine turnup). You will remove the WEAPON LOADED sign from the cockpit, and close and secure access doors. Normally, these procedures are performed at the same time as the pilot's aircraft walkaround inspection before manning the aircraft.

REARMING OR ARMING AREA (AFTER ENGINE TURNUP)

The procedures performed in the rearming area or arming area (after engine turnup) are done after the engine start and normally after the plane captain completes the pretaxi signals. Stations loaded with bomb-type ammunition and other stores are normally armed in the arming area. All forward-firing ordnance must be armed in the arming area. Final arming of bomb-type ammunition requires that a safety person be positioned in view of the pilot. The safety person notifies the pilot of the intention to remove safety pins, and ensures that the pilot places his hands in full view. When this is done, a member of the arming crew removes the safety pins from the parent racks. Finally, a crew member unlocks the IMER/ITER safety stop levers.

DEARMING OR REARMING AREA (IMMEDIATELY AFTER ENGINE SHUTDOWN)

Dearming procedures are performed after aircraft landing or ground abort. Aircraft bombs are normally dearmed in the rearming area. However, if the aircraft has missiles or rockets aboard, they are safed in the designated dearming area.

WARNING

Do not attempt to disarm a partially or fully armed fuze. Notify the proper authority (EOD). If any component is missing, loose, or damaged, notify the proper authority. If an arming wire is not installed in the fuze or arming device, the fuze or arming device may be armed. You should notify the proper authority.

The first step you take when dearming an aircraft is to make sure the fuzes or arming devices or firing mechanisms are safe and arming wires are installed through fuze vanes and pop-out pins, as applicable. Then, inspect the weapons for missing, loose, or damaged components. If an IMER/ITER is involved, position the safety stop levers to lock on loaded racks. Install the safety pins in loaded stations.

NOTE: If an aircraft returns with unexpended ordnance, a WEAPON LOADED sign must be placed in the cockpit.

Check that all cockpit armament switches are OFF, SAFE, or NORM. As applicable, remove arming wires, lanyards, or lanyard tabs from empty stations. Finally, report the status of the aircraft to the proper authority.

UNLOADING PROCEDURES

Before you unload a weapon from the parent rack, the aircraft should be in the rearming area. Make sure that electrical power to the aircraft is removed, and the aircraft is properly grounded. Verify the following: verify that all cockpit armament switches are OFF or SAFE; that safety pins are installed in all loaded parent racks. Finally, if an IMER/ITER is being unloaded, verify that the safety stop lever is locked on each loaded ejector unit.

Now you can open the pylon access doors. For a parent rack, disconnect the ejector unit breech caps and remove the cartridges. If unloading an IMER/ITER (with a weapon) from the parent rack, remove the breech caps from the breech chambers, the cartridges from the breech chambers, position the breech caps to prevent damage during unloading, and disconnect the adapter connector, and, if applicable, the electric fuze adapter harness from the IMER/ITER.

WARNING

Do not remove a fuze or arming wire that was not installed during loading procedures. Do not remove an arming wire unless the fuze safety pin or device is installed.

Ensure that the M904E3/E4 fuze is safe by verifying the installation of the arming wire in the arming wire guide and the arming vane. Make sure you can't see a black letter *A* against a red background in the upper (external) window. If the arming delay isn't set on 6 or 18 seconds, the upper (external) window should be vacant. If the arming delay is set on 6 or 18, you should see matching numbers on a green background in the window. Then, you can install a safety wire through the arming wire guide and the arming vane.

WARNING

If the arming wire is not in place or if the upper (external) window indication is a black letter A against a red background, the fuze is armed. Do not attempt to change the arming delay settings to disarm the fuze, or to remove the fuze from the bomb. Notify the proper authority (EOD) when an armed or partially armed condition is indicated.

WARNING

If a green background without the number 6 or 18 appears in the upper (external) window when the arming delay is set on 6 or 18, or if the number in the upper (external) window does not match the arming delay setting number, the fuze is partially armed. Notify the proper authority.

Other actions you should take when unloading weapons include checking to see that the arming wire is installed in the pop-out pin for Mk 344, Mk 376, and FMU-139 electric fuzes. If an electric fuze was used, you need to disconnect the Mk 122 arming safety switch lanyard tab from the spring latch. Then, if applicable, install the fin release band safety (cotter) pin. Disconnect the fin release wires, lanyards, and arming wires from the aircraft.

If applicable, you can remove the M904E3/E4 fuzes by installing a safety wire, and then removing the arming wire and removing the fuze from the bomb. After you have removed the fuze, make sure the lower window is vacant or dark colored. Set the arming delay to 6 or 18 seconds. Then, make sure a green background with a white number 6 or 18, depending on the arming delay setting, appears in the upper window. The lower window must remain vacant or dark colored.

WARNING

If the lower window is red or has a black letter A against a red background, the fuze is armed. Notify the proper authority (EOD).

NOTE: Each fuze must be checked for safety on the 6- or 18-second arming delay setting before it is returned to the weapons division.

Now you're ready to position the handling or loading equipment under the station you want to unload. As applicable, install a manual hoisting bar or a bomb hoisting unit. Retract the ejector foot to the full up position. Then, retract the sway braces to the full up position. Position the required number of personnel at the front and at the tail of the weapon to steady and guide the weapon onto the bomb handling equipment. Raise the weapon until the suspension lugs float in the hooks. Remove the parent rack safety pin, or move the IMER/ITER safety lock lever from lock to unlock, as appropriate. Operate the manual release to open the suspension hooks and lower the weapon onto the handling or loading equipment. If an electrically fuzed bomb is being unloaded, lower the weapon approximately 4 inches, and then disconnect the Mk 122 arming safety switch quick-disconnect connector from the rack Then, you can lower the weapon to the handling or loading equipment. Properly secure the weapon to the handling or loading equipment.

When all weapons have been unloaded, remove the WEAPON LOADED sign from the cockpit. Then, remove all weapons and handling or loading equipment from the area. Finally, report the status of the aircraft to the proper authority.

REVIEW NUMBER 2

Q1. What is the grounding strap static check requirement for naval squadrons ?

Q2. During a weapons inspection, you find a weapon or component that doesn't meet inspection criteria. What is the first step you should take?

Q3. What is the maximum weight you are authorized to manually load/download?

Q4. When manually loading GP bombs, what hoisting bar should you use?

Q5. *If a sway brace on a bomb rack isn't being used, it should remain in what position?*

Q6. *What is the maximum tightening range of a sway brace screw?*

Q7. *When you begin dearming an aircraft, what is the first step you should take?*

SAFETY PRECAUTIONS

LEARNING OBJECTIVE: *Recognize the safety precautions to follow when loading or unloading aircraft.*

Safety precautions were given in this chapter as WARNINGS, CAUTIONS, and NOTES. However, there are other safety precautions that you should observe when loading or handling aircraft bombs and practice bombs. A few of these safety precautions are as follows:

- Before removing aircraft bombs from the weapons staging area, verify that the bombs are properly secured to the handling equipment.

- A board ship, when the bombs are delivered to the aircraft for loading, they must be positioned fore and aft to help prevent inadvertent movement of the handling equipment by the side-to-side roll of the ship.

- Once bombs have been delivered to the aircraft, a person must remain in the immediate area. Bombs must not be left on the flight deck unattended.

- Never attempt to load/download bombs without sufficient personnel.

- When installing signal cartridges in practice bombs, never assemble more bombs than are needed for the next event. When the day's flight schedule has been completed, practice bomb signals must be removed from practice bombs before returning them to storage.

- Because of the nonexplosive nature of practice bombs, AOs have a tendency to be lax when handling and loading practice bombs. Remember, a Mk 76 practice bomb weighs 25 pounds and could cause severe injury if dropped on a person's foot or hand. Additionally, when a practice bomb signal is installed and the bomb is accidentally dropped, sufficient fire and metal fragments can be ejected from the tube to cause severe personal injury.

For further information concerning flight deck operational procedures, you should refer to the *NATOPS Manual,* NAVAIR 00-80T-105, and the *LHA, LPH, LHD NATOPS Manual,* NAVAIR 00-80T-106.

REVIEW NUMBER 3

Q1. What maximum amount of subcaliber practice bombs should be assembled at any one time?

Q2. When loading certain bombs, AOs tend to be careless and get injured. What type of bombs usually cause this attitude ?

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REVIEW NUMBER 2 ANSWERS TO QUESTIONS Q1. THROUGH Q7.

A1. The grounding strap static check requirement for naval squadrons is 25 ohms or less, conducted at least every 6 *months.*

A2. During a weapons inspection, you find a weapon or component that doesn't meet inspection criteria. You should reject the weapon, and notify the proper authority.

A3. You are authorized to manually load up to 1,000 pounds.

A4. When manually loading GP bombs, you should use the HLU-256/E hoisting bar.

A5. If a sway brace on a bomb rack isn't being used, it should remain in the fully up position with the jam nuts tightened.

A6. The *maximum tightening range of a sway brace screw is not to exceed one-half turn.*

A7. When you begin dearming an aircraft, the first step you should take is to make sure fuzes or arming devices or firing mechanisms are in a safe condition. Also, install arming wires through the fuze vanes and pop-out pins.

REVIEW NUMBER 3 ANSWERS TO QUESTIONS Q1. AND Q2.

A1. Only assemble the amount of practice bombs needed for the next event at any one time.

A2. When loading certain bombs, AOs tend to be careless and get injured. Practice bombs usually cause this attitude.

CHAPTER 15

AIRCRAFT WEAPONS SYSTEMS

Modern supersonic fighter and attack aircraft attack a target automatically and accurately. These aircraft are designed and built as a completely integrated weapons system. The weapons subsystems are interconnected and dependent on each other or on other aircraft systems. For example, the bomb release system in some modes of operation depends on the aircraft's flight control system; the missile system is interconnected with the aircraft's radar system for missile guidance. In addition to delivering weapons more accurately, computer-controlled weapons systems provide a higher degree of safety by reducing human error.

The Navy currently uses the F-14 and F/A-18 fighter aircraft, the P-3 and S-3 aircraft, and the SH-3 and SH-60 helicopter antisubmarine warfare weapons systems. The F/A-18 is a dual-mission aircraft (fighter/attack), and is discussed under fighter aircraft. The weapons systems used in modern aircraft are complex. The information on fighter, attack, and antisubmarine warfare weapons systems in this chapter is basic. As you work in your rating, you will learn more about specific systems, and you will be trained in their operation.

FIGHTER AIRCRAFT WEAPONS SYSTEMS

LEARNING OBJECTIVE *Identify fighter aircraft weapons systems to include those used in the F-14 and F/A-18 aircraft.*

The following text discusses the F-14 and F/A-18 aircraft. You will be introduced to information on the available aircraft armament systems and the basic controls and components common to these systems.

F-14 AIRCRAFT WEAPONS SYSTEMS

The F-14 aircraft is a two-seat (in-line), supersonic, fighter aircraft. It has a servo air fitting and ground cooling air inlet fitting. The servo air fitting provides air to operate servo valves in the environmental control system during built-in-test (BIT) checks and to pressurize the AWG-9 waveguide and gun gas purge valve operation during aircraft ground checks. The ground cooling air inlet fitting provides cooling air to electronic equipment during ground operation.

External power can be applied to all F-14 (series) aircraft. You can use mobile ac power plants, carrier, or hangar ac power cables to apply electrical power to the aircraft when the engines are not operating.

The aircraft armament system consists of a missile control system, multiple weapons release system, M61A1 20-mm automatic gun fire control system, AN/AWW fuze function control system, AN/ALE-39 decoy dispensing system, and jettison system. The F-14 armament system consists of the following basic controls and components common to all systems:

- Air combat maneuver (ACM) panel
- Armament control indicator panel
- Displays control panel
- Control stick
- Master light control panel
- Landing gear handle
- Armament safety override switch

Air Combat Maneuver (ACM) Panel

The ACM panel (fig. 15-1) is located on the forward cockpit center console. It contains switches for missile preparation, missile operating mode selection, and for arming the system. Indicators inform the pilot of weapon status, when the missile is locked on the target, and when the missile is ready to be launched. When the ACM encounter mode is selected, gun high-firing rate and the AIM-9 missile cooling are automatically selected, The ACM panel switches are discussed in the following paragraphs,

Armament Control Indicator Panel

The armament control indicator panel (fig. 15-2) is located in the aft cockpit left vertical console. It contains the attack mode (ATTK MODE) selector switch, weapon-type (WEP TYPE) thumb-wheel switch, electric fuze (ELECT FUZE) selector switch, delivery (DLVY MODE) switches, delivery options (DLVY OPTNS) switches, station set (STA SET) switches, missile option (MSL OPTION) switches, missile speed gate (MSL SPD GATE) selector switch, and select jettison (SEL JETT), tank jettison (TANK JETT), and jettison options (JETT OPTIONS) switches.

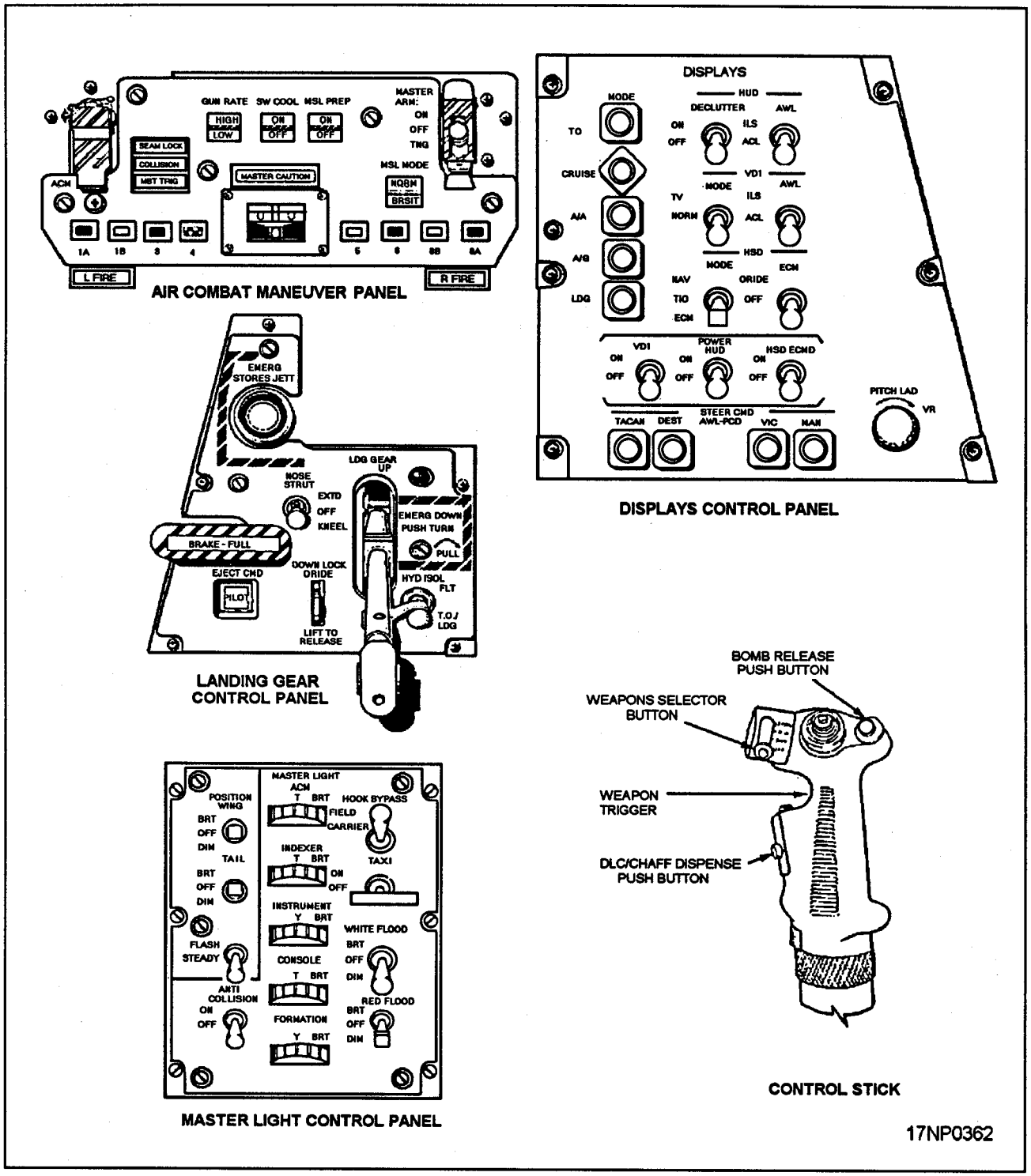


Figure 15-1.—F-14 control panels.

Displays Control Panel

The displays control panel (fig. 15-1) is located on the forward cockpit's right vertical console. It contains the air/ground mode (A/G MODE) push-button switch for air-to-ground mode selection, the air/air mode (A/A MODE) push-button switch for air-to-air mode selection, and the all-weather landing/precision course direction (AWL/PCD) push-button switch for the all-weather landing or precision course direction mode. The AWL/PCD switch is used when bombs are to be released by using the data link system.

Control Stick

The control stick (fig. 15-1), located in the forward cockpit, contains the weapons selector button, weapon

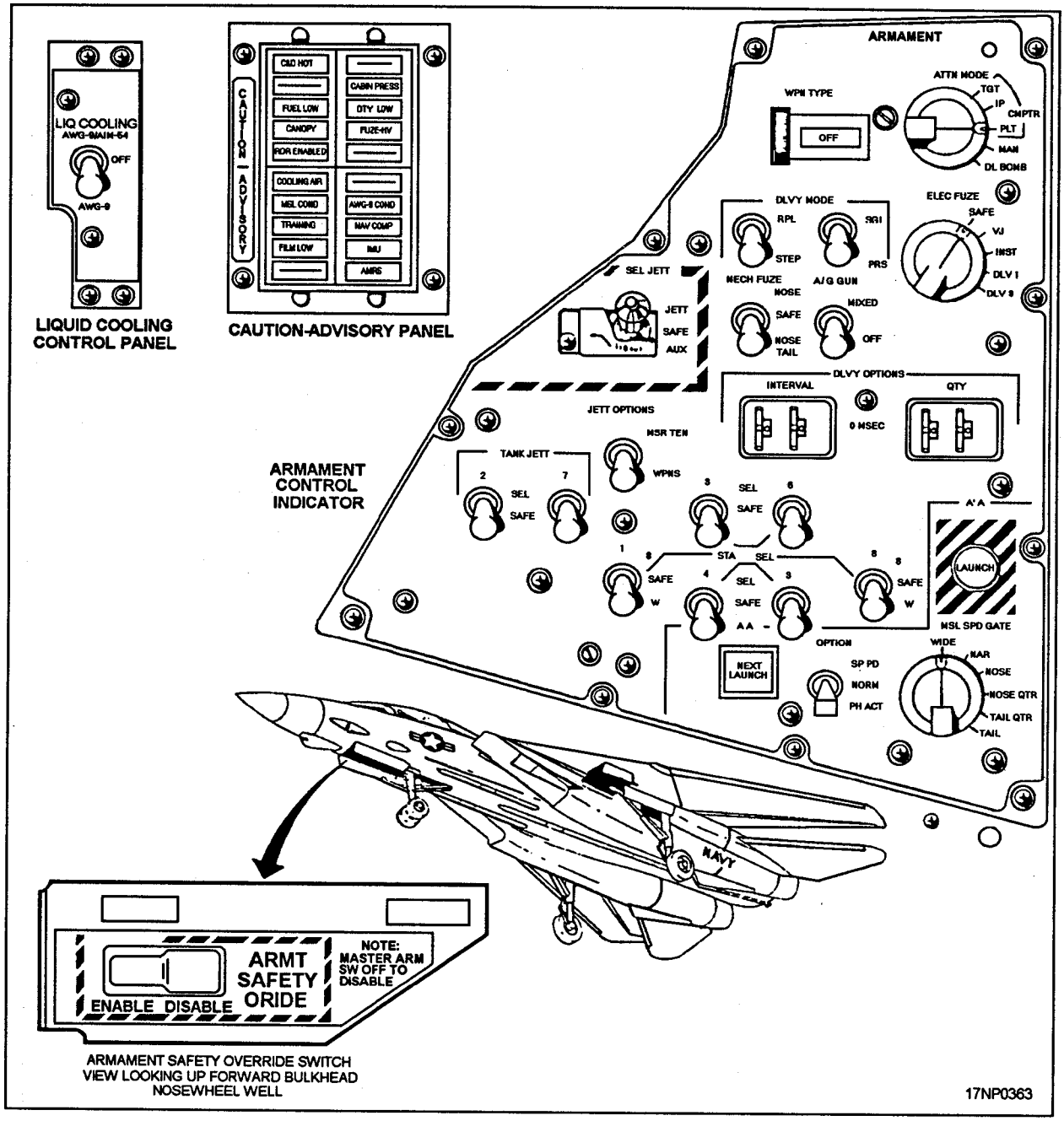


Figure 15-2.—F-14 weapons control panels.

trigger, bomb-release push button, and the DLC/CHAFF DISPENSE push button.

Master Light Control Panel

The master light control panel (fig. 15-1) is located on the right side console of the forward cockpit. It contains the ACM thumb-wheel control, which controls the 26 volts of ac to the ACM panel indicator lights.

Landing Gear Handle

The landing gear handle (LDG GEAR) handle (fig. 15-1) is located on the left vertical console of the forward cockpit. It operates a switch assembly that functions as an armament safety device. As such, it prevents accidental missile launching, bomb release, rocket firing, and ACM encounter jettison of external weapons/stores when the aircraft is on the ground. Master arm power is prevented when the LDG GEAR handle is in the down (DN) position. When the LDG GEAR handle is in the UP position, the fire control system master arm power is available.

Armament Safety Override Switch

The armament safety override (ARM SAFETY ORIDE) switch (fig. 15-2) is located in the nosewheel well. It is a magnetically held closed switch. The

switch is used as an armament safety override to bypass the open landing gear safety circuit when the LDG GEAR handle is in the DN position. This lets you make functional checks of the system during ground maintenance.

Missile Control System

The missile control system consists of the controls and components you have already read about. It also contains the following missile system controls and components:

- Weapons status indicators
- Liquid (LIQ) cooling control panel
- Aft cockpit caution advisory panel

The AIM-54 and AIM-7 missile fire control systems help to select, prepare, and launch AIM-54 and AIM-7 missiles. The AIM-54 is a long-range, semiactive, radar midcourse guided and active radar terminal guided missile. It operates in either the normal or boresight mode. The F-14 carries a maximum of six AIM-54 missiles-two are suspended from multipurpose pylons on stations 1B and 8B, and the remaining four at weapons rail stations 3R, 4R, 5R, and 6R. The AIM-7 is a medium-range, semiactive, radar-guided missile. It also operates in either the normal or boresight mode. The F-14 carries a maximum of six AIM-7 missiles—two are suspended from multipurpose pylons on stations 1B and 8B and four at semisubmerged fuselage stations 3, 4, 5, and 6.

The AIM-9 fire control system enables selecting, preparing, and firing of the AIM-9 (series) missiles. The AIM-9 missile is a supersonic, short-range, air-to-air intercept missile that uses passive infrared for target detection and guidance. The F-14 carries a maximum of four AIM-9 missiles-one missile each on stations 1A, 1B, 8A, and 8B.

The weapons status indicators are located on the ACM panel. They notify the pilot of the weapon status of the AIM-9 missiles on stations 1A, 1B, 8A, and 8B.

The Sidewinder cool (SW COOL) switch (fig. 15-1) is a two-position, push-button switch on the ACM panel. This switch is used to generate the AIM-9 missile cool signal to cool the missiles. When in the ACM encounter mode, AIM-9 missile cooling is automatically selected, regardless of the SW COOL switch position.

The throttle quadrant, located on the left side console of the forward cockpit, contains the CAGE/SEAM push-button switch for initiating the Sidewinder expanded acquisition mode (SEAM) lock-on command. The pilot presses the CAGE/SEAM push-button switch when the missile is locked on the target, as indicated by the AIM-9 tone in the pilot headset. The SEAM LOCK advisory indicator, located on the ACM panel, lights to notify the pilot that the AIM-9 missile selected is locked on the target. A tone volume control panel with an SW potentiometer, located on the pilot's left side console, controls the AIM-9 tone to the pilot's headset.

Multiple Weapons Release System

The multiple weapons release system has basic controls and components and multiple weapons system controls and components. They are discussed in the following paragraphs.

The bomb release and rocket control systems enable selecting, preparing, and delivering of the air-to-ground stores. Weapons that can be carried on stations 3R, 4R, 5R, and 6R range from general-purpose bombs of various sizes to CBU, and GBUs.

M61A1 20-MM Automatic Gun Fire Control System

The M61A1 20-mm automatic gun fire control system enables selecting, arming, and firing of the gun. Depending upon the mission objective, the gun fire control system can be operated in an air-to-ground (A/G), air-to-air (A/A), or air combat maneuver (ACM encounter) mode. Two attack modes of operation are available—computer pilot attack mode and manual attack mode. The computer pilot attack mode operates with the weapon control system, command signal decoder system (CSDC), and the vertical display indicator system to display target data. The manual attack mode is used primarily as a backup mode to provide a manually controlled sight reticle if a system malfunction occurs.

GUN RATE SWITCH. The GUN RATE switch (fig. 15-1) is located on the ACM panel. It is a two-position, push-button, indicator switch that selects HIGH (6,000 rounds per minute) or LOW (4,000 rounds per minute) rate of fire. This switch is only active in the A/G and A/A modes.

A/G GUN SWITCH. The A/G GUN switch (fig. 15-2) is located on the armament control indicator panel. It is a two-position toggle switch that enables or inhibits a mixed bomb and gun mode operation. The MIXED position enables bomb and gun mode operation while the OFF position inhibits it.

GUN CONTROL UNIT. The gun control unit, located above the gun barrels, contains the BURST

selector switch. This switch limits the number of rounds that can be fired per burst (50, 100, or 200), or it permits unrestricted firing (MAN position).

HOOK/GUN PANEL. The HOOK/GUN panel, located on the forward cockpit vertical console, contains the gun rounds counter. This counter provides a digital countdown readout of the rounds remaining.

Decoy Dispensing Systems

The F-14 aircraft uses the AN/ALE-39 decoy dispensing system. The CHAFF/FLARE DISPENSE panel is located on the aft cockpit right side console. The MANUAL DISPENSE switch on the CHAFF/FLARE DISPENSE panel is used to initiate rounds from the aft cockpit. Rounds can also be initiated from the forward cockpit by the decoy dispense push button on the control stick.

Jettison System

The jettison system allows jettison of certain external stores. There are four jettison modes:

1. Emergency, which is pilot controlled
2. ACM encounter, which is NFO selected and pilot controlled
3. Selective, which is NFO controlled
4. Auxiliary, which is NFO controlled (BRU-32 air-ground weapons)

In all modes, arming and fuzing is disabled during jettison operations. The landing gear handle must be UP for ACM encounter, selective, and auxiliary jettison modes.

Aircraft Armament Configuration Capabilities

The basic armament configuration (fig. 15-3) of the F-14 aircraft consists of four fuselage-mounted LAU-92

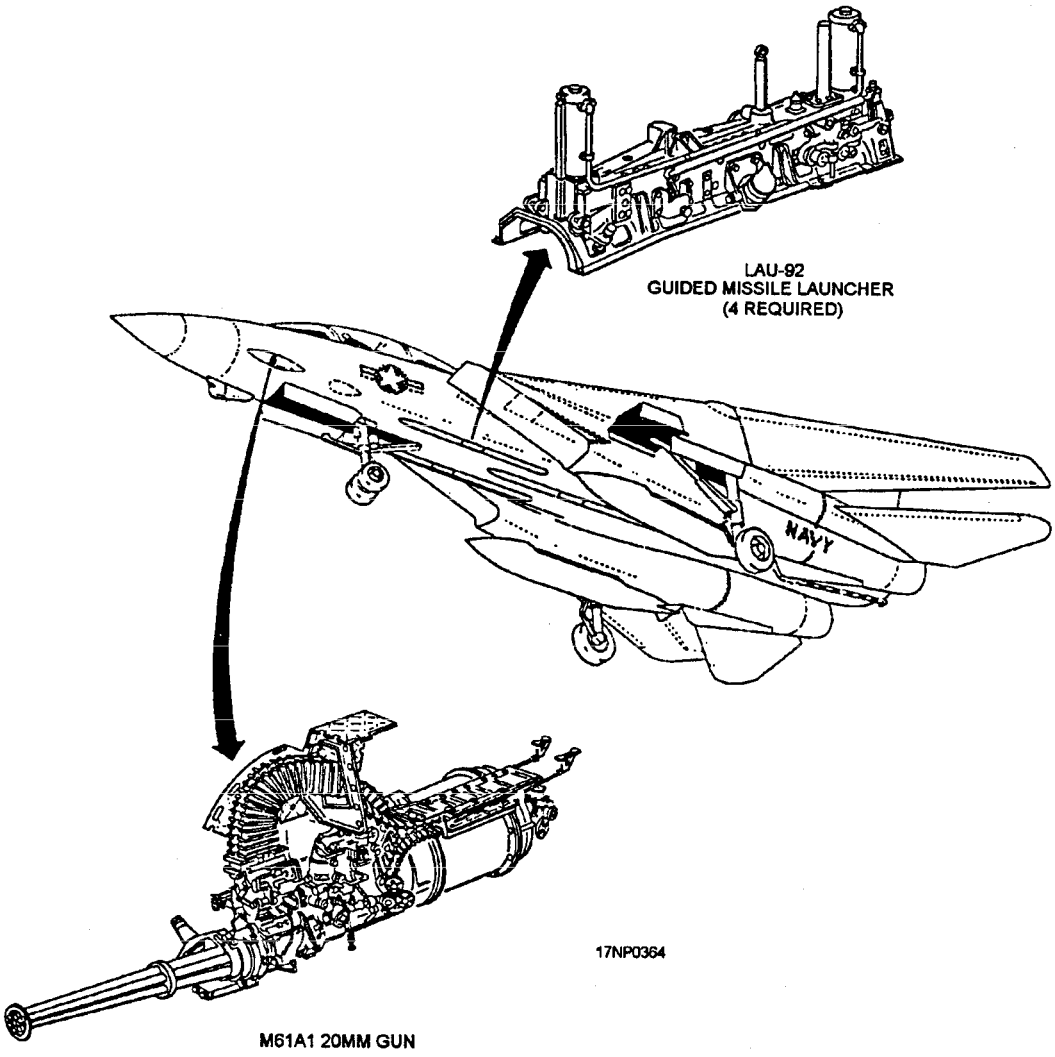
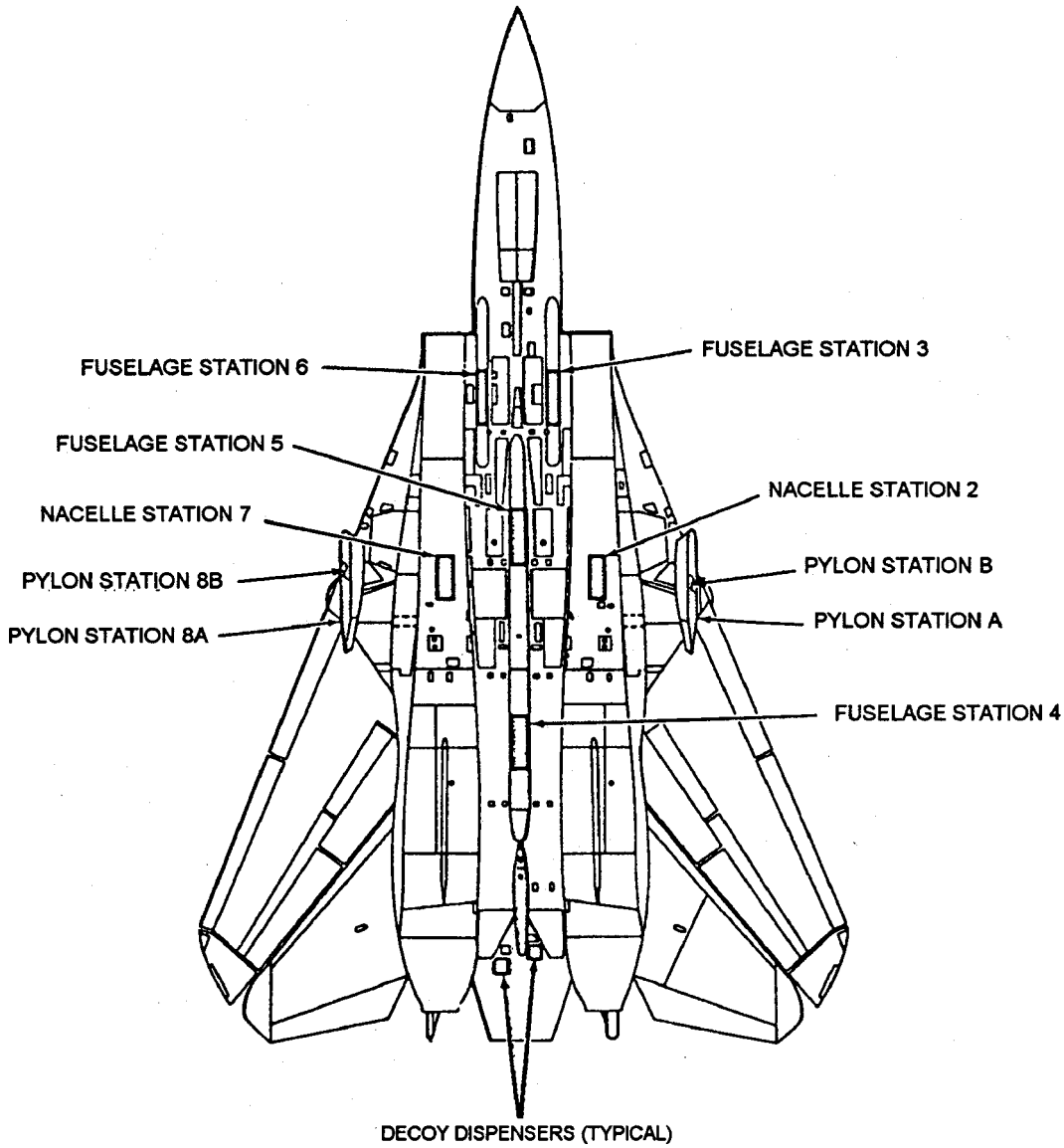


Figure 15-3.—Basic armament configuration.

missile launchers and an internally mounted M61A1 20-mm gun. However, the aircraft has a total of eight weapons stations that hold a variety of missile launchers and weapons rails. Figure 15-4 shows the location of weapons stations 1 through 8. Figures 15-5 through 15-11 show the various station and equipment configurations.

For more information on the authorized configurations of aircraft, you should refer to *F-14 Tactical Manual,* NAVAIR 01-F14AAA-1T. If you want more information on F-14 weapons systems, refer to *Airborne Weapons/Stores Loading Manual,* NAVAIR 01-F14AAA-75.

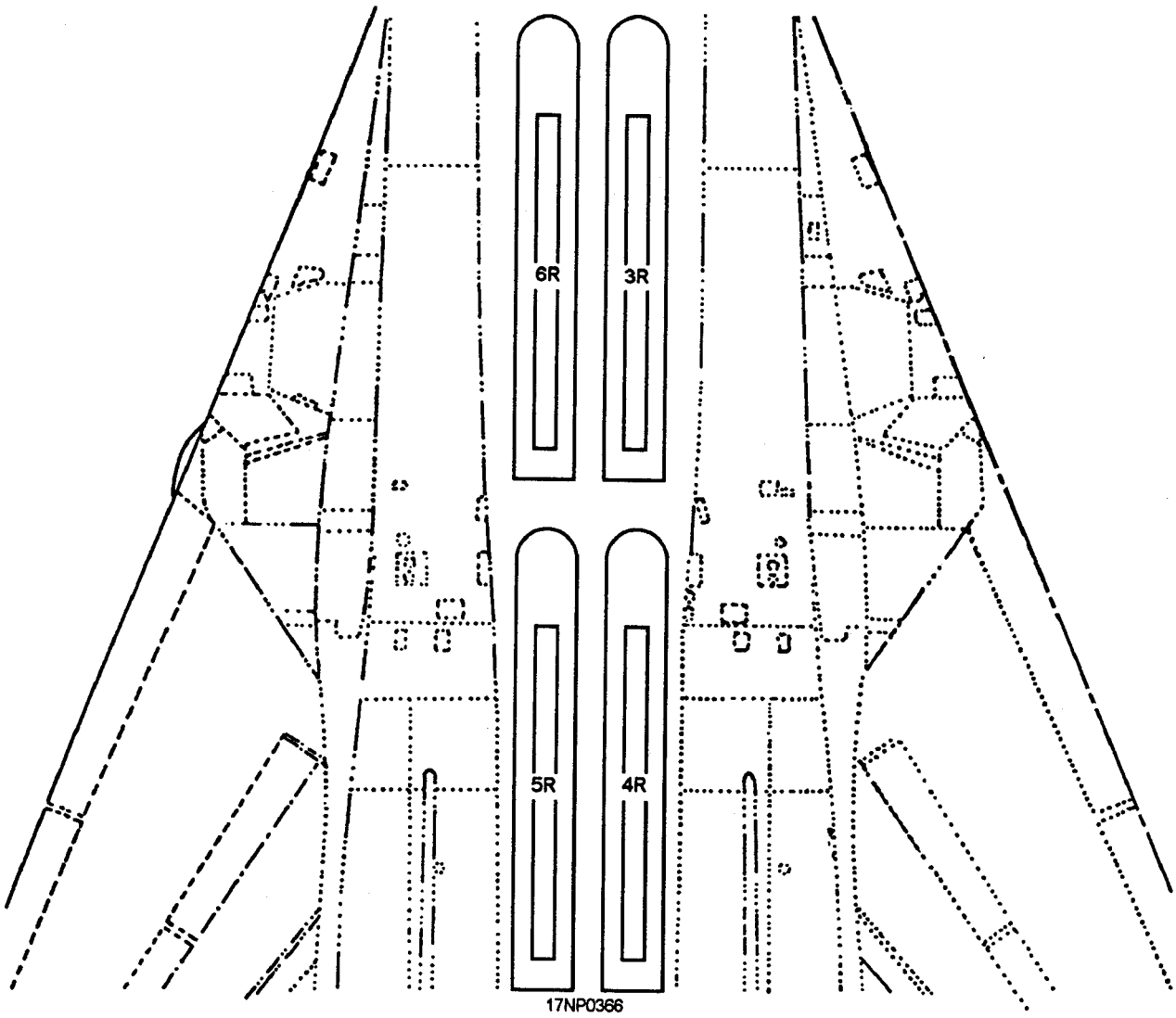


VIEW LOOKING UP

17NP0365

EQUIPMENT	FUSELAGE, NACELLE, AND PYLON STATIONS									
	1A	1B	2	3	4	5	6	7	8B	8A
LAU-7 Guided Missile Launcher	X	X							X	X
LAU-92 Guided Missile Launcher		X		X	X	X	X		X	
LAU-93 Guided Missile Launcher		X							X	
MXU-611 Fuel Tank Release Mechanism			X					X		

Figure 15-4.—Location of weapons stations.



VIEW LOOKING UP

EQUIPMENT	WEAPONS RAIL STATION			
	3R	4R	5R	6R
LAU-93 GUIDED MISSILE LAUNCHER	X	X	X	X
BRU - 32	X	X	X	X
BRU - 42	X	X	X	X

Figure 15-5.—Station configuration capabilities.

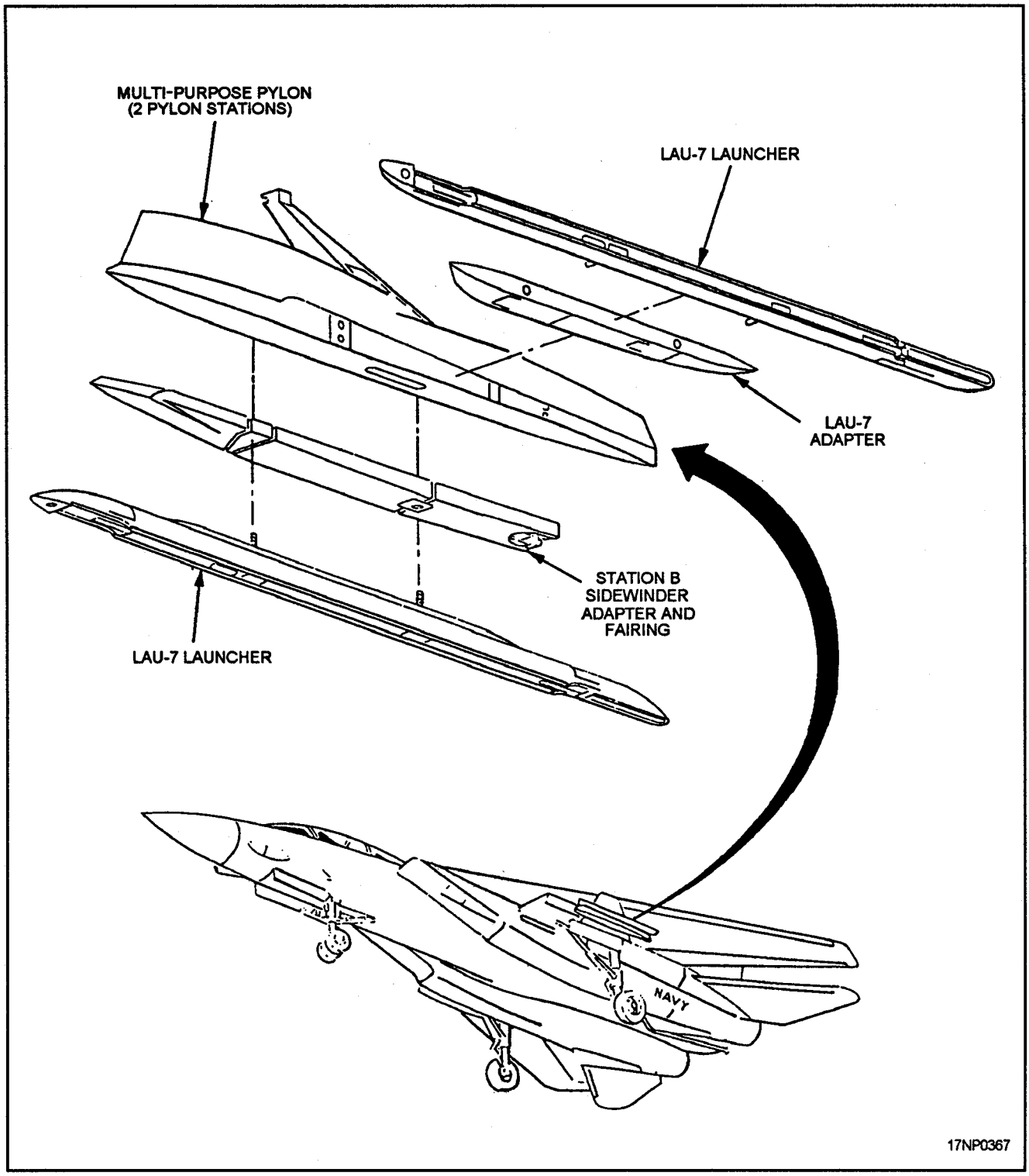


Figure 15-6—LAU-7 configuration on aircraft.

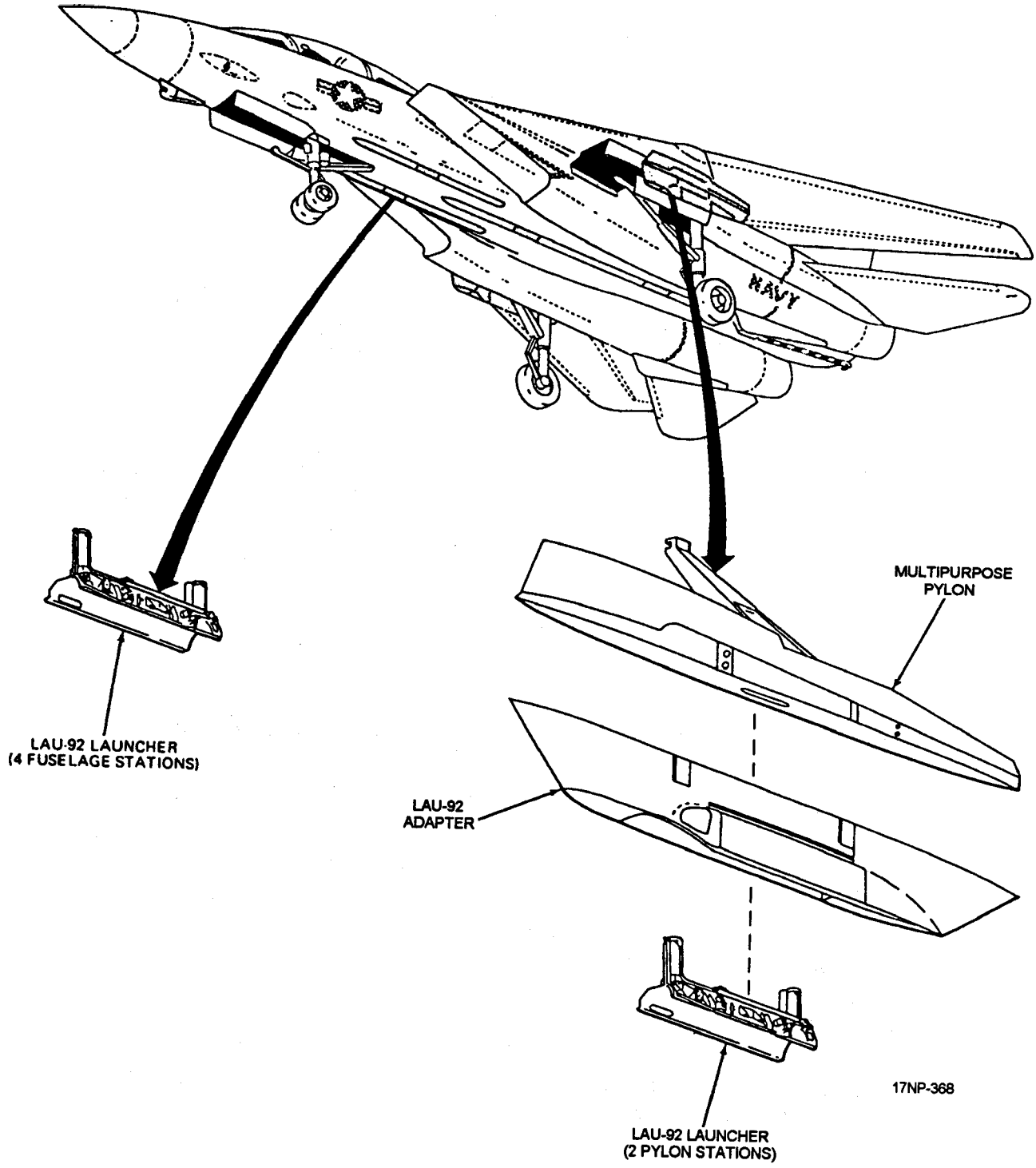


Figure 15-7.—LAU-92 configuration on aircraft.

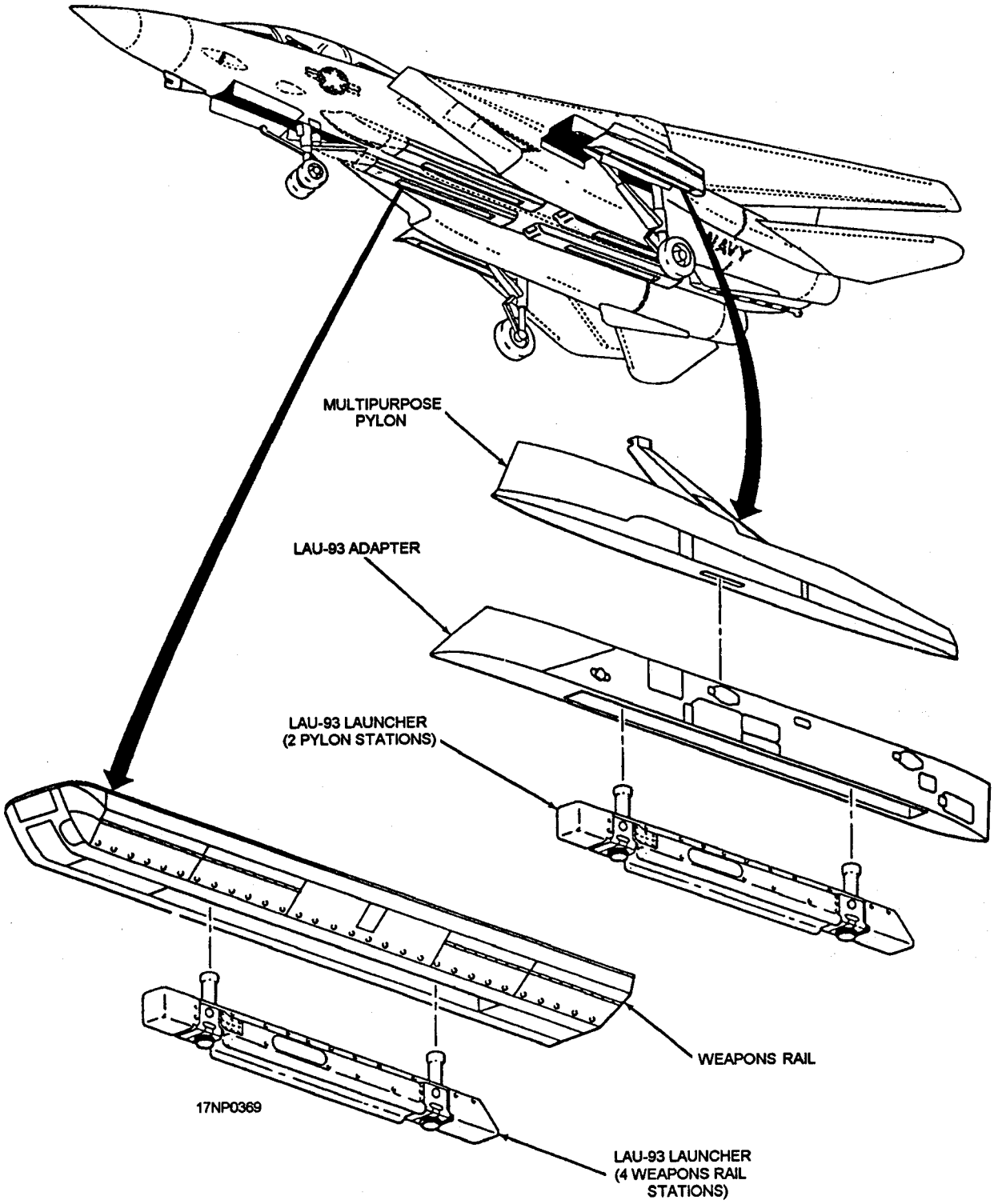


Figure 15-8.—LAU-93 configuration on aircraft.

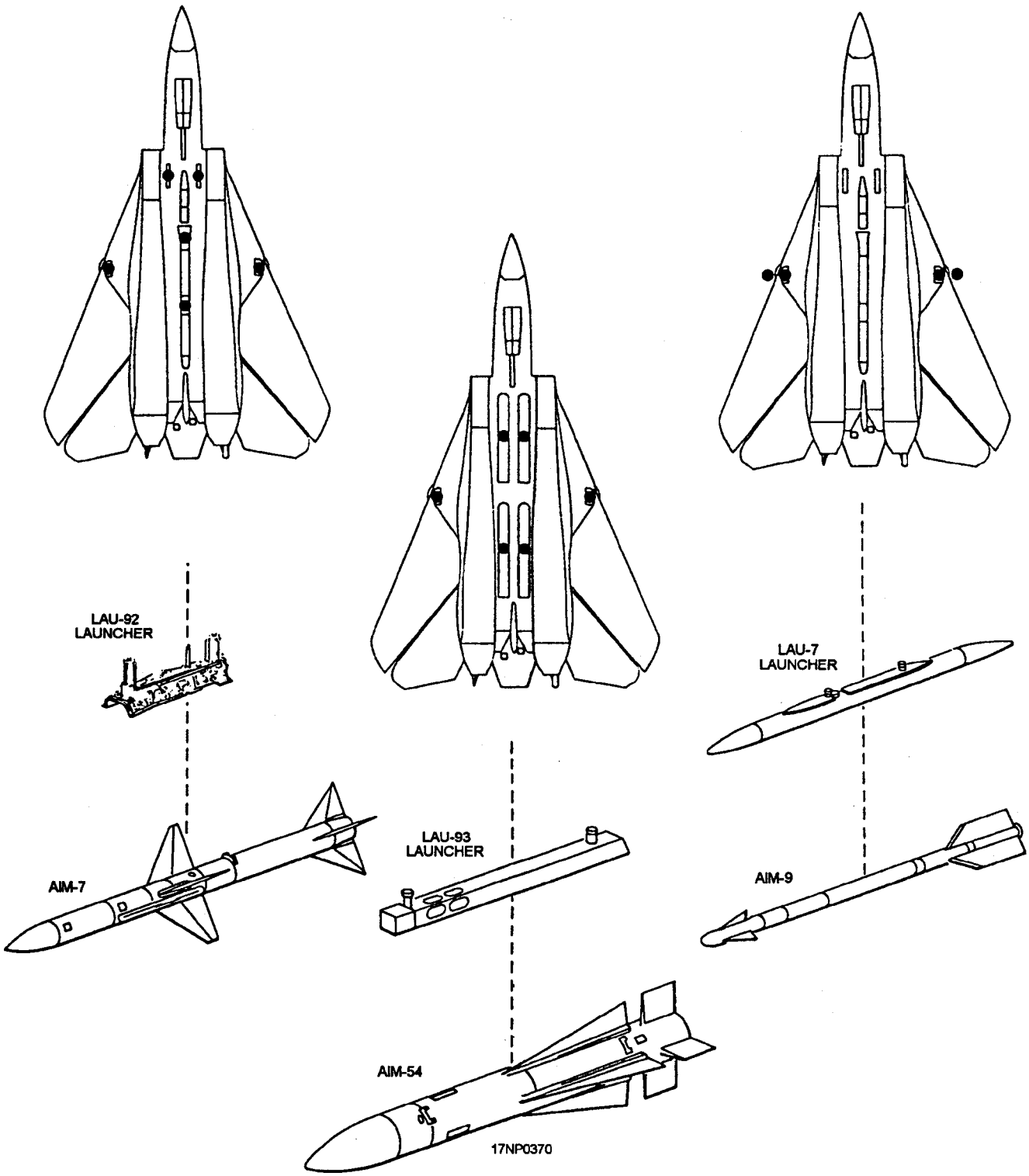


Figure 15-9.—Air intercept missiles configuration on aircraft.

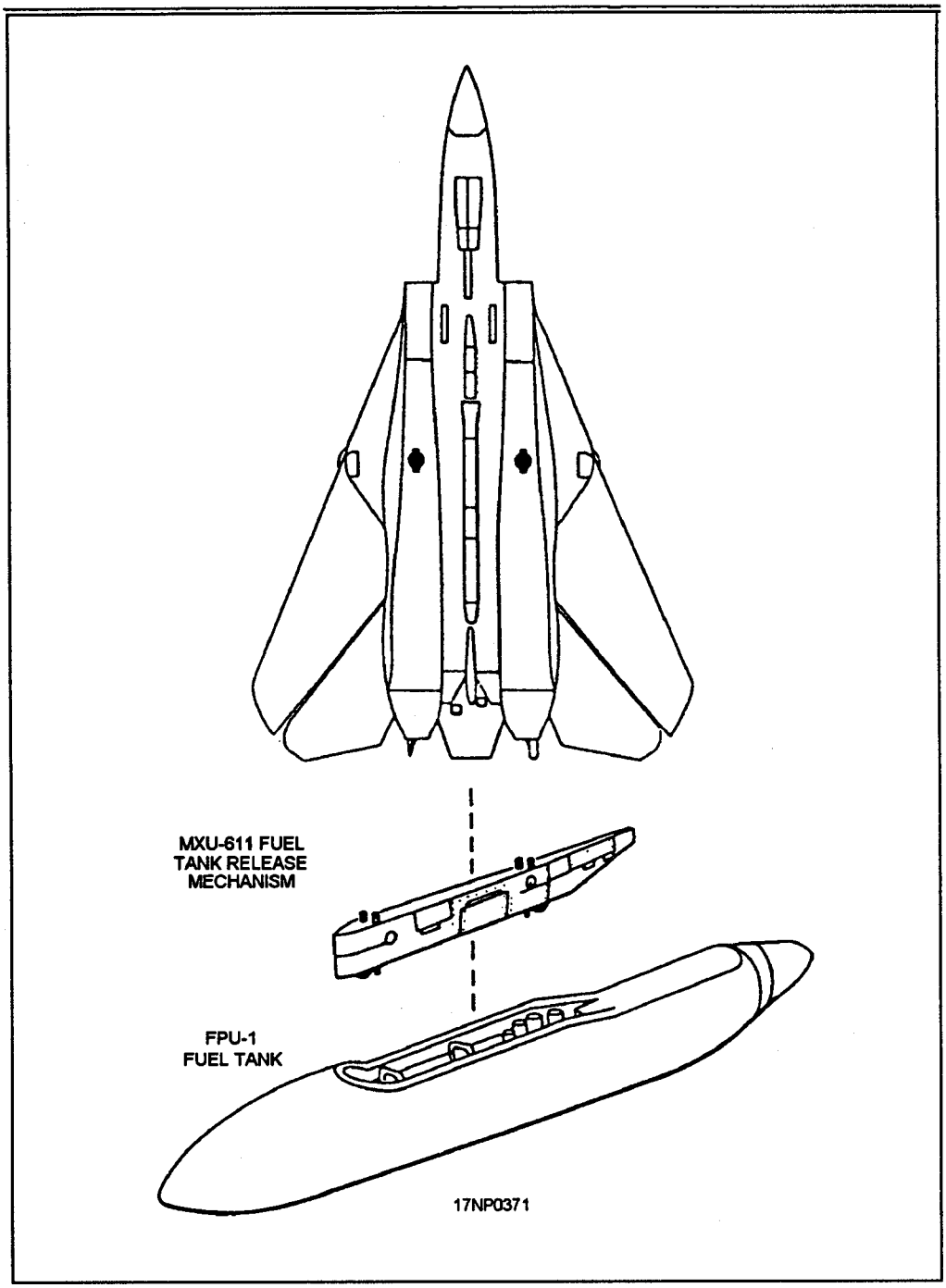


Figure 15-10.—Fuel tank configuration on aircraft.

REVIEW NUMBER 1

Q1. What naval aircraft is a dual-mission, fighter bomber?

Q2. The F-14 aircraft incorporates the_____ chaff dispensing system.

Q3. When the landing gear handle is in the down position on the F-14 aircraft, what switch is used to bypass the open loading gear safety circuit?

Q.4 The F-14 aircraft can hold a maximum of _____ AIM-54 missiles.

Q5. List the fuselage stations of the F-14 aircraft that are used to suspend AIM-7 missiles.

Q.6 The F-14 aircraft can hold a maximum of_____ AIM-9 missiles?

Q7. List the stations of the F-14 aircraft that are used to carry Sidewinder missiles.

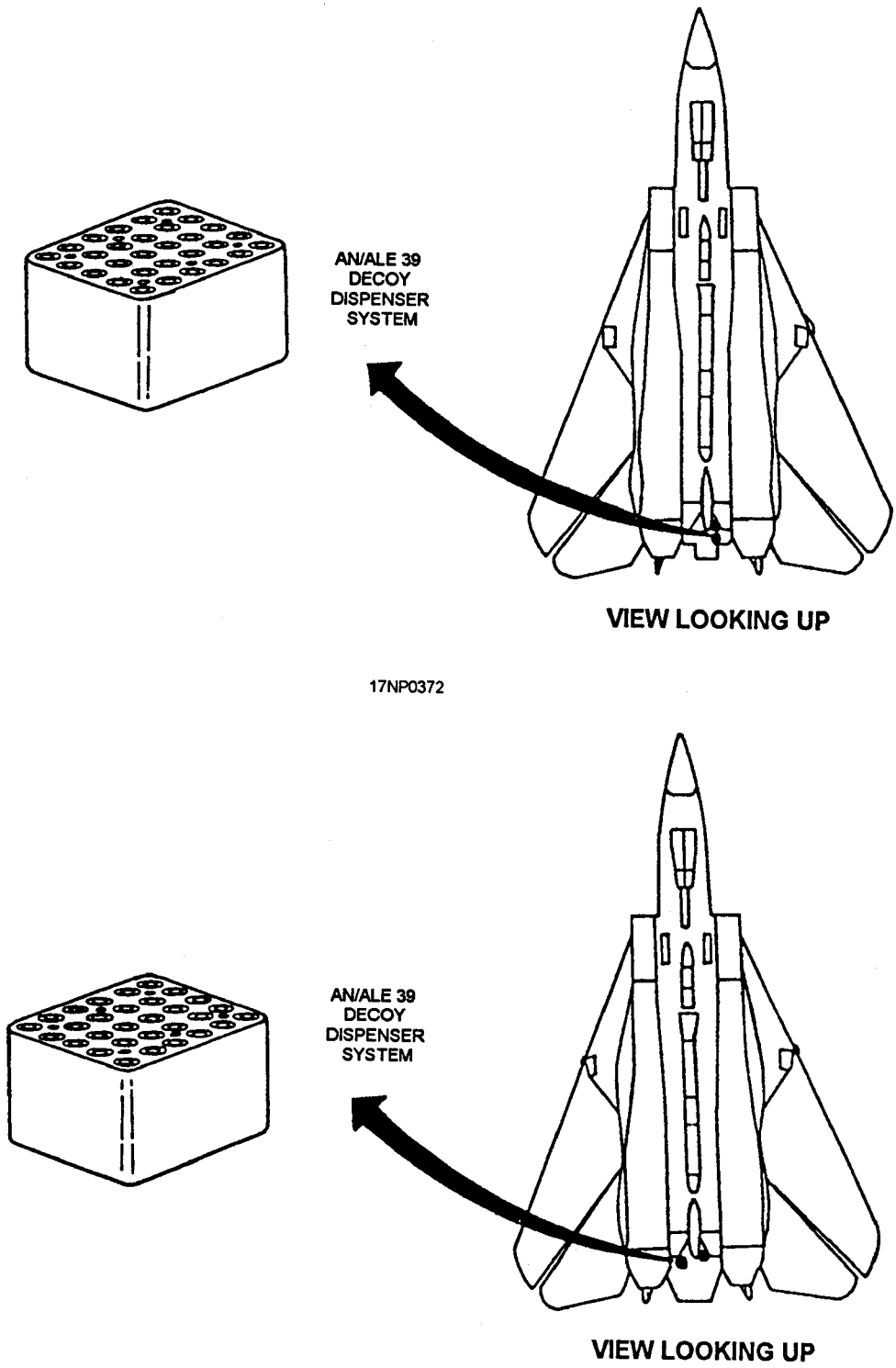


Figure 15-11.—Decoy dispenser configuration on aircraft.

Q8. What are the HIGH and LOW rates of fire for the M61A1 gun when it is mounted in the F-14 aircraft?

Q9. What switch on the F-14 aircraft limits the number of rounds that are fired per burst?

Q10. List the four jettison modes of the F-14 aircraft.

Q11. What jettison mode is the only one controlled by the pilot?

F/A-18 AIRCRAFT

The F/A-18 aircraft is a single-seat, dual-role (fighter/bomber), supersonic aircraft. External

electrical power can be applied at the external power receptacle on the left side of the forward fuselage. This is easily accessible from the deck level. The external power connector connects 115/208-volt, three-phase, 400-hertz ac external power to the ac bus. When external power is not available, the aircraft has an auxiliary power unit (APU) to drive either of the aircraft generators for functional checkout of the aircraft system.

The systems and subsystems of the F/A-18 aircraft armament system are discussed in the following text. The aircraft armament system, basic controls, and components all function in relation to each other.

Ground Power Control Panel Assembly

The ground power control panel assembly has four toggle switches. Three of these switches control the application of external power to avionic and instrument systems. This prevents excessive equipment operating time because of other unassociated ground operations.

The EXT PWR (external power) switch is a three-position switch used to apply electrical power to the aircraft. In the NORM (normal) position, electrical power is supplied to the aircraft. In the OFF position, no power is supplied to the aircraft. The RESET position resets power for the external monitoring circuit when there is a temporary overload. Switch 1 is a three-position switch with B ON to provide enabling power to the mission computers. Switch 2 is a three-position switch with B ON to provide enabling power to the digital display indicators (DDIs). The B ON switch also enables power to the aircraft radar. Switch 3 is a three-position switch with B ON to provide enabling power to the armament computer stores management panel (SMP), AN/AWW-4 system, HARM system, and the AN/ALE-39 system.

Landing Gear Control Handle

In the DN position, the LDG GEAR control (fig. 15-12) disables normal weapon release, launch, and fire signals. In the UP position, 28-volt dc power is applied

REVIEW NUMBER 1 ANSWERS TO QUESTIONS Q1. THROUGH Q11.

A1. The F/A-18 is a dual-mission, fighter bomber naval aircraft.

A2. The F-14 aircraft incorporates the AN/ALE-39 chaff dispensing system.

A3. When the landing gear handle is in the down position on the F-14 aircraft, the armament safety override switch is used to bypass the open loading gear safety circuit.

A4. The F-14 aircraft can hold a maximum of six AIM-54 missiles.

A5. The fuselage stations of the F-14 aircraft used to suspend AIM-7 missiles include stations 3, 4, 5, and 6.

A6. The F-14 aircraft can hold a maximum of four AIM-9 missiles.

A7. The stations of the F-14 aircraft that are used to carry Sidewinder missiles include stations 1A, 1B, 8A, and 8B.

A8. The HIGH and LOW rates of fire for the M61A1 gun, when it is mounted in the F-14 aircraft, are HIGH—6,000 and LOW— 4,000 rounds per minute.

A9. The burst selector switch on the F-14 aircraft limits the number of rounds that are fired per burst.

A10. The four jettison modes of the F-14 aircraft areas follows: (1) emergency, (2) ACM encounter (3) selective, and (4) auxiliary.

A11. The emergency jettison mode is the only one controlled by the pilot.

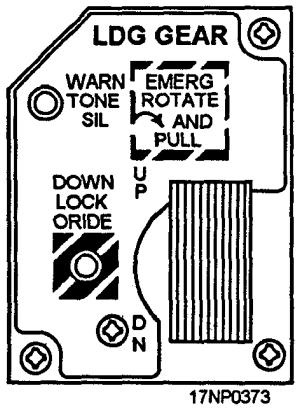


Figure 15-12.—Landing gear control handle.

from the main landing gear weight-off-wheels relay to the master arm circuit breaker.

Armament Safety Override Switch

The armament safety override switch (fig. 15-13) is in the maintenance panel located in the nosewheel well. In the override position, it overrides the landing gear handle DN position so ground operational maintenance can be pulled on the weapon systems.

Master Arm Control Panel Assembly

The master arm control panel assembly (fig. 15-14) is located in the forward cockpit. It contains the A/A, A/G, and MASTER switches. The A/A and the A/G are push-button switches that provide a ground to the SMP. They select the air-to-air or air-to-ground computer modes, respectively. The MASTER switch is used with the LDG GEAR handle or the armament safety override switch. In the SAFE position, weapons cannot be released or fired, although emergency jettison can be initiated. The ARM position provides an input to the SMP and power for weapon release, fire, or jettison. The switch position (SAFE/ARM) is displayed on the DDIs in the wing-form display.

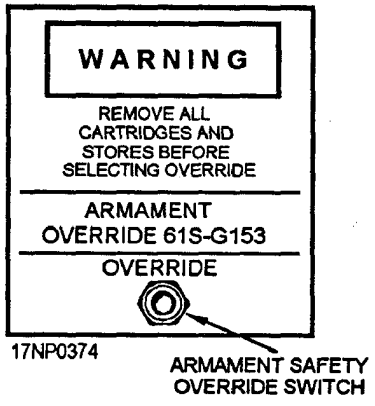


Figure 15-13.—Armament safety override switch.

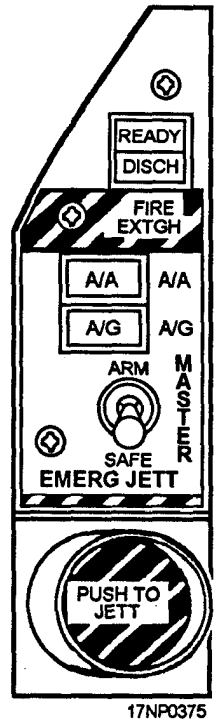


Figure 15-14.—Master arm control panel assembly.

Aircraft Controller Grip Assembly

The aircraft controller grip assembly (fig. 15-15) contains the A/G weapons release switch (bomb release switch). The switch is spring-loaded to the OFF position. When the switch is pressed, it completes a circuit from the armament computer and provides an input back to the armament computer. The aircraft grip controller assembly also contains an A/A switch and the trigger switch, which is discussed later in this chapter.

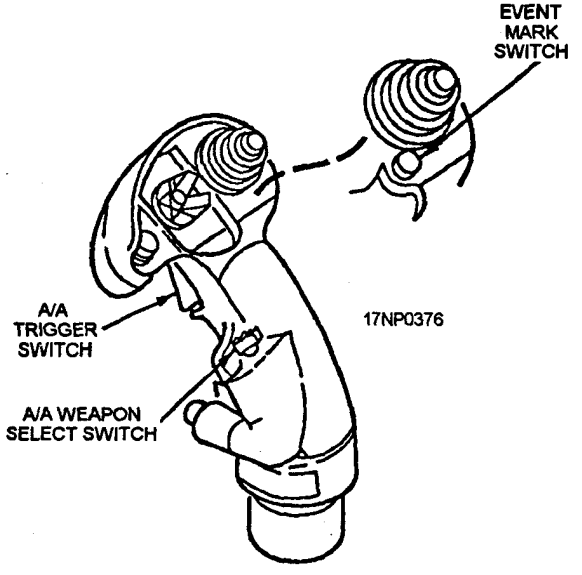


Figure 15-15.—aircraft controller grip assembly.

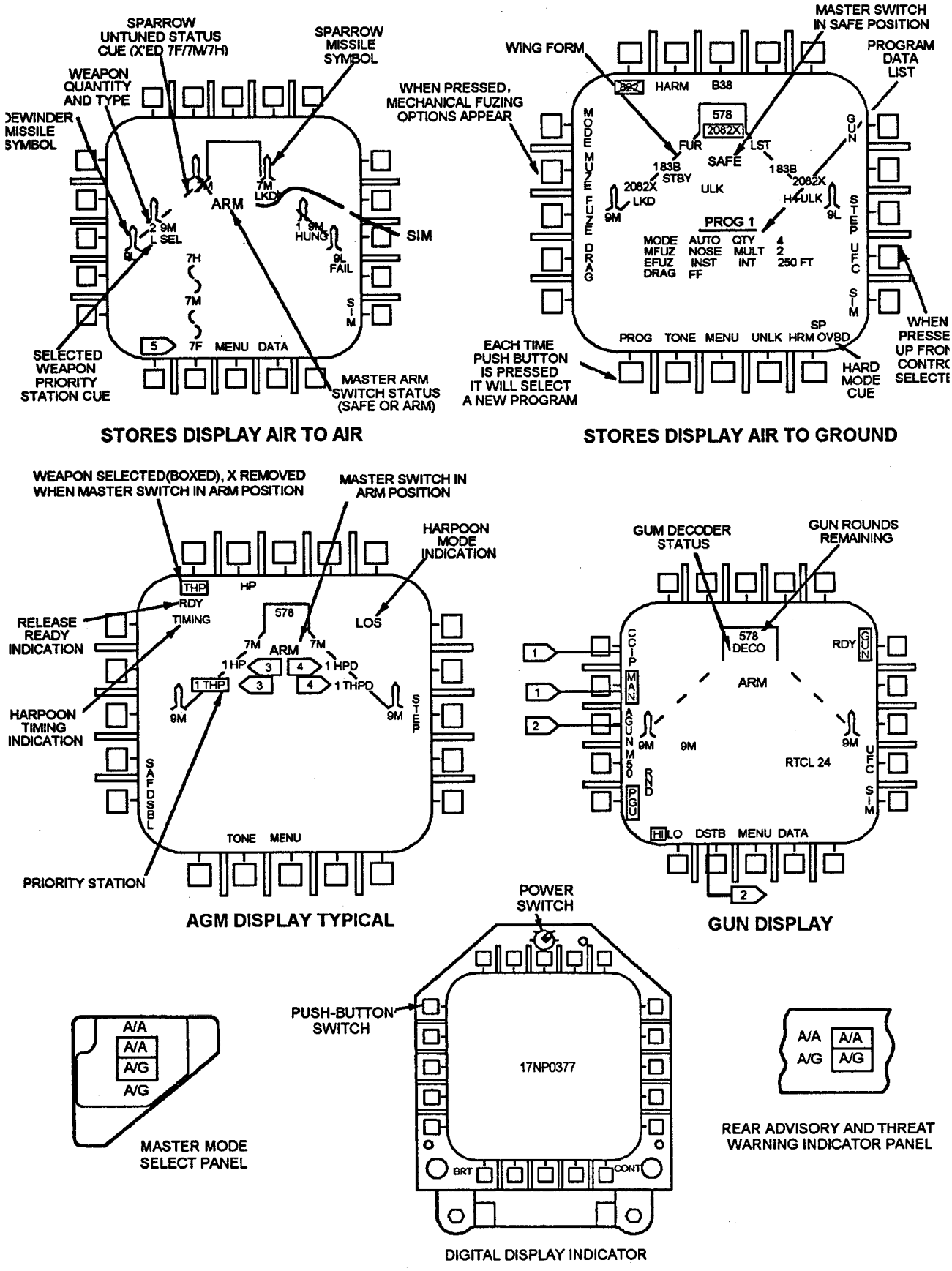


Figure 15-16.—Digital display indicators.

Digital Display Indicators

The digital display indicators (DDIs) (fig. 15-16) are located on the rear cockpit instrument panel vertical consoles. The DDIs on aircraft 161354 through 163778 are connected in parallel with the DDIs in the front cockpit and respond to the last action taken by either pilot. Rear DDIs on F/A-18D 163986 and up have independent displays.

Armament Computer

The armament computer (fig. 15-17) is interfaced with and controlled by the mission computers. The armament computer is also interfaced with and controls the weapon station command encoders-decoders. The armament computer has a weapon insertion panel (fig. 15-18) with code wheels. These code wheels are used to enter the code into the weapon-type (ARMAMENT') and nose or tail fuzes (FUZING). The weapon-type code must match the weapon loaded, and the nose fuze or tail fuze code **must be** compatible with the weapon or the armament computer won't allow it to release normally. For weapons without nose or tail fuzes, the codes must still match the weapon loaded

Digital Computers

Two digital computers makeup the mission computer system and control the avionics systems. They interface with the armament computer and allow the armament computer to route power to the encoders-decoders for weapon release. The digital computers are controlled by the MC switch on the MC/HYD ISOL panel.

Jettison System

The jettison system gives the pilot or crew a way to jettison weapons, stores, launchers, and fuel tanks. The

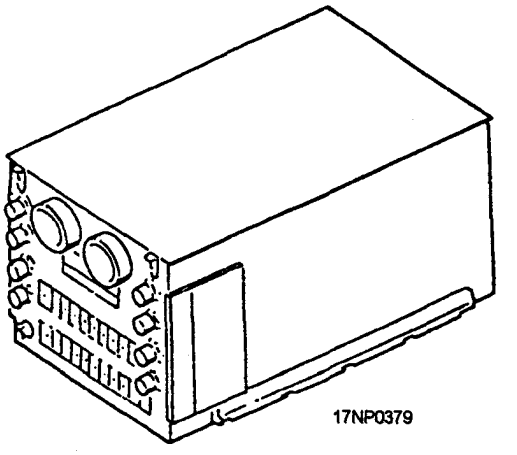


Figure 15-17.—Armament computer.

jettison system has three modes of release-emergency jettison, selective jettison, and auxiliary jettison.

The emergency jettison mode jettisons all weapons from the five pylon stations.

The selective jettison mode individually jettisons the left fuselage missile, the right fuselage missile, racks, launchers, and stores.

The auxiliary jettison mode is a gravity mode to jettison the five pylon stations when emergency and/or selective jettison fails.

Bomb Release System

The bomb release system provides the aircraft with capabilities for release of conventional weapons. The system uses the BRU-32, BRU-33, BRU-41, and BRU-42 gas ejector bomb racks for suspension and release of weapons. Normal release is provided in four electrically controlled modes of operation. The system

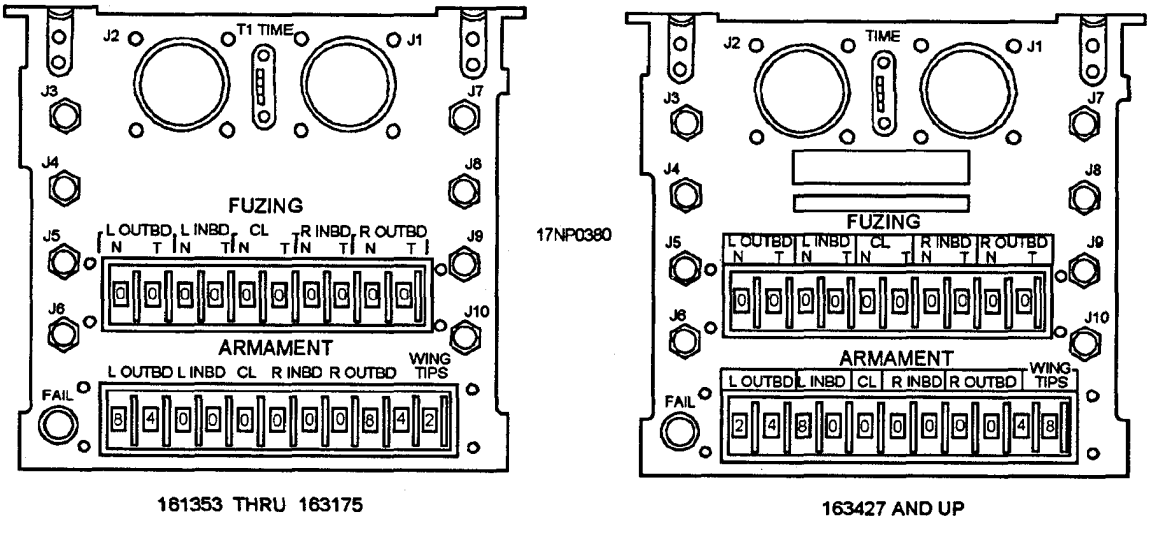


Figure 15-18.—Weapon insertion panel.

consists of the A/G weapon release switch and weapon control system's basic controls and components.

AN/AWW-4 Fuze Function Control System

The AN/AWW-fuze function control system gives the aircraft the capability of using electric fuzes. The system uses the Mk 39 bomb arming unit in the BRU-32/A and BRU-33/A bomb racks. The Mk 39 bomb arming unit denies all voltage to the weapon until it has actually separated from the bomb rack. Voltage is supplied by the PP-6419 power supply to the bomb arming unit through the aircraft wiring. There are four voltages selected on the DDIs. When release is initiated, voltage is supplied through an interconnecting cable to the weapon during the first few inches of fall of the weapon. No voltage is supplied to the bomb rack until the bomb release switch is pressed. The system consists of the PP-6419 power supply and the armament system's basic controls and components.

Rocket Firing System

The rocket firing system gives the aircraft the capability to fire rockets. The system uses the BRU-32/A and BRU-33/A bomb racks for suspension of the rocket launchers. When the bomb release switch is pressed, voltage is supplied through aircraft wiring to the vertical ejector rack (VER). Wiring within the VER allows the rocket to fire. The system consists of the armament system's basic controls and components.

Walleye Guided Weapon System

The Walleye guided weapon system gives the aircraft the capability for release and guidance of a Walleye weapon. The system uses the BRU-32/A bomb rack, bomb release system, and the AN/AWW-4 fuze function control system for fuzing. Video is supplied from the weapon through the aircraft wiring to the DDIs. No voltage is supplied to the bomb rack until the bomb release switch is pressed. The system consists of the CAGE/UNCAGE switch and the armament system's basic controls and components. The CAGE/UNCAGE switch is on the throttle. When the switch is pressed, it cages/uncages the weapon selected.

The AN/AWW-9B, AN/AWW-12A, and AN/AWW-13 data link systems are used with the Mk 21 and Mk 27 Walleye weapons and with the Walleye guided weapon system. The data link systems provide control and guidance to these weapons by using a data pod that is externally mounted to the aircraft. The systems use the BRU-32/A bomb rack. Video is supplied from the weapons and pod to the DDIs through the aircraft wiring. The systems consist of the armament system's basic controls and components.

AGM-65 Maverick System

The AGM-65 Maverick system gives the aircraft the capability to fire a Maverick missile. The system uses the BRU-32/A bomb rack and the LAU-117/A launcher for suspension and firing of the Maverick missile.

AGM-88 HARM System

The AGM-88 HARM system gives an aircraft the capability to fire a HARM missile. The system incorporates the BRU-32/A bomb rack and the LAU-118/A launcher for suspension and firing. Control of the missile is supplied through the armament computer.

AIM-7 Sparrow Fire Control System

The AIM-7 Sparrow fire control system gives the aircraft the capability to fire an AIM-7 missile. The system incorporates the LAU-116/A launcher for fuselage stations and the BRU-32/A bomb rack with the LAU-115C/A launcher on wing pylon stations for suspension and firing. Control of the missile is supplied through the armament computer and the radar system.

AIM-9 Sidewinder Fire Control System

The Sidewinder fire control system gives an aircraft the capability for firing an AIM-9 missile. The system uses the LAU-7 launcher for wing tip stations and the BRU-32/A bomb rack with a LAU-115C/A launcher configured with the LAU-7 launcher on wing pylon stations for suspension and firing. Control of the missile is supplied through the armament computer.

M61A1 20-MM Gun System

The M61A1 20-mm gun system gives an aircraft the capability to fire this gun. The system enables selecting, arming, and firing. Depending on the mission objective, the gun can be operated in the air-to-air (A/A) or air-to-ground (A/G) computer mode. There are two A/G modes-continuously computed impact point (CCIP) and manual (MAN). There are three A/A modes-director, disturbed, and cage. Control of the gun is supplied through the SMP. No voltage is supplied to fire the gun until the trigger switch is pulled and all landing gear is up and locked. The gun fire control

system consists of four subsystems—the gun and associated ammunition feed, hydraulics, gun gas purging and ammunition cooling, and gun electronics.

AN/ALE-39 Decoy Dispensing System

The AN/ALE-39 decoy dispensing system gives an aircraft the capability to dispense chaff or flares. The decoy rounds are contained in two dispensers at the fuselage underside area. Control is supplied through the SMP. The system consists of the dispenser/ECM control panel, engine throttle lever grip assembly, left console DISP switch, AN/ALE-39 programmer, two AN/ALE-29A dispensers, MX-7721/ALE-29A dispenser housings, two 1874/ALE-39 sequencer switches, and the armament system's basic controls and components.

Aircraft Armament Configuration Capabilities

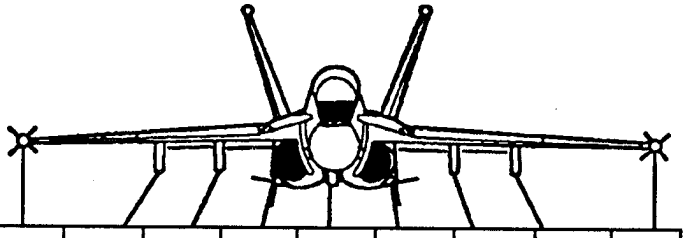
The basic armament configuration of the F/A-18 aircraft consists of LAU-116/A missile launchers, LAU-7 missile launchers, SUU-63/A pylons, SUU-62/A pylon, BRU-32/A bomb racks, and an M61A1 20-mm gun.

The F/A-18 basic armament configuration can be reconfigured to accommodate a variety of weapons. Figure 15-19 shows the station configuration capabilities.

If you want more information about authorized aircraft configurations and weapons loading, refer to *A1-F18AA-TAC-000,* volume 1, and *A1-F18AA-TAC-100,* volume 2, *NATOPS Tactical Manual.* A general description of the F/A-18 armament systems and suspension or releasing equipment is contained in the *Airborne Weapons/Stores Loading Manual, A1-F18AAA-LWS-000.*

REVIEW NUMBER 2

Q1. In the F/A-18 aircraft, the armament safety override switch is located on the _____.



EQUIPMENT	9	8	7	6	5	4	3	2	1
SUU-62 PYLON					X				
LAU-116 SERIES LAUNCHER				X		X			
MER/BRU-41		X	X				X	X	
BRU-42		X	X				X	X	
BRU-33 (VER)		X	X		X		X	X	
BRU-32 BOMB RACK		X	X		X		X	X	
SUU-63 PYLON		X	X				X	X	
LAU-117 LAUNCHER		X	X				X	X	
LAU-118 LAUNCHER		X	X				X	X	
LAU-115 SERIES LAUNCHER		X						X	
LAU-115 SERIES LAUNCHER WITH TWO LAU-7 OR LAU-127 LAUNCHERS		X						X	
LAU-7 LAUNCHER	X								X

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Figure 15-19.—F/A-18 aircraft station configuration capabilities.

Q2. List the jettison modes of the F/A-18 aircraft.

Q3. If the emergency jettison is selected on the F/A-18 aircraft what weapons are released?

Q4. Under what condition would the auxiliary jettison mode be used in the F/A-18 aircraft?

Q5. What fuze function control system gives the F/A-18 aircraft the capabilities of using electric fuzes?

Q6. To suspend and fire the Maverick missile from the F/A-18 aircraft, you should use what bomb rack and launcher combination?

Q7. What missile launcher should you use to suspend the AGM-88 HARM missile on the F/A-18 aircraft?

Q8. What missile launcher is used on the wing pylon stations of the F/A-18 aircraft to suspend and launch an AIM-7 Sparrow missile?

ANTISUBMARINE WARFARE WEAPONS SYSTEMS

LEARNING OBJECTIVE: *Identify antisubmarine warfare weapons systems to include the basic system, the kill store system, the release and control system, the release and control systems checks, and weapons system maintenance.*

Antisubmarine warfare (ASW) is becoming a broad field. New developments are being made in submarine detection as well as in the tactical deployment of the equipment. The search stores (primarily sonobuoys), launched at precise intervals and locations and with the airborne electronics equipment, give accurate information in the detection of submarines. The kill stores consist of torpedoes, mines, bombs, rockets, and guided missiles. The basic ASW search and kill store system and its associated equipment are currently used in the P-3 and S-3 fixed-wing aircraft and the SH-60 rotary-wing aircraft.

P-3 AIRCRAFT

The basic P-3 (fig. 15-20) ASW weapons system consists of the equipment and accessories necessary for carrying and releasing kill stores and search stores. The system's equipment and accessories are discussed in the following text.

Pilots Armament Control Panel

The armament control panel provides the pilot with control of all kill and search stores.

Pilots Search Stores Control Panel

The pilots search stores control panel provides the pilot with operational control of the search stores system and provides a visual indication of the stores that are loaded and are available for release.

TORP Presetter Panel

This panel provides the controls and indicators for manual or automatic preset of Mk 46 or Mk 50 torpedoes.

Weapon Release Switches

The pilot and copilot have two switches for release of weapons other than missiles. Release of kill stores by the tactical coordinator is limited to bombs and torpedoes.

Harpoon Aircraft Command Launch Control (Missile Control Panel)

The missile control panel provides power application, controls, and displays for the Harpoon missile. The controls and displays are used for manually

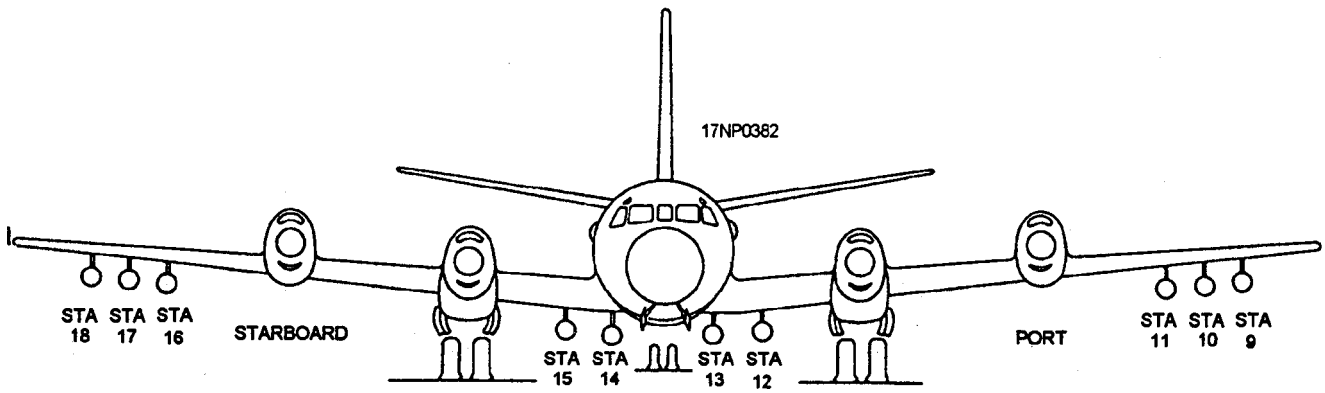


Figure 15-20.—P-3 ordnance stations.

defining missile selection or deselection, warhead fusing, target range and relative bearing, attack and seeker modes, and aircraft true airspeed and altitude inputs.

Data Processor Computer (DPC)

The data processor is a digital computer that provides the digital communications link between the Harpoon Aircraft Command Launch Control System (HACLCS) and the Harpoon missile.

Armament Subsystems

The following text provides general information on the aircraft armament subsystems and components.

WEAPON SYSTEM.— The weapon system consists of the equipment and accessories necessary for loading, carrying, and releasing of kill and search stores. There are two subsystems, the armament (kill store) subsystem and the ordnance (search store) subsystem. The armament system refers to carriage and delivery of weapons or stores from the wing and bomb bay stations. The ordnance system refers to equipment used for carriage and delivery of search stores. A maximum of 8 bomb bay stations and 10 wing stations are available for carriage of weapons. There are 48 unpressurized sonobuoy launch tubes (SLT), 3 pressurized SLT, and 1 free-fall chute used with the search store system (fig. 15-21).

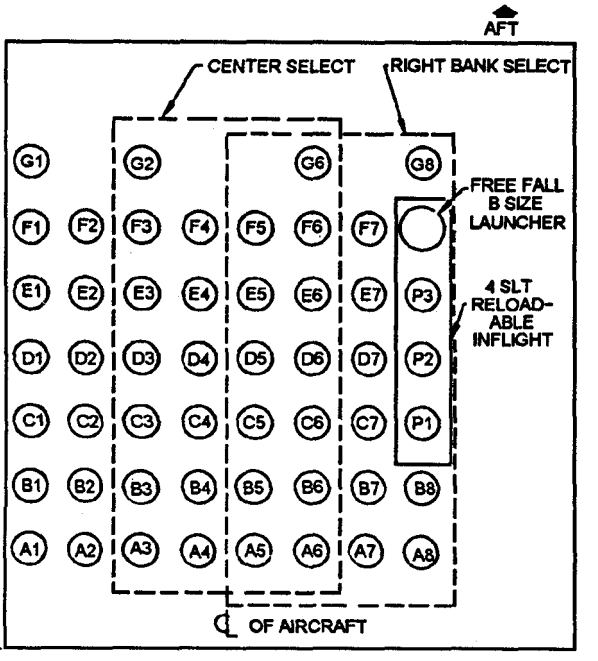


Figure 15-21.—P-3 sonobuoy launch tube arrangement.

BOMB BAY SYSTEM.— The bomb bay has a maximum of eight stations available at one time. The eight basic stations are arranged in two layers; odd numbered stations in the upper layer and even numbered stations in the lower layer. This configuration limits the release of weapons from the upper layer until the interfering weapon on the lower level has been released. Bomb racks are attached to removable pylons with two types of pylons (primary pylon and 1,000- to 2,000-pound class store pylon). Bomb rack installations are assigned a number or a number followed by a letter (fig. 15-22).

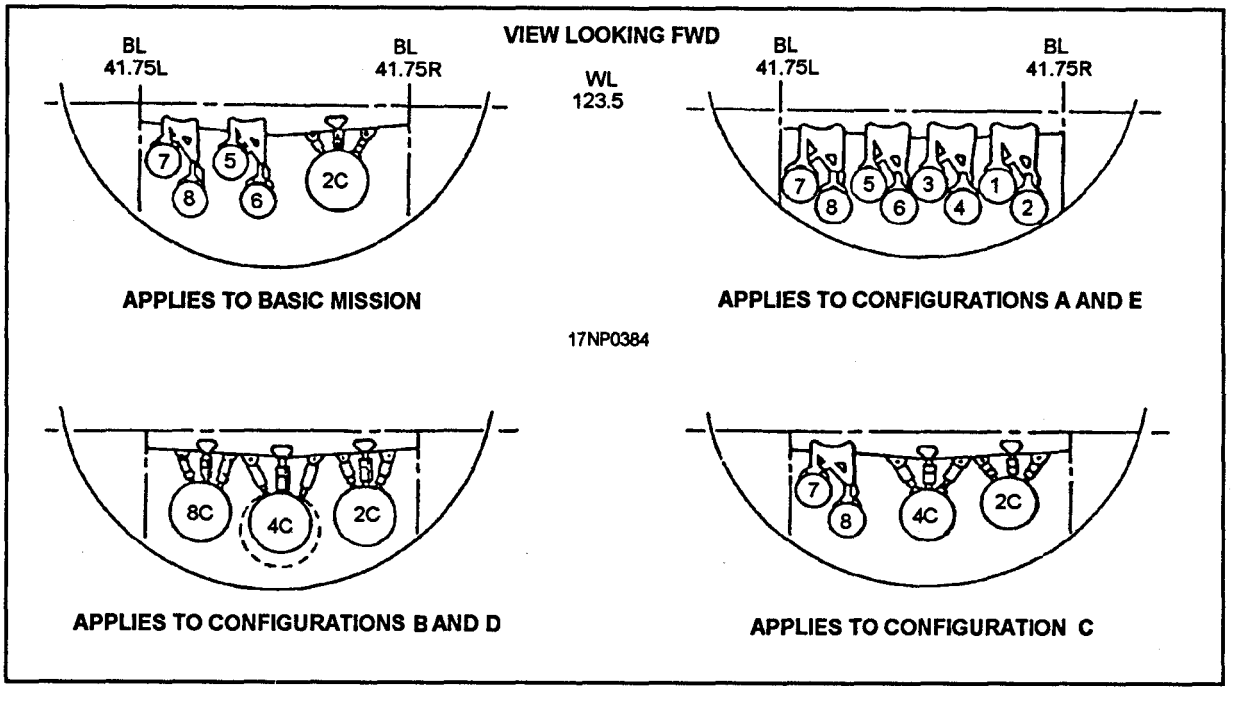


Figure 15-22.—Bomb bay weapons stations.

BOMB BAY CONFIGURATION.— There are four primary pylon assemblies (fig. 15-23) provided for carrying a maximum of eight bomb bay stores. The pylon consists of two BRU-12/A bomb racks mounted between two pylon ends. The BRU-12A bomb rack (fig. 15-24) is a modified MAU-38 series bomb rack. The BRU-12/A is interchangeable with the MAU-38, and installation, operation, maintenance, safety, and testing procedures are the same. There are three 1,000- or 2,000-pound class store pylon assemblies (fig. 15-25) provided for carrying a maximum of three 1,000- or one 2,000-pound class weapon. The pylon assembly consist of a BRU-14/A bomb rack with mounting adapters on station 4C. The Aero 1A adapters provide the BRU-14/A bomb rack with 30-inch suspension and load capabilities. Figures 15-26 through 15-31 show the various wing stations and bomb bay equipment configurations.

For more information on the P-3 aircraft, refer to *Airborne Weapons/Stores Loading Manual,* NAVAIR 01-75PA-75.

S-3 AIRCRAFT

The S-3 (fig. 15-32) weapon control system has the units, panels, switches, logic circuits, interfaces, computer, and controls necessary for selecting, arming, and releasing the kill or search stores. Status lights indicate store selection errors and stores go or no-go status. Electrical jettison release systems are used to release or eject all the wing stores and all search stores of the S-3 aircraft.

Armament Control Panel

The armament control panel (ACP) provides the pilot with control for the manual delivery of forward-firing weapons, droppable stores, and the release of the SAR sonobuoy.

AN/ALE-39 Countermeasures Dispensing System

The system dispenses expendable payloads that consist of chaff, flares, or RF jammers, either individually or in groups. Three dispensers are installed in the aircraft, one on each side of the fuselage and one on the centerline on the fuselage bottom.

REVIEW NUMBER 2 ANSWERS TO QUESTIONS Q1. THROUGH Q8.

A1. In the F/A-18 aircraft, the armament safety override switch is located on the maintenance panel in the nosewheel well.

A2. The jettison modes of the F/A-18 aircraft include (1) emergency, (2) selective, and (3) auxiliary.

A3. If the emergency jettison is selected on the F/A-18 aircraft, all weapons from the five pylon stations are released.

A4. The auxiliary jettison mode is used in the F/A-18 aircraft when emergency and/or selective jettison fails. It is a gravity jettison mode.

A5. The AN/AWW-4 fuze function control system gives the F/A-18 aircraft the capability of using electric fuzes.

A6. To suspend and fire the Maverick missile from the F/A-18 aircraft, you should use the BRU-32A and the LAU-117/A combination.

A7. You should use the LAU-118/A to suspend the AGM-88 HARM missile on the F/A-18 aircraft.

A8. The LAU-115C/A missile launchers used on the wing pylon stations of the F/A-18 aircraft to suspend and launch an AIM-7 Sparrow missile.

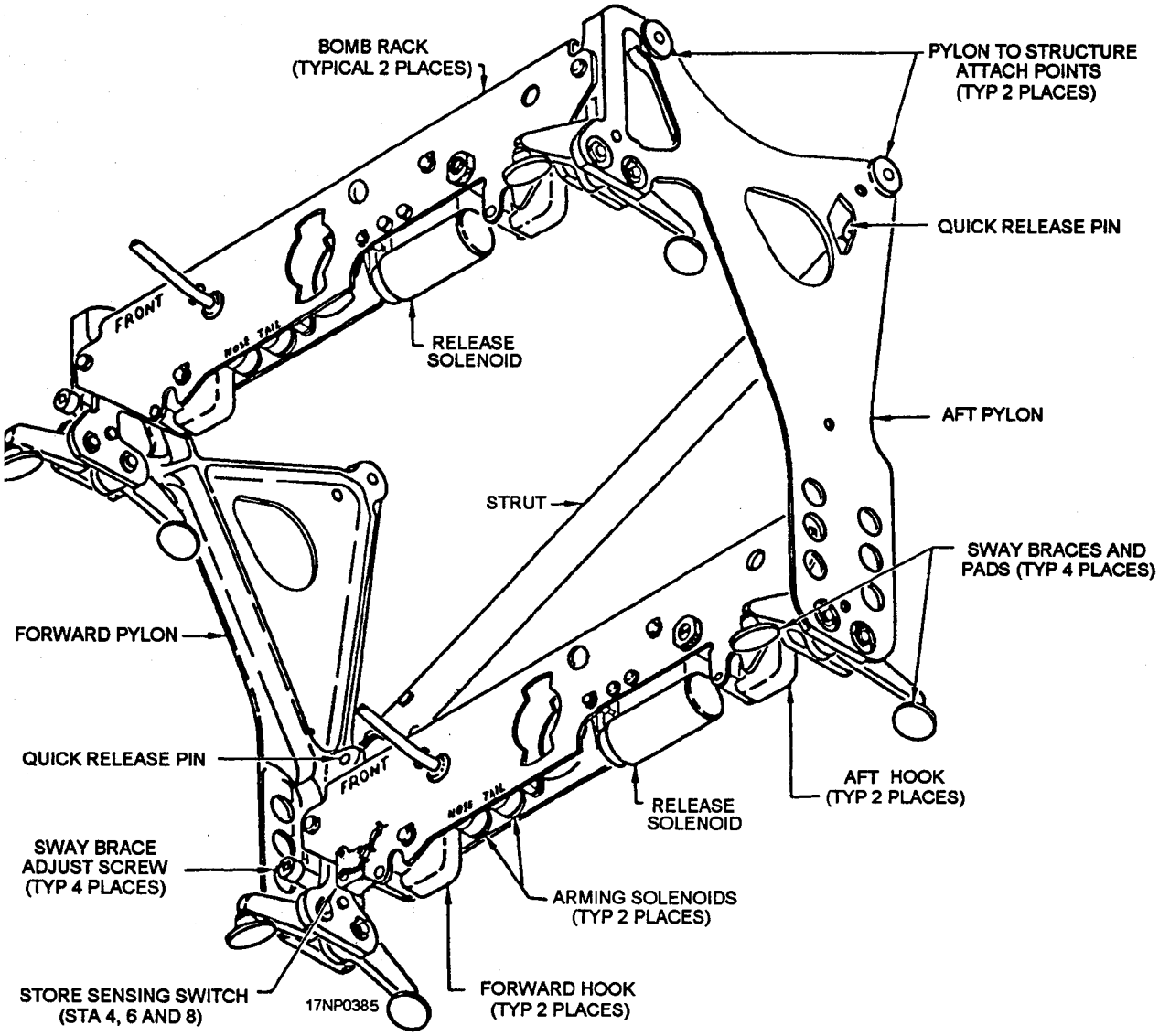


Figure 15-23.—Primary pylon assembly.

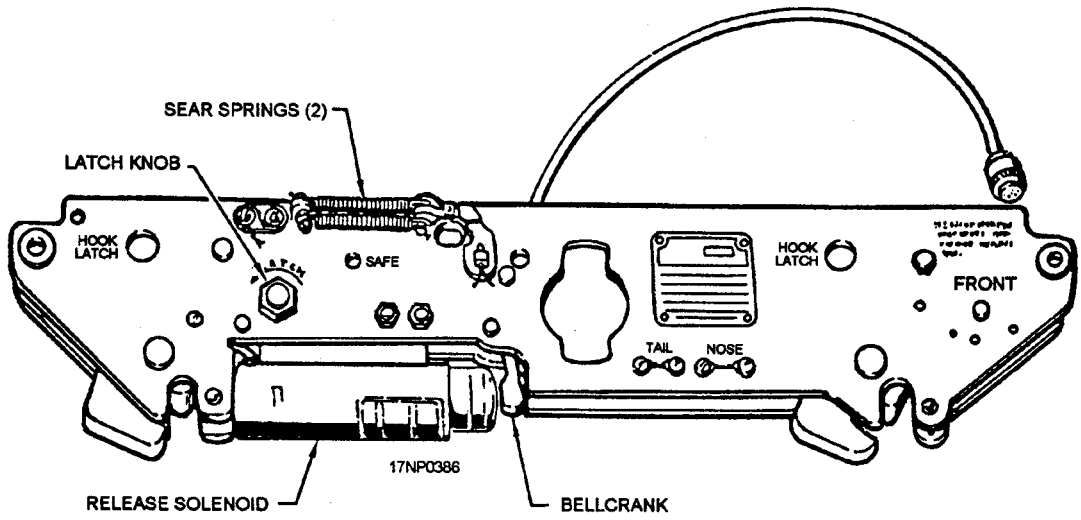


Figure 15-24.—BRU-12/A bomb rack.

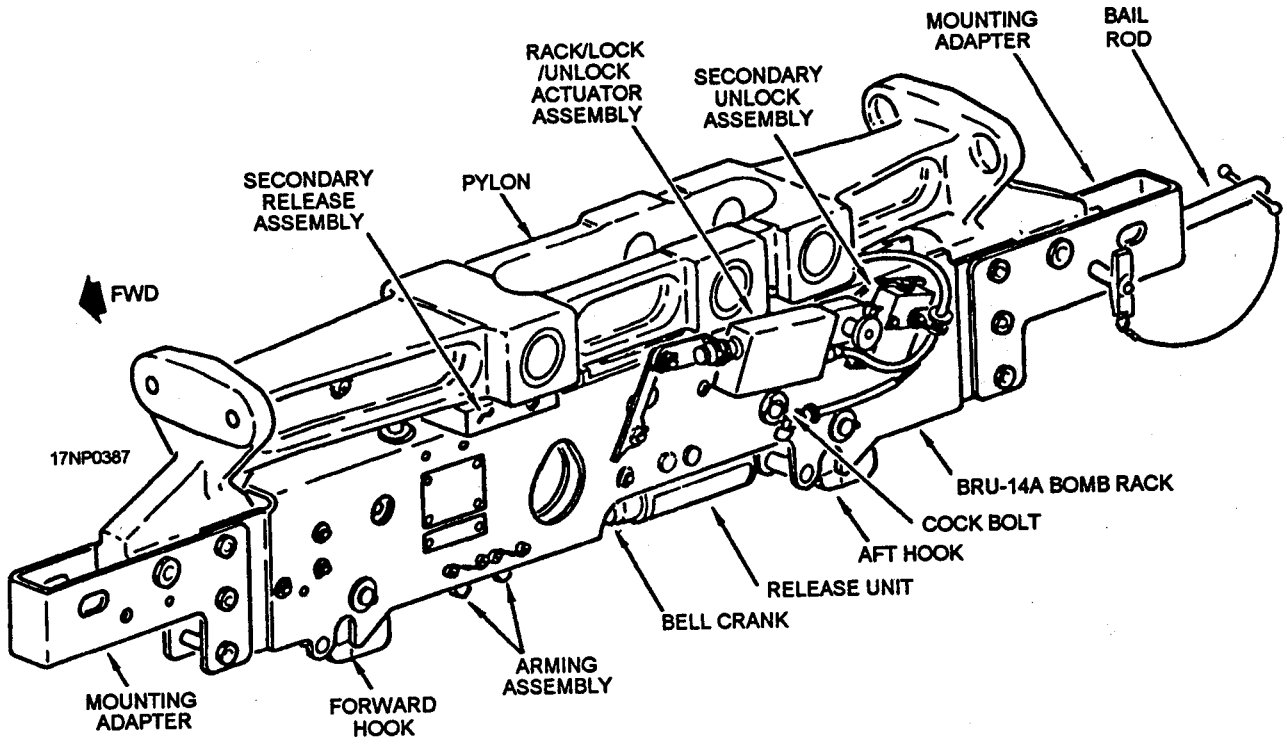


Figure 15-25.—P-3 1,000- or 2,000-pound class store pylon assembly with BRU-14/A bomb rack.

Search Store System

The search store system has the necessary equipment and accessories to carry and release sonobuoys. Also, the sono system can carry and release several other search-related stores.

Part of the search store system consists of unpressurized size A sonobuoy launch tubes (SLTs). These are installed in the underside of the aircraft fuselage. There are 60 SLTs. The SLTs are not accessible from the pressurized aircraft cabin (flight station); therefore, the designation "unpressurized."

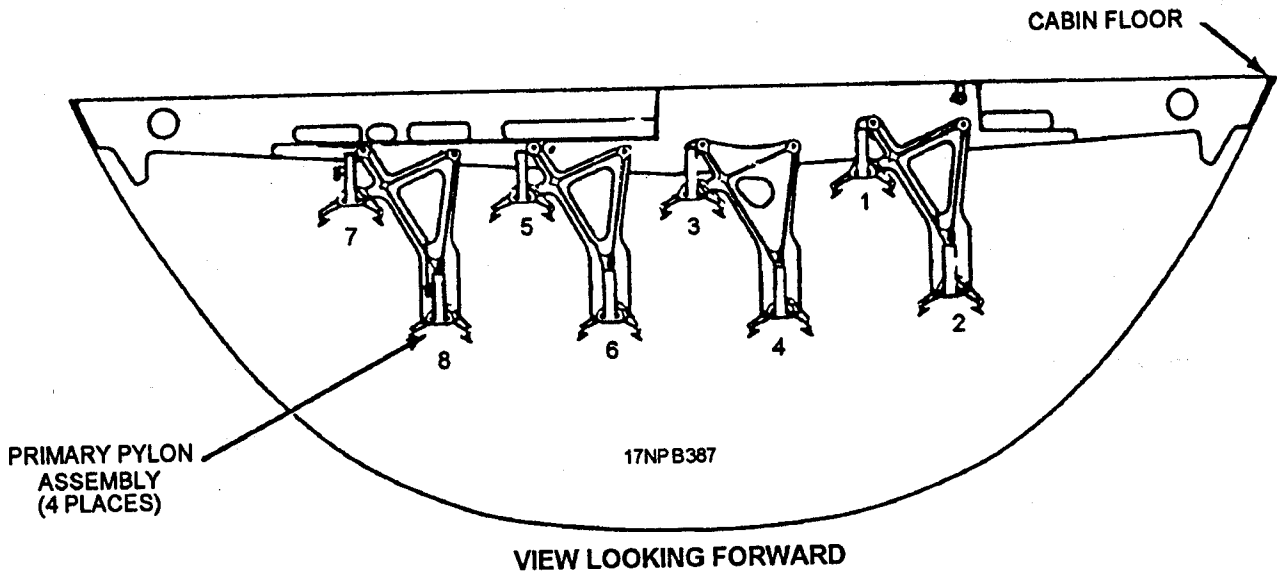


Figure 15-26.—Bomb bay configuration with four primary pylons.

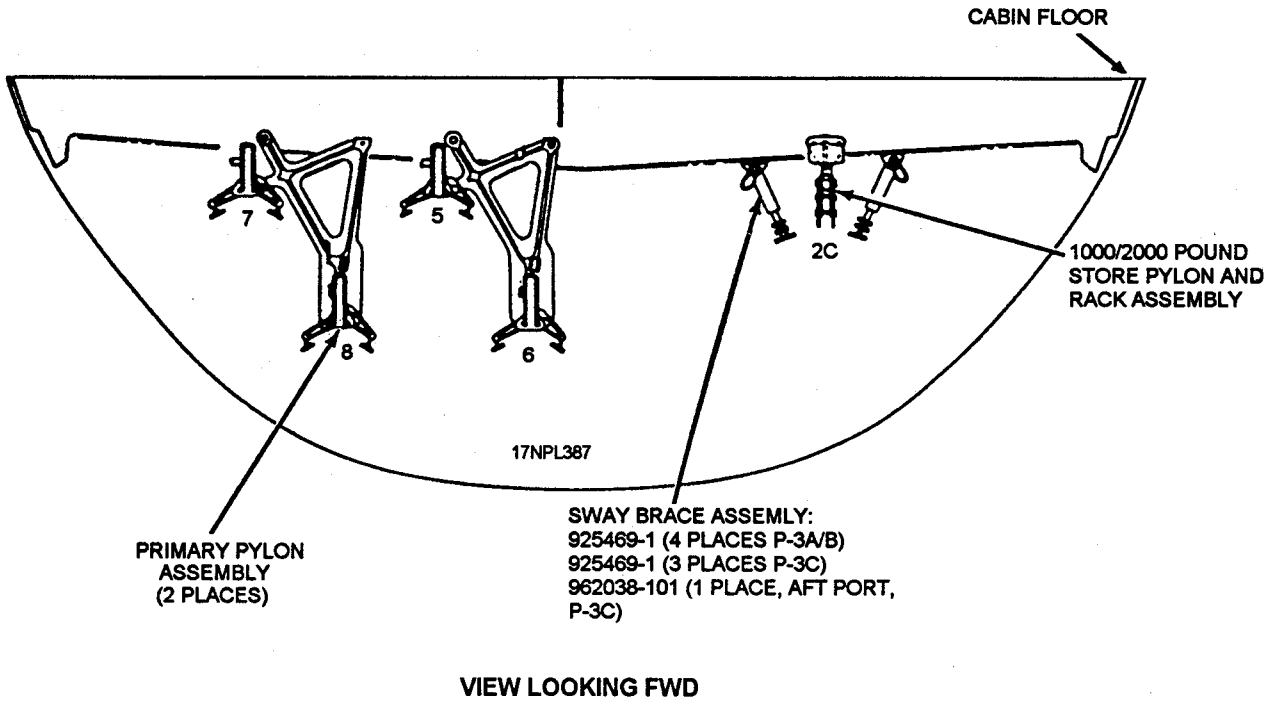


Figure 15-27.—Bomb bay configuration with two primary pylons and one 1,000- or 2,000-pound stores pylon.

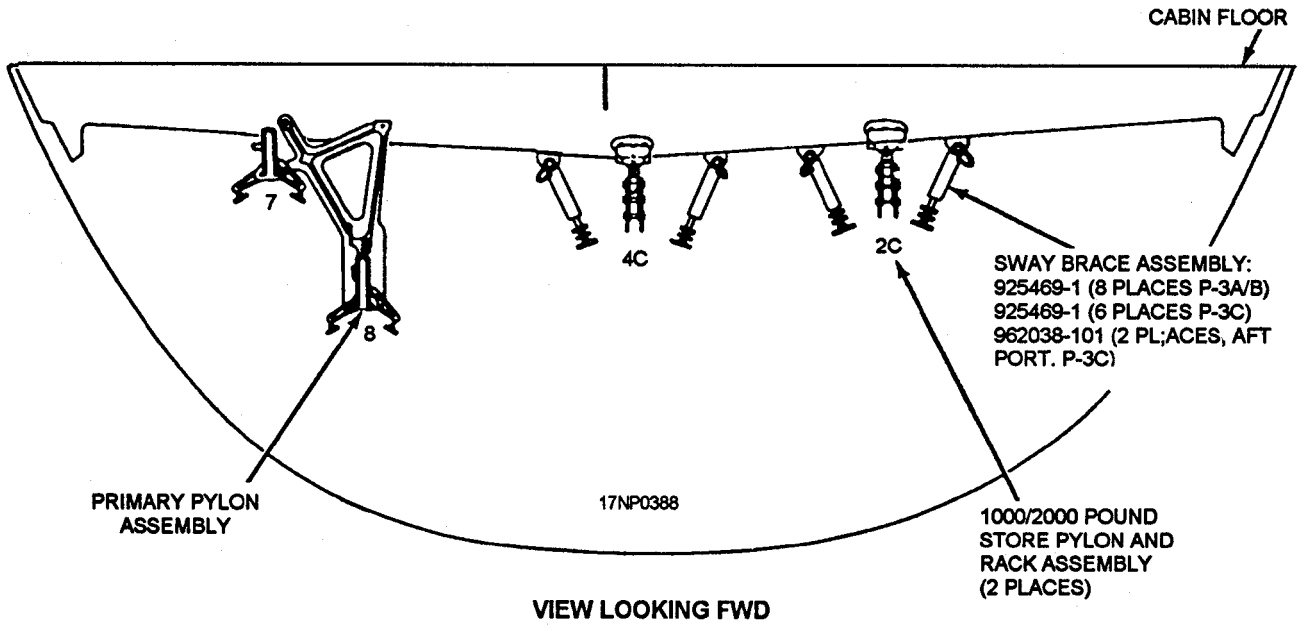


Figure 15-28.—Bomb bay configuration with one primary pylon and two 1,000- or 2,000-pound store pylons.

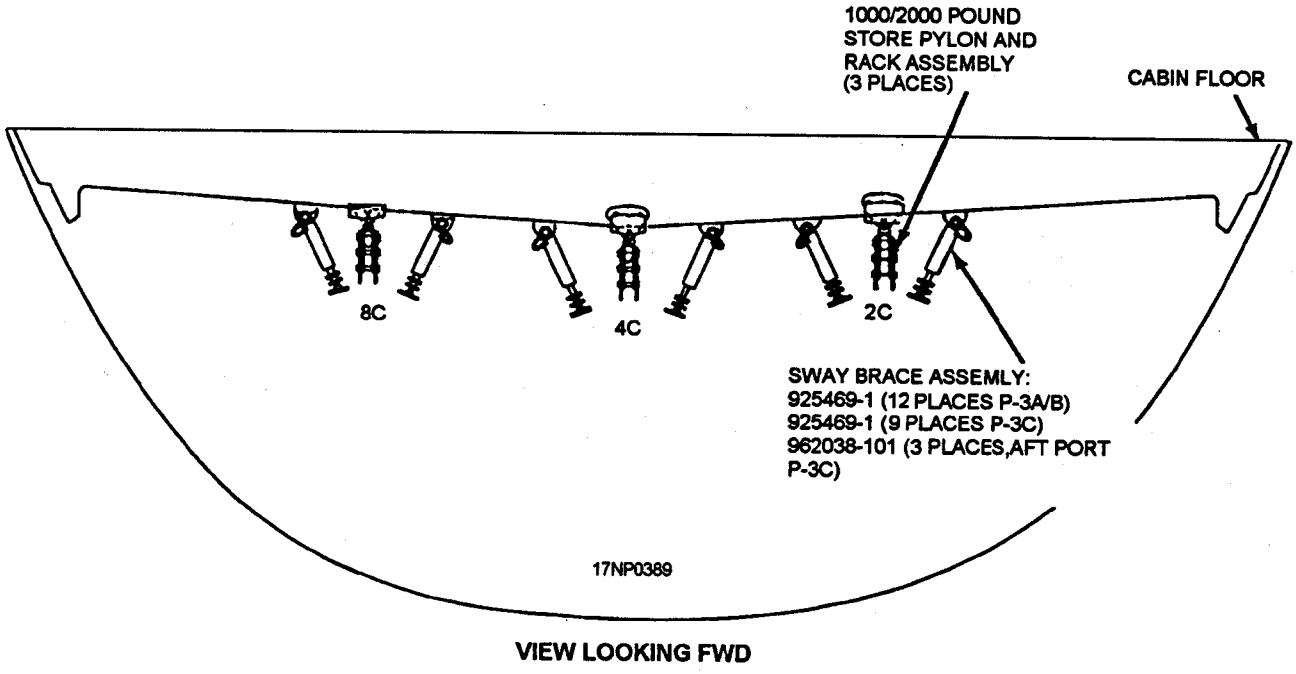


Figure 15-29.—Bomb bay configuration with three 1,000- or 2,000-pound store pylons.

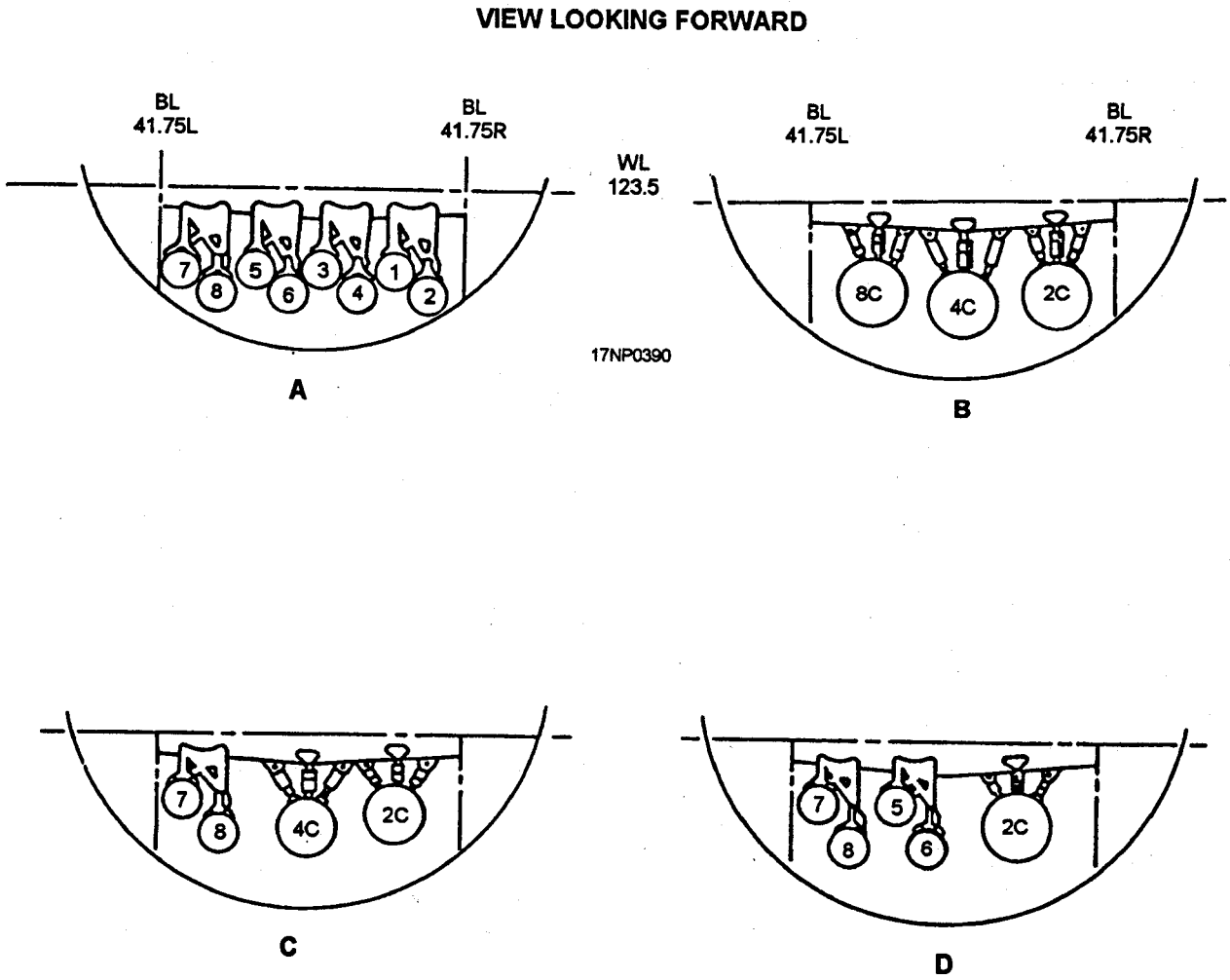
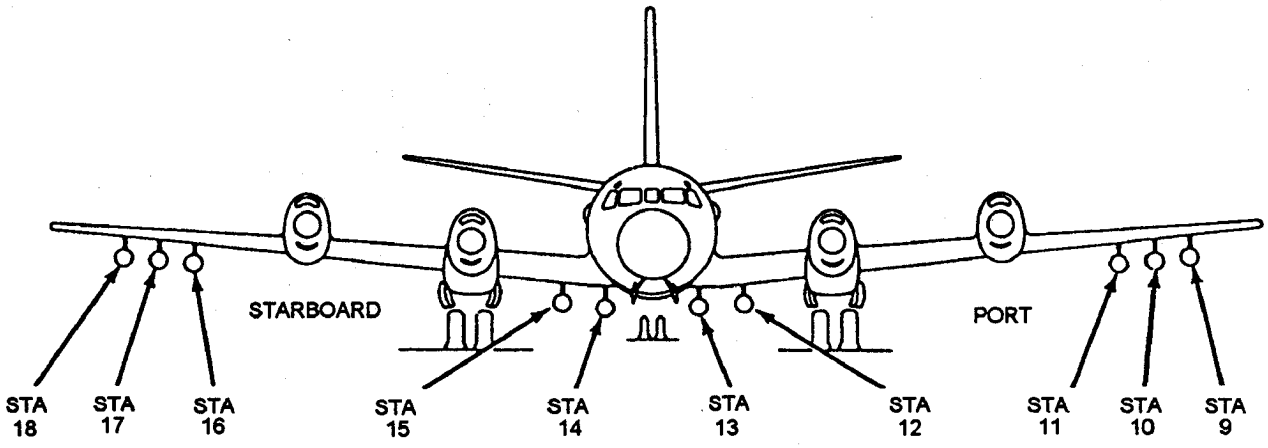
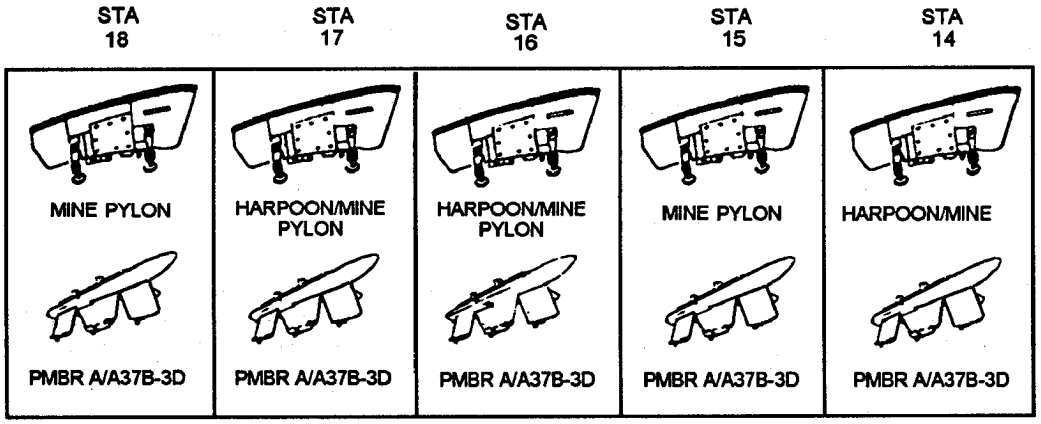


Figure 15-30.—Various bomb bay configurations.





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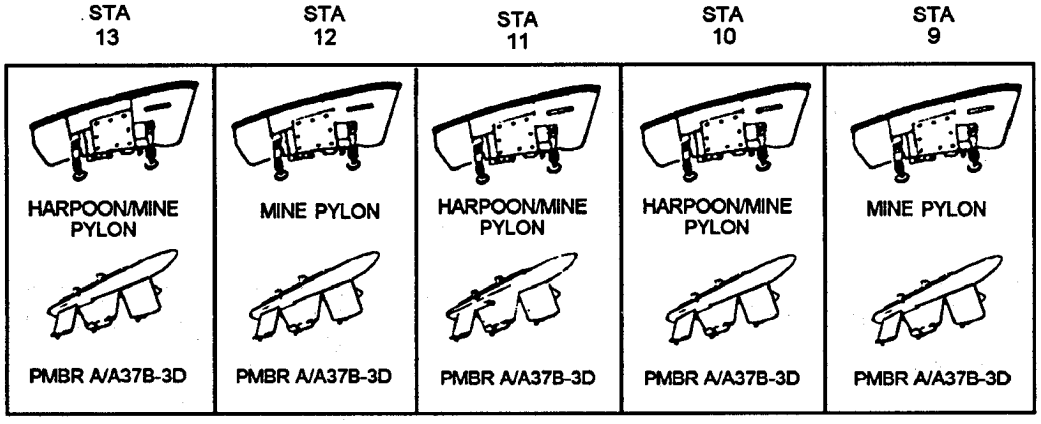

Figure 15-31.—Wing station configurations.

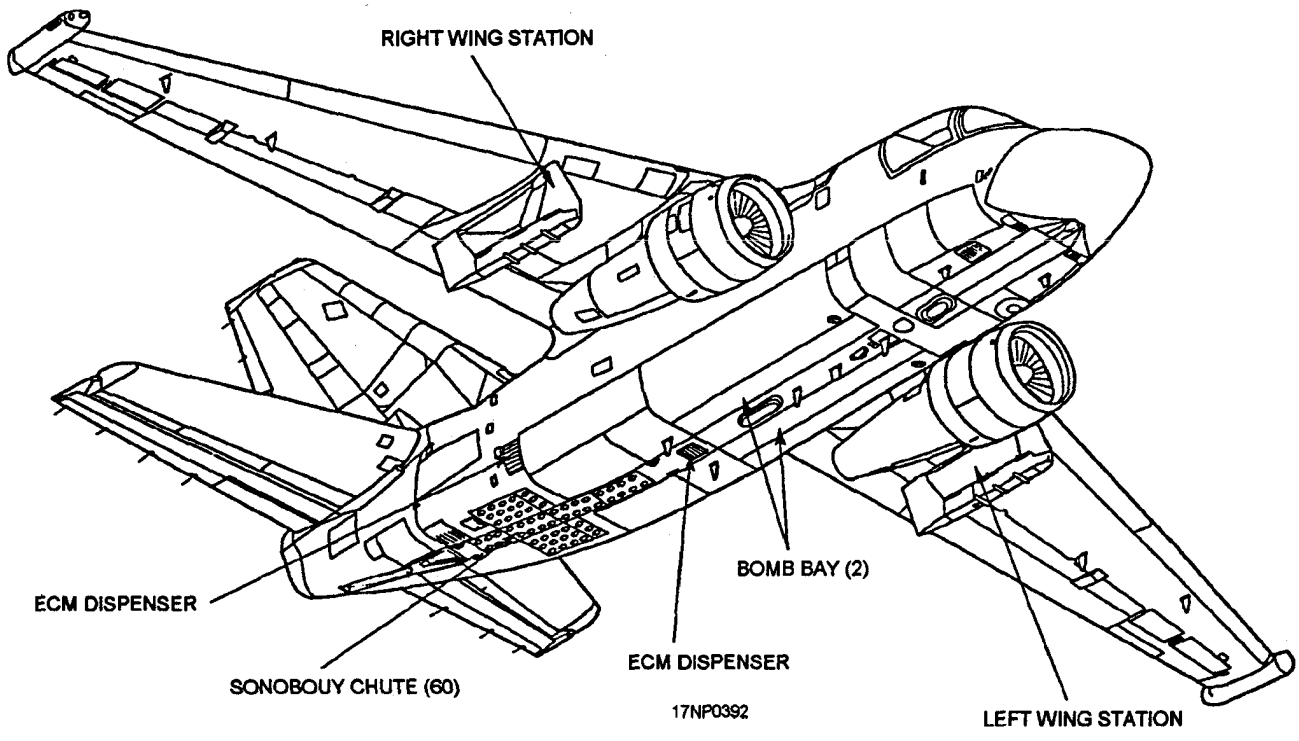

Figure 15-32.—S-3 aircraft configuration.

The SLTs maybe reloaded only from the outside of the aircraft. Look at figure 15-33. It shows the arrangement of the SLTs as you look up at the lower fuselage.

Bomb Bay System

The bomb bay system consists of the units and components needed to carry, arm, and release stores. The bomb racks are attached to brackets mounted to the aircraft in a cruciform pattern. Each of these basic installations is assigned a station number. Numbers followed by a letter (such as A or B) designate these stations for special capacities or types of stores. These stations are arranged in pairs, such as stations 1 and 2, 3 and 4, etc.

For ground maintenance without power on the S-3, you need to use a 3/8-inch drive crank to open or close the doors. Both aircraft have a ground safety pin to disable the door mechanism in the open position. The door safety pin must be inserted when you are working in the bomb bays.

The release of bomb bay stores is normally accomplished by the computer, as programmed by the TACO and controlled by the TACO with copilot backup. The pilots have final control because they must activate the master arm switch.

S-3 Configurations

The S-3 bomb bay suspension has two BRU-14/A bomb racks. The racks are suspended from the bomb bay overhead support braces. Different configurations are made by arranging the racks in various locations on the support braces. Figure 15-34 shows the configurations available for each bomb bay.

The basic configuration of the S-3 consists of dual stations-stations 1 and 2 and stations 3 and 4 across the bays. The station A configuration consists of dual tandem stations in each bay—1A and 2A, 3A and 4A. These two configurations are used, as necessary, to provide store clearance, depending on the shape and size of the store. The single store configuration consists of one station per bay—1B and 4B. This configuration is used for special purposes, such as special weapons.

The BRU-14/A rack is held in position by two mounting bolts through the forward mount. Mounting pins secured to the aircraft braces restrain the rear of the rack assembly. Electrical receptacles at each mounting position provide connection for the rack to the aircraft circuits.

Foldable scrub rails, or guides, secured to the bomb bay centerline bulkhead, are used with some stores to prevent damage to the aircraft structure as the store falls away.

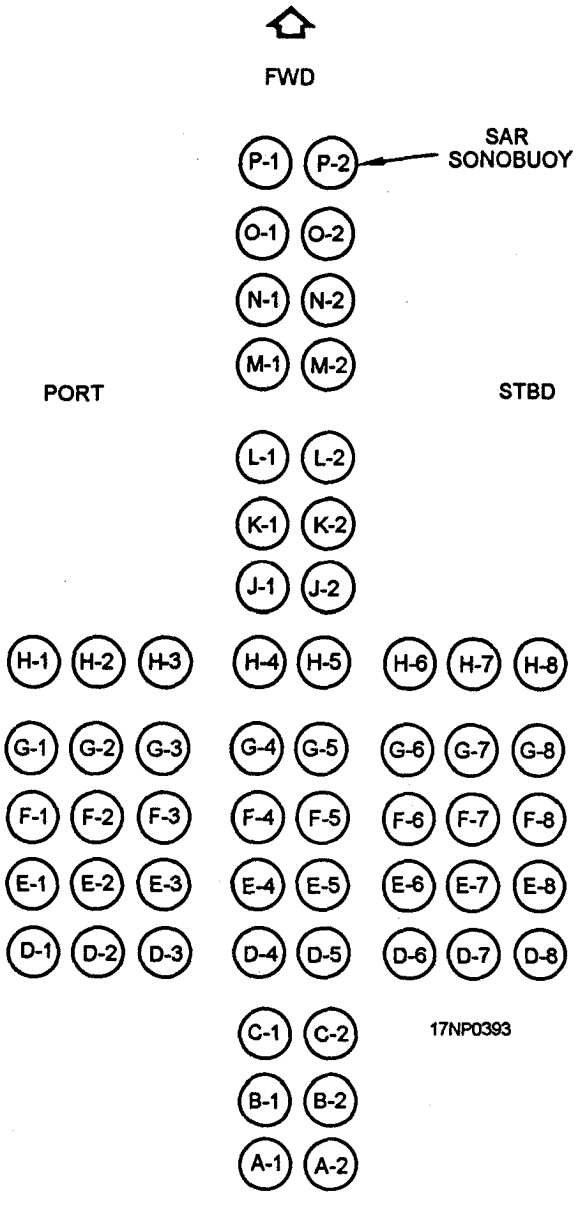

Figure 15-33.—S-3 sonobuoy launch tube arrangement.

The distribution box provides the necessary interface between the decoder and the bomb racks in both auto (computer) and manual modes. The decoder contains the necessary electronics for receiving commands from the armament control panel for arming and releasing bomb bay stations and transmitting station status information.

Wing Store System

The wing store system consists of the units and components necessary for carrying, arming, and releasing external stores. The stores are suspended from two wing stations (fig. 15-35)—W5 (left) and W6 (right).

S-3 Pylon and Rack Assembly

The S-3 pylon and rack assembly consists of a pylon supporting a BRU-11A/A ejector rack The rack is a self-contained unit that performs all the functions of carrying, arming, and releasing the stores. It is controlled by the aircraft armament circuits. The pylon provides structural attachment between the aircraft wing and the rack. It also contains the necessary wiring and components to connect the rack to release and status indicating circuits.

SH-60B/F Helicopter

The search store system of SH-60 helicopters is less complex than that of the P-3 and S-3 aircrafts, but it serves the same purpose. The SH-60 has all weather capabilities. The SH-60B is designed to operate off frigates, destroyers, and cruisers. Its primary missions are detection, classification, localization, and interdiction of surface ships and submarines. Its secondary missions include communications relay, vertical replenishment, search and rescue (SAR), medevac, and fleet support. The SH-60F is designed to replace the SH-3, and it operates off aircraft carriers. The primary mission is close-in ASW protection for the carrier battle group, and secondary missions include SAR and plane guard. Both the SH-60B and SH-60F are equipped with 25 sonobuoy launch tubes, BRU-14/A bomb racks (2 on the SH-60B and 3 on the SH-60F) for carriage of torpedoes. The SH-60F also has air-to-surface missile capabilities. The various models of the SH-60 helicopter (B, F) have different configurations and capabilities.

REVIEW NUMBER 3

Q1. List the three basic aircraft used by the Navy for ASW operations.

Q2. The P-3 aircraft has _____ bomb bay stations.

Q3. What is the total number of unpressurized sonobuoy launch chutes in a P-3 aircraft?

Q4. Three pressurize SLTs are used in P-3 aircraft. What size SLTs are used?

Q5. Describe the numbering system of the P-3 bomb bay stations.

Q6. You can mount _____ BRU-12/A racks on the primary pylon assembly of a P-3 aircraft.

Q7. What rack and adapters are found in the P-3 aircraft wing launcher assembly?

Q8. What bomb rack or release unit is used with the SH-60 helicopter?

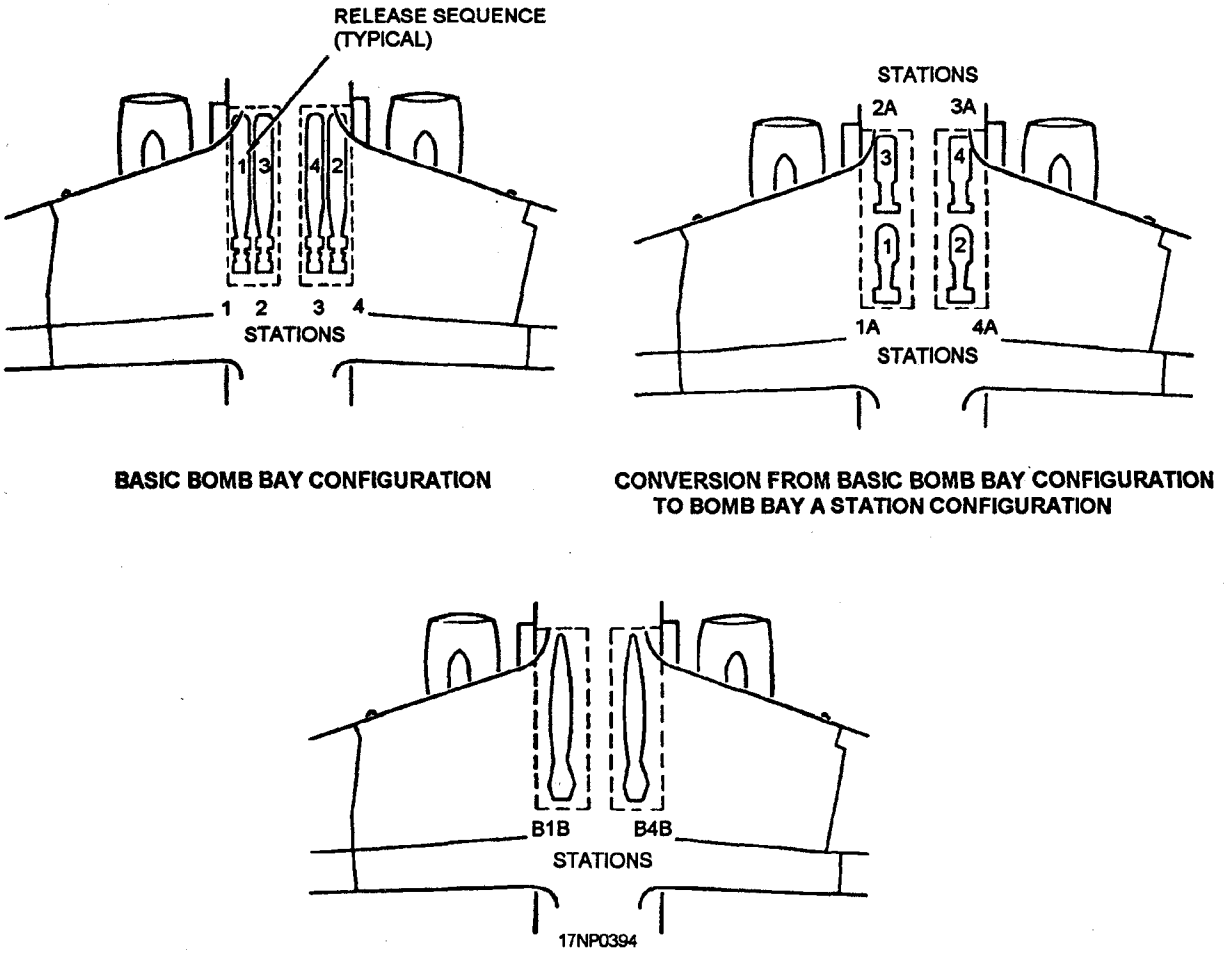

Figure 15-34.—S-3 bomb bay configurations.

REVIEW NUMBER 3 ANSWERS TO QUESTIONS Q1. THROUGH Q8.

A1. The three basic aircraft used by the Navy for ASW operations include the P-3 and S-3 aircraft and SH-3 helicopter.

A2. The P-3 aircraft has eight bomb bay stations.

A3. There are 48 unpressurized sonobuoy launch chutes in a P-3 aircraft.

A4. Three pressurized size A SLTs are used in P-3 aircraft.

A5. P-3 bomb bay stations are numbered as follows: odd-numbered stations in the upper level and even-numbered stations on the lower level.

A6. You can mount two BRU-12/A racks on the primary pylon assembly of a P-3 aircraft.

A7. One Aero 65A-1 rack with two Aero 1A adapters are found in P-3 aircraft wing launcher assembly

A8. The BRU-14/A bomb rack is used with the SH-60 helicopter

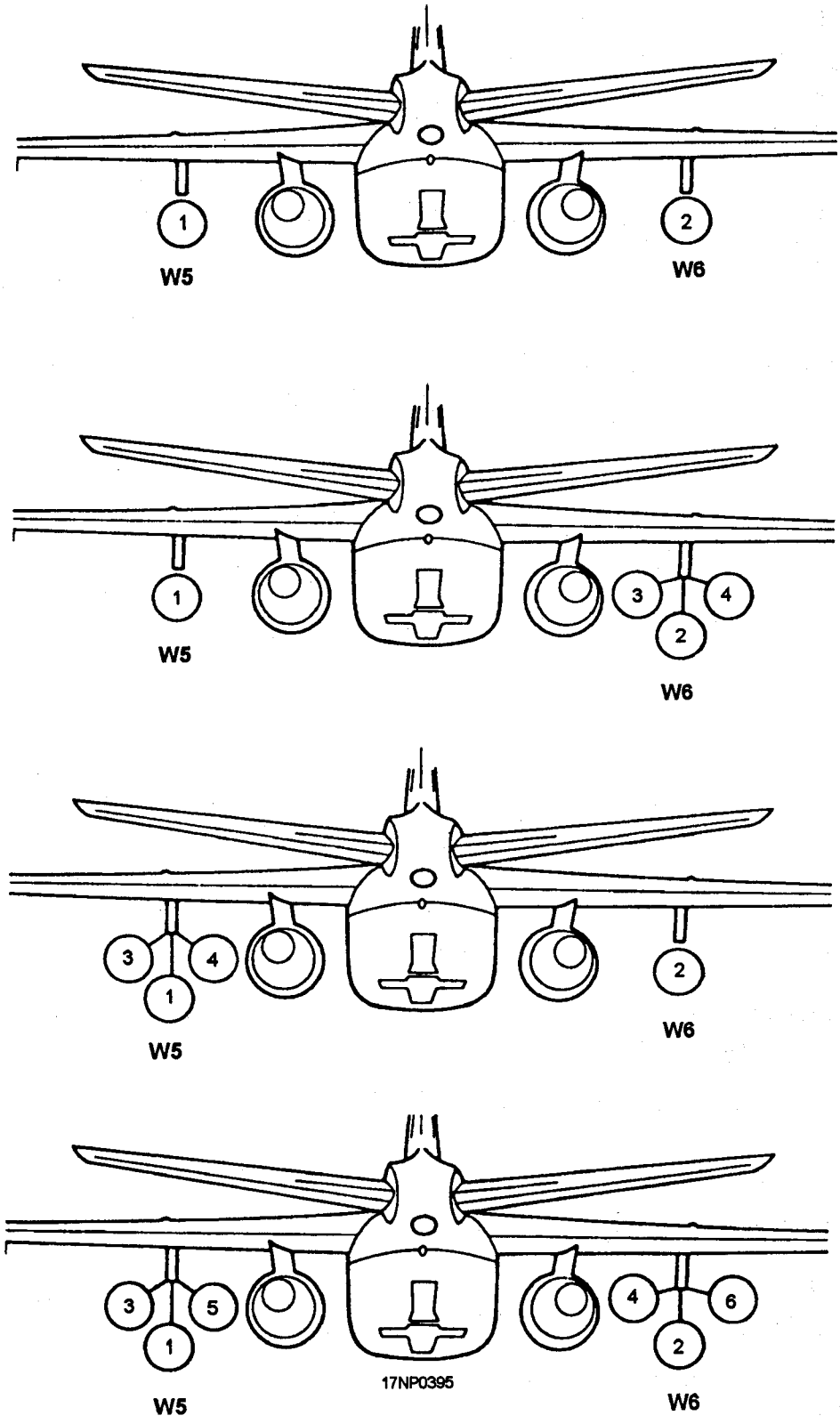

Figure 15-35.—Wing station configuration.

SAFETY PRECAUTIONS

LEARNING OBJECTIVE: *Recognize safety precautions to follow when handling aircraft weapons systems.*

The safety precautions you should follow when dealing with aircraft systems, and their maintenance are outlined in various publications. The repetition of safety precautions in the manuals makes sure they are widely distributed and read. A few of the safety precautions applicable to the aircraft discussed in this chapter are listed below.

- Do not open or close the bomb bay doors when personnel or equipment are in the vicinity of the bomb bay. Also, do not enter the bomb bay until the door safety pin is installed.

- Beware of APU noise. It can cause permanent ear damage to the unprotected ear. Wear ear protection devices when working in the vicinity of an operating APU.

- Provide adequate interphone communications between personnel inside and outside the aircraft to ensure safety between personnel and to compensate for the size of the aircraft.

- Before you apply external power to the aircraft, make sure that personnel are not performing maintenance on electrical or electronic systems.

- Make sure that personnel working with or near high voltage are familiar with modern methods of resuscitation.

- Observe the aircraft external danger areas shown in the particular loading manual.

- Be extremely careful near breakaway suspension bands. They can release with enough force to cause serious injury.

CHAPTER 16

AIRCRAFT WEAPONS SYSTEMS TEST EQUIPMENT

Aviation ordnancemen use test equipment in all phases of electrical testing of weapons systems. The testing procedures you use are required at specific maintenance levels, such as depot, intermediate, or organizational. Test equipment varies in complexity, from a small pocket tester to a very large and complex unit. No matter the size or complexity, the purpose of the test equipment is to make sure that the weapon and the launching platform (aircraft) function correctly.

TEST EQUIPMENT

LEARNING OBJECTIVE: *Identify the test equipment used with aircraft weapons systems. Recognize the purpose and use of each.*

All the test equipment you will use isn't described in this chapter. Also, the step-by-step procedures required to operate the test equipment aren't listed. To do your job, you need to be able to identify the equipment, know what it is used for, and how it is used. The specific step-by-step procedures that you should follow when you use test equipment can be found in applicable publications.

MULTIMETERS

The AN/PSM-4 and 77/AN multimeters (figs. 16-1 and 16-2) are used to measure resistance (ohms) and voltage (ac or dc) in an electrical circuit. You use them to test aircraft circuits when no special test equipment is available, or when reasonably accurate measurements are required.

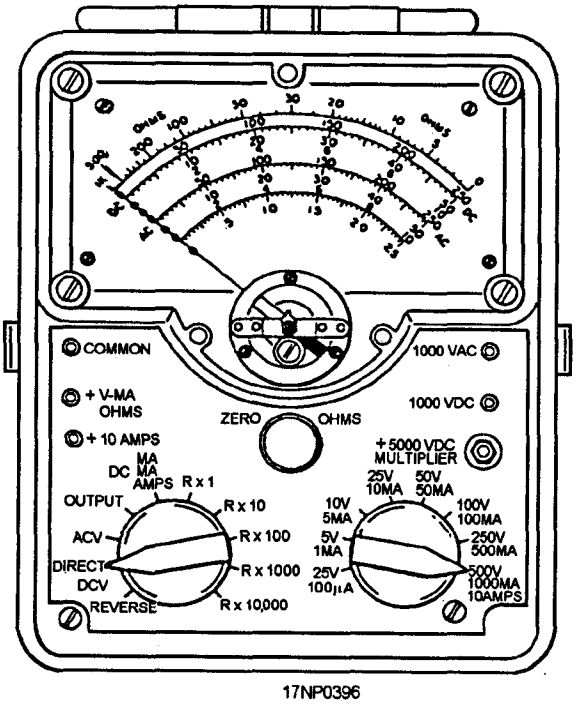

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Figure 16-1.—AN/PSM-4 multimeter.

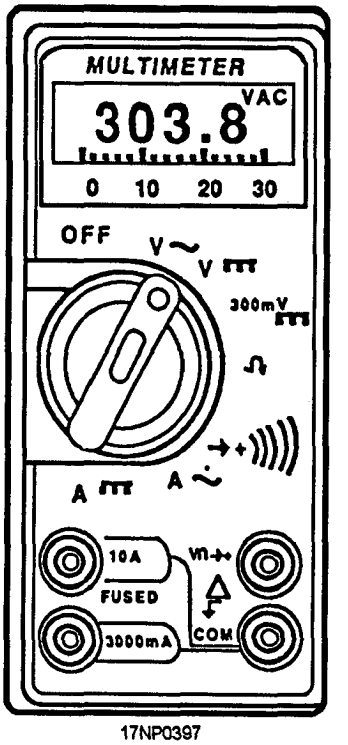

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Figure 16-2.—77/AN multimeter.

AN/AWM-54 AIRCRAFT FIRING CIRCUIT TEST SET

The AN/AWN-54 aircraft firing circuit test set (fig. 16-3) is a portable, battery-operated, flight line test set used at duty stations ashore or afloat. You use this test set to check for stray voltages and various aircraft firing circuits, such as rocket firing, bomb release, missile firing, and JATO.

The complete AN/AWM-54 test set includes the following components:

- AWM-54 test set
- Transit case
- Spare battery pack
- Spare extension cable

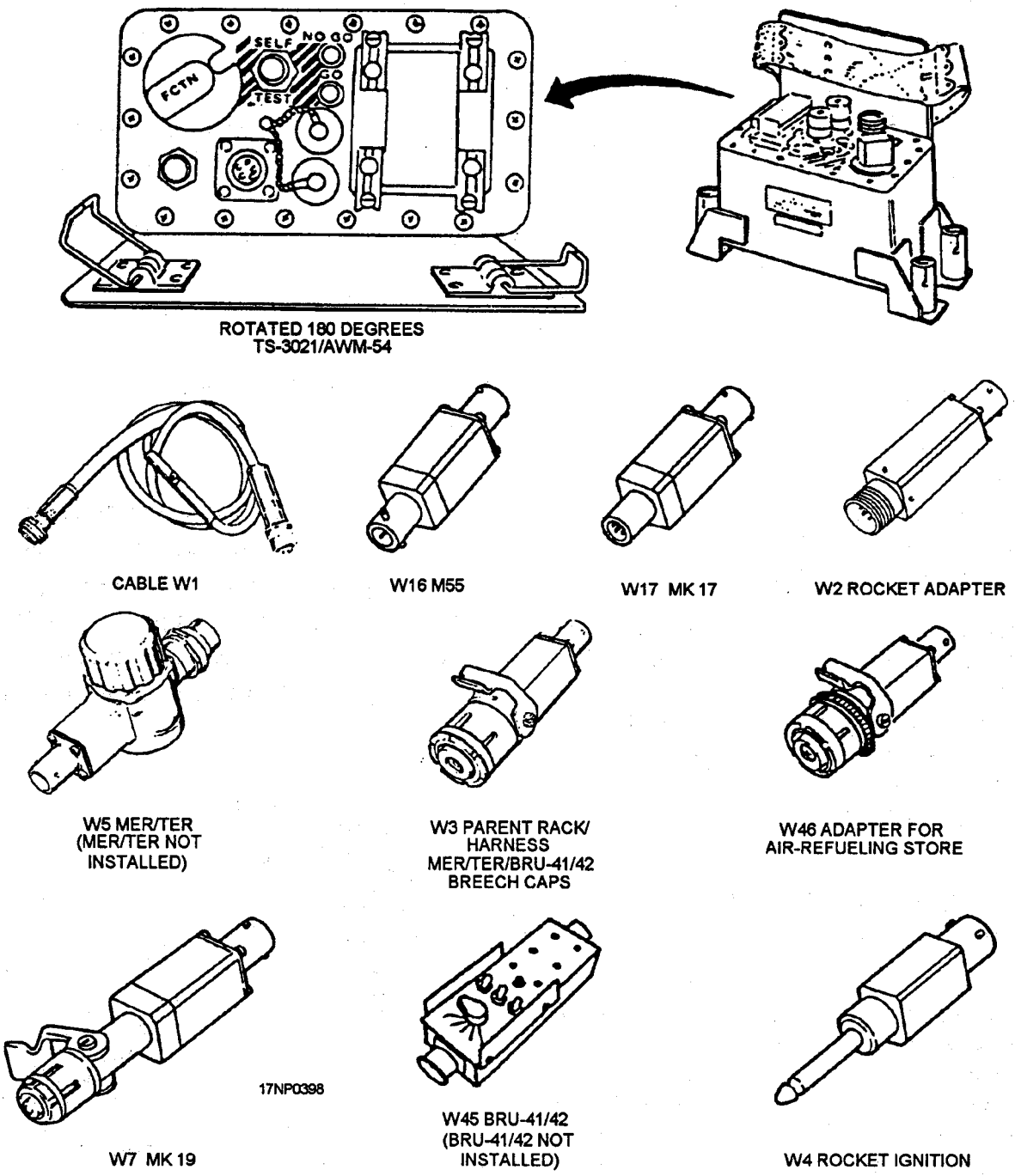


Figure 16-3.—AN/AWM-54 aircraft firing circuit test set.

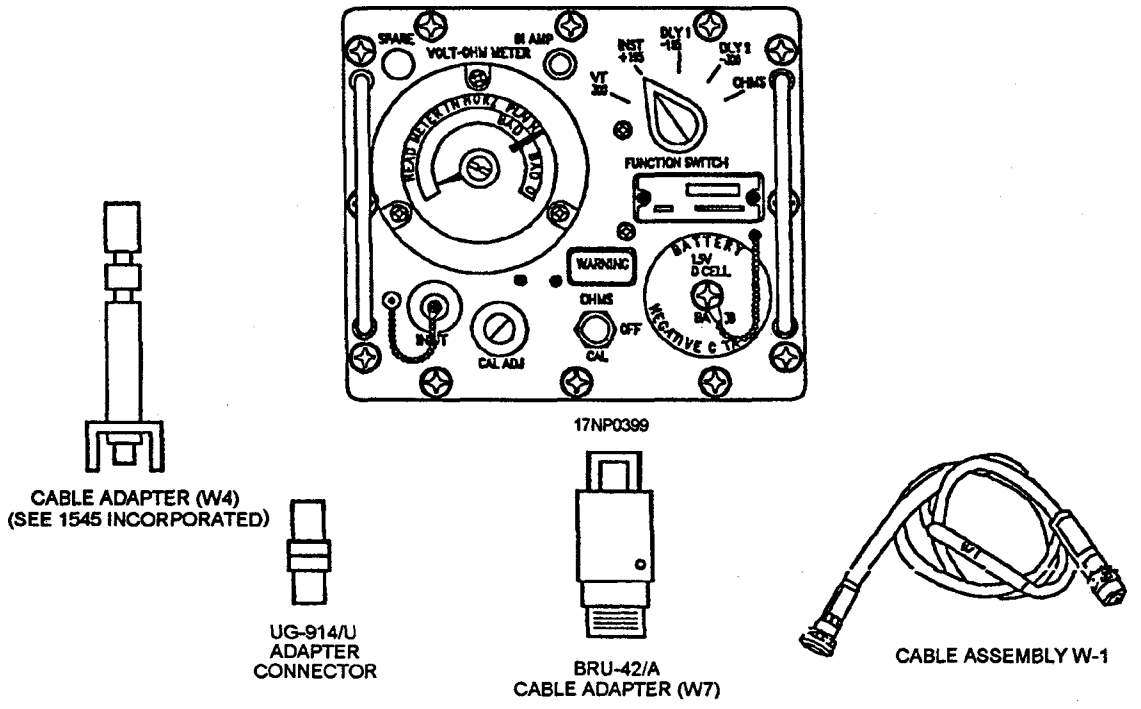


Figure 16-4.—AN/AWM-42A fuze function control test set.

- Adapter retainer assembly
- Technical manual

A battery charger (not shown) is also available, but you need to order it separately. The AWM-54 test set weighs about 7.5 pounds. It has a strap you can place around your waist for carrying the set.

Several accessory adapter assemblies are available for the test set. These adapters allow you to connect the test set to various armament configurations found on different aircraft. Some aircraft require only one or two adapter assemblies while others require five or six. These adapters are not furnished with the test set; they must be ordered separately.

AN/AWM-42A FUZE FUNCTION CONTROL TEST SET

The AN/AWN-42A fuze function control test set (fig. 16-4) is used to check the dc fuzing capabilities of fuze function control circuits. You use it to check for continuity and resistance in the electric fuzing. The test set has its own power source. The AN/AWM-42A fuze function control test set is used on all Navy and Marine Corps aircraft that have electric fuzing capabilities.

TTU-304/E GUIDED MISSILE TEST SET

The TTU-304/E guided missile test set (fig. 16-5) is used during prior-to-launch procedures for checking the tone and missile lock-on operability of the guidance control group of the Sidewinder missile. The TTU-304/E guided missile test set is used on all Navy aircraft that have Sidewinder missile capabilities.

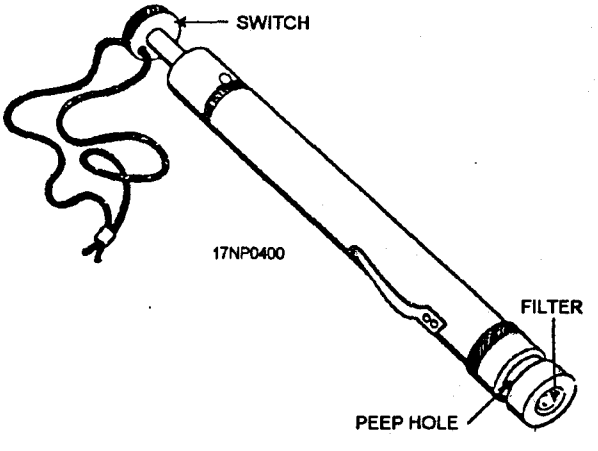
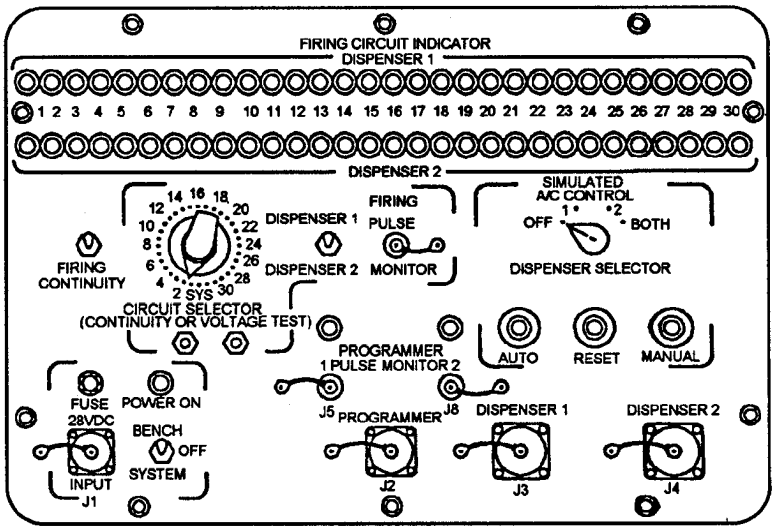


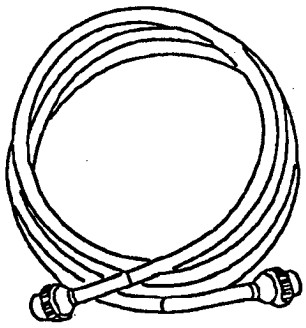
Figure 16-5.—TTU-304/E guided missile test set.

AN/ALM-70A COUNTERMEASURE DISPENSER TEST SET

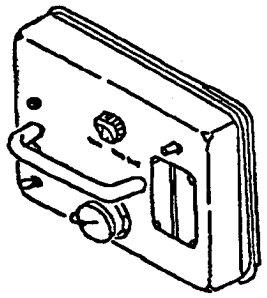
The AN/ALM-70A countermeasure dispenser test set (fig. 16-6) is used to check the AN/ALE-39 chaff and decoy dispensing system and the AN/ALE-37A dispenser. You connect the test set to the system being checked by test set cables or test set adapters. The test set uses aircraft power for its operation. The AN/ALM-70A test set is used on the A-6, F/A-18, S-3, and F-14 aircraft, and the H-60 helicopter.



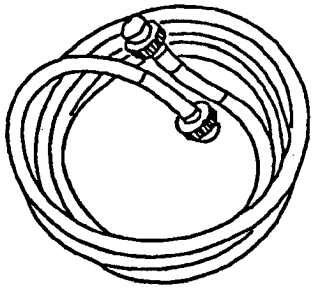
TS-2614/ALM-70 TEST SET



DISPENSER CABLE W-4



MX-7910/ALM-70 TEST ADAPTER



DISPENSER CABLE W-3

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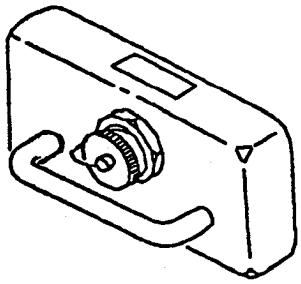


MX-8455/ALM-70A ADAPTER

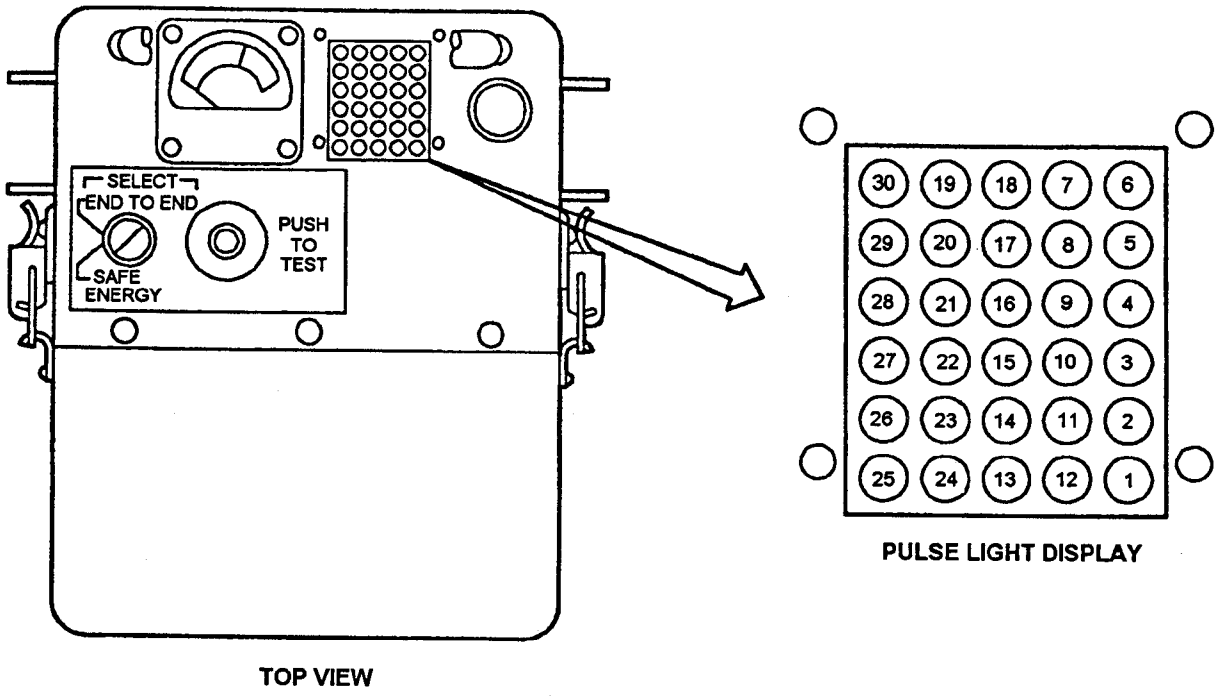
Figure 16-6.—AN/ALM-70A countermeasure dispener test set.

AN/ALM-225 COUNTERMEASURE DISPENSER TEST SET

The AN/ALM-225 (fig. 16-7) is used for preflight testing of the AN/ALE-39 countermeasures dispenser system.

AN/DSM-139 GUIDED WEAPON TEST SET

The AN/DSM-139 guided weapon test set (fig. 16-8) is used to check the operation of the data link antenna on the Mk 21, Mk 23, and Mk 27 Walleye



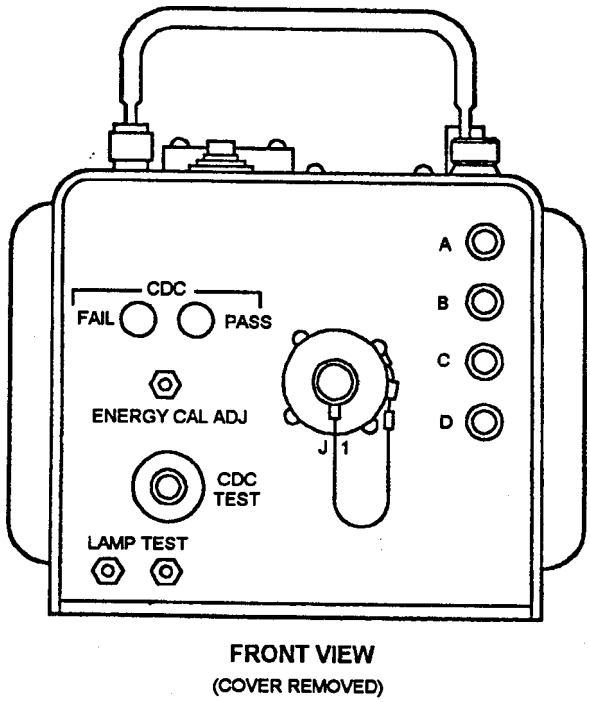


Figure 16-7.—AN/ALM-225 countermessure dispenser test set.

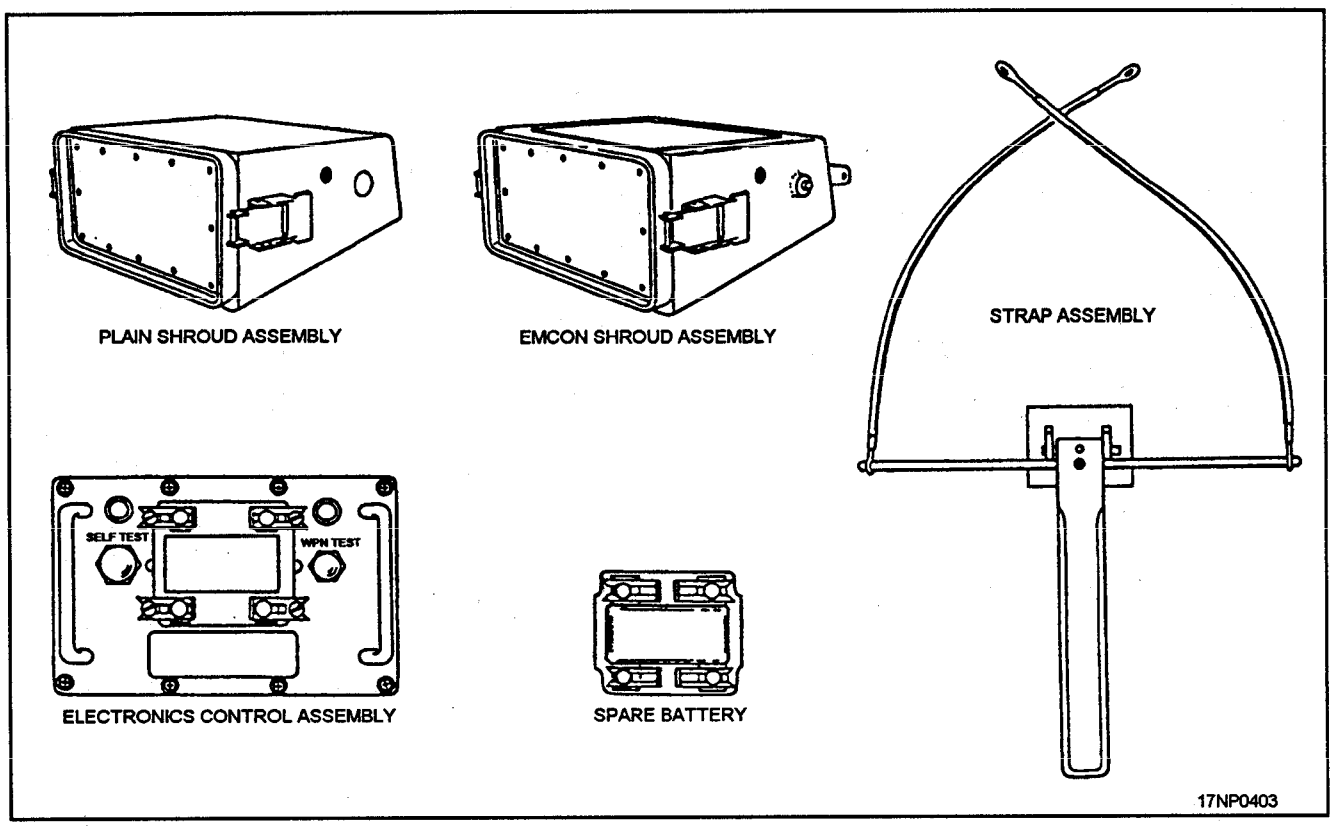


Figure 16-8.—AN/DSM-139 guided weapon test set.

extended-range, data link weapons. The test set has its own power source and built-in self-test features. The test set ensures the weapon antenna transmits at high power within a prescribed frequency after the weapon has been loaded on the aircraft. The AN/DSM-139 test set is used with the F/A-18 aircraft.

AN/ASM-184B(V)-1 AIRCRAFT WEAPON CONTROL TEST SET

The AN/ASM-184B(V)-1 aircraft weapon control test set (fig. 16-9) is a GO/NO GO test set designed to check the aircraft's Walleye weapon system at the pylon umbilical connection. The test set is used to check signals from the aircraft control system to the rack umbilical connection. It lets you check fuze function system power inputs to the weapon, and it simulates signal output from the weapon to the aircraft.

REVIEW NUMBER 1

TO ANSWER QUESTIONS 1 THROUGH 4, MATCH THE TEST SET WITH ITS DESCRIPTION.

	DESCRIPTION	*TEST SET*
Q1.	*Used to make stray voltage checks on Navy aircraft*	*A. TTU-304/E*
Q2.	*Used to check the dc fuzing capabilities of fuze function control circuits*	*B. AN/ALM-70A countermeasures dispenser test set*
Q3.	*Used to check the tone operability of the Sidewinder missile during prior-to-launch procedures*	*C. AN/AWM-54*
Q4.	*Used to check the AN/ALE-39A and AN/ALE-37 chaff/ decoy dispensing systems*	*D. AN/AWM-42A*

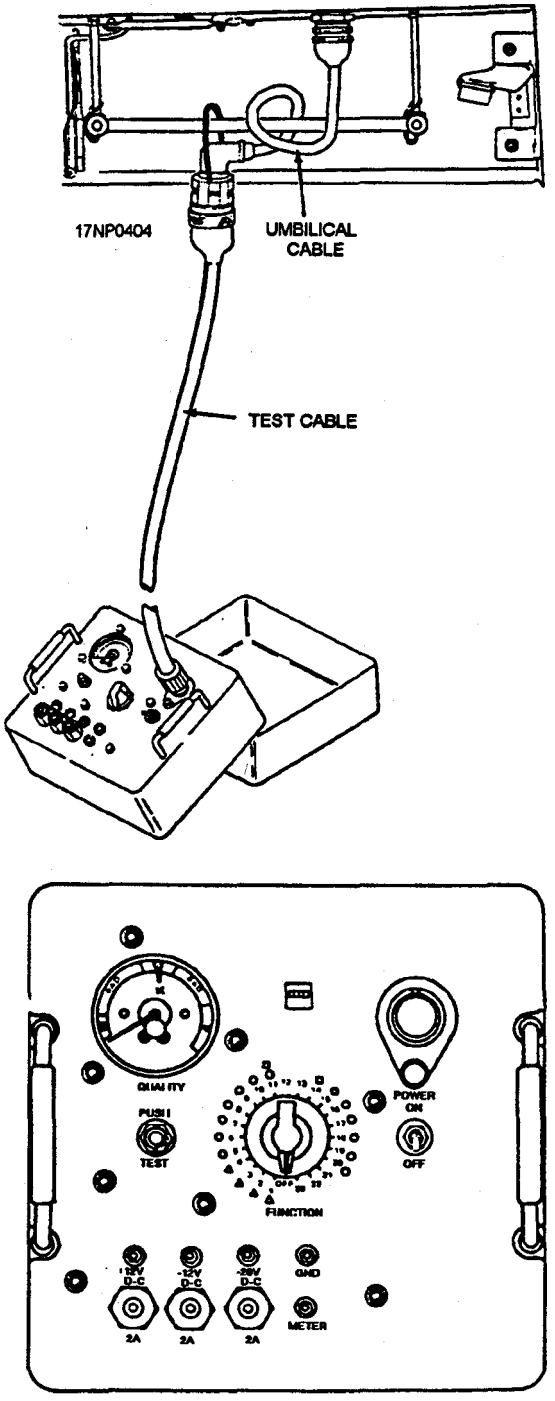


Figure 16-9.—AN/ASM-184B(V)-1 aircraft weapon control test set.

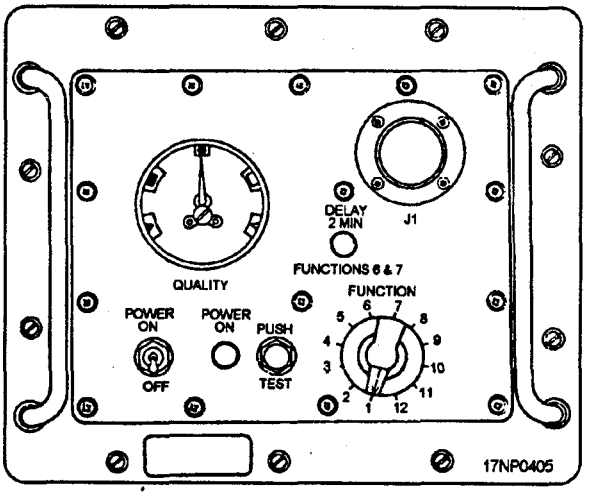


Figure 16-10.—AN/ASM-496 data link controller test set.

Q5. *Describe the purpose of the AN/DSM-139 guided weapon test set.*

Q6. *What test set simulates signal output from the Walleye weapon to the aircraft?*

AN/ASM-496 DATA LINK CONTROLLER TEST SET

The AN/ASM-496 data link controller test set (fig. 16-10) is a small, portable, flight-line test device used to perform preflight and periodic performance evaluations of the guided weapons controller. The controller initiates certain data link commands and proportional signals for the AN/AWW-7B guided weapons monitor control set. The test set is used with the AN/ASM-184B(V)-1 aircraft weapon control test set to completely evaluate the aircraft interface for the AN/AWW-7B guided weapons monitor control set, Operation, output frequencies, and certain voltage levels are evaluated by the test set. The test set results are displayed on a quality meter mounted on the front panel. A total of 11 test results are resolved into a quality meter readout.

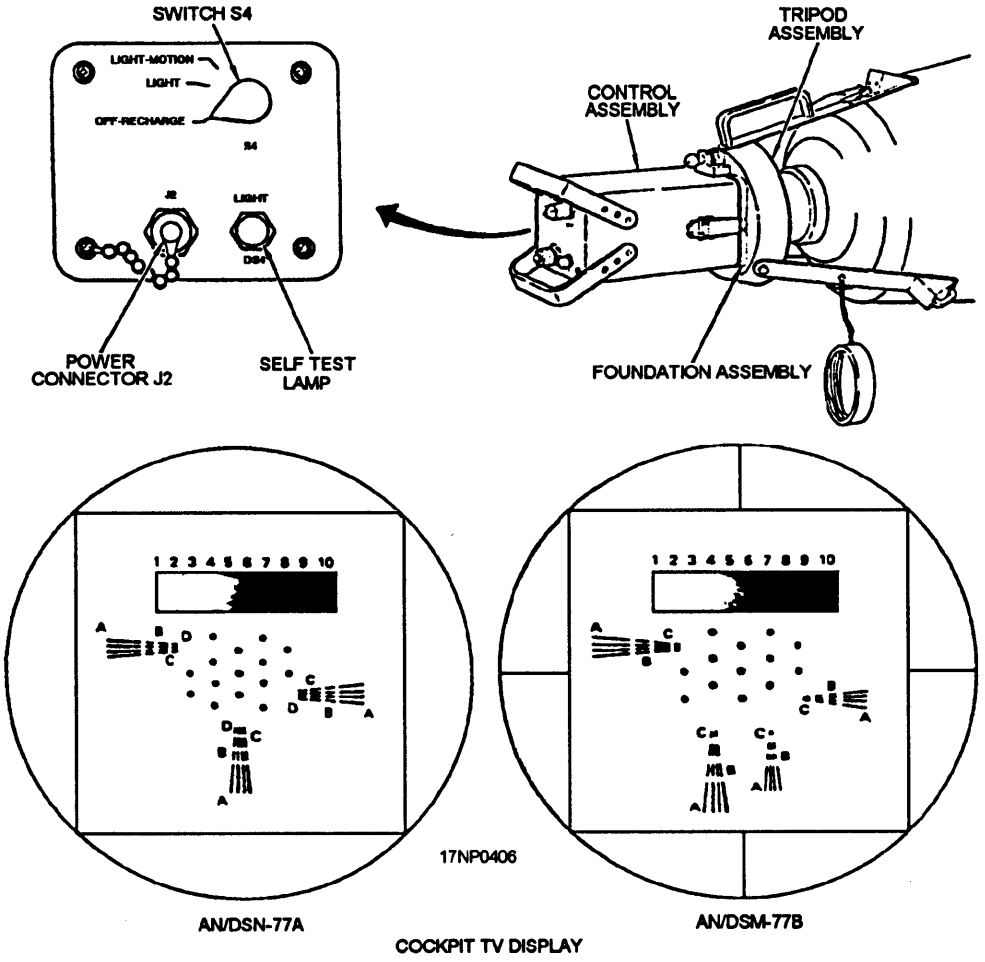


Figure 16-11.—AN/DSM-77 series test set.

REVIEW NUMBER 1 ANSWERS TO QUESTIONS Q1. THROUGH Q6.

	DESCRIPTION	*TEST SET*
A1.	*Used to make stray voltage checks on Navy aircraft*	*C. AN/AWM-54*
A2.	*Used to check the dc fuzing capabilities of fuze function control circuits.*	*D. AN/AWM-42A*
A3.	*Used to check the tone operability of the Sidewinder missile during prior-to-launch procedures*	*A. TTU-304/E*
A4.	*Used to check the AN/ALE-39A and AN/ALE-37 chaff/decoy dispensing systems*	*B. AN/ALM-70A countermeasures dispenser test set*

A5. The AN/DSM-139 guided weapon test set is used to check the operation of the data link antenna on the Mk 21, Mk 23, and Mk 27 Walleye extended range, data link weapons.

A6. The AN/ASM-184B(V)-1 aircraft weapon control test set simulates signal output from the Walleye weapon to the aircraft.

AN/DSM-77 TEST SET

The AN/DSM-77 test set (fig. 16-11) is used to evaluate the operational readiness of the Walleye weapon guidance section and aircraft cockpit television display. You use the test set to check the television camera and guidance section in the weapon, the lock-on control in the aircraft, and the video display.

AN/ASM-464 GUIDED MISSILE LAUNCHER TEST SET

The AN/ASM-464 guided missile launcher test set (fig. 16-12) is a portable flight line test device. It is used to perform the operational checks of AIM-9 missile launching, visual target acquisition system (VTAS), and Sidewinder expanded acquisition mode (SEAM)

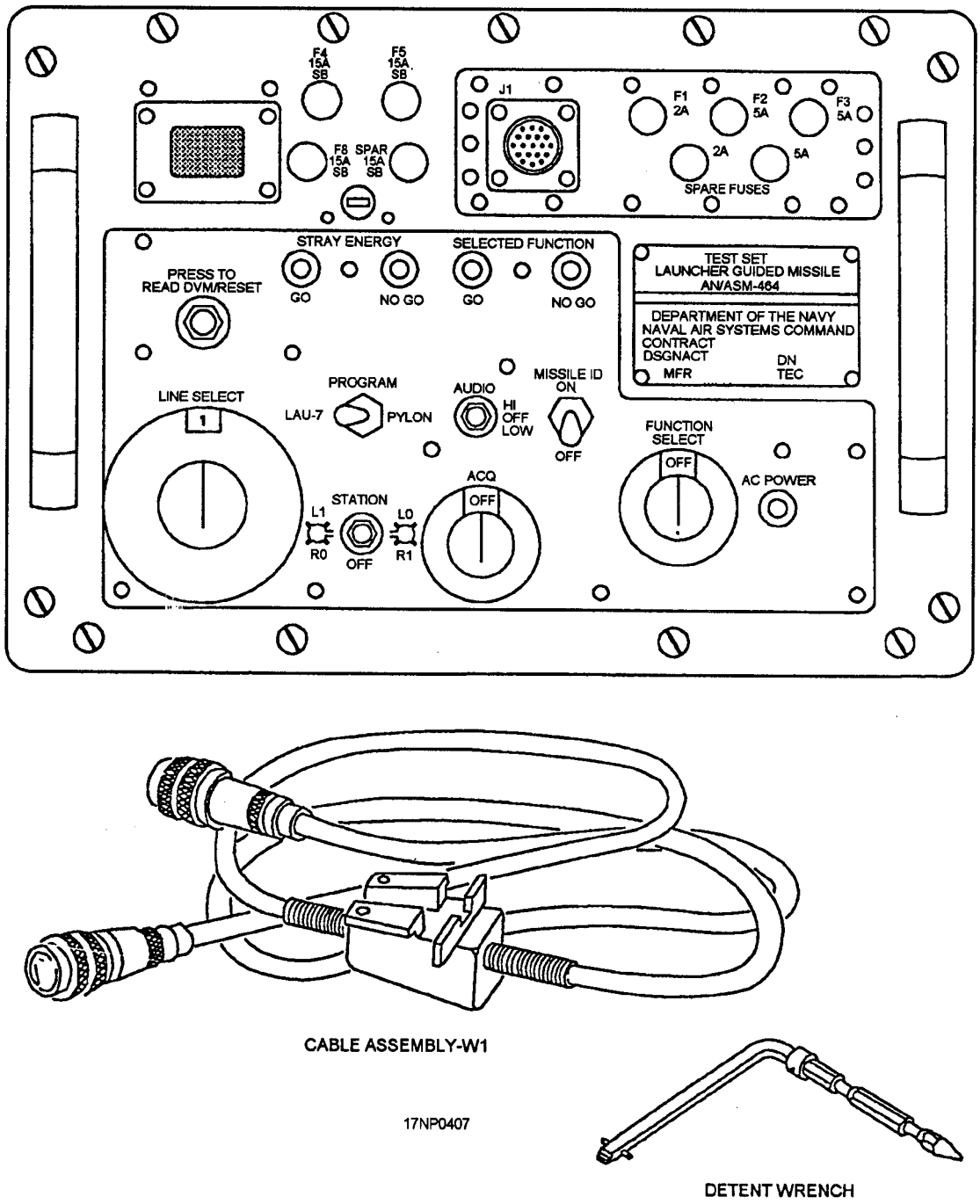


Figure 16-12.—AN/ASM-464 guided missle launcher test set.

circuits associated with the guided missile launcher LAU-7 (series). The AN/ASM-464 test set is used with the F/A-18 and F-14 aircraft and the H-1 and H-60 helicopters.

TS-3279/ASM GUIDED MISSILE AVIONICS TEST SET

The TS-3279/ASM guided missile avionics test set (fig. 16-13) is used to test the Visual Target Acquisition System/Sidewinder Expanded Acquisition Mode (VTAS/SEAM) aircraft system applicable to AIM-9 missiles.

TS-3479/AWM-23 MISSILE AUXILIARIES TEST SET

The TS-3479/AWM-23 missile auxiliaries test set (MATS) (fig. 16-14) is used to verify the operational status and functions of the AIM-54 Phoenix missile control system. The test set gives a GO/NO GO indication for circuit continuity and signal presence. The TS-3479/AWM-23 is used with the F-14 aircraft.

TS-4142/AWM-23 MISSILE INTERFACE TEST SET

The TS-4142/AWM-23 missile interface test set (MITS) (fig. 16-15) is used to perform the AIM-54

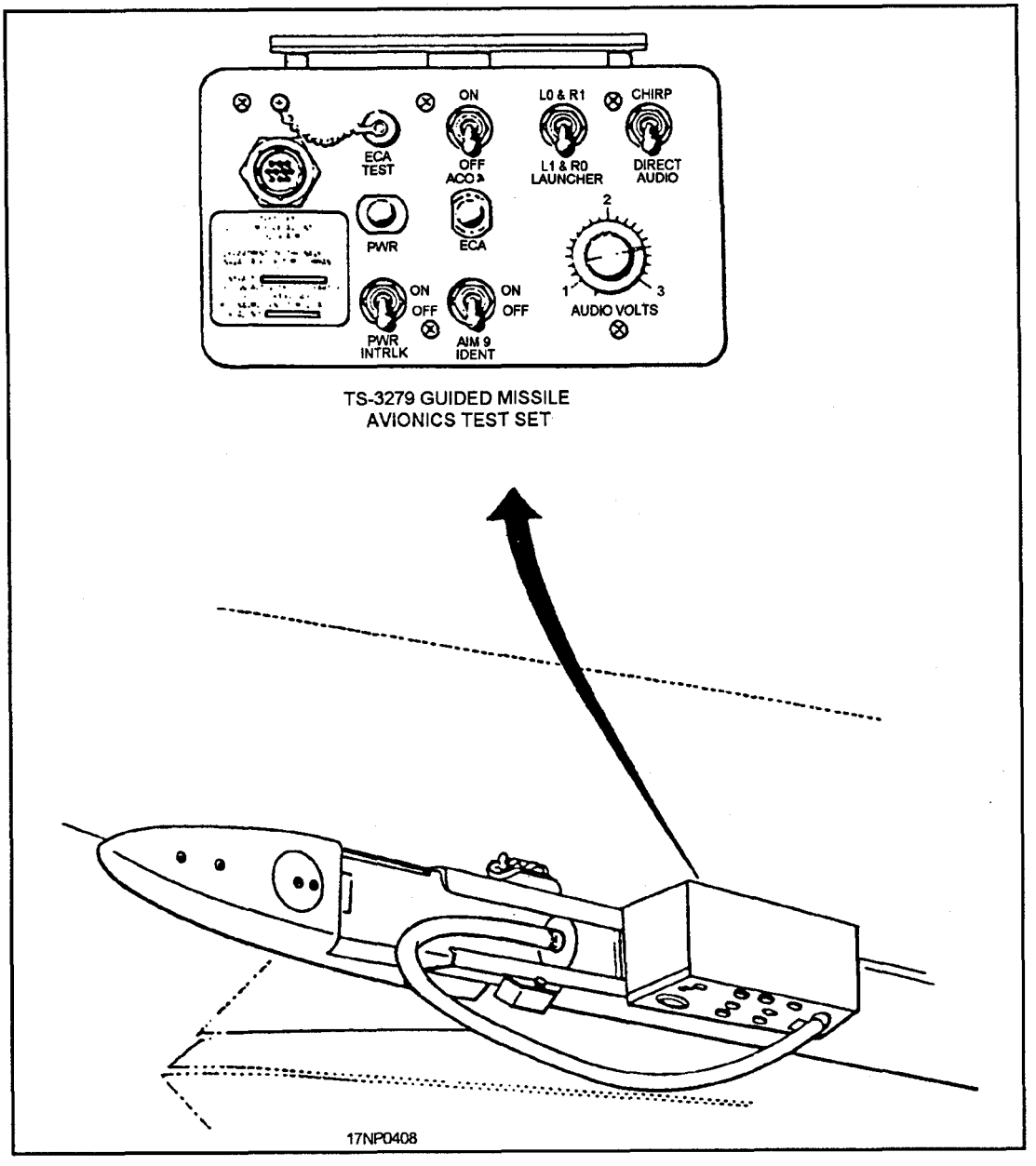


Figure 16-13.—AIM-9 SEAM system check.

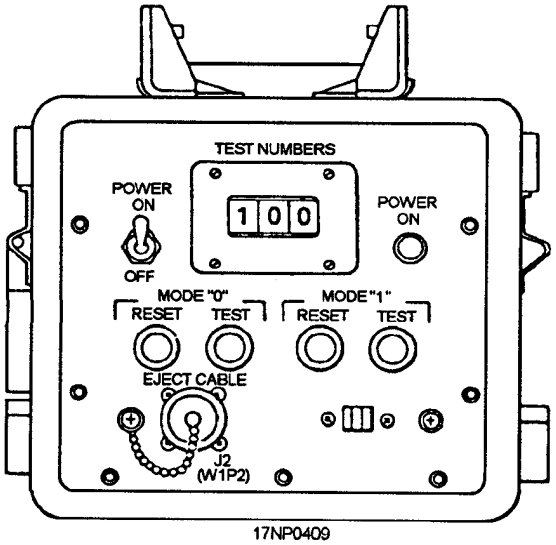


Figure 16-14.—TS-3479/AWM-23 missile auxiliaries test set.

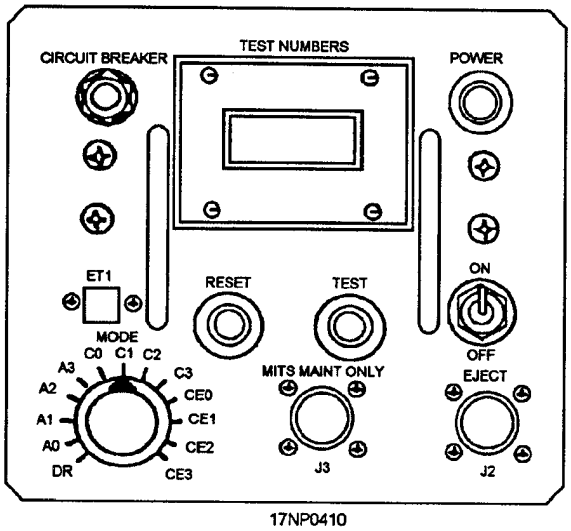


Figure 16-15.—TS-4142/AWM-23 missile interface test set.

missile station (LAU-93) checks. The TS-4142/AWM-23 test set is used with the F-14 aircraft.

SPARROW MISSILE STATION TEST SET

The Sparrow missile station test set (SMTS) (fig. 16-16) is used to verify the operational status and functions of the AIM-7 Sparrow missile control system. When connected to the aircraft, the MSTS simulates the missile and provides visual indications of received inputs. The test set is used with the F-14 aircraft.

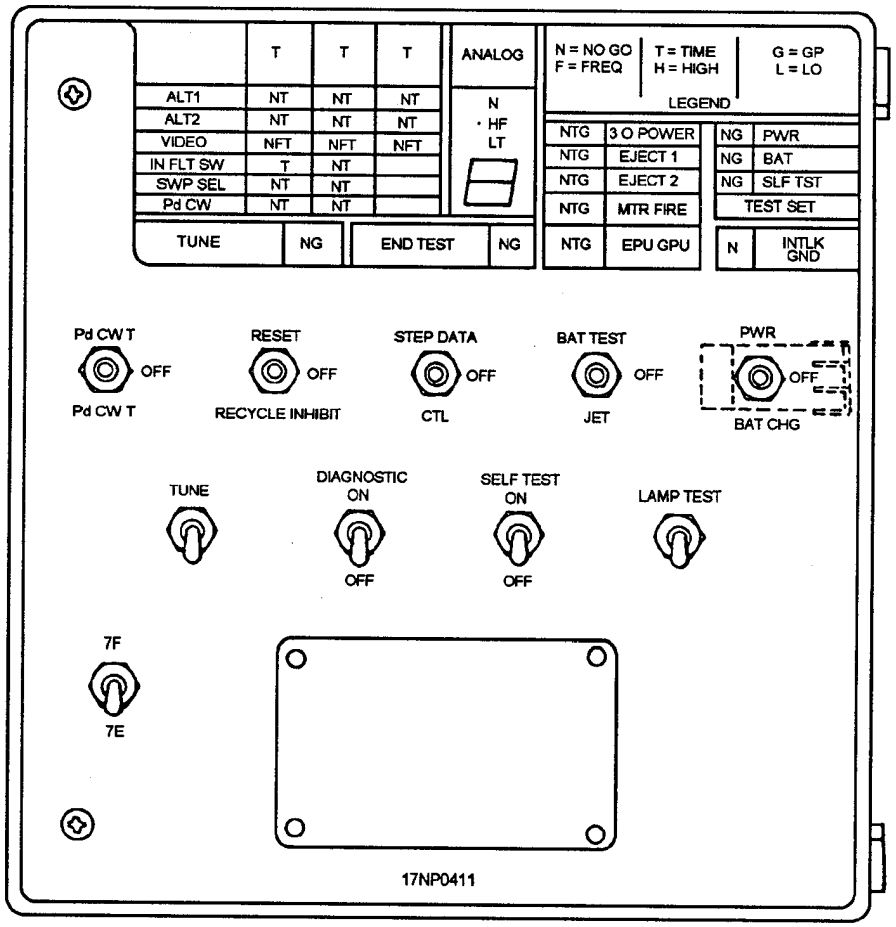


Figure 16-16.—Sparrow missile test set.

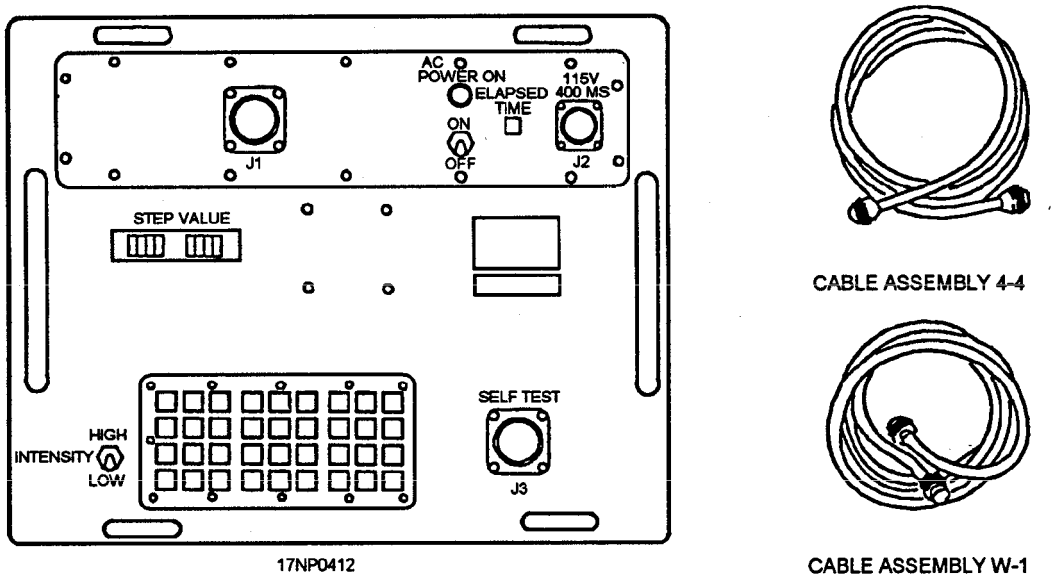


Figure 16-17.—AN/AWM-92 aircraft weapons control test set.

AN/AWM-92 AIRCRAFT WEAPONS CONTROL TEST SET

The AN/AWM-92 test set (fig. 16-17) is used to perform operational checks of the HARM, Maverick, Walleye, and AWW-9 missile launch and control systems. This test set is used with the F/A-18 and A-6 aircraft.

B203 TORPEDO HEAT AND CONTROL SYSTEM TEST SET/B473 TEST SET OVERLAY

The B203 torpedo heat and control system test set (fig. 16-18) is used to perform circuit continuity tests on Mk 46 torpedo preset circuits. The B473 test set (fig. 16-19) consists of an overlay and an adapter cable. It is used with the B203 torpedo heat and control test set to

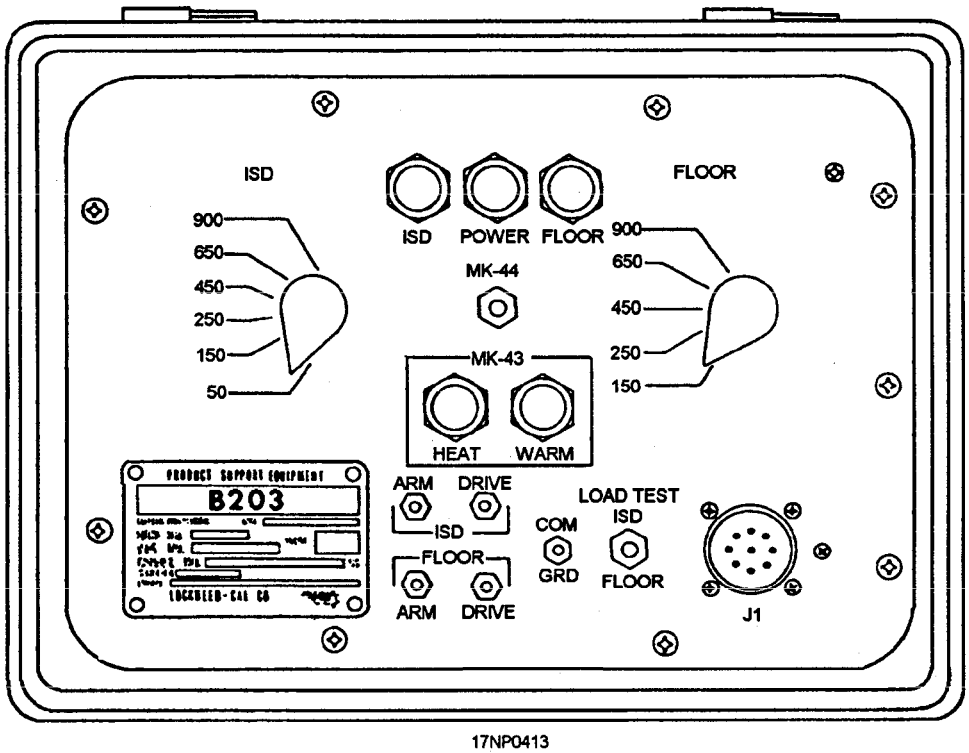


Figure 16-18.—B203 torpedo heat and control system test set.

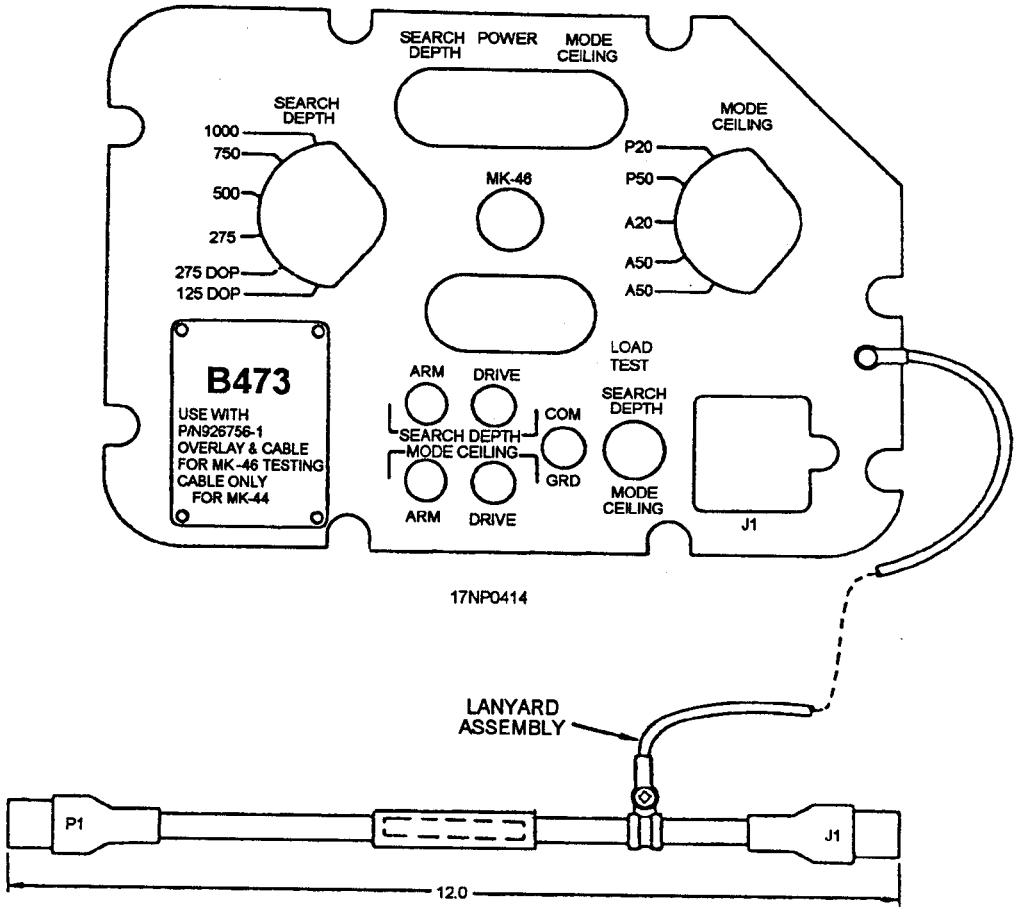


Figure 16-19.—B473 test set overlay.

perform circuit continuity tests on Mk 46 torpedo preset circuits. Both the B203 and B473 test sets are used with the P-3 aircraft.

TS-3519D/DSM TEST SET SIMULATOR

The TS-3519D/DSM test set simulator (fig. 16-20) is a manually programmable digital test set. It is used

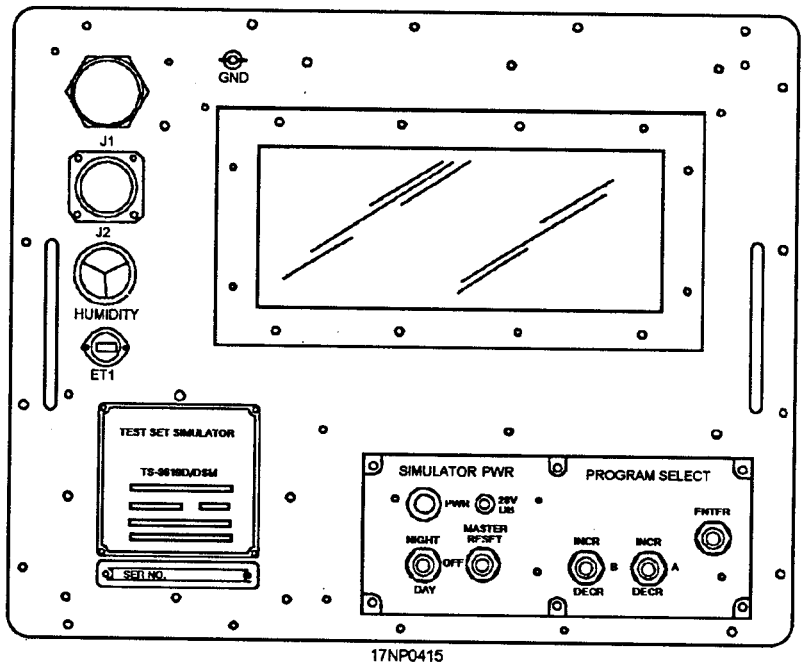


Figure 16-20.—TS-3519D/DSM test set simulator.

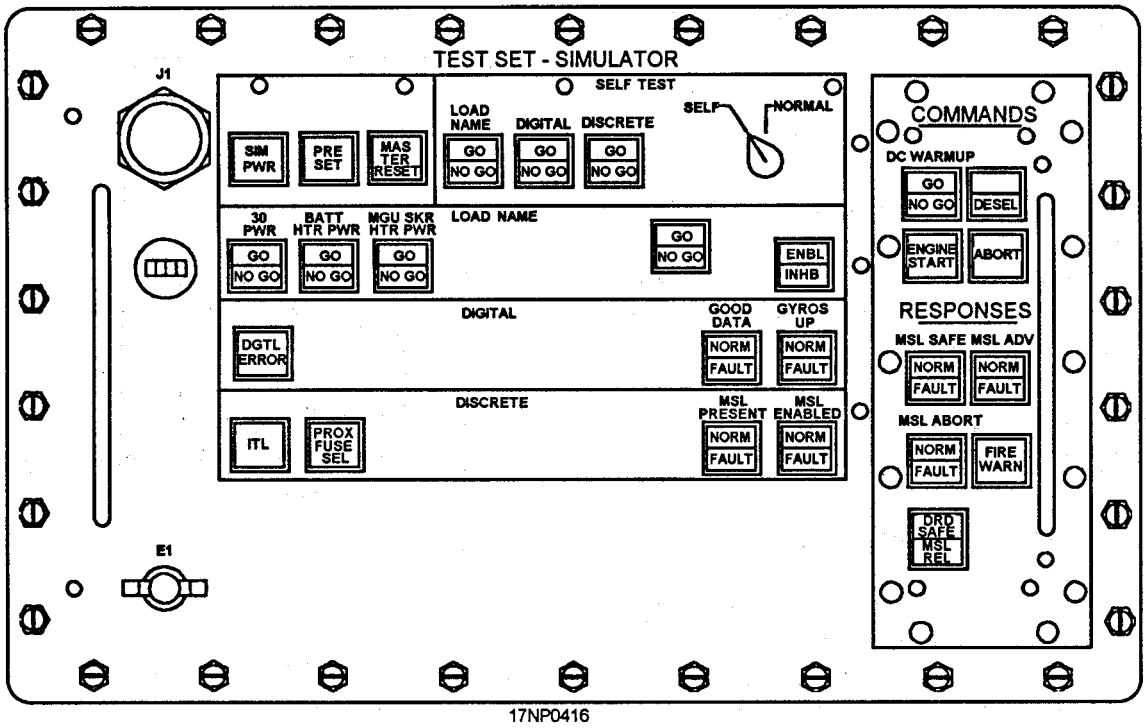


Figure 16-21.—TS-3519/DSM test set simulator.

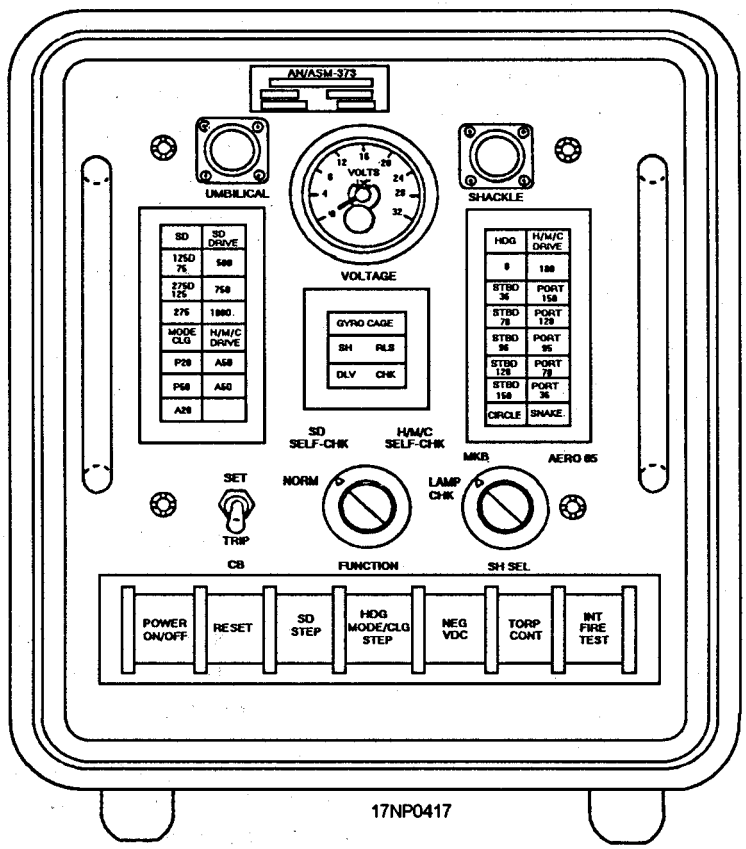


Figure 16-22.—AN/ASM-373A airborne torpedo presetter test set.

to functionally check the AGM-84 system prior to loading.

TS-3519/DSM TEST SET SIMULATOR

The TS-3519/DSM test set simulator (fig. 16-21) is a portable test set. It is used to simulate a Harpoon missile for wing station checkout, power-on fictional testing, and fault isolation. The TS-3519/DSM is used with the P-3 and S-3 aircraft.

AN/ASM-373A AIRBORNE TORPEDO PRESETTER TEST SET

The AN/ASM-373A airborne torpedo presetter test set (fig. 16-22) has capabilities for functionally testing the presetter portion of the armament control panel subassembly in the aircraft. It can also be used to check aircraft wiring and the torpedo umbilical connector. The AN/ASM-373A test set is used with the S-3 aircraft.

FORCE RETENTION GAUGE

The force retention gauge (fig. 16-23) is used to functionally check the bomb rack nose and tail arming solenoids. You should refer to the applicable maintenance instruction manual for the proper retention readings.

REVIEW NUMBER 2

IN ANSWERING QUESTIONS 1 THROUGH 5, MATCH THE DESCRIPTION WITH THE TEST SET.

	DESCRIPTION	*TEST SET*
Q1.	*Used to evaluate the operational readiness of the Walleye weapon guidance section cockpit television display*	*A. TS-3279*
Q2.	*Used to perform the operational checks of the AIM-9 missile launching, visual target acquisition system (VTAS), and Sidewinder expanded acquisition mode (SEAM)*	*B. B203 torpedo heat and control system test set*
Q3.	*Used to check the VTAS/SEAM system on AIM-9 missiles*	*C. AN/DSM-77*
Q4.	*Used to verify the operational status and function of the AIM-7 Sparrow missile on the F-14 aircraft*	*D. Sparrow missile test set*
Q5.	*Used to perform circuit continuity tests on Mk 46 torpedo preset circuits*	*E. AN/ASM-464*

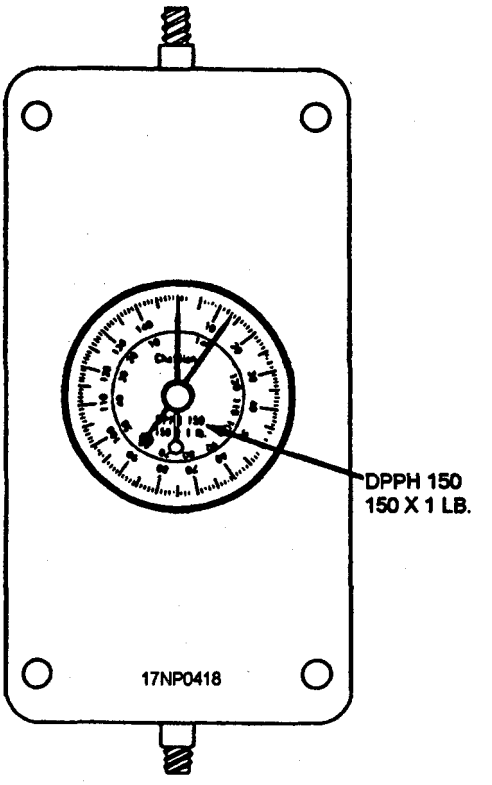


Figure 16-23.—Force retention gauge (typical).

TEST EQUIPMENT SAFETY SUMMARY

LEARNING OBJECTIVE: *Recognize the safety precautions to follow when working with aircraft weapons systems test equipment.*

The test equipment discussed in this chapter is designed to perform various functions. Two of the most important functions are—

1. to ensure the correct firing voltage is available at the appropriate station when the cockpit switches are properly set, and

2. to ensure that voltage or stray voltage is not present before electrical connection of certain launchers, such as rocket launchers, is made.

These two functions are called *aircraft release and system control checks.* Normally, you perform aircraft release and system control checks before the weapons are installed on the aircraft. However, some checks require the weapons to be loaded on the aircraft. As part of the loading process, the Sparrow, Phoenix, Walleye, and Sidewinder (on some aircraft) weapons are electrically mated to the aircraft. Then, the external power is applied to the aircraft, and a missile-on-aircraft test (MOAT) is performed. This test is normally performed during the prior-to-launch sequence.

You conduct the Sparrow and Phoenix MOAT by activating the circuits within the aircraft. Then, you observe the indications as they are received in the cockpit, No test equipment is required to perform this test.

The Sidewinder MOAT is performed by at least two team members and a team leader using an audio headset and a TTU-304/E tester. The TTU-304/E tester is basically a pencil flashlight with an infrared filter lens.

The person in the cockpit plugs the headset into the audio connection and turns on the switches indicated in the checklist. These switches are Sidewinder COOL, STATION SELECT, and AUDIO CONTROL. The person at the missile station removes the missile protective dome cover. Then, with the tester turned ON, the beam of the tester is moved across the nose of the missile from a distance of 4 to 6 feet. As the missile senses radiation from the tester through the launcher's audio amplifier, a tone is heard in the headset. If more than one missile is loaded each missile should be tested and the dome covers replaced. Sidewinder MOAT may also be performed during pretaxi arming signals with the pilot as the person in the cockpit.

The Walleye MOAT also requires at least three persons and a DSM-77 test set. The DSM-77 test set projects a test image to be received by the Walleye. The test image is displayed on the aircraft cockpit monitor. (See figure 16-11.)

With the cockpit switches ON, as listed in the checklist, the Walleye dome cover removed, and the tester mounted on the weapon and switched to LIGHT, a display appears on the aircraft monitor. When the tester is switched to LIGHT-MOTION, the image moves from side to side, diagonally, or up and down, depending upon the position of the tester. The tester control assembly is rotated around the foundation assembly during the testing process. During each position test, the person in the cockpit pulls the trigger switch and the weapon's television camera will lock on to one of the target dots and follow it as it moves. As

REVIEW NUMBER 2 ANSWERS TO QUESTIONS Q1. THROUGH Q5.

DESCRIPTION	*TEST SET*
A1. Used to evaluate the operational readiness of the Walleye weapon guidance section cockpit television display	*C. AN/DSM-77*
A2. Used to perform the operational checks of the AIM-9 missile launching, visual target acquisition system (VTAS), and Sidewinder expanded acquisition mode (SEAM)	*E. AN/ASM-464*
A3. Used to check the VTAS/SEAM system on AIM-9 missiles	*A. TS-3279*
A4. Used to vetify the operational status and function of the AIM-7 Sparrow missile on the F-14 aircraft	*D. Sparrow missile test set*
AS. Used to perform circuit continuity tests on Mk 46 torpedo preset circuits	*B. B203 torpedo heat and control system test set*

each test is completed for each weapon loaded, the dome cover should be replaced.

WARNING

During MOAT, or any other test being performed after weapons have been loaded on the aircraft the MASTER ARMAMENT switch must NEVER be placed in the ON position.

When performing aircraft release and system control checks, you should always use the step-by-step procedures (checklist) provided in the aircraft loading manual. A few safety precautions must be observed when performing aircraft release and system control checks. These precautions are listed below.

1. Before you begin an aircraft release and system control check, make sure the aircraft is parked in a designated area, secured, and electrically grounded.

2. Before you apply external electrical power to the aircraft, make sure all cockpit switches have been positioned to OFF, NORMAL, or HOLD. If required, apply external air conditioning.

3. Release and control system checks will not be performed with weapons loaded on the aircraft. Checks may be performed with airborne stores (fuel tanks, empty MERs/VERs, pods, etc.) installed on the aircraft stations, provided cartridge retainers, breech caps, and ejector cartridges are removed

4. Test equipment should only be used by personnel who have become qualified through an established qualification and certification program.

Stray voltage checks are normally performed with the weapon loaded on the aircraft, but they are made before making an electrical connection between the weapon and the aircraft. Additionally, this check is normally performed after the aircraft's engines have been started and all aircraft preflight checks have been completed. The stray voltage check is performed at the last possible moment before the aircraft takes off. This is to ensure that no voltage has been induced in the aircraft firing circuitry from external sources, such as the ship's radar. The launcher electrical safety pin must not be removed until the aircraft is positioned on the catapult for takeoff.

REVIEW NUMBER 3

Q1. How many persons are required to perform a MOAT on a Sidewinder missile?

Q2. In what position should the MASTER ARM switch be set when a MOAT is being conducted on a naval aircraft?

REVIEW NUMBER 3 ANSWERS TO QUESTIONS Q1. AND Q2.

A1. At least three persons are required to perform a MOAT on a Sidewinder missile.

A2. The MASTER ARM switch should be set in the OFF or SAFE position when a MOAT is being conducted on a naval aircraft.

CHAPTER 17

AMMUNITION ADMINISTRATION ASHORE AND AFLOAT

Ammunition is vital to naval operations. Because of its high cost and logistical characteristics, the status of ammunition is carefully and continuously studied at the highest echelons of the defense establishment. Ammunition is a high-priority consideration by operational and logistics commanders. It is essential for logistics planning that current and accurate information concerning Navy ammunition stock status be available at the appropriate time. This information must be available to commanders of naval forces when planning their training and operational expenditures. For these reasons, accurate and prompt reporting of individual ammunition transactions directly affects the Navy's ability to sustain a high degree of readiness.

FLEET OPTICAL SCANNING AMMUNITION MARKING SYSTEM (FOSAMS)

LEARNING OBJECTIVE: Identify the various components and the reports generated by FOSAMS.

Historically, the record shows the Navy has had problems in accurate ammunition accountability and reporting. Improving this situation worldwide has become a top priority because the defense of our country depends on it. FOSAMS was created in an effort to improve ammunition management by automating many error-prone manual processes. The FOSAMS uses optical scanning physical inventory system technology and procedures. Another initiative to improve accountability problems was the creation of the Non-Nuclear Ammunition Inventory Accuracy (NAIA) Program, managed by the Naval Sea System Command. This program targets improvement of inventory accuracy at reporting activities and in the computer data base where CAIMS is located The objective of NAIA is to achieve 99.5% record accuracy and 100% asset visibility. This goal can and is being achieved at some activities.

When FOSAMS is initially installed at an activity, the activity's entire on-board ammunition inventory is programmed into the microcomputer. Additionally, all ammunition is labeled with barcode labels. Thereafter, the microcomputer maintains all the ammunition records, including ammunition transaction reports for that activity. Upon receipt, issue, turn-in, or expenditure of ammunition material, bar coding and optical scanning is used to capture data and update the activity's records. These programs and procedures are designed to automatically accept and process the information received into a machine-readable format by a system/display printer. This reduces the labor-intensive, error-prone record keeping and ammunition reporting methods presently being used

The FOSAMS is currently located at 140 sites. However with ship deactivations occurring, reinstallations occur with regularity. Ship types that use FOSAMS include CV/CVN, AE, AOE, AOR, LHA, LPH, LHD, LKA, LPD, and AOJ. Most NASs and many Marine Corps Air Stations (MCASs), NATO bases, NAFs, naval stations, subsupport facilities, amphibious bases, naval magazines, and marine air logistics squadrons use FOSAMS.

SYSTEM COMPONENTS

The components required for system implementation are as follows:

Computer terminal (fig. 17-1). This is the monitor or window for the FOSAMS database.

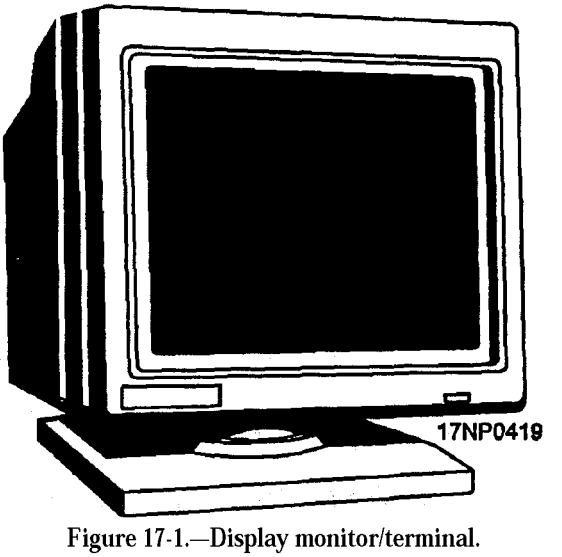


Figure 17-1.—Display monitor/terminal.

Computer keyboard (fig. 17-2). The keyboard allows you to input information into the computer system.

System unit (fig. 17-3). This is the CPU (central processing unit), which contains a floppy disk drive, a hard disk drive, and a streaming tape drive.

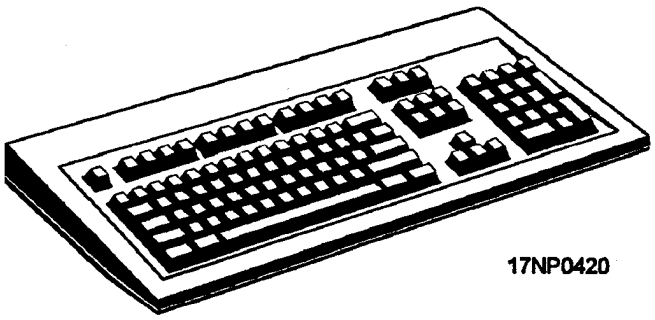


Figure 17-2.—System keyboard.

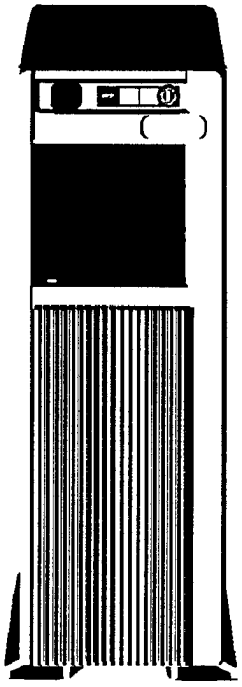


Figure 17-3.—Central processing unit (CPU).

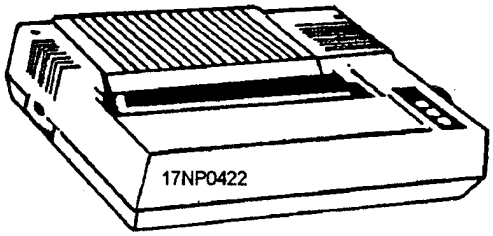


Figure 17-4.—Character printer.

Figure 17-5.—Bar code label printer.

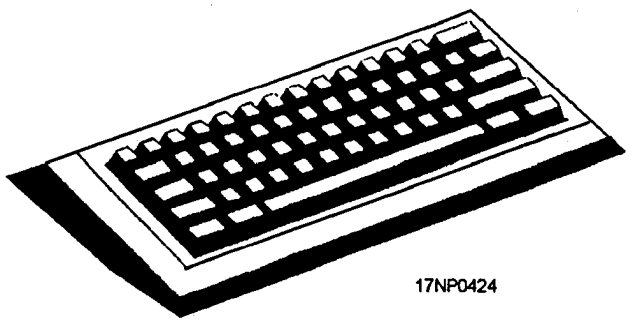


Figure 17-6.—Bar code label printer keyboard.

Character printer (fig. 17-4). This unit prints the documents that are generated from the CPU.

Bar code label printer (fig. 17-5). This unit prints bar code labels, which are applied to and identify ammunition items.

Bar code lapel printer keyboard (fig. 17-6). The keyboard is used to enter information to be printed on bar code labels.

Bar code reader (fig. 17-7). This portable device (also known as a scanner) is used to read or scan bar code labels on ammunition.

FOSAMS SYSTEM ADMINISTRATOR

At the time of FOSAMS installation, a FOSAMS administrator (FSA) is appointed. The weapons officer has the responsibility to appoint this person, or the weapons officer could retain the responsibility and become the FSA. The FSA has absolute authority and responsibility for managing the FOSAMS computer

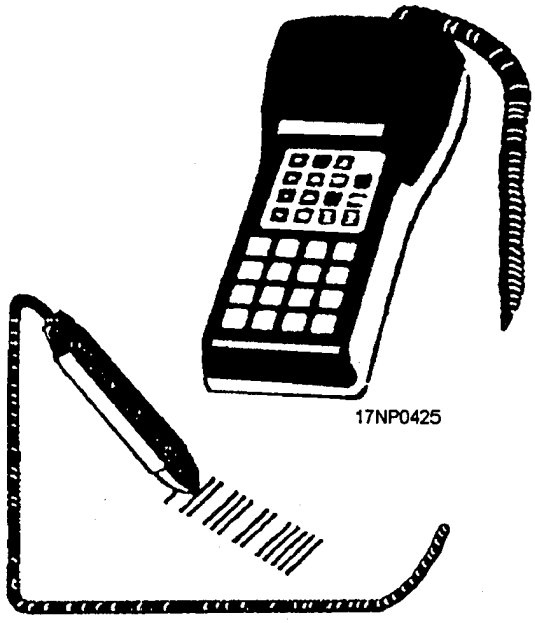


Figure 17-7.—Portable bar code reader/scanner.

system. Some of the responsibilities of the FSA are as follows:

- Control access to the computer system by assigning user IDs and, if necessary, removing user IDs and passwords.
- Ensure database backups are performed.
- Restore the FOSAMS data base when files are damaged or lost.
- Ensure required reports from the computer system (especially ammunition transaction reports) are forwarded to the communications center in a timely manner for transmitting.
- Serves as the principal point-of-contact in communications with the FOSAMS Program management office and the FOSAMS trouble desk for system-related discussions.
- Ensure new software and/or operating system updates provided by the PMO are installed on the local FOSAMS.

FOSAMS REPORTS

The FOSAMS generates various reports to aid in the management of ammunition. There are three basic report categories—daily transaction reports, monthly reports, and general reports.

Daily Reports

The following reports are part of the daily functions. Application and various inquiries of the data base can be made in the inquiry subsystem.

DAILY TRANSACTION REPORT.— This report will list all transactions processed that day and should be run every workday.

AGED VERIFICATION REPORT.— This report lists transactions from receipt and asset maintenance that have not been verified by scanning. If the record is between 5 and 9 days old, it is printed on the report.

Aged Scanner Work File.— For each record of the scanner work file, the transaction date is compared to the system date. If the record is between 5 and 9 days old, it is printed on the report. If the record is 10 days old or older, it is printed on the report with an indication that the record has been deleted from the scanner work file. Scanner work records are obtained from receipt, issue, asset maintenance, inventory, and restow applications.

Aged Temporary Stow Record.— Each activity assigns a specific number of days in which material can be temporarily stowed at another activity. The number of days assigned are added to the date of the temporary stow, and a list is printed for each record that is within 10 days of the system date, or older than the system date. The report is printed each day until the temporary stow indicator is removed, or the item is issued.

Monthly Reports

The monthly reports should be run at the beginning of every month (or as often as needed).

AGED NAR REPORT.— The Notice of Ammunition Reclassification (NAR) history file is searched for all records that do not have a date entered in the NAR completion date field. A listing is provided for all lots with the specific NAR number with a transaction date more than 2 days older than the current system date.

MASTER LOT ASSET DISCREPANCY REPORT.— This report is produced after various checks of data base quantities to assure data integrity.

INVENTORY ADJUSTMENT REPORT.— This report lists inventory adjustments and adjustment reversals by ATR Source code and extended dollar value of the adjustment. The report provides the Physical Security code. Information from this report is used to prepare the Physical Inventory report section of the DOD Inventory Control Effectiveness Report and to determine if there is a requirement to prepare a missing, lost or stolen report.

INVENTORY REMINDER REPORT.— This report lists assets that are required to be inventoried within the next 30 days. A requirement for annual or semiannual inventory is based on the Security Risk Code of the item. The date of last inventory of each National Item Identification Number in the master asset file is compared to the current system date and the inventory frequency requirement.

MAINTENANCE DUE DATE REMINDER REPORT.— Each record in the lot/serial asset file with a maintenance due date that expires within the next 3 months is listed on this report.

General Reports

The general reports are accessed through the inquiry subsystem and should be printed/run as often as needed.

ADDRESS REPORT.— The address report contains all the information on the address file (Unit Identification Code, activity name, routing Identifier code, plain language address used for naval messages, and the shipping address). This report is used to determine the addresses of activities that your FOSAMS activity issues to or receives ammunition from.

ALLOWANCE REPORT.— This report provides information on allowances, by NALC and COG, for each UIC. This report also lists NCEA expended year-to-date by UIC, and NALC substitutes. Types of allowances that could be listed are ABSLA, SHIPFILL, MISSION/CARGO, and NCEA.

BUILDING/HOLD REPORT.— This report contains the lists of static magazine characteristics and, optionally, the date of last inventory for a particular building/hold or for all locations.

DUE-IN REMINDER REPORT.— This report is used to determine what material has been requisitioned or is due in.

LOT ASSET REPORT.— This report provides a list of all lots at the site or specific lot information.

NAR REPORT.— This report contains all NAR information. The report can be obtained for a specific NAR number, NALC, NIIN, or all NARS.

NIIN ASSET REPORT.— This report provides information on all assets held on hand or reserved, or lists information pertaining to a specific NIIN.

RESERVATION REPORT.— This report is used to obtain information about material reserved for issued, for further transfer (FFT), and excess.

SECURITY RISK CATEGORY REPORT.— This report is used to determine where assets of a specific Physical Security code are stored.

SPACE CONTROL REPORT.— The information in this report includes building/hold, hazard class, waiver number (if applicable), cubic feet utilized, explosive weight utilized, cubic feet available, explosive weight available, and the Security Risk codes and Compatibility codes for material stored in a given building/hold.

TECHNICAL DATA REPORT.— This report is used to obtain technical data about any assets on hand.

TRANSACTION HISTORY REPORT.— This report provides a historical report of transactions, sorted by date, for a specific NALC/NIIN or all transaction between a range of dates.

VERIFICATION REPORT.— This report is used to determine what material has not been scanned and verified. When material is verified, the records are deleted from the verification report.

REVIEW NUMBER 1

Q1. What does FOSAMS stand for?

Q2. What technology does FOSAMS use?

Q3. Who has absolute authority and responsibility for managing the FOSAMS computer system?

Q4. Which FOSAMS report lists all transactions processed that day?

CONVENTIONAL AMMUNITION INTEGRATED MANAGEMENT SYSTEM

LEARNING OBJECTIVE: *Describe the functions and state the purpose of the Conventional Ammunition Integrated Management System (CAIMS).*

The Conventional Ammunition Integrated Management System (CAIMS) is a management tool for all echelons of the Navy that relate assets to requirements and to inventory managers for item decision-making purposes. The Naval Ordnance Center (NAVORDCEN) in Mechanicsburg, Pennsylvania, maintains the CAIMS ammunition stock status file. Pertinent data is extracted from this file for distribution to interested fleet and area commanders. The CAIMS ammunition stock status file is not automatically distributed to commands. It is available and maybe requested by individual commands through normal chain-of-command procedures. The CAIMS ammunition stock status file provides the following data:

1. Date of the last transaction report
2. Monthly and cumulative (to date this fiscal year) expenditures by ammunition type, as listed below:
   a. Combat
   b. Training
   c. Test/evaluation
   d. Noncombat operations
   e. Disposal
   f. Loss by inventory
   g. Out of system transfers

3. Quantity on hand

   a. Serviceable

   b. Unserviceable/suspended

4. Allowance

5. Percent of allowance on board

The foregoing data is provided by Navy Ammunition Logistics Code (NALC), Department of Defense Identification Code (DODIC), or by activity (listing the NALCs/DODICs carried by each activity).

The accuracy of CAIMS relates to the ammunition actually on hand at your command. Therefore, you must accurately report all receipts, issues, Condition code changes, and inventory adjustments. Currently, Navy activities report to CAIMS by two methods—transaction item reports (TIRs) and ammunition transaction reports (ATRs). TIRs are transceived daily by activities that use automated information systems. ATRs are submitted by fleet activities via naval messages.

AMMUNITION REQUISITIONING AND TURN-IN PROCEDURES

LEARNING OBJECTIVE: *Use the terms and definitions associated with ammunition requisitioning and turn-in; describe the procedures to be followed when preparing requisition documents; identify the variables that affect requisitioning by fleet units; and describe file maintenance procedures, turn-in procedures, and temporary custody of ordnance ashore.*

The military standard requisitioning and issue procedures (MILSTRIP) are used for ordering all ordnance. *MILSTRIP/MILSTRAP Manual,* NAVSUP P-437, and *Afloat Supply Procedures Manual,* NAVSUP P-485, provide complete MILSTRIP procedures. Each fleet commander (CINCLANTFLT and CINCPACFLT) issues instructions that provide detailed guidance for requisition and turn-in of ammunition within their jurisdiction, The information and procedures in both instructions are basically the same. For simplicity, the information in this chapter pertains to units within the Atlantic Fleet and European areas. (The references are CINCLANTFLTINST 8010.4 and NAVORDCENINST 8010.2.)

TERMS AND DEFINITIONS

Because you work with ordnance, you need to be familiar with ammunition terms and definitions. Some terms are discussed in more detail later in this chapter. The following terms and definitions are used throughout this chapter:

All-Up-Round (AUR). An AUR is a weapon that is issued as a complete assembly (less wings and fins).

Ammunition. Ammunition is conventional expendable ordnance material, which includes gun-type ammunition, bombs, rockets, ASW weapons, guided missiles, mines, torpedoes, demolition, and pyrotechnic materials. For the purpose of this discussion, ammunition includes all items assigned a four-digit NALC as listed in the publication Navy *Ammunition Logistics Codes,* NAVAIR 11-1-116B/TW010-AA-ORD-030. This also includes OT-cognizance material (Marine Corps expendable ordnance).

Ammunition allowances. Ammunition allowances are established to maintain operational units in a mission-ready posture. The different types and quantities of ammunition a unit is allowed to carry depends upon the unit's mission assignment. Also, a unit's ammunition allowance reflects allowances for training, peacetime missions, and wartime missions.

Ammunition allowance lists are approved by the Chief of Naval Operations. Ammunition stocking level lists identify the type and quantity of combat ordnance authorized to be carried on board. Separate cargo and/or mission load ammunition allowance lists are provided for combat landing force (CLF) ships, amphibious force ships, tenders and aircraft carriers, which are developed by the fleet and type commanders. These lists identify the ordnance authorized to support the mission assignment. A few of the ammunition allowances are described in the following statements.

Approved basic stock level of ammunition (ABSLA) is the quantity of non-nuclear ordnance at a shore facility to support all aspects of that activity's mission until resupply can be effected.

Cargo load allowance is the allowance of ammunition carried by AE, AOE, AOR, and AO class ships. This ammunition is issued to other fleet units in support of their assigned mission.

Mission load allowance is the allowance of ammunition carried by CV, LPH, AD, and AS class ships in support of their assigned mission, exclusive of the ships's own armament.

Shipfill allowance (formerly ship's service allowance) is the allowance of ammunition for the ship's permanently installed armament. Shipfill ammunition does not include-ammunition held for issue to other activities.

Changes to the shipfill allowance list requires prior approval of the Chief of Naval Operations. A proposed change should be submitted by letter from the ship concerned through the normal chain of command. Changes to the cargo or mission load allowance lists require prior approval of CINCLANTFLT. Proposed changes to the cargo or mission load allowance lists should be submitted to CINCLANTFLT through the normal chain of command.

Check-sum-digit. The check-sum-digit is the last digit in a sum of numbers. It is entered after a slant mark (/) immediately following the number being checked. For example, in the entry E487 (4+8+7=19), 9 is the check-sum-digit. The entry is written as E487/9. The check-sum-digit provides NOC with a check and balance to ensure that the proper NALC is entered on DD Form 1345, register four.

Cognizance symbol (COG). The cognizance symbol is a two-digit NSN prefix that identifies the systems command, office, agency, or inventory control point exercising supply management for a specific category of ammunition. For example, in NSN 2E1425-00-940-1347-E075, the two-digit symbol 2E is the COG. (Refer to fig. 17-8.) COG symbols are listed in NAVAIR 11-1-116B/TW010-AA-ORD-030.

Complete round. A complete round is one that is or can be assembled from any acceptable combination of components. It is capable of being used operationally without the performance of work on the round other than normal assembly operations.

Department of Defense Ammunition Code (DODAC). The Department of Defense Ammunition Code (DODAC) is made up of the federal supply class (FSC) plus the DODIC or NALC. For example, in NSN 2E1425-00-940-1347-E075, the DODAC is 1425E075. (See fig. 17-8.)

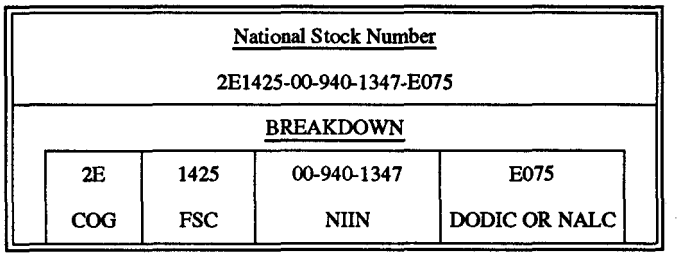


Figure 17-8.—National stock number (NSN) breakdown.

Department of Defense Identification Code (DODIC). The Department of Defense Identification Code (DODIC) is a four-digit code assigned by the Defense Logistics Services Center (DLSC), and it identifies ammunition and explosive items. The acronyms DODIC and NALC, or their respective meanings, are used interchangeably in the remainder of this chapter.

Expenditure. An expenditure occurs when an item is permanently removed from the Navy inventory. A round that is detonated, burned, fired, exploded, surveyed or lost by inventory, deepwater dumped, or transferred to other services or another country is posted and reported as an expenditure. Transfers of ammunition to other Navy/Marine Corps activities are **NOT** expenditures. The various types of expenditures include combat, training, test and evaluation, operational, disposal, loss by inventory, and transfers out of the Navy reporting system.

Gain by inventory (GBI). A GBI is an increase in the asset position based upon physical inventory of an ammunition item.

Issue. An issue is the transfer of an item, regardless of its serviceability condition, to another activity. This includes off-loads to shore activities and transfers to other ships.

Lead time. Lead time is the time difference between the Julian date of the requisition and the required

REVIEW NUMBER 1 ANSWERS TO QUESTIONS Q1. THROUGH Q4.

A1. FOSAMS stands for Fleet Optical Scanning Ammunition Marking System.

A2. The technology FOSAMS uses is the optical scanning physical inventory.

A3. The weapons officer has absolute authority and responsibility for managing the FOSAMS computer system.

A4. The FOSAMS report that lists all transactions processed that day is the Daily Transaction Report.

delivery date (RDD). It consists of submission time, or the time to transmit the requisition from the requisitioner to the stock point, plus processing and delivery time at the stock point.

Loss by inventory (LBI). An LBI is a decrease in the asset position based upon a physical inventory of an ammunition item.

Maintenance due date (MDD). The maintenance due date of a weapon is predicated on the component of the weapon that next requires intermediate- or depot-level maintenance or testing. MDDs vary from weapon to weapon and within configurations of weapons. They are used to determine serviceability. Weapons with an expired MDD are not serviceable.

National stock number (NSN). An NSN is a 13-digit number used to identify an item of material in the supply distribution system of the United States. It consists of a four-digit federal supply class (FSC) and a nine-digit national item identification number (NIIN). (See fig. 17-8.)

Navy ammunition reclassification (NAR) system. *NARs* provide information pertaining to the degree of serviceability of non-nuclear explosive ordnance or explosive material used by the Navy, Marine Corps, and Coast Guard Reclassification refers to the change of an item's material condition code. NARs are issued by message and often contain information directly related to the safety of personnel and/or equipment. NARs are numbered consecutively within each calendar year and serve as supplements to the *Ammunition—Unserviceable, Suspended, and Limited Use, TW024-AA-ORD-010,* until incorporated by a change or revision.

Receipt. A receipt is any transaction that increases the on-hand inventory of an item, regardless of its serviceability condition. Receipts from another ship, activity, service, and GBIs are included.

Reconciliation. Reconciliation is the process of reporting on-hand assets of items that have had no transactions since the previous reconciliation. NOC Mechanicsburg uses reconciliation reports to identify and correct errors in individual ship's or activity's data files and in the CAIMS data base.

Serial/lot item tracking (SLIT). Serial/lot item tracking is a subsystem of CAIMS that accounts for certain items of ordnance by individual serial, lot, or register number.

Temporary custody ashore. Temporary custody ashore refers to ammunition temporarily stored ashore by a ship that intends to reload the ammunition aboard at a later date. It does not include ammunition held temporarily for further transfer (FFT).

Transaction. For reporting purposes, a transaction is any change in the reported asset posture of an ammunition item. Examples of transactions are receipt, reclassification from suspended to serviceable, expenditure, and issue.

Transfer. Transfer is the movement of assets from a Navy activity to an activity outside the Navy accounting system such as the Army, Air Force, Coast Guard, or a foreign government.

Type Maintenance Due Code (TMDC). A Type Maintenance Due code is a code that indicates what type of maintenance action is due next for an individual item.

Unserviceable/suspended ammunition. Unserviceable/suspended ammunition are components that are not ready for use and cannot be made serviceable using immediately available maintenance and repair capability. This includes both unserviceable items and items suspended pending quality evaluation, test, renovation, or ammunition reclassification. Torpedoes and missiles that are not ready for unrestricted use or are overdue for maintenance are considered unserviceable. Unserviceable ammunition includes Condition codes ECHO, FOXTROT, GOLF, HOTEL, JULIET, KILO, LIMA, MIKE, and NOVEMBER.

REQUISITION DOCUMENT PREPARATION

MILSTRIP requisitioning is based upon the use of the coded, single-line, item document, DD Form 1348. MILSTRIP relies upon automatic data processing equipment and coded data for processing requisitions. Therefore, the requisitioner must take extreme care in selecting and assigning coded data elements.

MILSTRIP documents consist of requisitions, follow-ups, and cancellations. There are two different methods for submitting ammunition MILSTRIP documents into the ammunition supply system. The choice and method are determined by the following criteria:

1. Submission by the Defense Automatic Addressing System (DAAS). Submission of MILSTRIP documents by the DAAS is the preferred method for submitting MILSTRIP documents, unless they are specifically excluded.

2. Submission by naval message. A naval message is used only for those MILSTRIP documents specifically excluded from submission by DAAS.

Requisition System Document (DD Form 1348)

Preparation of a DD Form 1348 requisition system document is described in detail in the following paragraphs. Refer to the sample DD Form 1348, shown in figure 17-9, as you read this section.

NOTE: A complete list of MILSTRIP codes are contained in NAVSUP Publication 437 or NAVSUP Publication 485. However, you can quickly locate commonly used codes and definitions by referring to the *MILSTRIP/ MILSTRAP Desk Guide,* NAVSUP Publication 409.

DATA BLOCK A (SEND TO:). Enter the Service Designator code, Unit Identification Code (UIC), and the name of the activity to which the requisition is submitted. Identification of the supply source is a mandatory entry. In this case, the service designator is indicated by the letter N and the UIC is indicated by the number 00109. This UIC identifies Naval Weapons Station, Yorktown, Virginia, as the supply source.

DATA BLOCK B (REQUISITION IS FROM:). Enter the Service Designator code, UIC, and name of the requisitioning activity.

DATA BLOCK C. You may enter the noun name of the item requested in this block This is an optional entry, and completion of block C depends upon local policy.

DATA BLOCKS D, E, and F. Leave these blocks blank.

CARD COLUMNS 1 THROUGH 3 (DOCUMENT IDENTIFIER). The Document Identifier code is a mandatory entry. It identifies the purpose of the document (requisition, follow-up, modifier, or cancellation). Supply actions, such as follow-ups, modifiers, and cancellations are discussed later in this chapter. To requisition enter the applicable document identifier as follows:

1. For material for delivery within the Continental United States (CONUS) or from an overseas activity to a Navy activity in the same geographic location, use one of the following document identifiers:

   a. AOA when requisitioning with an NSN

   b. AOD when requisitioning with a DODAC

   c. AOE when the requisition contains data in the remarks block

2. For material to be delivered from CONUS to an overseas site, use one of the following document identifiers:

   a. A01 when requisitioning with an NSN

   b. A04 when requisitioning with a DODAC

   c. A05 when the requisition contains data in the remarks block

Thus, the document identifier AOD informs you that the item is being requisitioned by using the item DODAC. It also informs you that both the supply source and the requisitioner are in CONUS; or, that both

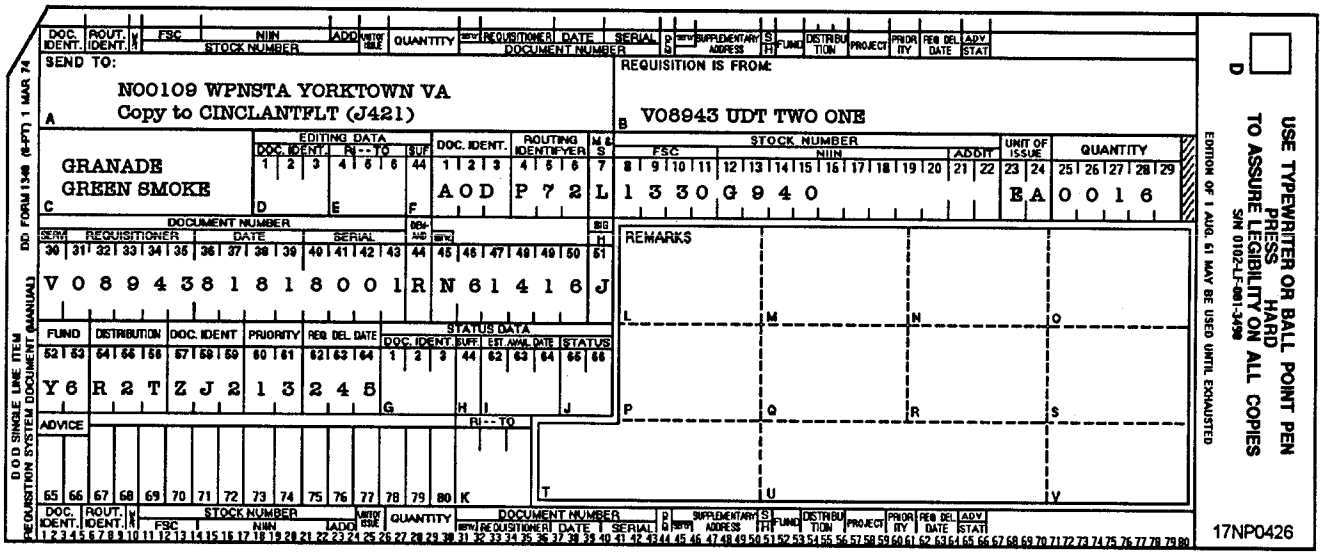


Figure 17-9.—DD Form 1348.

the supply source and requisitioner are in the same geographic location overseas.

CARD COLUMNS 4 THROUGH 6 (ROUTING IDENTIFIER). The routing identifier identifies the activity that is to receive the requisition. The routing identifier is a mandatory entry. In this case, the routing identifier P72 identifies Naval Weapons Station, Yorktown, Virginia, as the activity that is to receive the requisition.

CARD COLUMN 7 (MEDIA AND STATUS CODE). The Media and Status (M&S) code is a mandatory entry. It is used to indicate the type of MILSTRIP status required, who is to receive the status, and by what communications media the status is to be furnished. The following three status types are available:

1. Exception status. This status provides information relative to any action taken by the supply source, other than issuing of the material requisitioned. For example, the requisition is rejected, or the requisition is referred to another activity for action.

2. 100 percent supply status. This status provides information relative to any action taken by the supply source, except shipping data.

3. Shipping status. This status provides positive advice concerning shipping. This includes date of shipment, mode, bill of lading, or airway bill.

Table 17-1 lists applicable M&S codes. Ships or squadrons within 60 days of deployment and deployed units use M&S code for all ammunition requisitions with priorities 1 through 8. Other afloat units and deployed units with requisition priorities 9 through 15 use one of the other M&S codes listed in table 17-1. As appropriate, shore activities may use any of the media and status codes listed in NAVSUPP-437. A copy of all status requested by requisitioners is automatically provided by the supply source to CINCLANTFLT, as well as the UIC in the supplementary address.

CARD COLUMNS 8 THROUGH 22 (STOCK NUMBER). These card columns are used to enter the DODAC (four-digit FSC plus the four-digit NALC) or NSN of the item being requisitioned. Either one or the other must be used. Make the entry beginning at the left, and leave any unfilled spaces blank. DODACs and NSNs are listed in the *Navy Ammunition Logistic Codes,* NAVAIR 11-1-116B/TW010-AA-ORD-030, and *Stock List of Navy Ammunition,* NAVAIR 11-1-116A/TW010-AA-ORD-010.

Table 17-1.—Media and Status(M&S) Codes

M & S CODE	MEANING
3	Exception status to requisitioner by mail.
6	Exception status to requisitioner by message.
C (Note 1)	100% supply status to requisitioner by mail.
F (Note 1)	100% supply status to requisitioner by message.
L	Exception supply status plus shipment status to requisitioner by mail.
R	Exception supply status plus shipment status to requisitioner by message.
T (Note 1)	100% supply status plus shipment status to requisitioner by mail.
W (Note 1)	100% supply status plus shipment status to requisitioner by message.
Note 1: Authorized for use only with priority 01 through 08 requisitions.	

CARD COLUMNS 23 and 24 (UNIT OF ISSUE). Enter the appropriate two-digit abbreviation for the unit of issue of the requested item. Unit of issue abbreviations are found in NAVAIR 11-1-116B/ TW010-AA-ORD-030.

CARD COLUMNS 25 THROUGH 29 (QUANTITY). Enter the quantity required. Enter zeros in the unused columns that precede the quantity required.

CARD COLUMNS 30 THROUGH 43 (DOCUMENT NUMBER). The document number is a 14-digit nonduplicative number constructed to identify the service, requisitioner, Julian date, and serial number.

1. Card column 30 (service code). Enter one of the following service codes:

V — Atlantic fleet operating units

N — Navy activities other than fleet operating units, including precommissioned ships

M — Marine Corps activities

Z — Coast Guard activities

2. Card columns 31 through 35 (requisitioner). Enter the five-digit UIC of the requisitioning activity.

3. Card columns 36 through 39 (date). Enter the four digits that represent the Julian date on which the requisition is transmitted to the supply source. The Julian date consists of two elements-the last digit of the calendar year and the numeric consecutive day of the calendar year. For example, 8181 represents 30 June 1988. The numeric consecutive days of the year can be found on government-issue calendar pads.

4. Card columns 40 through 43 (serial). Enter a four-position serial number. Automated ships should use 5000 (series) serial numbers; nonautomated ships should use 8000 (series) serial numbers. Never duplicate the same serial number on the same Julian date.

CARD COLUMN 44 (DEMAND). The demand code shows whether the demand is recurring or nonrecurring. Use demand code R (recurring) when the item requisitioned is for shipfill, mission load, cargo load, or ABSLA allowance. Use N (nonrecurring) when the item requisitioned is clearly a onetime request.

CARD COLUMNS 45 THROUGH 50 (SUPPLEMENTARY ADDRESS). The supplementary address field is a mandatory entry and a multiuse field. Fleet units use this field to indicate where the requisitioned material is to be received and loaded by entering the service code and UIC of the loading activity. Shore activities use this block for local information (such as storage location) by first entering the letter Y in block 14.

CARD COLUMN 51 (SIGNAL). The signal code identifies the activity to which the material is shipped and/or billed. Table 17-2 provides a list of signal codes and their meaning. Enter the appropriate signal code.

Table 17-2.—Signal Codes

SIGNAL CODE	MEANING
A	Ship and bill to requisitioner "For use by shore facilities only" (block 10)
B	Ship to requisitioner (Block 10) and bill to supplementary address (Block 15)
J (See note)	Ship to supplementary address (Block 15) and bill to requisitioner (Block 10)
K	Ship and bill to supplementary address (Block 15)
Note: Use Signal code J when the supplementary address is used to indicate the loadout activity.	

CARD COLUMNS 52 THROUGH 53 (FUND). The Fund code is a two-character code that cites accounting data on Navy requisitions. Fleet units should enter Fund code Y6 and shore activities should enter Fund code 26.

CARD COLUMNS 54 THROUGH 56 (DISTRIBUTION). Distribution field entries serve a dual purpose and are mandatory entries. The first position indicates the monitoring activity, and the other two positions indicate the cognizance symbol of the material being ordered. CINCLANTFLT is the monitoring activity for all ammunition requisitions. Fleet units enter code R and shore activities enter code 8 in card column 54. With this code, CINCLANTFLT receives 100-percent supply and shipment status on the requisition. In card columns 55 and 56, enter the applicable cognizance symbol of the material being ordered. Table 17-3 lists the material and COG symbols.

CARD COLUMNS 57 THROUGH 59 (PROJECT). The Project code is a mandatory entry for identifying the purpose of the requisitioned item. There are several Project codes for requisitioning ammunition. They are all within the 800 series. A few of the more

Table 17-3.—Cognizance Symbols

COG	MATERIAL
OT	Expendable Marine Corps ground ordnance
2E	Conventional air ordnance
2T	Conventional surface ordnance
4T	Torpedoes/ASROC and components
6T	Underwater mines and components
8E	Air-launch missile material
8S	SUBROC and components
8T	Surface-launch missile material

Table 17-4.—Project Codes

APPLICABLE ALLOWANCE	PURPOSE	PROJECT CODE
Shipfill	Ammunition requisitioned for replacement of service ammunition.	835
Training	Ammunition requisitioned for a turn-in for annual training or fleet exercise.	876
Shipfill	Ship deployment: Ammunition requisitioned for ship deployment.	877
Shipfill	Emergency download of ammunition due to ship CASREP and subsequent onload following restoration of CASREP.	879
Mission	ANORS: Requisition of expendable ordnance such as CADS without which aircraft becomes not operationally ready.	821
Mission	Ships Overhaul: Download (turn-in) of ammunition prior to entering yard for overhaul and onload (requisitioning) of such ammunition upon leaving overhaul yard.	891
Mission	CV Post-Deployment Download: The off-load (turn-in) of CV mission load ammunition when off-loaded at a pier or anchorage.	897
Mission	CV Post-Deployment Download by AE: The off-load (turn-in) of CV mission load ammunition when backloaded to MLSF ships.	898
Mission	Ships Restricted Availability (SRA): Ammunition off-load (turn-in) required by entering a restricted availability period and the subsequent onload (requisitioning) of ammunition upon completion of restricted availability.	892

frequently used 800-series Project codes are listed in table 17-4.

CARD COLUMNS 60 and 61 (PRIORITY). The priority designator is a mandatory entry. It expresses the relationship between the requisitioner's assigned force/activity designator (F/AD) and the selected urgency of need designator (UND). F/AD assignment and the UND criteria are defined in OPNAVINST 4614.1 (series) and NAVSUP P-485. The UNDs applicable to the priority requirements are listed in table 17-5.

CARD COLUMNS 62 THROUGH 64 (REQUIRED DELIVERY DATE). The required delivery date (RDD) is a mandatory entry. Enter the specific three-digit Julian date that the material is required by the requisitioner.

CARD COLUMNS 65 AND 66 (ADVICE). An Advice code is an optional code. It provides the supply source with special instructions applicable to the requisitioned item. When these card columns are not

Table 17-5.—UND Equated to Priority Designators

URGENCY OF NEED DESIGNATOR	PRIORITY DESIGNATOR				
A (UNABLE TO PERFORM)	01	02	03	07	08
B (PERFORMANCE IMPAIRED)	04	05	06	09	10
C (ROUTINE)	11	12	13	14	15

used, they should be left blank. The optional Advice codes are listed in table 17-6.

DATA BLOCKS L THROUGH V (REMARKS). Normally, requisitions should not contain remarks. Enter remarks only when absolutely necessary to identify acceptable substitutes, clarify delivery, or to indicate the planned firing month of training missiles. Avoid including superfluous data that can be coded within the MILSTRIP format. For example, by placing the UIC of the activity where the material is to be delivered in the supplementary address, by using Signal code J, and by providing an RDD, the requisitioner can encode where and when delivery should be made and eliminate any remarks. If remarks are used, you should ensure that a document identifier of AOE or A05 is used.

Message Requisitioning by DAAS

Ammunition MILSTRIP requisitions are prepared by fleet units in a specially coded standard format and transmitted by message directly to DAAS, Dayton, Ohio. DAAS redirects each requisition on the message to the activity indicated by the routing identifier. DAAS redirects the message by way of the automatic digital network (AUTODIN) system. The activity receiving the message takes the necessary action to fill or refer the requisition, as appropriate. Referrals and retransmittals are done by AUTODIN. The AUTODIN system provides the addresses with a punched card for each document in the originator's message. This process alleviates the need for message handling or keypunching by the addressee.

Table 17-6.—Advice Codes

ADVICE CODES	MEANING
2B	Requested item only will suffice. Do not substitute or interchange.
2D	Furnish exact quantity requested. Do not adjust to unit pack quantity.
2T	Deliver to the ultimate consignee by the RDD or cancel requirement.
5C	Do not centrally back order or procure. Substitute acceptable. Reflect unfilled quantity not available for delivery. Fill or kill at inventory control point level.

Unclassified MILSTRIP requisitions without remarks are the only ammunition requisitions that qualify for DAAS transmission. As mentioned earlier, remarks can normally be avoided by careful coding of the requisition. When necessary, remarks can be transmitted in a separate (non-DAAS) message. The following types of requisitions are NOT submitted by DAAS:

1. Requisitions that require remarks

2. Requisitions for a CV loadout where the CV is loaded by an AE/AOE

3. Requisitions submitted to COMNAVAIRSYSCOM (for 8E COG material) or to COMNAVSEASYSCOM (for 8T or 8S COG material)

4. Requisitions with a classification of CONFIDENTIAL or higher

Requisitions that qualify for DAAS transmission are discussed in the following paragraphs.

FORMS.— NAVSUPForms 1353 and 1353-1, or a locally prepared MILSTRIP message transmittal work sheet, should be used to submit requisitions by DAAS. The sample worksheet shown in figure 17-10 is NAVSUP 1353.

FORMAT.— Refer to the format shown in figure 17-10. You should remember that this chapter deals specifically with units under the jurisdiction of CINCLANTFLT, and that some of the information is different for units under CINCPACFLT jurisdiction. However, the procedures for preparation of a NAVSUP 1353 are identical in both areas of jurisdiction

You should route the unclassified message for action to DAAS DAYTON OH, with information copies to CINCLANTFLT NORFOLK VA, the immediate operational commander, and the activity where the material is to be delivered (the supplementary address activity). The subject line should be AMMO MILSTRIP REQN. To be accepted for transmission by DAAS, each line can contain a maximum of 66 characters of data in the following sequence:

COLUMN	ENTRY
1-3	Document Identifier: Enter A0A or A01 when requisitioning with an NSN. Enter A0D or A04 when requisitioning with a DODAC or an NALC.
4-6	Routing Identifier: Enter the routing identifier of the activity that is to receive the requisition for action. Routing identifiers are contained in the

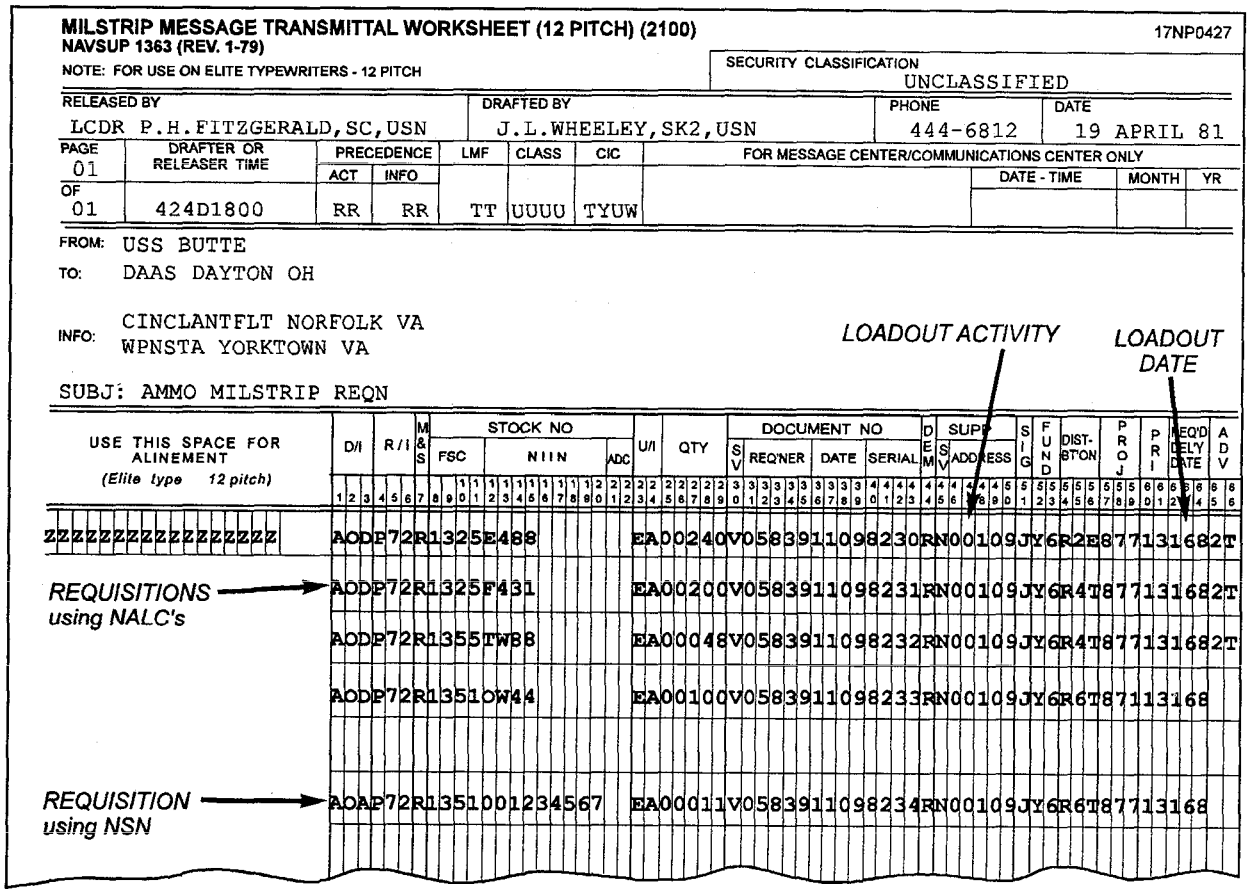


Figure 17-10.—MILSTRIP message transmittal worksheet (NAVSUP 1353).

appropriate CINCLANTFLT or CINCPACFLT instruction. In this case, P72 identifies WPNSTA YORKTOWN VA as the activity to receive the requisition for action.

7 Media and Status Code: Enter 3, 6, C, F, L, R, T, or W, as appropriate.

8-22 You should enter the DODAC/NALC of the item being requisitioned in columns 8-15 and leave columns 16-22 blank (do NOT write BLANK in columns 16-22). When using an NSN, you should enter the 13-digit NSN in columns 8-20 and leave columns 21-22 blank.

23-24 Unit of Issue: Enter the appropriate two-digit abbreviation for the unit of issue.

25-29 Quantity Requisitioned: Enter the quantity required Enter zeroes in the unused columns that precede the quantity required.

30-43 Requisitioned Document Number: Enter the requisition document number.

This consists of the service code and the UIC of the activity where the requisitioned material is to be delivered or loaded.

44 Demand Code: Enter R for recurring demands; N for nonrecurring demands.

45-50 Supplementary Address: Enter the Service code and UIC of the activity where the requisitioned material is to be delivered or loaded.

51 Signal Code: Enter Signal code J.

52-53 Fund Code: Enter Fund code Y6 for fleet units; enter code 26 for shore activities.

54 Distribution Code: Fleet units enter Distribution code R. Shore activities enter Distribution code 8.

55-56 Cognizance Symbol: Enter the cognizance symbol of the item being requisitioned.

57-59 Project Code: Enter the appropriate Project code.

60-61 Priority: Enter the appropriate Priority code.

62-64 Required Delivery Date: Enter the three-digit Julian date on which the material is to be delivered or loaded.

65-66 Advice Code: The Advice code is an optional entry Leave columns 65 and 66 blank when an entry is not needed.

Do NOT include paragraph numbers, slants between date elements, BLNK for blank data elements, remarks at the end of a line, or remarks at the bottom of a message.

MILSTRIP documents with different document identifiers, routing identifiers, or cognizance symbols may be included in the same message. DAAS will reroute each line item to the proper addressee.

REJECTED DOCUMENTS.— To preclude transmission of erroneous data, DAAS validates the following data fields in MILSTRIP documents:

1. Document Identifier code
2. Routing Identifier code
3. Quantity
4. Requisitioner
5. Supplementary address
6. Signal code

Omissions or invalid MILSTRIP codes in any of these fields cause DAAS to reject the document. DAAS sends a message back to the originator with a statement outlining the reason for rejection. Rejections are minimized by careful drafting and proofreading by personnel at the originating activity.

PROCESSING.— Requisitions coded in the above format and submitted to DAAS are automatically readdressed to the activity in the routing identifier. When the requisition cannot be filled by that activity, it is passed to the inventory manager for action to fill it. Supply status is provided to the requisitioner, the supplementary address, and to CINCLANTFLT according to the M&S code used. All status messages should come directly from the processing activity or from DAAS. These status messages should contain a subject line indicating that it concerns ammunition requisition status.

Exception Requisitioning by Naval Message

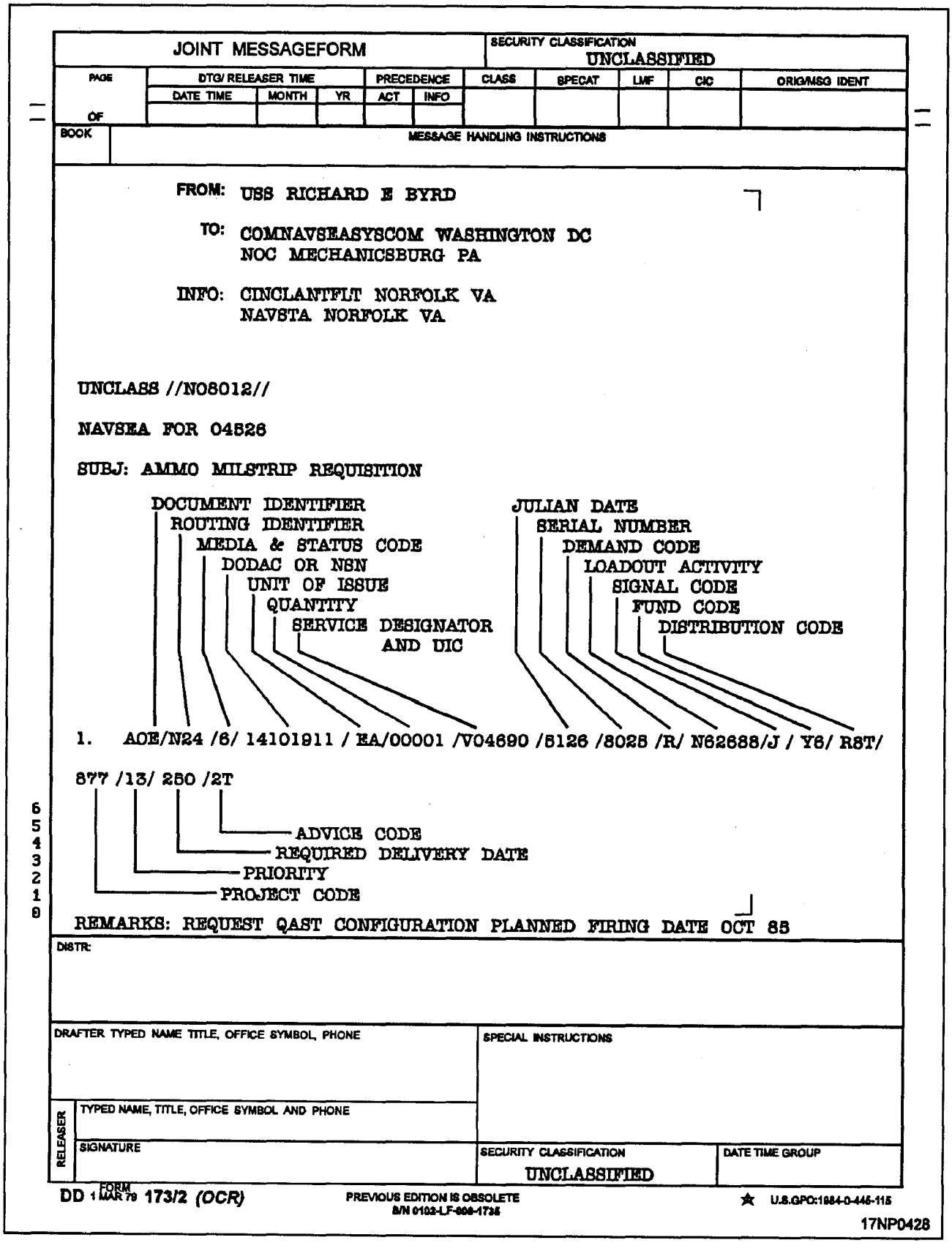
Requisitions that are excluded from submission by DAAS (mentioned earlier) are the only ones that can be submitted by naval message. The requisition should be submitted by using the Joint Messageform, DD 173/2(OCR), as shown in figure 17-11. The message should be sent for action to the supply source indicated in the routing identifier of the MILSTRIP. The message must be sent for information to CINCLANTFLT and the activity where the material is to be delivered.

A MILSTRIP requisition sent by naval message is normally unclassified. Since none of the MILSTRIP data elements contain classified information, the classifying of ammunition requisitions is unnecessary. If classified remarks are necessary, they must be provided by a separate message.

The subject line is shown as SUBJ: AMMO MILSTRIP REQUISITION, and the message requisition is submitted in complete MILSTRIP format with the data elements separated by a slant mark(/), as shown in figure 17-11. Essentially, a MILSTRIP requisition submitted by naval message contains the same data elements as the DD Form 1348 or the NAVSUP 1353. The major difference is that no data elements of a MILSTRIP requisition submitted by naval message can be left blank. When data elements are not applicable, they must be identified by BLNK (blank).

Multiple requisitions are included in the same message providing they contain the same routing identifier. The routing identifier shown in figure 17-11 is N24. The routing identifier N24 identifies NAVSEASYSCOM, Washington, D.C., as the activity to receive the requisition. Additional ammunition items can be included on the same message providing all the items are to be requisitioned from NAVSEASYSCOM, Washington, D.C. Each ammunition item must be listed as a separate line item and sequentially numbered (1., 2., 3.).

Additionally, for all requisitions having the same document identifier, routing identifier, Media and Status code, unit of issue, requisitioner's Service code and UIC, Julian date, Demand code, supplementary address, Signal code, Fund code, Distribution code (including the same COG symbol), Project code, priority, and RDD, the codes maybe shown once in the MILSTRIP message format, with BLNK in the fields for stock number, unit of issue, quantity, and serial number, as



JOINT MESSAGEFORM

SECURITY CLASSIFICATION: UNCLASSIFIED

PAGE OF	DTG/ RELEASER TIME: DATE TIME	MONTH	YR	PRECEDENCE: ACT	INFO	CLASS	SPECAT	LMF	CIC	ORIG/MSG IDENT

BOOK | MESSAGE HANDLING INSTRUCTIONS

FROM: USS RICHARD E BYRD

TO: COMNAVSEASYSCOM WASHINGTON DC
NOC MECHANICSBURG PA

INFO: CINCLANTFLT NORFOLK VA
NAVSTA NORFOLK VA

UNCLASS //N08012//

NAVSEA FOR 04526

SUBJ: AMMO MILSTRIP REQUISITION

DOCUMENT IDENTIFIER
ROUTING IDENTIFIER
MEDIA & STATUS CODE
DODAC OR NSN
UNIT OF ISSUE
QUANTITY
SERVICE DESIGNATOR AND UIC
JULIAN DATE
SERIAL NUMBER
DEMAND CODE
LOADOUT ACTIVITY
SIGNAL CODE
FUND CODE
DISTRIBUTION CODE

1. AOE/N24 /6/ 14101911 / EA/00001 /V04690 /5126 /8025 /R/ N62688/J / Y6/ R8T/

877 /13/ 250 /2T

6 5 4 3 2 1 9

ADVICE CODE
REQUIRED DELIVERY DATE
PRIORITY
PROJECT CODE

REMARKS: REQUEST QAST CONFIGURATION PLANNED FIRING DATE OCT 85

DISTR:

DRAFTER TYPED NAME TITLE, OFFICE SYMBOL, PHONE

SPECIAL INSTRUCTIONS

RELEASER: TYPED NAME, TITLE, OFFICE SYMBOL AND PHONE

SIGNATURE

SECURITY CLASSIFICATION: UNCLASSIFIED

DATE TIME GROUP

DD FORM 1 MAR 79 173/2 (OCR)

PREVIOUS EDITION IS OBSOLETE
S/N 0102-LF-008-1735

★ U.S.GPO:1984-0-446-115

17NP0428

Figure 17-11.—Joint Messageform, DD 173/2 (OCR).

shown in figure 17-12. The DODAC/NALC, unit of issue, quantity, and serial number for each item required are listed in columns immediately below the MILSTRIP data.

REQUISITIONING BY FLEET UNITS

The requisitioning procedures followed by fleet units are determined by the units mission assignment and geographical location. Fleet units are composed of cargo ships (AE/AOE/AOJ/AS), mission load ships (CV/LPH/AD/AS), and aircraft squadrons. Since the majority of Aviation Ordnancemen are assigned to aircraft carriers or aircraft squadrons, the discussion that follows concerning requisitioning procedures for fleet units is limited to these two units.

Stock Levels

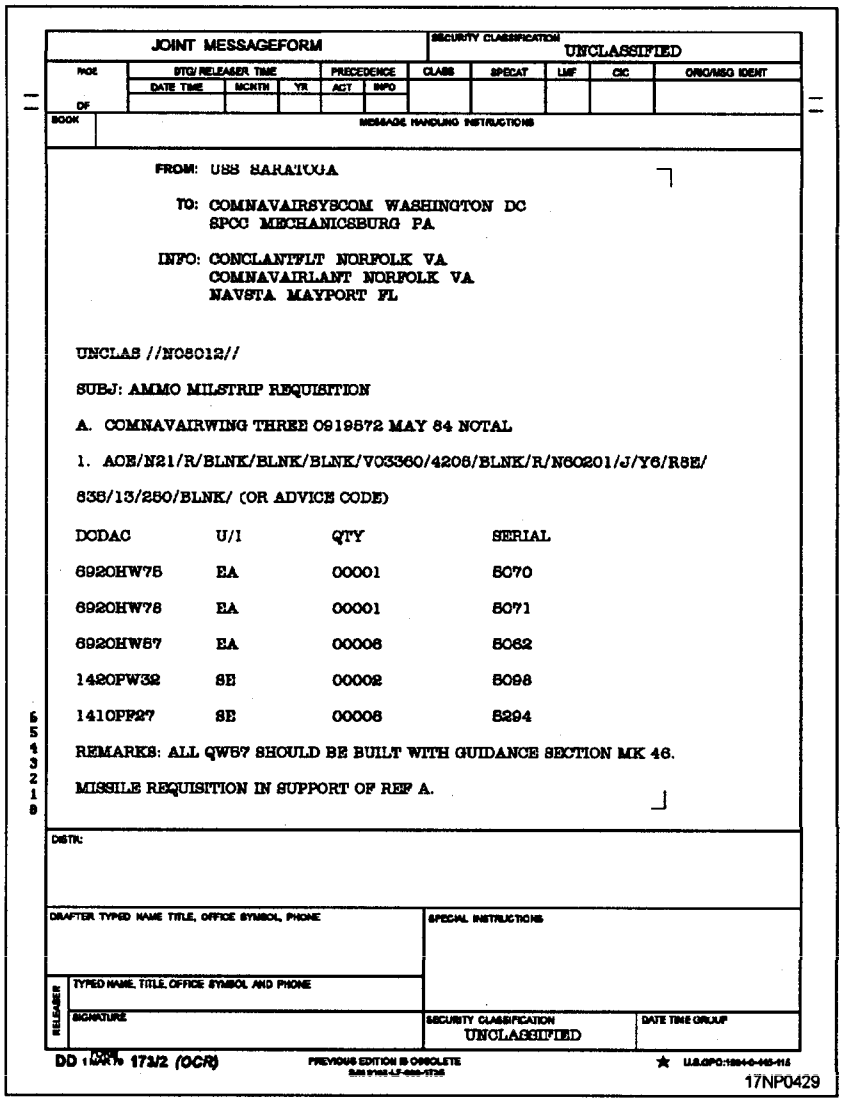
Ships are required to maintain 100 percent of their shipfill ammunition allowance on board or on order. One exception is that stock levels can be reduced to 90 percent to permit expenditures for training, or to carry exercise ammunition. Individual waivers of this requirement must be requested from the ship's operational commander.

Requisitioning Channels

The requisitioning channels for use by fleet activities are determined by the locality of the unit. Ships and units located in CONUS or CONUS operating areas should submit requisitions to DAAS. Requisitions for the following materials must be in the format previously discussed and submitted as follows:

Requisitions for 2E COG cartridge-actuated devices should be submitted to NAVORDCEN, Mechanicsburg, Pennsylvania.

Requisitions for 2E COG bombs and rockets should be submitted to the naval weapons station closest to the unit's homeport or to the weapons station designated for the loadout.



JOINT MESSAGEFORM — SECURITY CLASSIFICATION: UNCLASSIFIED

PAGE	DTG/ RELEASER TIME			PRECEDENCE		CLASS	SPECAT	LMF	CIC	ORIG/MSG IDENT
	DATE TIME	MONTH	YR	ACT	INFO					
OF										

BOOK — MESSAGE HANDLING INSTRUCTIONS

FROM: USS SARATOGA

TO: COMNAVAIRSYSCOM WASHINGTON DC
SPCC MECHANICSBURG PA

INFO: COMCLANTFLT NORFOLK VA
COMNAVAIRLANT NORFOLK VA
NAVSTA MAYPORT FL

UNCLAS //N03012//

SUBJ: AMMO MILSTRIP REQUISITION

A. COMNAVAIRWING THREE 0919572 MAY 84 NOTAL

1. AOE/N21/R/BLNK/BLNK/BLNK/V03360/4208/BLNK/R/N60201/J/Y6/R8E/
835/13/250/BLNK/ (OR ADVICE CODE)

DODAC	U/I	QTY	SERIAL
6920HW75	EA	00001	5070
6920HW76	EA	00001	5071
6920HW67	EA	00006	5062
1420PW32	SE	00002	5098
1410PF27	SE	00006	5294

REMARKS: ALL QW67 SHOULD BE BUILT WITH GUIDANCE SECTION MK 46.

MISSILE REQUISITION IN SUPPORT OF REF A.

DISTR:

DRAFTER TYPED NAME TITLE, OFFICE SYMBOL, PHONE — SPECIAL INSTRUCTIONS

RELEASER: TYPED NAME, TITLE, OFFICE SYMBOL AND PHONE

SIGNATURE — SECURITY CLASSIFICATION: UNCLASSIFIED — DATE TIME GROUP

DD FORM 173/2 (OCR) — PREVIOUS EDITION IS OBSOLETE

17NP0429

Figure 17-12.—Sample of completed Joint Messageform DD 173/2 (OCR).

- Requisitions for 2T COG material should be submitted to the naval weapons station closest to the unit's homeport or to the weapons station designated for the loadout.

- Requisitions for 4T COG torpedo components and ASROC components should be submitted to NAVORDCEN, Mechanicsburg, Pennsylvania.

- Requisitions for 6T COG material should be submitted to the Mine Warfare Engineering Activity (MINEWARENGACT), Yorktown, Virginia.

Requisitions for the following material must be requisitioned by naval message in the format previously discussed and submitted as follows:

- Requisitions for 2E COG aircrew escape propulsion system (AEPS) devices should be submitted to NAVORDCEN, Mechanicsburg, Pennsylvania, according to NAVORDCENINST 8010.2 (series).

- Requisitions for all 8E COG air-launch missiles, Harpoon missiles, Seasparrow missiles, 8T COG surface-launch missiles, and complete-round torpedoes require special requisitioning procedures, which are discussed later in this chapter.

When ships or units are deployed in the Atlantic Fleet or the Pacific Fleet, ammunition requisitions are submitted by naval message to the appropriate type commander or the applicable inventory manager. Instructions are available within each command to provide you with guidelines for properly submitting ammunition requisitions.

Requisition Lead Time

A maximum and minimum lead time has been established to provide sufficient time for submission and processing of ammunition requisitions. Lead time allows for adequate processing time of requisitions so mission requirements can be met on schedule. In addition, materials are not reserved too far in advance of requirements.

ROUTINE REQUISITIONS.— A maximum of 60 days and a minimum of 25 days should be allowed for routine requisitions incident to allowance replenishment, scheduled training, or deployment loadout.

CADS AND AEPS DEVICES.— All requisitions for CADS and AEPS devices should have a 90-day lead time.

CV COMPLETE DEPLOYMENT LOADOUT.— Because of the large quantity of ordnance involved, complete loadout requisitions for aircraft carriers must allow a maximum of 60 days and a minimum of 45 days lead time. When the ship is to be loaded pierside, requisitions should be submitted by using a DODAC in card columns 8 through 15 of DD Form 1348. When an aircraft carrier is scheduled to receive a deployment loadout by an ammunition cargo ship, the following actions should be taken

- Personnel aboard the assigned AE/AOE cargo ship send a message to personnel aboard the aircraft carrier advising them of the serviceable assets available in the cargo ship 65 to 55 days in advance of the cargo ship's scheduled onload date.

- The personnel aboard the aircraft carrier submit MILSTRIP requisitions by message for all items and quantities required but not available in the assigned cargo ship 55 to 45 days in advance of the cargo ship's scheduled onload date. Information copies of MILSTRIP requisitions are provided to personnel aboard the cargo ship. The supplementary address of the requisitions is the UIC of the loading activity. The RDD is the date that the loadout of the cargo ship commences. The remarks section of the requisitions contain DLVR (deliver) TO USS (the name of the cargo ship) FFT (for further transfer) USS (CV to receive the material).

At the same time the requisitions are submitted, the CV advises the cargo ship of the items and quantities required from the serviceable assets available in the cargo ship. The cargo ship then reserves these assets for the CV.

Requisitioning Procedures for Aircraft Squadrons

Aircraft squadrons ashore in CONUS submit requirements for all items to the supporting air station where the material will be loaded or expended. For example, a VF squadron located at NAS Oceana, Virginia, that needs ordnance for local training should submit its requirements to the weapons department as NAS Oceana, Virginia. A VA squadron located at NAS Cecil Field, Florida, that needs training ordnance at NAVSTA Roosevelt Roads, Puerto Rico, should submit its requirements to the weapons department at NAVSTA Roosevelt Roads. An aircraft squadron ashore outside CONUS submits all requirements to their supporting air station.

Aircraft squadrons or squadron detachments afloat submit requirements to the ship's weapons department according to current ship's instructions. Aircraft squadron support activities should first attempt to satisfy the squadron's requirements from on-hand assets (items already in stock). For those requirements that cannot be satisfied from on-hand assets, the support

activity will requisition the requirement. Requisitions must contain the UIC of the support activity in the MILSTRIP document number. The supplementary address must contain the UIC of the user squadron and the Signal code B. Ordnance should **not** be ordered by using the squadron's UIC as the requisitioner.

Aircraft squadrons and squadron detachments should submit requirements well in advance. The squadron should also keep the ship or support facility weapons department fully informed of their requirements. This will permit timely requisitioning to prevent shortfalls and minimize expensive problems that arise from emergency requisitions.

Requisitioning by United States Shore Activities Outside CONUS

United State shore activities outside the continental United States must maintain 100 percent of the routine fleet support requirement of their approved basic stock level of ammunition (ABSLA) either on hand or on order. When advised in advance of specific fleet requirements, additional stock should be requisitioned to meet the demand.

Normally, stock that satisfies the prepositioned war reserve material requirements, as shown in the ABSLA, are pushed to shore activities outside CONUS as assets when transportation becomes available. However, shore activities are responsible for maintaining complete round assets. Replacements should be requisitioned by the shore activity when components become unserviceable, issued, or expended.

All requisitions should be prepared in the format previously discussed in this chapter and submitted to the applicable inventory manager, listed in table 17-7. An information copy must be provided to CINCLANTFLT and NAVORDCEN.

Special Requisitioning Procedures for Missiles and Torpedoes

Special requisitioning procedures are part of an intensified management program to control critical assets and improve fleet readiness. Therefore, all air-launch missiles (including 8E COG material), such as the Seasparrow and Harpoon, must be submitted to the inventory manager and NOC Mechanicsburg, Pennsylvania, as indicated in table 17-8.

Requisitions must be submitted by naval message not earlier than 90 days but not less than 60 days before the RDD. The Seasparrow and Harpoon, when used as point-defense missiles, are classified as surface-launch missiles. They are managed by COMNAVAIRSYSCOM and not by COMNAVSEASYSCOM.

Requisitions for lightweight torpedoes must be prepared in message or DAAS MILSTRIP format. **Do NOT use DD Form 1348, and do not submit requirements by mail.**

There is a 90-day maximum and 45-day minimum requirement lead time when requisitioning torpedoes for complete loadouts and deployments. As a general rule, torpedoes are requisitioned in a torpedo-tube configuration, and air-launched accessories are requisitioned as individual items.

Warshot torpedo requisitions from afloat units are submitted directly to NOC with information copies to CINCLANTFLT, the immediate operational commander, and the activity where the torpedoes are to be loaded (supplementary address).

Requisitioning Procedures for Mine Exercise Training Material and Associated Services

A message request for mine exercise training (MET) material must be submitted to the appropriate mine assembly activity with the respective type commander as an information addressee. The

Table 17-7.—Requisitioning Channels for Ex-Continental United States Shore Activities

MATERIAL COGNIZANCE	SUBMIT REQUISITIONS TO	INFORMATION COPY TO	USE ROUTING IDENTIFIER
2E, 2T, 4T, 4E	NOC Mechanicsburg PA	CINCLANTFLT	NCB
6T	MINEWARENGACT Yorktown VA	CINCLANTFLT NOC	N79
8E	COMNAVAIRSYSCOM Washington DC	CINCLANTFLT NOC	N21
8S, 8T	COMNAVSEASYSCOM Washington DC	CINCLANTFLT NOC	N24
8U	Submit in accordance with COMNAVAIRLANTINST 8000.5 Series	AVNMATOLANT	N63

Table 17-8.—Requisitioning Channels for Air-Launched Missiles and SE COG Materials

MISSILE	SUBMIT TO	SEE NOTES
Sparrow (AIM-7)	COMNAVAIRSYSCOM (AIR-4122B) NOC Mechanicsburg	1, 2, 3
Seasparrow (RIM-7)	COMNAVAIRSYSCOM (AIR-4122B) NOC Mechanicsburg	1, 2, 3
Sidewinder (AIM-9)	COMNAVAIRSYSCOM (AIR-4122B) NOC Mechanicsburg	1, 2, 3
Phoenix (AIM-54)	COMNAVAIRSYSCOM (AIR-4122B) NOC Mechanicsburg	1, 2, 3
Walleye (AGM-62)	COMNAVAIRSYSCOM (AIR-4122B) NOC Mechanicsburg	1, 2, 3
Harpoon (A/R/UGM-84A)	COMNAVAIRSYSCOM (AIR-4122B) NOC Mechanicsburg	1, 2, 3
8E COG Containers	COMNAVAIRSYSCOM (AIR-4122B)	4

Note 1: Tactical and training ALMs can be ordered in the complete round configuration.

Note 2: All requisitions for training ALMs must include the planned date of firing in the remarks.

Note 3: Provide an information copy of all requisitions to CINCLANTFLT Norfolk, VA, COMPACMISTESTCENT PT Mugu, CA, OIC PACMISTESTCEN DETLANT Yorktown, VA, NAVSHIPWPNENGSTA Port Hueneme, CA, WPNSTA Yorktown, VA, and the type commander.

Note 4: Submit requisitions for 8E COG containers to COMNAVAIRSYSCOM Washington, DC, with information copies to CINCLANTFLT Norfolk, VA, NOC Mechanicsburg, PA, OIC PACMISTESTCEN DETLANT Yorktown, VA, and type commanders as soon as requirements are known but not later than 30 days prior to the RDD.

respective type commander must approve the material request before the appropriate MOMAG unit can release the material. Type commander approval must be received by the mine assembly activity at least 30 working days before the RDD. CINCLANTFLT, Commanding Officer, Mine War Command (COMINEWARCOM); Commanding Officer, Mobile Mine Assembly Group (COMOMAG); and the appropriate chain of command must be included as information addresses on all mine requests.

REQUISITION FILE MAINTENANCE

Thus far, you have learned about the procedures for requisitioning ammunition. However, you cannot merely submit requisitions and then sit back and expect all materials to be in place for loadout. Careful monitoring of actions taken on requisitions by the ammunition supply system and judicious expediting action is necessary to ensure the best possible loadout. The following paragraphs discuss actions required of the requisitioner to ensure that requisitions are processed expeditiously and are not lost.

Requisition Processing

Although there are many variations for specific items, requisitions normally follow a particular path. For example, a person aboard a ship submits requisitions to an ammunition stock point, such as a weapons station. If the stock point has the material requisitioned, it is reserved for the ship and issued to meet the RDD. If the stock point does not have the material. the requisition is referred to the inventory manager. The inventory manager does one of the following four things:

1. Refers the requisition to another stock point that has the material available or due in the RDD.

2. Refers the requisition to the U.S. Army Armament Material Command (ARRCOM) for issue by the Army.

3. Rejects the requisition. The requisitioner is notified of the reason why it cannot be filled, and unless otherwise advised, the requisition is canceled.

4. Refers the requisition to CINCLANTFLT or the type commander for possible redistribution of assets within fleet units. As a final alternative, CINCLANTFLT will attempt to redistribute fleet assets to meet the requirement.

Requisition Status

To keep units informed of action taken on their requisitions, MILSTRIP processing activities provide status follow-ups according to the Media and Status code selected in the requisition. Normally, status is provided to requisitioners by messages or punched and printed cards in MILSTRIP format.

MILSTRIP status documents contain a document identifier and a routing identifier. These identifiers denote the type of document and the sender of the status data. Supply status documents contain a Status code in card columns 65 and 66. For a current and complete description of MILSTRIP Status codes, refer to NAVSUP Publication 485.

Shipment status documents contain information regarding shipment. This includes date of shipment, mode of shipment, transportation control number, date available for shipment, and port of embarkation.

Requisitioners need not always accept the rejection/cancellation of a requisition as the final word. In some cases, requisitions are rejected/canceled because the RDD cannot be met. When a later RDD can be provided, the requisitioning unit should submit a MILSTRIP modifier with a request for reinstatement in the remarks section. Occasionally, the quantity requisitioned is questioned by the processing activity. This may happen when the quantity requisitioned exceeds the allowance or is not on allowance. Questions of this nature should be evaluated promptly and a reply forwarded to the processing activity. When the requisition is justified, say so and why.

Expediting Requisitions

Normally, ammunition requisitions are processed for delivery to the requisitioning activity by the ammunition supply system without problems. However, requisitions do become lost or delayed. To minimize this situation, there are several methods that can be used to review and expedite requisitions. These methods include follow-up, priority increase, and special assistance.

Aggressive submission of a MILSTRIP follow-up on an outstanding requisition is the first and best method of ensuring the requisition is not lost. All requisitions have some type of status requirement. Stock points and inventory managers are responsible for providing this status, and requisitioners should expect it.

MILSTRIP follow-ups should be submitted to the last known Navy holder after 14 days have elapsed since submission of the requisition or the last follow-up. You should continue to do this until a status is received. A follow-up should also be submitted whenever notification of backorder status (Status codes BB, BC, BD, or BP) has been received and there is an indication that delivery will not meet the RDD. Follow-up every 14 days until more positive status or confirmation of the delay is received.

There are three types of follow-up; each one is distinguished by a specific document identifier. When only the current status of a requisition is needed, you should use Document Identifier code AF1. A follow-up using a three-position document identifier in the code AT (series) is submitted when you are requesting the current status of a requisition. This follow-up serves as a replacement requisition when the supply source has no record of the previously submitted requisition. Activities located in CONUS should use Document Identifier code ATD, and activities outside CONUS should use AT4. The AT (series) Document Identifier codes are used only when status has not been received by the requisitioner. An AFC Document Identifier code is used to improve the estimated shipping date (ESD) when an unsatisfactory ESD has been received from the supply source.

A second follow-up method is to personally contact the holder of the requisition. This method should be reserved for more serious problems. It should NOT be used in a routine manner because it usually involves an extraordinary amount of time and effort for all personnel concerned

A third method of expediting requisitions is to raise the priority of the requisition. This can be done only when the F/AD is upgraded or when the urgency of the requirement increases (UND designator is raised). Normally, ships and units not deployed are assigned F/AD III. However, F/AD II is assigned to ships and units 60 days before and during deployment. Accordingly, requisitions submitted more than 60 days in advance of deployment use priorities authorized for F/AD III. When deployment is less than 60 days away, requisitioners may raise the priority to one of those authorized for F/AD II. Usually, when the priority is raised, the requisition rates a different M&S code.

While the requisitioner has the principal responsibility to monitor, follow-up, and expedite requisitions, there may be instances where the requisitioner is unable to do this. In these instances, assistance can be requested from CINCLANTFLT (for fleet requisitions) or from NOC (for requisitions of a shore activity outside CONUS).

Requisition Changes

When the need arises to change some part of a requisition, there are certain procedures you should follow. These procedures are discussed in the following paragraphs.

PRIORITY, MEDIA AND STATUS CODE, AND RDD CHANGES.— MILSTRIP provides a procedure for changing the priority, Media and Status code, and/or RDD of a requisition when either the F/AD or UND is

changed. To do this, a MILSTRIP modifier document is submitted as follows:

- For material to be delivered within CONUS. Use document identifier AMA when the requisition or the latest status contains an NSN. Use AMD when the requisition or latest status contains a DODAC. Use AME when the requisition or latest status contains either an NSN or a DODAC, and contains remarks.

- For material to be delivered outside CONUS. Use document identifier AM1 when the requisition or latest status contains an NSN. Use AM4 when the requisition or latest status contains a DODAC. Use AM5 when the requisition or latest status contains either an NSN or a DODAC, and contains remarks.

- Enter the new Media and Status code, priority and/or RDD. These are the only data elements of a requisition that can be modified by this procedure. Repeat all other MILSTRIP data as entered on the latest status document received or on the original requisition when no status has been received.

- For a requisition held by a weapons station, air station, NOC or NAVMINEGRFAC. Submit the MILSTRIP modifier by DAAS to the holder with an information copy to CINCLANTFLT.

- For a requisition held by ARRCOM or an Army ammunition activity. Submit a MILSTRIP modifier by DAAS to NOC with an information copy to CINCLANTFLT. Use routing identifier NCB.

- For a requisition held by COMNAVAIRSYSCOM or COMNAVSEASYSCOM. Submit a MILSTRIP modifier by naval message to the holder, Send an information copy to CINCLANTFLT, and use the subject line AMMO MILSTRIP MODIFIER.

ITEM OR QUANTITY CHANGE.— To change the item requisitioned, the requisitioner must cancel the old MILSTRIP requisition and submit a new MILSTRIP for the material desired. To increase the quantity requisitioned, the requisitioner must submit anew requisition for the additional quantity required. To decrease the quantity requisitioned, the requisitioner must submit a MILSTRIP cancellation request only for the quantity no longer required. By doing this, the uncancelled balance remains active and no lead time is lost.

REQUISITION CANCELLATION.— A requisition can be canceled by the requisitioner, the supplementary addressee, or CINCLANTFLT (as monitoring activity) when the requirement for the material no longer exists. The requisition can also be canceled when the ship is scheduled to deploy before the material is expected to be received, and shipment outside CONUS is not desired.

A MILSTRIP request for cancellation should be prepared by duplicating the latest status or, if no status has been received, the original requisition with the following exceptions:

- Use document identifier AC1.
- Use the routing identifier of the last known holder of the requisition.
- Enter the quantity to be canceled in the quantity field.

Ammunition supply activities that receive a requisition cancellation request are required by MILSTRIP to provide the requisitioner, supplementary addressee, and CINCLANTFLT with either a cancellation confirmation or shipment status (if the material has already been shipped) within 5 days after receipt of the AC1 document.

If confirmation of the cancellation or shipment status is not received within 10 days after submitting the cancellation request, you should take immediate follow-up action. The follow-up document must use document identifier AK1 and be prepared and submitted in the same format as the cancellation request.

Fleet units are required to cancel all outstanding requisitions upon departure for deployment. Shore activities review all outstanding requisitions annually and determine whether the material was received or is still required. Requisitions for material not received and no longer required are canceled. Requisitions must be resubmitted for materials that are still required.

AMMUNITION TURN-IN PROCEDURES

Procedures for turn in of ammunition, ammunition details, and the procedures for temporary storage and custody ashore are discussed in this section. It is impractical to cover every procedure for every conceivable ammunition item. Therefore, the discussion is limited to the more routine procedures. Regardless of the particular type of ammunition or ammunition details you are turning in, NAVSEA OP 4 and NAVSEA OP 5, volume 1, requires that all inert components, details, and cartridge cases be inspected and certified that the containers are inert. It is extremely important that you strictly adhere to these regulations. It is imperative that all applicable personnel be thoroughly familiar with the procedures required for inspection, certification, and marking of empty or inert items.

Turn-in of Air-Launch Missile Material

Ships must turn in air-launch missiles (ALMs) and ALM material (including wings and fins) before a regular overhaul. Upon return from deployment, CVs are normally directed to turn in or transfer all ALMs and ALM material to another ship or activity ashore. This does not include inert rounds used for training missile handling crews.

Present ALM maintenance policy permits ships to retain all serviceable deep-stowed ALMs, including ALMs on cargo load ships, until the maintenance due date (MDD) of the missile has been reached. Deep-stowed ALMs are missiles that have not been removed from their sealed shipping container. When a CV turns in missiles that have remained in deep-stowage and the MDD has not expired, the accompanying paperwork is normally marked ready for issue (RFI). When the shipping seals on the missile container are broken, or the missile is removed from the shipping container for any reason or the MDD has expired, the accompanying paperwork should be marked not ready for issue (non-RFI).

Serviceable assets from deep stowage that are turned in must be repackaged and tagged according to current directives. Unserviceable assets, including captive-flown missiles, missiles in ready-service stowage, and Seasparrow missiles carried on launchers must be segregated, packaged, and tagged according to current directives, and then routed to WPNSTA Yorktown, Virginia. Documentation is prepared on a DD Form 1348-1 according to the procedures discussed in the following paragraph.

Turn-in of Ammunition

When it is necessary to turn in ammunition two preliminary steps must be taken. First, when complete download is necessary, notify CINCLANTFLT, TYCOM, and weapons station or receiving ship by message of all the items to be off-loaded. In the message, identify all items by NALC, quantity, and the date of proposed download. Second, prepare a DOD Single-Line Item Release/Receipt Document, DD Form 1348-1, for each type of ammunition to be off-loaded

Preparation of DD Form 1348-1

When you prepare the DD Form 1348-1, there are certain data blocks that must be filled in. Other data blocks can be used when required for a particular situation. The following procedures describe the required information entered in these data blocks. See figure 17-13.

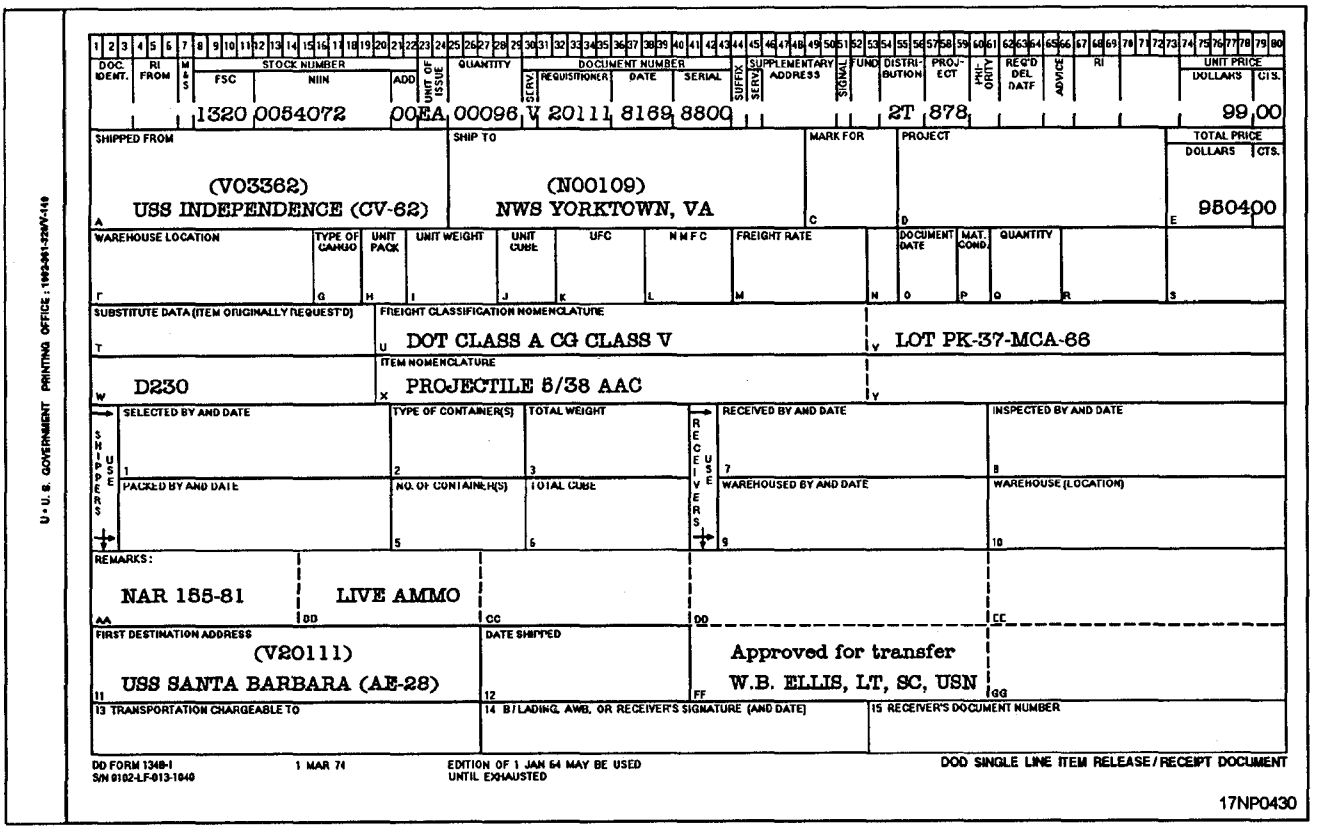


Figure 17-13.—DD Form 1348-1.

manual. This person is normally the ordnance handling officer.

Turn-In of Ammunition Details

Ammunition details are devices designed to protect explosives and/or facilitate their handling. They include boxes, containers, pallets and accessories, protective caps, tanks, and brass and steel cartridge cases. Many of these items are expensive to procure. It is essential for ammunition users and support activities to cooperate by ensuring these ammunition details are returned for reuse.

NOCINST 8010.2 (series), chapter IV, sections 1 and 2, lists the details and cartridge cases that must be returned. Ships and shore activities outside CONUS that make ammunition expenditures must retain all serviceable or repairable details and, at the earliest opportunity, initiate their shipment to the consignee listed in NOCINST 8010.2. Ammunition details and cartridge cases that are unserviceable or unrepairable should be turned in to the nearest property disposal office as saleable scrap.

Each shipment of ammunition details must be accompanied by a DOD Single-Line Release/Receipt Document, DD Form 1348-1, and prepared as follows:

DATA BLOCKS 23 AND 24. Enter GP.2.

DATA BLOCKS 25 THROUGH 29. Enter 00001.

DATA BLOCKS 30 THROUGH 43. Enter the document number.

DATABLOCK A. Enter the Service code, UIC, and the name of the activity turning in the material.

DATA BLOCK B. Enter the Service code, UIC, and name of the ultimate consignee, if known.

DATA BLOCKS U AND V. Enter SHIP TO CONUS AMMO STOCK POINT when the ultimate consignee is unknown.

DATA BLOCK X. Enter AMMO INERT ITEMS.

DATA BLOCK 2. Enter MC.

DATA BLOCK 5. Enter the number of containers.

DATA BLOCK 11. Enter Service code, UIC, name, and hull number of the ship/activity where the material will be turned in (when not the final destination).

DATA BLOCK FF. Enter CERTIFIED TO BE INERT.

DATA BLOCK GG. Enter APPROVED FOR TRANSFER.

TEMPORARY STORAGE AND CUSTODY ASHORE

Ships occasionally need to off-load ammunition for temporary storage and custody ashore. When this is necessary, the authority to off-load ammunition for temporary storage and custody ashore must be obtained from both the ship's type commander and from the activity where the material will be stored. The number of days of temporary storage must be stated, not to exceed a maximum of 45 days. If more than the maximum period is desired, an extension may be requested from the type commander.

For transaction reporting and inventory control purposes, ammunition in temporary custody ashore is considered aboard the ship and is carried on the ship's stock records. Therefore, personnel aboard ship do not submit an off-loading transaction report. Consequently, a receiving transaction report is not submitted when the ammunition is physically returned. In the recent past, confusion has resulted when personnel aboard ship forgot certain items were in temporary custody ashore. Personnel aboard ship must ensure stock record cards are carefully annotated to reflect items in temporary custody ashore.

The activity storing the material must keep all ammunition in temporary custody physically separate. This is necessary because the ammunition is not recorded on the activity's stock records as assets ashore. Rework or maintenance is not done on items temporarily stored ashore nor is unserviceable material replaced. The material is returned to the ship exactly as it was received for temporary custody ashore.

In summary, the primary advantage of temporary storage and custody ashore is that a ship retains its assets. Personnel aboard the ship do not have to reorder and run the risk of not getting everything ordered. The disadvantages are that items can be forgotten and subsequently lost, or items can become suspended/unserviceable and require last-minute replacement.

REVIEW NUMBER 2

Q1. Where is the Naval Ordnance Center located?

Q2. What classes of ships carry cargo load ammunition ?

Q3. How are NARs numbered?

DATA BLOCKS 8 THROUGH 22. Enter the NSN of the item. The NSN can be found in TW010-AA-ORD-010/NAVAIR 11-1-116A.

DATA BLOCKS 23 AND 24. Enter the unit of issue. Combatants (such as CVs) should always use the abbreviation RD (rounds) for the unit of issue.

DATA BLOCKS 25 THROUGH 29. Enter the quantity that is turned in.

DATA BLOCKS 30 THROUGH 43. Enter the local document control number.

DATA BLOCKS 55 AND 56. Enter the cognizance symbol of the material.

DATA BLOCKS 57 THROUGH 59. Enter one of the Project codes listed in table 17-9. When none of the Project codes listed in table 17-9 fit the reason for turn-in, leave these data blocks blank

DATA BLOCKS 74 THROUGH 80. Enter the unit price as listed in TW010-AA-ORD-010/NAVAIR 11-1-116A.

DATA BLOCK A. Enter the Service code, UIC, name, and hull number of the ship.

Table 17-9.—Project Codes

PROJECT CODE	MEANING
878	Off-load in exchange
879	Off-loaded because of a CASREP
883	Ordnance being returned from ex-CONUS activity
884	Off-load because of allowance change
885	Off-load because of cargo load adjustment
888	Off-load because of ship deactivation
889	Off-load for homeporting purposes
891	Download for regular overhaul
892	Download for restricted availability
897	CV post-deployment download to a weapons station
898	CV post-deployment download by AE/AOE/AOR/AOJ

DATA BLOCK B. Enter the Service code, UIC, and the name of the ship or activity (hull number, if applicable) that is to receive the material.

DATA BLOCK E. Enter the total extended price by multiplying the unit price by the quantity being shipped.

DATA BLOCK P. Enter the appropriate material Condition code. Material condition codes are listed in *Conventional Ammunition Integrated Management System (CAIMS),* NOCINST 8010.2 (series), chapter I, section 2, attachment C.

DATA BLOCK U. Enter the DOT class and CG class.

DATA BLOCK V. Enter the lot number and/or serial number, if required. When an air-launch missile is being shipped, the missile serial number and MDD must be entered in this data block. When shipping several missiles, you may have to list the serial numbers and MMDs on a separate sheet of paper and attach it to the reverse side of the DD Form 1348-1.

DATA BLOCK W. Enter the DODIC/NALC of the material. A separate DD Form 1348-1 must be used for each DODIC/NALC shipped.

DATA BLOCK X. Enter the noun name of the item as listed in TW010-AA-ORD-010/NAVAIR 11-1-116A.

DATA BLOCK 2. Enter the type of container used.

DATA BLOCK 5. Enter the number of containers.

DATA BLOCK AA. Enter the Navy ammunition reclassification (NAR) number or other remarks that explain the reason for turn-in.

Immediately upon receipt of a NAR, commands should determine whether stocks on hand include any of the affected lots or types listed on the NAR. Action must be taken to ensure that the use or issue of affected ammunition is consistent with the newly assigned Condition code. When required, package and ship the ammunition as directed by the NAR. Activities are required to make reports regarding NARs. Negative reports are also required.

DATA BLOCK BB. Enter either LIVE AMMO or INERT AMMO, as applicable.

DATA BLOCK FF. For inert items only, enter CERTIFIED TO BE INERT.

DATA BLOCK GG. Enter APPROVED FOR TRANSFER and the name of the person approving the transfer. All turn-ins must be approved for transfer by the signature of the accountable officer or petty officer specified in the activity's organization and regulations

Q4. What is meant by the term "unserviceable ammunition"?

Q5. What is the purpose of requisition lead times?

Q6. Aircraft squadrons afloat submit their requisitions to what department?

TRANSACTION REPORTING

LEARNING OBJECTIVE: *Identify transaction reporting procedures and describe the various types of transaction reports, the procedures to be followed when preparing the ammunition master stock record card, and the ammunition lot/location card.*

Reports of ammunition transactions form the basis for maintenance of the CAIMS data file. This file, in turn, is the sole source of asset and expenditure information for ammunition logistics management. The high cost and limited availability of many munitions create a need at all command levels for continuous, intensive, and careful management of ammunition. This can only be done if the CAIMS data file is current and reliable. Therefore, it is very important for individual reports of ammunition transactions to be accurately prepared and forwarded in a timely manner. Ammunition reports are normally forwarded by routine message and NOT by speedletter or naval letter.

TRANSACTION REPORTING PROCEDURES

The ammunition transaction report (ATR) is prepared in a message format, as prescribed by NOCINST 8010.2 (series), and transmitted electrically. The message report consists of 7 paragraphs. Paragraphs 1 through 5 identify the number of transactions being reported, the serial number of the report, UIC of the reporting activity, the Action Class Code (ACC) of the reporting activity, and the date of the transaction respectively.

Paragraph 6 provides specific information on the type of transaction, type of material, quantity of material involved in the transactions, on-hand assets of the material, and other data pertinent to the transaction. This section may contain one or more lines. Each line corresponds to a single transaction involving one type of material. All reportable transactions should be included in this paragraph, whether or not the items are included in paragraph 7 of the report.

Paragraph 7 is for remarks concerning weapon serial numbers and other explanatory data, as required.

Report Frequency

Whenever an ammunition transaction occurs (transfer, receipt, expenditure, reclassification), an ATR should be submitted within 24 hours. Normally, reports are submitted daily at the end of the flying day. Occasionally, during certain tactical operations, the command restricts message transmissions to those that directly affect a particular operation. This restriction is called MINIMIZE. Transmission of ammunition transaction reports during MINIMIZE is authorized

There are exceptions to submitting ammunition transactions within 24 hours. Ammunition onloaded or off-loaded by AE/AOE/AOR/AOJ/CV class ships in excess of 500 short tons is reportable within 2 days.

Ammunition received by a ship or shore activity for further transfer (FFT) to another ship or shore activity is not reportable, providing it is transferred to the ultimate consignee within 7 days. Ammunition received FFT and held for more than 7 days must be reported as being received. In the remarks paragraph indicate RCVD FM (issuing activity) FFT (consignee). When the subsequent issue is completed, an offsetting report of the issue must be made. Ammunition transferred to an activity FFT to another activity must be reported as an issue. In the remarks paragraph show ISSUED TO (receiving activity) FFT (ultimate consignee).

Ammunition Transaction Report Format

ROUTINE precedence is normally assigned to an ammunition transaction report. However, higher precedence can be assigned when authorized by proper authority. A transaction report is classified only when the data contained in paragraph 6 or 7 of the report is classified. Paragraphs 1 through 5 are always unclassified

A report that contains data in paragraph 6 on complete-round missiles, rockets, or torpedoes is CONFIDENTIAL. These reports should be declassified 6 years after the date-time group of the ammunition transaction report. This should be typed on the ATR at the left-hand margin on the first line after the last line of text as follows: DECL (enter day, month, and year for declassification).

When paragraph 6 contains data on mines or mine components, the ATR must be classified according to OPNAVINSTS5513.7 (series). When data on complete onloads or off-loads is contained in paragraph 6, the

ATR is CONFIDENTIAL and declassified (DECL) after 6 years.

ATRs are CONFIDENTIAL when paragraph 7 contains reports of expenditures of tactical missiles or remarks classified by other directives.

All ATRs should be submitted to NOC Mechanicsburg, Pennsylvania, with an information copy to CINCLANTFLT. Reports submitted by deployed units must also include CINCUSNAVEUR and COMSERVFORSIXTHFLT as information addressees. Reports that contain information relative to lightweight torpedoes must also include the activity's type commander as an information addressee. Reports that contain information relative to mine material must also include COMINEWARCOM and COMOMAG as information addressees. Activities afloat that receive ammunition from or issue ammunition to another afloat activity must ensure the issuing/receiving activity is an information addressee on the ATR.

The subject line of the ATR is SUBJ: AMMO TRANS RPT CINCLANTFLT 8010.4. The remainder of the ATR should be completed in the following format.

Paragraph 1. Enter the number of NALCs included in paragraph 6 of the report. Spell out the numbers. For example, when you are reporting 47 items in paragraph 6, you should make the entry ITEMS: FOUR SEVEN.

Paragraph 2. Enter the sequential serial number of the report. Spell out the digits. Initial ATR serial numbers begin with the number 1 (for a newly commissioned command) and subsequent reports are numbered through 999. At this point, only the sequence will recommence with the number 1. You do NOT revert to serial number 1 at the beginning of a new calendar/fiscal year. All ATRs released from one activity, regardless of ammunition type or activity classification, are numbered in the same sequence. These serial numbers are used by NOC to detect missing reports. For example, you should enter the serial number 897 as SER: EIGHT NINE SEVEN.

Paragraph 3. Enter the UIC. This entry is made by using the check-sum-digit method. For example, assume the UIC is 36725. You should enter this as UIC: 36725/3.

Paragraph 4. Enter the activity classification letter code. Spell out the letter code. For example, ALFA, BRAVO, DELTA. When the day's transactions involve more than one activity classification, you must report each activity classification on separate reports by using the same date but different serial numbers. Refer to table 17-10 for a list of activity Classification codes.

Paragraph 5. Enter the Julian date on which the transaction actually occurred, NOT the date the message is prepared. The Julian date is entered by using the check-sum-digit method. For example, if the transaction occurred on March 20, 1988, the date would be entered as DATE: 88080/4.

Paragraph 6. The data entered in this paragraph must be arranged in columnar format. Each column is lettered from A through N, and a letter must head each column. However, when a column or a number of columns have a zero quantity, it need not be listed. The data to be reported in each column is as follows:

REVIEW NUMBER 2 ANSWERS TO QUESTIONS Q1. THROUGH Q6.

A1. The *Naval Ordnance Center is located in Mechanicsburg, Pennsylvania.*

A2. The classes of ships that carry cargo load ammunition are AOE, AO, AOR, and AE.

A3. NARs are numbered consecutively within each calendar year.

A4. The term "unserviceable ammunition" refers to ammunition that is not ready for use and cannot be made serviceable.

A5. The purpose of requisition lead times is to allow for adequate processing time of requisitions so that mission requirements can be met on time.

A6. Aircraft squadrons afloat submit their requisitions to the ship's weapons department.

Table 17-10.—Activity Classifications

LETTER CODE	CLASSIFICATION
ALFA	Combatant ships and submarines reporting shipfull ammunition transactions. Destroyer-type ships should report ordnance carried for assigned helicopter detachments under this activity classification.
BRAVO	Auxiliary ships reporting shipfill ammunition transactions for their own use.
DELTA	Ships and NAVSUBSUPPFAC New London reporting fleet issue ammunition (cargo load or mission load) transactions, including aircraft squadron expenditures.
ECHO	Aviation Support Activity. Any shore activity holding fleet issue ammunition in support of aviation units. Report all of the ammunition to be held at the activity as ECHO, except that all Marine Corps Class V assets are to be reported under activity classification JULIET.
FOXTROT	Ammunition Support Shore Activities. Any shore activity holding fleet issue ammunition for units other than aviation units. Report all ammunition held at the activity under activity classification FOXTROT, except that all Marine Corps Class V assets are to be reported under activity classification JULIET.
GOLF	Other overseas activities and organizational unit commands holding expendable ordnance items for local support, local defense, or to carry out their primary mission.
HOTEL	Ships holding Marine Corps Class V (A) (LFORM) assets.
JULIET	Shore activities holding Marine Corps Class V (A and W) assets.
KILO	All activities holding nonservice mine assets. Service mine assets will be reported under activity class FOXTROT.
LIMA	Ships holding ordnance on board in support of an Underwater Demolition Team (UDT), Sea-Air-Land (SEAL) Team, Explosive Ordnance Disposal (EOD) Team, Amphibious Construction Unit (ACU), Amphibious Construction Battalion (ACB), or Naval Mobile Construction Battalion (NMCB).
NANCY	Ships holding Marine Corps Class V (W) L Form assets.

COLUMN A. Enter the NALC of the item for the transaction being reported. Column A is a mandatory entry. When more than one NALC is being reported, they should be listed alphabetically.

COLUMN B. Enter the quantity on hand as of the last report concerning the item. This quantity is obtained from the sum of column L and column M of the previous report.

COLUMN C. Enter the total number of units received from all sources. This includes receipts moved from one activity classification to another classification, ammunition held more than 7 days for FFT to another activity, and gains by inventory (GBI).

COLUMN D. Enter the total number of units transferred (issued) for custody to another activity, or intra-activity transfers from one activity classification to another. With the exception of lightweight torpedoes, this column does not concern issues to aircraft squadrons. Assets transferred to a non-Navy activity are reported in column K.

COLUMN E. Enter expenditures in support of combat operations or against a hostile target. This includes ammunition jettisoned by an aircraft for the purpose of landing during a combat mission.

COLUMN F. Enter expenditures for training. This includes combat readiness assessment exercises and operational readiness inspections.

COLUMN G. Enter expenditure of material for test and evaluation purposes.

COLUMN H. Enter expenditure of material for noncombat operational purposes (an activity's assigned mission), such as search and rescue, contact evaluation, firepower demonstrations, and humanitarian or lifesaving missions. Firings for which no training allowance is established, such as test primers, pyrotechnics, markers, offensive hand grenades, and saluting charges, are also entered in column H.

COLUMN I. Enter expenditure of material because of destruction, jettison, or deepwater dump. This column should be used only to report actual disposal. It should NOT be used to report transfer of material for disposal. The latter should be reported as an issue.

COLUMN J. Enter expenditure of material because of loss by inventory (LBI). LBIs must be accompanied by amplifying remarks in paragraph 7 of the ATR.

COLUMN K Enter expenditure of material because of transfer/issue to the Army, Air Force, Coast Guard, or foreign governments.

COLUMN L. Enter the quantity of serviceable on-hand assets.

COLUMN M. Enter the quantity of unserviceable/ suspended on-hand material.

COLUMN N. Enter the MILSTRIP document number. NOC maintains an in-transit file of all issues from CONUS shore activities to fleet units. To clear or offset this file, receiving activities must show the MILSTRIP document number for each receipt from a CONUS shore activity, including CV loadouts by an AE/AOE class ship.

You should take care to ensure entries under each report column in paragraph 6 are aligned. When the number of characters in a line exceeds the communications capacity, the columns should be split between columns K and L. This split will place columns L, M, and N on a different line of the report.

When it becomes necessary to correct the quantity on hand as of the last report (column B), appropriate entries are entered in the receipts, issues, or expenditure columns of the current ATR to mathematically balance and adjust the on-hand totals to the correct totals. To ensure all entries are understandable, you can provide narrative remarks in paragraph 7 of the ATR.

You must ensure components reported as combat or training expenditures correctly reflect complete rounds. For example, when your unit expended 100 Mk 82 bombs with mechanical nose fuzes and conical fins, you have to expend each individual component under its respective NALC. You would expend 100 Mk 82 bombs, 100 mechanical nose fuzes, 100 conical fins, and 100 arming wires.

You should ensure transaction reports are submitted when assets are shifted from serviceable to unserviceable. After filling in the appropriate columns, ensure each line in the report is mathematically balanced. For example, columns B+C-D-E-F-G-H-I-J-K = L+M. All entries are in the check-sum-digit format.

Paragraph 7. Enter narrative remarks, as appropriate. All GBIs are identified in this paragraph as well as column C of paragraph 6. All LBIs are identified by an entry in column J of paragraph 6 and a detailed explanation (including the date-time group) of the missing, lost, stolen, recovered (MLSR) report that was submitted. When ammunition is missing, lost, stolen, or recovered, *Missing, Lost, Stolen Government Property, Reporting of*, SECNAVINST 5500.4 (series), requires that a report be submitted. Paragraph 7 is used to identify activities that issued and/or received the materials. When materials are reclassified you should give the NALC of the item and authorization for the reclassification. This paragraph is also used for reporting items accounted for by serial number, lot number, or registration number.

Issues To Aircraft Squadrons

Aircraft Squadrons are not CAIMS reporting activities (except for sonobuoys). Therefore, all issues to aircraft squadrons are converted by CAIMS to training expenditures. Ordnance normally loaded and retained aboard aircraft (CADs) or retained in custody of the squadron (inert training ordnance) is reported as expended at the time of issue. Ordnance of this nature that is subsequently turned in by an aircraft squadron is reported as a receipt.

For ordnance that is normally unloaded after a mission (bombs, rockets, missiles, or torpedoes), no report of issues or expenditures should be made unless the ordnance was actually expended. Squadrons are responsible for advising their support unit/activity of the ordnance actually expended (by expenditure category), returned, and/or retained. Upon notification of actual expenditures, the support unit/activity should submit the appropriate transaction report.

Serial/Lot Item Tracking (SLIT)

SLIT is required for air-and surface-launch missiles and boosters. SLIT provides for the complete tracking of certain items from birth to death by their unique serial or lot number.

Table 17-11.—ALM Leading Serialized Components

ALM	LEADING SERIALIZED COMPONENT	EXAMPLE
Sidewinder (AIM-9)	Guidance and Control Group	DZX1234
Sparrow (AIM-7)	Target Seeker	R1208-B-2
Shrike (AGM-45)	Guidance Section	1234
Harpoon (AGM-84)	Warhead	L123
Phoenix (AIM-54)	Guidance Section	20001
Walleye (AGM-62)	Warhead	EQX1002

Fleet units must SLIT-report onloads from or offloads to CONUS shore activities. They must also report intership transfers (including FFT material involving a shore activity), expenditures, and Condition code changes of all-up-rounds (AURs) and components. SLIT reporting is required of both the receiving and issuing ships when an intership transfer is involved The receiving/issuing ship must address each other for information on ATR message submissions. This requirement enables each ship to verify the transfers, correct discrepancies, and submit appropriate modified ATRs to NOC.

All items that require SLIT reporting are contained in TW010-AA-ORD-010/NAVAIR 11-1-116A, and are identified by material control codes B, C, and E. A few of the most common SLIT-reported items are discussed in the following paragraphs.

AIR-LAUNCH MISSILES.— Air-launch missiles (ALMs) require SLIT tracking; consequently, whenever a reportable transaction occurs, appropriate entries must be made in paragraph 7 of the ATR

The serial number of an ALM is determined by the serial number of the leading serialized component of the missile and should be reported, regardless of the ALM configuration. The tracking of these serial numbers should be reported from individual unassembled components up to an AUR. The leading serialized components of ALMs are shown in table 17-11.

In addition to the missile serial number, the maintenance due date (MDD) and the Type Maintenance Due code (TMDC) must be reported when a missile is removed from deep stowage to a ready-service locker, or when a missile has been captive-flown. To indicate either condition, a transaction report should be submitted initially for each removal or captive flight of a missile. The report should show the missile serial number, MDD, and TMDC. After the initial report, it is unnecessary to make subsequent reports of deep-stowage removals or captive flights on a specific missile.

SURFACE MISSILES.— The issuing, receiving, stowing, and reporting of surface missiles are the responsibility of the weapons department aboard aircraft carriers. Surface missiles aboard aircraft carriers are part of the ship's point defense system. Surface missiles are SLIT-reportable items, and are reported in the same manner as discussed for ALMs. Table 17-12 provides examples of surface missile serial number locations.

Table 17-12.—Surface Missile Leading Serialized Components

SURFACE MISSILE	LEADING SERIALIZED COMPONENT	EXAMPLE
Terrier BT (RIM-2D)	Electronic Section	4933
Terrier HT (RIM-2F)	Warhead Shroud	5012
Terrier Booster	Booster	C1131R
STD ER (RIM-67)	None	7834F
STD MR (RIM-66)	None	5621M
Tartar (RIM-24)	Aft Section	2334
Seasparrow (RIM-7)	Target Seeker	R1209-B-2
Harpoon (RGM-84)	Warhead	L136

Other items that require SLIT reporting are warshot and exercise torpedoes and underwater mines. Additionally, Mk 75 DST modification kits and Mk 503 test sets require tracking. Therefore, the receiving and issuing activities must provide the Mk/Mod of each Mk 75 DST modification kit and the Mk/Mod and serial number of each test set issued or received in paragraph 7 of the ATR

TRANSACTION REPORTS

You should now be familiar with the general procedures for submitting ammunition transaction reports. The following paragraphs provide you with a few typical reporting situations and illustrations of completed ATRs.

Receipt Transactions

An example of an ATR indicating receipt from a shore activity is shown in figure 17-14. The informational content of the ATR shown in figure 17-14 is explained in the following paragraphs:

R 152332Z JUN 88. This number represents the date-time group (DTG) of the message. The DTG is assigned by the local communications center. This

R 152332Z JUN 88

FROM: USS NIMITZ
TO: NAVORDCEN MECHANICSBURG PA
INFO: CINCLANTFLT NORFOLK VA

UNCLAS //N08010//
SUBJ: AMMO TRANS RPT CINCLANTFLT 8010-4

1. ITEMS TWO

2. SER EIGHT FOUR

3. UIC 03368/0

4. ACT CLASS DELTA

5. DATE 88166/5

6.

A	B	C	L	N
H542/1	220/4	200/2	420/6	V03368/3280/8634/4
J421/7	0/0	400/4	400/4	V03368/3280/8365/5

7. REMARKS: RCVD FM WPNSTA YORKTOWN.

Figure 17-14.—ATR showing receipt from a shore activity.

number is very important because it provides the only means of tracking/referencing the message after it is transmitted. The message is designated as R (Routine) precedence. The DTG provides you with the date (15), time (2332Z), month (JUN), and the year (88) of the message. The message DTG is assigned by the communications center only after the message has been properly drafted and released.

FROM: USS NIMITZ. ATRs are always from the ship/unit submitting the report.

TO: NAVORDCEN MECHANICSBURG PA. All ATRs are addressed for action to NOC.

INFO: CINCLANTFLT NORFOLK VA. The number of commands addressed for information on an ATR varies. This depends primarily upon the type of transaction being reported. In any case, CINCLANTFLT is always an information addressee.

UNCLAS //N08010//. ATRs are either unclassified or classified, depending upon the type of transaction being reported and/or by the information contained in paragraph 6 or 7 of the report. In this case, the ATR is unclassified. The Standard Subject Identification Code (SSIC) is the last element of the classification line, and it is required on most naval messages. The SSIC is derived from SECNAVINST 5210.11 (series). The SSIC consists of a six-character code preceded and followed by two slant signs. It is used as a message processing aid and by communication centers for internal message distribution. For ATRs the SSIC is always //N08010//.

SUBJ: (Subject) AMMO TRANS RPT CINCLANTFLT 8010-4. This is the subject line of the ATR AMMO (ammunition) TRANS (transmittal) RPT (report) CINCLANTFLT 8010-4.

1. ITEMS TWO. Two indicates the total number of items reported in paragraph 6.

2. SER EIGHT FOUR. The serial number of the report is 84.

3. UIC 03368/0. The originator's Unit Identification Code. The check-sum-digit procedure was used as previously discussed.

4. ACT CLASS DELTA. This is the ACT (activity) CLASS (classification) line. For an explanation of activity classification DELTA, refer to the activity classifications listed in table 17-10.

5. Date 88166/9. The ATR was submitted on the 166th day of 1988 and the check-sum-digit is 9.

6. This paragraph reflects the NALCs for which the transactions are being reported, the on-hand quantity of items, quantity received, serviceable on-hand quantity, unserviceable/suspended quantity on hand, requisition document number, and narrative remarks.

Column A. This column shows the NALCs for which the transaction is reported. The NALC is listed directly beneath column A; subsequent NALCs are located directly under the preceding NALC. NALCs should be arranged in alphanumeric sequence. Remember, the NALC is always a mandatory entry.

Column B. This column shows the on-hand quantity of the item as of the last report. The last ATR serial number submitted for a particular NALC can be easily obtained by referring to the Ammunition Master Stock Record Card (discussed later in this chapter). After obtaining the last report for a particular NALC, add the digits in column L (serviceable on-hand) and column M (unserviceable/suspended on-hand) to obtain the sum. This sum provides the total quantity on hand and is entered in column B.

Column C. This column shows the quantity received. When all the items under an NALC are shipped from the same UIC, the total amount should be entered in column C. When some of the items under the NALC are received from more than one UIC, an entry must be made in paragraph 7 to show the shipping activities.

Column L. This column shows the new serviceable on-hand quantity. The sum of columns B and C provides you with the new serviceable on-hand quantity.

Column M. This column shows the unserviceable/suspended quantity on hand. When this quantity has not changed since the last report, no entry is required. When items reported under the NALC have become unserviceable or suspended since the last report, an entry reflecting the new balance must be made under column M. Remember, the quantity added to column M must be deducted from column L.

Column N. This column shows the requisition document number of the material shipped.

7. REMARKS: This paragraph contains the name(s) of the activity(ies) that shipped the material. When the material involved in the transaction requires SLIT, the appropriate information is entered in this paragraph. Remember that all numerical entries require check-sum-digit procedures.

Gains and Losses by Inventory Reports

An example of an ATR with GBIs and LBIs is shown in figure 17-15. The reporting of GBIs is basically the same as previously discussed for reporting receipts. In figure 17-15, NALC A662 is reported as a GBI. Column A lists the NALC, column B lists the total quantity on hand as of the last report, column C lists the quantity gained by inventory, and column L lists the new total-on-hand balance. NALC A662 is entered in paragraph 7 of the report as a GBI with a brief explanation.

The ATR also shows NALCs A661 and M128 as LBIs. Note that column A lists the NALC, column B lists the total quantity on hand as of the last report, column C lists the quantity received as zero because no material was received, column J lists the quantity LBI, and column L lists the total quantity remaining. The column J quantity must be deducted from the quantity in column B. An entry is made in paragraph 7 of the report showing NALCs A661 and M128 as LBIs. The LBI involving NALC A661 was an error in reporting, and no further action is required. Since the loss of NALC M128 cannot be determined, an MLSR report was submitted and the date-time group of that message is indicated.

Receipts and Issues for Further Transfer Reports

An example of the ATR showing receipts and issues FFT is shown in figure 17-16. Since the material involved is FFT to *USS Saratoga* and *USS America,* these two ships are information addressees on the ATR

R 151810Z JUN 88

FROM: USS INDEPENDENCE
TO: NAVORDCEN MECHANICSBURG PA
INFO: CINCLANTFLT NORFOLK VA

UNCLAS //N08010//
SUBJ: AMMO TRANS RPT CINCLANTFLT 8010-4

1. ITEMS THREE

2. SER ONE SIX TWO

3. UIC 03362/4

4. ACT CLASS DELTA

5. DATE 88166/5

6.

A	B	C	J	L
A661/3	16800/5	0/0	1200/3	15600/2
A662/4	12000/3	1200/3	0/0	13200/6
M128/1	200/2	0/0	100/1	100/1

7. REMARKS:

NALC A661/3 LBI NALC A662/4 GBI DUE TO ONE PALLET (2400 RDS) MIXED HALF-HALF BOTH NALCS RCVD AS NALC A661/3. NALC M128/1 LBI. MSLR SUBMITTED. USS INDEPENDENCE 151800Z JUN 84 APPLIES.

NOTE: Missing, lost, stolen, or recovered (MSLR) reports are required for gains/losses of sensitive ordnance IAW SECNAVINST 5500.4 (Series). Remarks (paragraph 7) should include date-time group of message for subject MLSR. A detailed explanation for losses other than sensitive ordnance items that do not require an MSLR submission is still required in the REMARKS section of the ATR.

Figure 17-15.—ATR showing gains and losses by inventory.

R 221830Z JUN 88

FROM: USS SEATTLE
TO: NAVORDCEN MECHANICSBURG PA
INFO: CINCLANTFLT NORFOLK VA
USS SARATOGA
USS AMERICA

C O N F I D E N T I A L //N08010//
SUBJ: AMMO TRANS RPT CINCLANTFLT 8010-4 (U)

1. (U) ITEMS TWO

2. (U) SER ONE EIGHT FIVE

3. (U) UIC 05848/5

4. (U) ACT CLASS DELTA

5. (U) DATE 88173/3

6.

(C) A	B	C	D	L	N
PA68/4	9/9	0/0	1/1	8/8	
1611/9	3/3	1/1	0/0	4/4	N03366/3104/8321/0

7. (U) REMARKS:

NALC	SERIAL	MDD	FM/TO
1611/9	5108/4	0482/4	RCVD FM NWS YORKTOWN FFT USS AMERICA
PA68/4	R10048B4/7	0483/5	ISSUED TO NWS YORKTOWN FFT USS SARATOGA

DECL 22 JUNE 1994

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Figure 17-16.—ATR showing receipts and issues for further transfer.

Also, this particular ATR is classified CONFIDENTIAL. Notice that the subject line and paragraphs 1, 2, 3, 4, 5, and 7 include a (U) and paragraph 6 includes a (C). When an ATR is classified, each paragraph must be identified as to the classification of its contents. This is indicated by a (U) for unclassified, or(C) for Confidential.

NALC PA68 (column A) shows the balance on hand as 9 (column B), 0 received (column C), 1 issued (column D), and the new balance on hand as 8 (column L). This NALC was issued to NWS YORKTOWN FFT to *USS Saratoga,* and is a SLIT-controlled item, Therefore, the intermediate activity, ultimate receiving activity, serial number, and MDD are entered in paragraph 7.

NALC 1611 (column A) shows an on-hand balance of 3 (column B), quantity received as 1 (column C), 0 issued (column D), a current on-hand balance of 4 (column L), and the requisition document number (column N), This NALC was received from NWS YORKTOWN FFT to *USS America,* and is a SLIT-controlled item. Therefore, the activity from

which the item was received, the ship to which the item is to be transferred, the serial number, and the MDD are entered in paragraph 7.

Reconciliation Reports

When NOC requests a reconciliation report to correct errors between the ship's data files and the CAIMS database, you should submit a response in the format shown in figure 17-17. When the on-hand balance of a NALC listed on the reconciliation request does not agree with your data files, an on-sight inventory must be conducted to verify the actual on-hand balance.

The reconciliation report shown in figure 17-17 shows no change in the ship's data files because the on-hand balance as of the last report (column B) and the current on-hand balance (column L) is the same. However, when the on-sight inventory results in GBIs or LBIs, columns C and J have to be completed as appropriate. Paragraph 7 of the report should reference the date-time group of the reconciliation request received and provide amplifying remarks when GBIs or LBIs exist.

Corrected Reports

The request for a corrected report is always initiated by NOC to the activity concerned. When an activity is advised by NOC that a corrected report is required, it should be submitted in the format shown in figure 17-18.

Normally, NOC requests a corrected report under the following circumstances: A report is not in mathematical balance; an erroneous NALC has been reported; the beginning on-hand balance does not equal the last ending on-hand balance.

Corrected reports should be submitted by message using the identical date and ATR serial number of the original report. Only those items that are corrected should be included in paragraph 6. Paragraph 7 of the report should contain the words CORRECTED REPORT IAW NOC (use appropriate message date-time group). When the corrected entry in paragraph 6 alters the SLIT/registry data, enter these changes in paragraph 7.

R 082130Z FEB 88

FROM: USS AINSWORTH
TO: NAVORDCEN MECHANICSBURG PA
INFO: CINCLANTFLT NORFOLK VA

UNCLAS //NO8010//
SUBJ: AMMO TRANS RPT CINCLANTFLT 8010-4

1. ITEMS THREE

2. SER TWO ZERO ONE

3. UIC 20068/6

4. ACT CLASS ALFA

5. DATE 88039/4

6.

A	B	L
A165/2	2400/6	2400/6
D336/2	30/3	30/3
L525/2	21/3	21/3

7. REMARKS: RECONCILIATION REPORT IAW NOC, 051432Z FEB 84

Figure 17-17.—ATR showing reconciliation response.

R 151830Z JUN 88

FROM: USS MULLINNIX
TO: NAVORDCEN MECHANICSBURG PA
INFO: CINCLANTFLT NORFOLK VA

C O N F I D E N T I A L //N08010//
SUBJ: AMMO TRANS RPT CINCLANTFLT 8010-4 (U)

1. (U) ITEM ONE

2. (U) SER FOUR ZERO (see note 1)

3. (U) UIC 52203/2

4. (U) ACT CLASS ALFA

5. (U) DATE 88166/5 (see note 2)

6. (C) A B F L (see notes 3 and 4)
D316/0 750/2 86/4 664/6

7. (U) REMARKS: CORRECTED REPORT IAW NOC, 051425Z JUN 84

DECL 15 JUN 1994

NOTES: 1. Use the serial number of the report being corrected, NOT a new serial number.

2. Use the report date of the report being corrected, NOT the present date.

3. List only the NALC(s) that require correction. Do NOT include other or new transactions.

4. Ensure the entry is in mathematical balance.

5. When the corrected entry in paragraph 6 changes SLIT/registry data, enter these changes in paragraph 7.

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Figure 17-18.—ATR showing corrected report.

Modified Reports

In contrast to corrected reports, modified reports (fig. 17-19) are initiated by the activity. An activity should submit a new report when it discovers an incorrect NALC has been reported; serial numbers of SLIT items were improperly reported; or an improper quantity was reported as a receipt, issue, expenditure, transfer, or LBI. The new report must be assigned a new ATR serial number, and you should use the present date.

You should use whatever transactions (including GBIs or LBIs) are required to bring the reported on-hand balances submitted on the last ATR into agreement with the actual on-hand balance. Adjustments of receipts, issues, LBIs, and so forth, are done by using the beginning inventory entry in column B for the modified report. This entry can be obtained from the ending inventory on the last ATR for the NALCs involved.

Paragraph 7 should contain a statement similar to the following: MODIFICATION OF DATA SUBMITTED ON ATR XXX FOR NALCS XXXX, XXXX, AND XXXX. Column J entries must be explained in detail in paragraph 7, and reference the DTG of the MLSR report submitted.

AMMUNITION MASTER STOCK RECORD CARD

The Ammunition Master Stock Record Card, NAVSUP Form 1296, is used to record all pertinent data for each NALC carried within an activity or ship. These cards are yellow in color and are designed for filing in

R 151830Z JUN 88

FROM: USS BLUEFISH
TO: NAVORDCEN MECHANICSBURG PA
INFO: USS L. Y. SPEAR

UNCLAS //NO8010//
SUBJ: AMMO TRANS RPT CINCLANTFLT 8010-4

1. ITEMS TWO

2. SER FOUR ZERO

3. UIC 05723/7

4. ACT CLASS ALFA

5. DATE 88166/5

6.

A	B	C	J	L
A475/6	3220/7	0/0	200/2	3020/5
1569/1	1/1	0/0	0/0	1/1

7. REMARKS: MODIFICATIONS OF DATA SUBMITTED ON ATR 33 FOR NALCS A475/6 AND 1569/1.

NALC	REMARKS
A475/6	LBI, ATR 33 REPORTED RECEIPT OF 50 CLIPS, 5 ROUNDS EACH, TOTAL OF 250 ROUNDS; ACTUAL RECEIPT WAS 1 BOX OF 50 ROUNDS, 200 ROUNDS REPORTED AS RECEIVED WERE NOT RECEIVED BECAUSE OF DIFFERENT UNIT PACK. AN MLSR SUBMITTED. USS MULLINNIX 151829Z JUN 84 APPLIES.
1569/1	ATR 33 REPORTED INCORRECT SERIAL NUMBER OF 151729/5. CORRECT ENTRY IS:

NALC	SERIAL	MDD	FM
1569/1	151792/5	0578/0	USS L. Y. SPEAR

Figure 17-19.—ATR showing modified report.

a McMillan binder or KARDEX file. They should be filed in alphanumeric sequence by NALC. The Ammunition Master Stock Record Card is very important because it provides you with a complete history of each NALC from the day it was received. However, the information on these cards is only as accurate as the information entered on them. It is extremely important that you enter data on these cards accurately.

The preparation of the Ammunition Master Stock Record Card, NAVSUP 1296, is discussed in the following paragraphs. An example of NAVSUP 1296 is shown in figure 17-20.

BLOCK 1 (ENTRY DATE). Enter the five-digit Julian date on which the transaction occurred.

BLOCK 2 (DOCUMENT NUMBER). Enter the Service code and Unit Identification Code in block 2a (ACTIVITY), the Julian date in block 2b (DATE), and the serial number in block 2c (SERIAL) from the receipt document, issue document, or outstanding requisition document, as applicable,

BLOCK 3 (TRANSACTIONS). Enter the type of transaction (receipt, issue, expenditure, etc.). For block 3a (TYPE), refer to NOCINST 8010.2, chapter 8, section 5, attachment F, for the appropriate code. Block 3b indicates the quantity of transactions listed in block 3a.

BLOCK 4 (ON-HAND BALANCES). Enter the on-hand balances for each condition on board. Block 4a will contain "A" condition material. Blocks 4b through 4e will be filled in with Condition codes as appropriate.

BLOCK 5 (ATR SER). Enter the three digit transaction report number from the ATR in block 5.

BLOCK 6 (QUANTITY DUE IN). Enter the quantity on order but not yet received.

BLOCK 7 (UNEXPENDED TRAINING ALLOWANCE). Enter the number of rounds available for training for the remainder of the fiscal year. You must compute this number by subtracting the training expenditures (as they occur) from the unexpended training allowance.

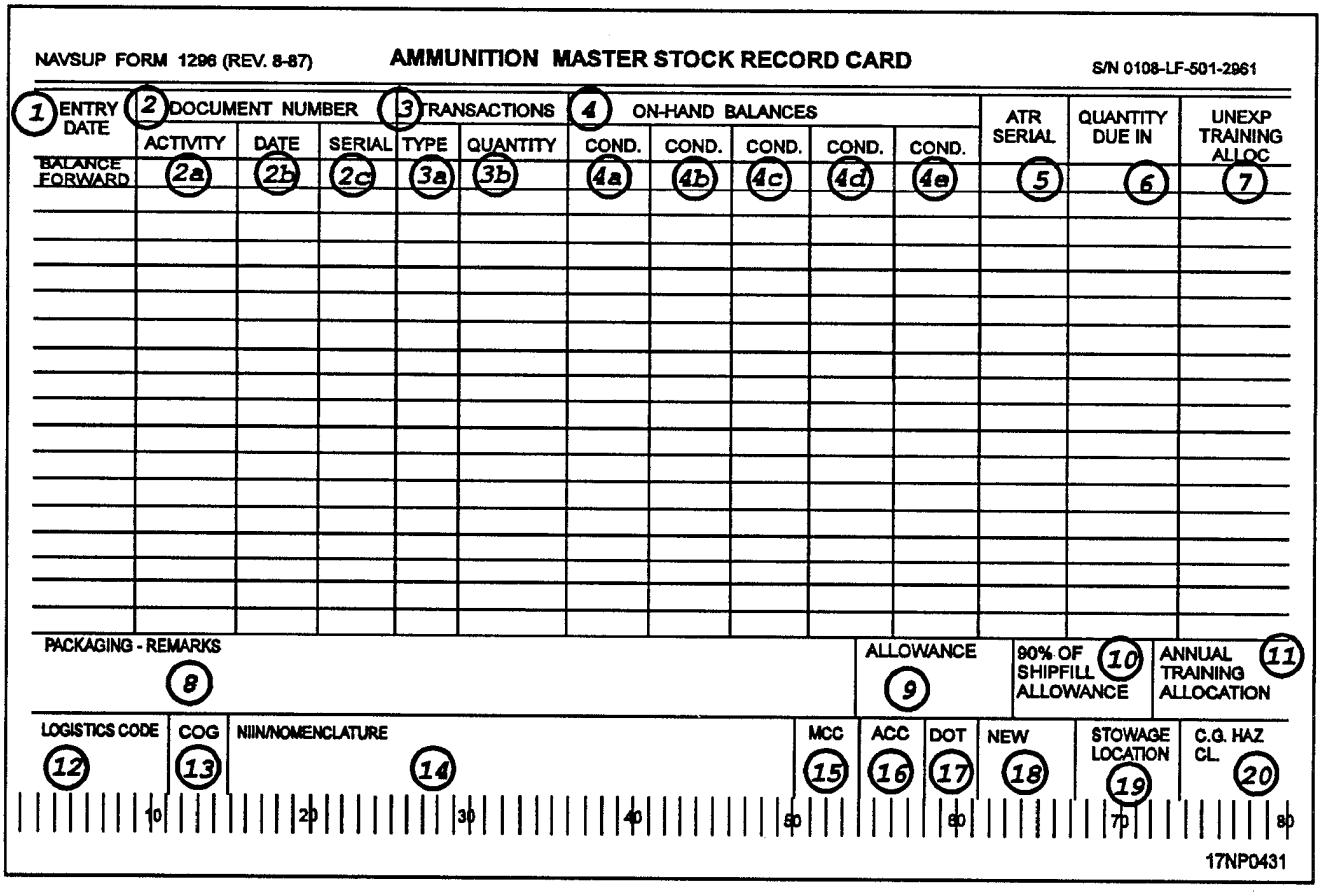

Figure 17-20.—Example of a blank Ammunition Master Stock Record Card (NAVSUP Form 1296).

BLOCK 8 (PACKAGING REMARKS). Enter the pertinent packaging information, such as 2,000 rounds/case or 50 rounds/box. This entry is not absolutely necessary but is beneficial when you have to do an inventory.

BLOCK 9 (ALLOWANCE). Enter the shipfill, mission, load, or cargo load allowance, as applicable. It is possible for a particular NALC to be applicable to two or more allowances. When this situation exists, you must maintain a separate Ammunition Master Stock Record Card for each allowance category. For example, there are presently 20,000 rounds of AO11 authorized aboard the ship. The allowances are 10,000 rounds as shipfill allowance, 5,000 rounds as mission allowance, and 5,000 rounds as load allowance. Although all 20,000 rounds were received in the same shipment and stowed in the same magazine, you still must initiate one Ammunition Master Stock Record Card for each of the three allowance categories. You must ensure expenditures are posted to the correct Ammunition Master Stock Record Card within the correct allowance category.

BLOCK 10 (90% OF SHIPFILL ALLOWANCE). Enter the quantity that represents 90 percent of the applicable shipfill allowance (this is for shipfill allowance only). For example, when the shipfill allowance permits an allowance of 20,000 rounds aboard, you are required to maintain an on-hand balance of 18,000 rounds.

BLOCK 11 (ANNUAL TRAINING ALLOWANCE). Enter the annual training allowance, as appropriate.

BLOCK 12 (LOGISTICS CODE). Enter the NALC as shown in the *Stock List of Navy Ammunition,* TW010-AA-ORD-010/NAVAIR 11-1-116A.

BLOCK 13 (COG). Enter the appropriate cognizance symbol.

BLOCK 14 (NIIN/NOMENCLATURE). Enter the nomenclature and other information, such as the NSN.

BLOCK 15 (MATERIAL CONTROL CODE). Enter the MCC if a SLIT reportable item (B, C, E).

BLOCK 16 (ACC). Enter the appropriate activity Classification code, as discussed previously in this chapter.

BLOCK 17 (DOT). Enter the DOT hazard class as indicated in the Navy *Transportation Safety Handbook For Hazardous Materials,* NAVSEA OP 2165, volume 2.

BLOCK 18 (NEW). Enter the net explosive weight (NEW) in this block. NEWs can be found in the *Navy Transportation Safety Handbook For Hazardous Materials,* NAVSEA OP 2165, volume 2.

BLOCK 19 (STOWAGE LOCATION). Enter the appropriate building or magazine number where the materials are located

BLOCK 20 (CG HAZ CL). Enter the Coast Guard hazard class as indicated in the *Navy Transportation Safety Handbook for Hazardous Materials,* NAVSEA OP 2165, volume 2.

Figure 17-21 is an example of an Ammunition Master Stock Record Card with several types of actions posted. A few of these entries are discussed in the following paragraphs. The actions discussed are identified in Block 1 (ENTRY DATE) as follows:

BALANCE FORWARD. The balance forward line indicates the beginning on-hand balance is 746. Of the 746, none are unserviceable, 150 are allotted for training, and none are on order.

ENTRY DATE 84312. This entry indicates that 63 rounds are expended under a type F (training) expenditure. You must deduct the 63 rounds expended from the serviceable on-hand total. This leaves a total of 683 rounds. Since this is a training expenditure, you must also deduct 63 rounds from the unexpended training allowance. This leaves a total of 87 rounds. Now, the ATR serial number on which the transaction was reported is entered. The second entry date of 88312 indicates that 63 rounds are on order (block 6).

ENTRY DATE 84350. This entry indicates that the 63 rounds ordered on 84312 have been received. You should enter the document number, the amount received, and add the amount received to the serviceable on-hand total (receipt) in the appropriate blocks. Also, you must enter the ATR serial number on which this transaction was reported.

ENTRY DATE 84353. This entry indicates that a notice of ammunition reclassification (NAR) was received. The NAR number is 472-76. This number should be entered in blocks 2a, 2b, and 2c. This particular NAR indicates that Lot BE-68-SJ-55 is suspended. You should refer to the ammunition lot/location card to verify that this particular lot number is aboard. Ammunition lot/location cards are discussed later in this chapter. In this case, there are 21 items aboard with this lot number. Therefore, you must add a total of 21 items to the unserviceable/suspended on-hand column and subtract a total of 21 items from

NAVSUP FORM 1296 (REV. 8-87) **AMMUNITION MASTER STOCK RECORD CARD** S/N 0108-LF-501-2961

ENTRY DATE	DOCUMENT NUMBER			TRANSACTIONS		ON-HAND BALANCES					ATR SERIAL	QUANTITY DUE IN	UNEXP TRAINING ALLOC
	ACTIVITY	DATE	SERIAL	TYPE	QUANTITY	CODE "A"	CODE "J"	CODE "H"	CODE	CODE			
BALANCE FORWARD						746					–	0	150
84312				F	63	683					034		87
84312	Y03574	4312	8109			683					–	63	
84325				G	12	671					035		75
84350	Y03574	4312	8109	C	63	734					036	0	
84353	NAR	472	-76	X	21	713	21				037		
85003				F	32	681					038		43
85016	NAR	18-77		X	21	681	0	21			040		
85037				E	119	562					042		
85038	Y03574	5038	8110			562					–	184	
85087				H	15	547					043		28
85087				I	1	546					043		
85089	Y03574	5037	8111	D	21	546		0			044		
85116	Y03574	5038	8110	C	184	730					045	0	
85123				F	21	709					046		7
85135				J	2	707					047	0	
85135	Y03574	5135	8112	D	707	0					047	0	

PACKAGING - REMARKS: Palletized with 48 rds

ALLOWANCE	90% OF SHIPFILL ALLOWANCE	ANNUAL TRAINING ALLOCATION
746	671	150

LOGISTICS CODE	COG	NIIN/NOMENCLATURE	MCC	ACC	DOT	NEW	STOWAGE LOCATION	C.G. HAZ CL.
D232	2T	00-039-2769 Proj 5"/38 VT-SD		A	A	7.9234	NALC MASTER	VII

17NP0432

Figure 17-21.—Example of an Ammunition Master Stock Record Card (NAVSUP Form 1296) with several types of actions posted.

the serviceable on-hand column. You must also enter the ATR serial number on which this transaction was reported.

ENTRY DATE 85089. This entry indicates the 21 unserviceable/suspended items that have been off-loaded. You should enter the document number on which the material was shipped in blocks 2a, 2b, and 2c. Enter the amount off-loaded in block 3b (QUANTITY). Then, deduct the amount issued (21) from the unserviceable/suspended on-hand balance (21). This leaves an unserviceable/suspended on-hand balance of zero. You must also enter the ATR serial number on which this transaction was reported.

ENTRY DATE 85135. This entry indicates that 707 rounds were off-loaded. You should enter the document number on which the material was shipped in the appropriate blocks. Enter the quantity shipped in the issued column. Now, deduct this amount from the serviceable on-hand balance. This leaves a remaining balance of zero. The unexpended training on-hand balance is also zero because it was included in the serviceable on-hand balance.

You can see there is a close relationship between the ammunition stock record cards and the ATRs. ATRs are filed by serial number. Each transaction reported on an ATR is posted on the Ammunition Master Stock Record Card, along with the applicable ATR serial number. Therefore, any transaction regarding a particular NALC can be verified quickly and efficiently.

AMMUNITION LOT/LOCATION CARD

The Ammunition Lot/Location Card, NAVSUP Form 1297 (green), is used to record lot numbers and stowage locations of items. This card is used with the Ammunition Master Stock Record Card and should be filed by NALC behind each Ammunition Master Stock Record Card.

Nearly all items of ordnance are assigned a lot number and are lot controlled. However, it is not always practical to place every item under lot control; for example, practice bombs or general-purpose bombs. These items are used in such large quantities that it is impractical to record the lot number for each item expended. However, when these items are received, the

lot numbers should be recorded on an Ammunition Lot/Location Card for information purposes.

Cartridges, cartridge-actuated devices, rocket motors, and small arms ammunition require close lot control. The total number of each item should be recorded on an Ammunition Lot/Location Card by lot number and stowage location. When items are issued, expended, or reclassified, the entry on the Ammunition Lot/Location Card must reflect the quantity by lot number and from which stowage location they were removed.

The Ammunition Lot/Location Card, shown in figure 17-22, is very similar to the Ammunition Master Stock Record Card in format. Therefore, preparation of the Ammunition Lot/Location Card is not discussed in detail.

AMMUNITION SERIAL/LOCATION CARD

The Ammunition Serial/Location Card (fig. 17-23) will be used for all items for which serial control is required (Material Control code C-serial controlled, E-serial and lot controlled). These cards will be filed by NSN with the corresponding Ammunition Master Stock Record Card. One Ammunition Serial/Location Card will be maintained for each torpedo; assembled air-launched missile (ALM), as well as selected components; and surface missile (SMS). The serial number of the leading serialized component will be reported regardless of the missile configuration. The leading serialized components for these items can be found in OPNAWNST 8010.12, chapter 8, section 5, appendix A.

STANDARDIZED CONVENTIONAL AMMUNITION AUTOMATED INVENTORY RECORD (SCAAIR)

LEARNING OBJECTIVE: *Identify the purpose, components, and operating system for SCAAIR.*

The SCAAIR system is used to manage and report ordnance to CAIMS and to the Marine Ammunition Automated Reporting System (MAARS). The NAVORDCEN (N341) is the SCAAIR resource

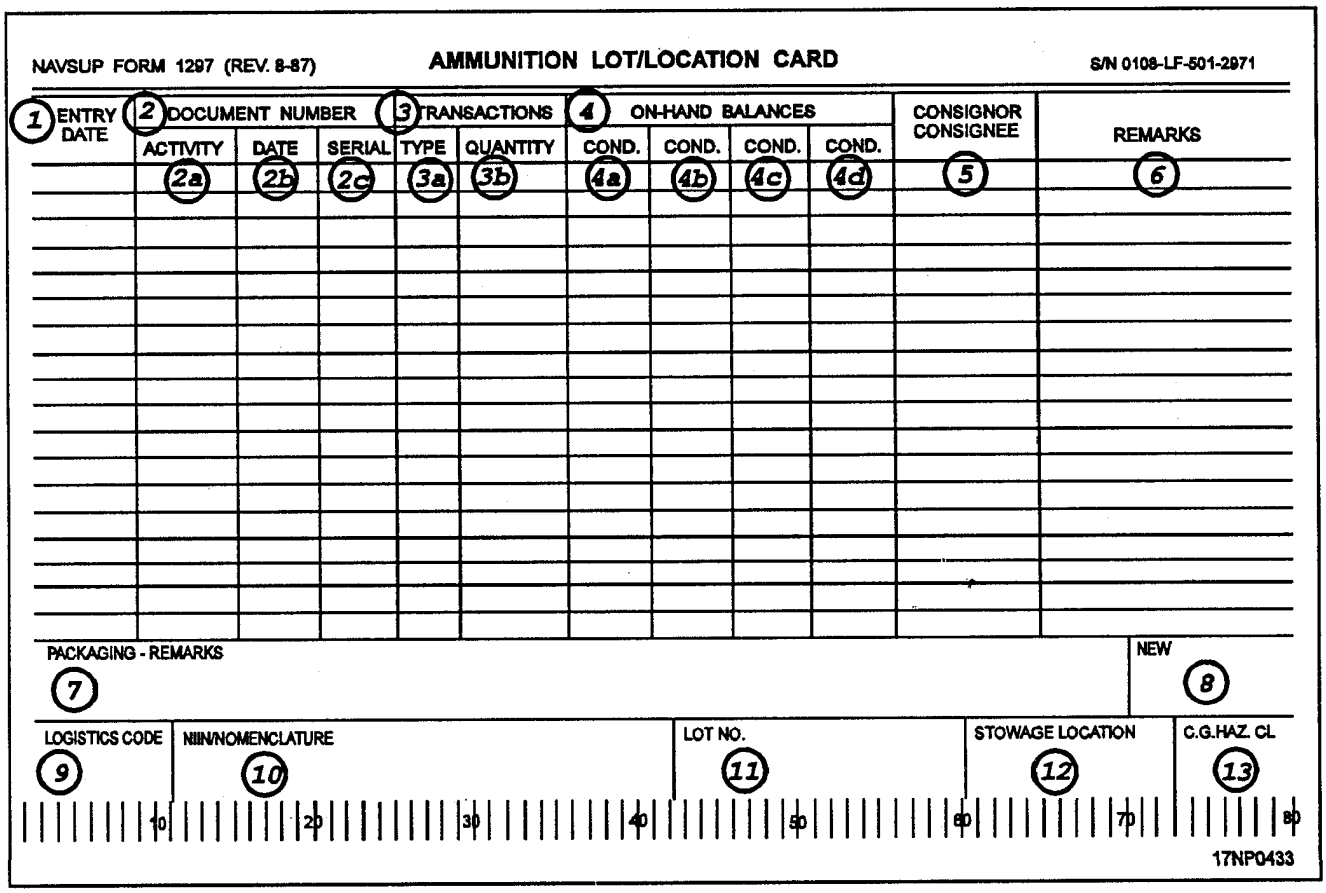

Figure 17-22.—Example of blank Ammunition Lot/Location Card, NAVSUP Form 1297.

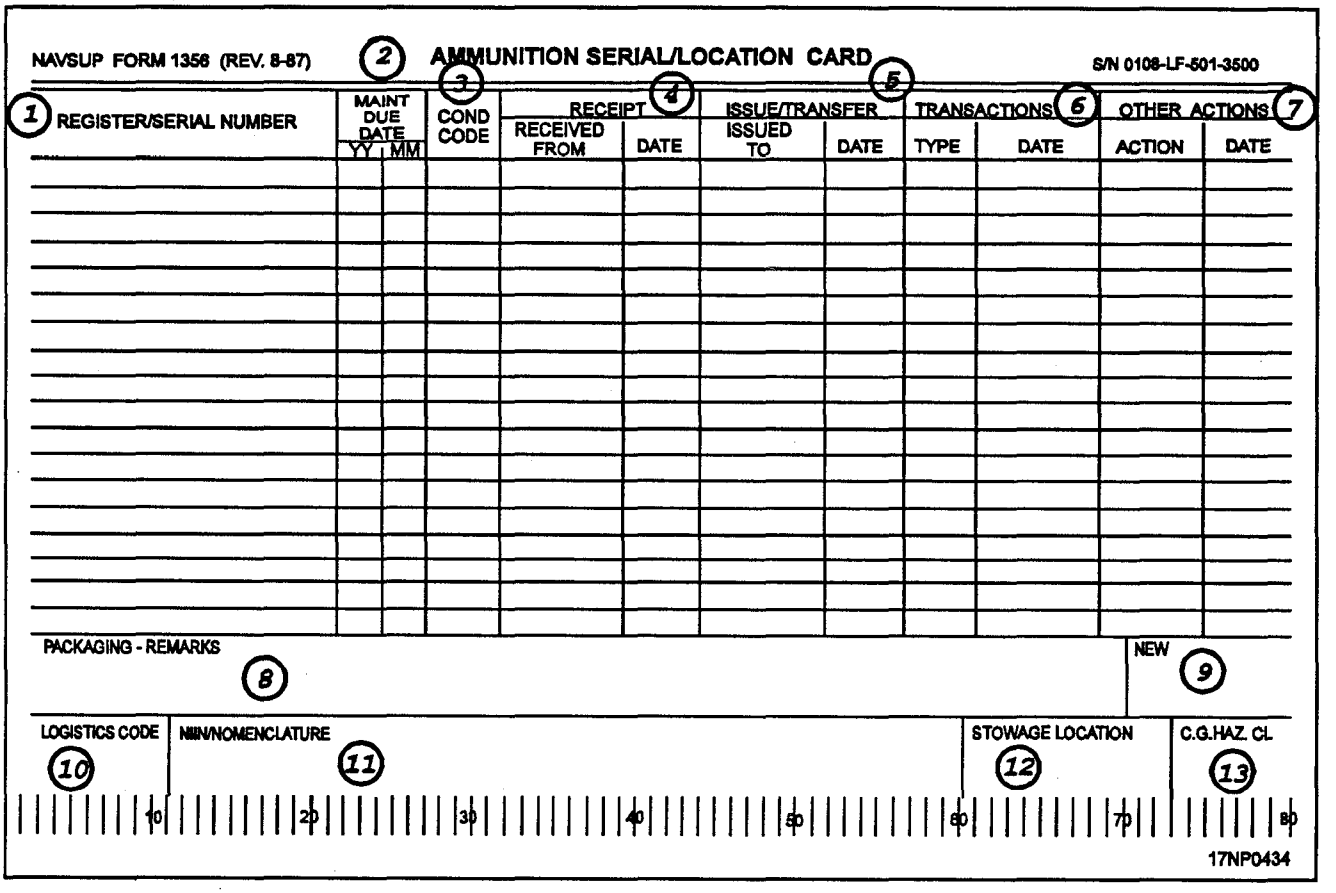

Figure 17-23.—Example of blank Ammunition Serial/Location Card, NAVSUP Form 1356.

sponsor. Program management and project management resides with NAVSURFWARCEN, Cane Division, Crane, Indiana.

The SCAAIR system uses the Microsoft Foxbase+ Data Base Management System. The SCAAIR system requires an IBM-PC, or compatible, with a 10- to 20-megabyte hard disk, one 5-1/4-inch floppy disk drive, and 640K bytes of random access memory. The system can perform the following tasks:

- Requisitioning
- Transaction Reporting
- Inventory Reporting
- Utilities

REVIEW NUMBER 3

Q1. *Ammunition received FFT should be reported after how many days?*

Q2. *Issues to aircraft squadrons are converted by CAIMS to what type of expenditure?*

Q3. *Why is the date-time group of an ATR important?*

REVIEW NUMBER 3 ANSWERS TO QUESTIONS Q1. THROUGH Q3.

A1. Ammunition received FFT should be reported after 7 days.

A2. Issues to aircraft squadrons are converted by CAIMS to training expenditures.

A3. The date-time group of an ATR is important because it provides the only means of tracking/referencing the message after it is transmitted.

APPENDIX I

GLOSSARY AND ACRONYMS

A/A— Air to air.

AAB— Aviation armament bulletin.

AAC— Aviation armament change,

ABSLA— Approved basic stock level of ammunition.

ACM— Air combat maneuver.

AFB— Airframe bulletin.

AFC— Airframe change.

AFTER ENGINE TURNUP– That time in the prior-to-launch phase when the pilot has completed his pretaxi checklist.

AFTER LANDING/GROUND ABORT— That time after landing or ground abort phase when the pilot has completed the after landing checklist.

AIG— Air to ground.

AGM– Air-launched, surface attack, guided missile.

AIM— Air-launched, aerial intercept, guided missile.

AIMD— Aviation intermediate maintenance department.

AIRBORNE STORE— Fuel and spray tanks, nonexpendable training weapons, pods (refueling, gun, ECM, etc.). This includes all similar items intended for carriage by aircraft, including racks, launchers, and detachable pylons that do not normally separate from the aircraft in flight.

AIRBORNE WEAPON— All missiles, rockets, bombs, mines, torpedoes, and all similar items intended for carriage by aircraft that are normally separated from the aircraft in flight.

AIRCRAFT ARMAMENT SYSTEM– Aircraft armament subsystems that, when interconnected, give the aircraft its airborne weapons/stores capability.

AIRCRAFT CONFIGURATION— The system and components required to carry or deliver a specific airborne weapon/store.

AIRCRAFT LOAD PLAN— A chart/form used to assign weapons to a particular bomb rack/station for loading.

AMAC— Aircraft monitor and control. A functional test of the aircraft monitor and control system, release system, and jettison system for nuclear weapons.

AOCS– Aviation ordnance control station.

ARM– Antiradiation missile.

ARM, ARMING— The action that changes ammunition from a safe condition to a state of readiness for initiation.

ASW— Antisubmarine warfare.

AT– Arming time.

ATM– Air-launched, training, guided missile.

AT/PERS– High-explosive antitank/antipersonnel.

ATR– Ammunition transaction report.

AUR– All-up-round. The complete assembly of a weapon normally shipped to the operating forces. The weapon requires no assembly or functional checks before loading on the aircraft for delivery to the target.

AVB— Avionics bulletin.

AVC– Avionics change.

AWB— Airborne weapons bulletin.

AWC– Airborne weapons change.

AYB— Accessory bulletin.

AYC– Accessory change.

BD– Base detonating.

BDU– Bomb dummy unit.

BEFORE ENGINE TURNUP– That time in the prior-to-launch evolution when the pilot is commencing general aircraft ground inspection or checks and extending until the inspections or checks are complete.

BIT, BITE— Built-in test.

BPDSMS– Basic Point Defense Surface Missile System.

CAD— Cartridge-actuated device.

CAIMS— Conventional Ammunition Integrated Management System.

CARTRIDGE— A complete assembly consisting of an initiator and a pressure-producing propellant in a suitable case. Impulse cartridges have no projectiles. A cartridge may be electrically or mechanically fired.

CAUTION— An operating procedure, practice, or condition that, if not strictly observed, could result in damage to or destruction of equipment.

CBU— Cluster bomb unit. It consists of a number of bombs contained in a dispenser or clustering device and suspended from a bomb rack. A CBU may function while on the rack or after release.

CCG— Computer control group.

CCO— Combat cargo officer.

CG— Center of gravity.

CHAFF— A radar reflective material used to deceive or counteract unfriendly radar or destructive offensive ordnance.

CHECKLIST– An individual sequence of procedures bearing a title and constituting a part of a publication designated as the loading checklist.

CINCLANTFLT— Commander-in-Chief Atlantic Fleet.

CINCPACFLT– Commander-in-Chief Pacific Fleet.

CNO– Chief of Naval Operations.

CO– Commanding Officer.

COG— Cognizance symbol, Indicates the command, bureau, or office that has control over supply and/or distribution of the material.

CONVENTIONAL WEAPONS– Nonnuclear weapons. This excludes all biological weapons and generally excludes chemical weapons except for existing smoke, incendiary agents, and agents of riot-control weapons.

CV– Aircraft carrier.

DAAS— Defense Automatic Addressing System.

DEARMING AREA– That area where a weapon is changed from a state of readiness for initiation to a safe condition. When forward-firing weapons are involved, the area ahead of the aircraft must be clear and kept clear until weapon safing procedures are completed.

DODIC– Department of Defense Identification Code.

DOT– Department of Transportation.

DOWNLOADING— An operation that removes airborne weapons/stores from aircraft.

DROPPING SAFE– Releasing an airborne weapon/store in a safe or unarmed condition so that it will not function upon impact.

DST- Destructor.

DTRM- Dual-thrust rocket motor.

DUD- Explosive ammunition that has failed to function.

ECCM- Electronic counter-countermeasures.

ECM— Electronic countermeasures,

EEA— External evidence of arming.

EED— Electroexplosive device.

EMCON- Emission control.

EOD- Explosive ordnance disposal.

ERDL— Extended range data link,

EXPLOSIVE ORDNANCE DISPOSAL UNIT- Personnel with special training and equipment who render explosive ordnance safe, make intelligence reports, and supervise the safe removal of ordnance.

FAE— Fuel-air explosive.

FCLP- Field carrier landing practice.

FFAR— Folding-fin aircraft rocket.

FFT— For further transfer.

FOSAMS— Fleet Optical Scanning Ammunition Marking System.

FORWARD-FIRING WEAPONS— Weapons, such as missiles, rockets, and guns, that are propelled in a forward direction.

FSC- Federal supply class.

FUZE— A term used for the mechanical or electrical device that initiates detonation of an explosive at a desired time.

GBI— Gains by inventory.

GBU— Guided bomb units.

GCBS- Ground controlled bombing system. Weapons are released from the aircraft by a controller on the ground.

GCG— Guidance control group.

GCU- Gun control unit.

GP- General purpose.

GUIDED WEAPON- A weapon that has no propulsion but does have guidance control capability.

HARM— High-speed, antiradiation missile.

HDC- Helicopter Direction Center.

HE- High explosive,

HEAT- High-explosive antitank.

HE-FRAG— High-explosive fragmentation.

HEI- High-explosive incendiary.

HERO- Hazardous electromagnetic radiation to ordnance.

HTW— Helicopter trap weapon.

HUD— Head-up display.

HUNG WEAPON- A weapon that accidentally remains attached to an aircraft after an attempt to release it from the rack.

IF APPLICABLE- Used to preface a step/procedure meaning that, when required, must be performed. When the step/procedure is not required, it may be omitted.

IFOBRL— In-flight operable bomb rack lock.

INTERVALOMETER— An electrical or electromechanical device that controls the release or firing of airborne weapons/stores at a specified interval or sequence.

IPDSMS- Improved Point Defense Surface Missile System.

IPB– Illustrated parts breakdown

IRRP— Improved Rearming Rate Program.

IWHS— Improved Weapons Handling System.

JATO– Jet-assist takeoff.

JETTISON— Releasing of an airborne weapon or store by an emergency or secondary release system.

LABS— Low altitude bombing system.

LALS— Linkless Ammunition Loading System.

LBI– Loss by inventory.

LDGP– Low-drag, general purpose.

LEMA— Linear electromechanical actuator.

LGB– Laser-guided bomb.

LGTR– Laser guided training round (LGTR).

LSFFAR– Low-spin, folding-fin, aircraft rocket.

MACH— A measurement of sonic speed under standard atmospheric conditions. Mach 1.0 is about 766 miles per hour.

MDD– Maintenance due date.

MER— Multiple ejector rack

MIARS— Maintenance Information Automated Retrieval System.

MILSTRIP— Military Standard Requisitioning and Issue Procedures.

MIM– Maintenance instruction manual.

MMMU— Mobile missile maintenance unit.

MOAT– Missile on aircraft test.

MOD– Modification.

MOMAT— Mobile mine assembly team.

MRC– Maintenance requirements card.

NADEP– Naval ammunition depot.

NALC– Naval ammunition logistics code.

NAPI– Naval Aeronautic Publications Index.

NAR– Naval ammunition reclassification.

NATO– North Atlantic Treaty Organization.

NATOPS– Naval Air Training and Operating Procedures Standardization.

NATSF– Naval Air Technical Services Facility.

NAVAIR– Naval air.

NAVAIRSYSCOM– Naval Air Systems Command.

NAVSEASYSCOMINAVSEA— Naval Sea Systems Command.

NAVSUPSYSCOM/NAVSUP— Naval Supply Systems Command.

NAWMP– Naval Airborne Weapons Maintenance Program.

NIIN– National item identification number.

NOTE– An operating procedure, practice, or condition that is essential to highlight.

NSN– National stock number.

NWS— Naval weapons station.

OD– Ordnance data.

OIC– Officer in charge.

OHO– Ordnance handling officer.

OJT– On-the-job training.

OP– Ordnance publication.

PD– Point detonating.

PMIC– Periodic maintenance inspection cards.

PMS- Preventive Maintenance System.

PWP— Plasticized white phosphorus.

Q-D— Quantity-distance.

RAC— Rapid action change. Issued to provide timely information of changes to manuals.

RADHAZ— Radiation Hazards to Ordnance.

RAT— Ram air turbine.

RDD— Required delivery date.

REARMING AREA- That area where an operation that replenishes the prescribed airborne weapons/stores, ammunition, bombs, and other armament items for an aircraft is conducted. This operation may include fuzing and any stray voltage checks, as applicable.

RELEASE AND CONTROL SYSTEM CHECK— Functional test of an aircraft electrical/mechanical conventional weapon release and/or control subsystem.

RF- Radio frequency.

RIM— Ship-launched intercept-aerial guided missile.

RPM- Rounds per minute.

S&A— Safety and arming device.

SASS— Special armament stowage space.

SAT— Safe air travel.

SATS— Short airfield tactical site.

SEAM— Sidewinder expanded acquisition mode. A means of slaving the AIM-9 optics to the air intercept radar to enhance tactical employment.

SEB— Support equipment bulletin.

SEC— Support equipment change.

SHOLS— Single Hoist Ordnance Loading System.

SLC- Sonobuoy launch tube.

SPCC— Ships Parts Control Center.

SRC— Stores reliability card.

STRAY VOLTAGE— An undesired voltage existing between two specified points of a weapon system that is capable of producing a flow of current when a designated electrical measuring device is connected between the two points.

SWL— Safe working load.

SWP- Subordinate work package.

TACO or TACCO- Tactical coordinator.

TALD- Tactical air-launched decoy.

TCB- Target control system bulletin.

TDD- Target detecting device.

TER- Triple ejector rack.

TMDC- Type Maintenance Due code.

TMINS- Technical Manual Identification Numbering System.

TPDR- Technical Publication Deficiency Report.

TRAMAN— Training manual.

UNO- United Nations Organization.

UIC- Unit Identification Code.

VER- Vertical ejector rack.

VT— Proximity fuze, so called because the original devices contained one or more vacuum tubes.

WARNING- An operating procedure, practice, or condition that, if not correctly followed, could result in personal injury or loss of life.

APPENDIX II

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INDEX

A

Adapter boosters, 1-13
adapter booster M150/T46 (series), 1-14
M148/M148E1/T45 (series) adapter booster, 1-13
Aerial targets, 8-6
AQM-37C missile target, 8-7
BQM-34A/S target system, 8-9
BQM-34E/T missile target, 8-10
BQM-74C/E target drone, 8-8
Air-laid mines and torpedoes, 5-1
Air-launched decoy, 8-10
Aircraft bomb ammunition and associated components, 1-23
arming wire assemblies, 1-27
fin assemblies, 1-27
fuze charging circuit, 1-24
fuze wells, 1-24
general-purpose bombs and fin assemblies, 1-23
identification, 1-26
nose plugs, 1-26
shipping configuration, 1-24
suspension lugs, 1-24
Aircraft general-purpose bombs, 13-1
bomb assembly crew, 13-1
bomb assembly tools and equipment requirements, 13-1
Aircraft gun ammunition, 7-1
classification, 7-1
Aircraft rocket launchers, 2-20
2.75-inch rocket launchers, 2-20
2.75-inch (series) launchers, 2-28
5.0-inch rocket launchers, 2-20
5.0-inch (series) launchers, 2-28
breaker switch, 2-24
fairings, 2-24
intervalometer, 2-27
mode selector switch, 2-27
RF barriers, 2-22
Aircraft rockets, 2-1
Aircraft-laid mines, 5-6
classifications, 5-7
Aircraft-launched torpedo configurations, 5-2
Ammunition handling, 11-20, 12-21
hoists, 11-21
weapons elevators, 11-22
Ammunition identification, 12-1
ammunition lot number, 12-4
Department of Defense Identification Code (DODIC) and Navy Ammunition Logistic Code (NALC), 12-3
lettering, 12-3
mark and modification designation, 12-3
marking, 12-3
nonservice ammunition, 12-1
service ammunition, 12-1
Ammunition lot/location card, 17-39
Ammunition master stock record card, 17-36
Ammunition requisitioning and turn-in procedures, 17-5
exception requisitioning by naval message, 17-14
message requisitioning by DAAS, 17-12
requisition document preparation, 17-7
requisition lead time, 17-17
requisitioning by fleet units, 17-16
requisitioning procedures for aircraft squadrons, 17-17
stock levels, 17-16
Ammunition serial/location card, 17-40
Ammunition storage ashore for advanced bases, 12-12
administration and personnel areas, 12-13
disposal areas, 12-13
enemy ammunition areas, 12-13
magazine areas, 12-12
renovation areas, 12-12
Ammunition stowage, 11-6
ammunition stowage spaces, 11-6
Ammunition turn-in procedures, 17-21
turn-in of ammunition details, 17-24
AN/ALE-29A countermeasures chaff dispensing set, 10-32

AN/ALE-37A countermeasures chaff dispensing set, 10-34
Arming safety switch Mk 122 Mod 0, 1-20

B

Beams, 9-9
Bomb ejector racks, 10-8
Aero 7A-5 and Aero 7B-4 bomb ejector racks, 10-8
BRU-10A/B bomb ejector rack, 10-13
BRU-11A/A bomb ejector rack, 10-14
BRU-32/A bomb ejector rack, 10-15
BRU-33/A and BRU-33A/A vertical ejector rack, 10-16
improved multiple ejector rack BRU-41/A (IMER) and improved triple ejector rack BRU-42/A (ITER), 10-16
Bomb hoists, 9-14
Bomb loading and unloading procedures, 14-7
Bomb racks, 10-1
Aero 1A adapter assembly, 10-2
Aero 65A series bomb rack, 10-1
BRU-12/A bomb rack, 10-6
BRU-14/A bomb rack, 10-6
BRU-15/A bomb rack, 10-7
MAU-38/A bomb rack, 10-5
Penguin missile launch adapter, 10-5
Bombs, fuzes, and associated components, 1-1

C

Carriers, 9-1
CBU-78/B gator, 1-44
Certification board, 11-6
responsibilities, 11-6
Chemical bombs/weapons, 1-50
Mk 116 Weteye chemical bomb, 1-50
Mk 94 chemical bomb, 1-50
Chemical spray tanks, 1-51
Aero 12 aircraft chemical tank, 1-51
Aero 14B spray tank, 1-51
Conical fin, 1-29
Conventional ammunition integrated management system, 17-4
Conveyor system, 7-8
chute support assembly, 7-8
chutes, 7-8
drum drive assembly and flexible drive shaft, 7-10
entrance unit assembly, 7-10
exit unit assembly, 7-10
interface unit assembly, 7-10

D

Decoying devices, 4-13
Department of Transportation explosive hazard classifications, 12-22
Destructors, 1-38
Dispensers and ejectors, 10-26
SUU-25F/A dispenser, 10-28
SUU-44 flare dispenser, 10-27
Drum loader assembly, 7-8
Drum unload assembly, 7-8

E

Electrical fuzes, 1-2, 1-15
Environmental control systems, 11-10
Explosives driver, 12-22

F

F-14 aircraft weapons systems, 15-1
air combat maneuver (ACM) panel, 15-1
armament safety override switch, 15-3
control stick, 15-2
decoy dispensing systems, 15-5
gun rate switch, 15-4
M61A1 20-MM automatic gun fire control system, 15-4
F/A-18 aircraft, 15-13
armament computer, 15-17
armament safety override switch, 15-15
jettison system, 15-17
M61A1 20-MM gun system, 15-18
master arm control panel assembly, 15-15
Walleye guided weapon system, 15-18

F/A-18 gun system installation, 6-15
F-14 gun system installation, 6-17
Firing components, 5-10
acoustic, 5-10
magnetic type, 5-10
pressure, 5-10
Fleet optical scanning ammunition marking system (FOSAMS), 17-1
FOSAMS reports, 17-3
FOSAMS system administrator, 17-2
system components, 17-1
FMU-139 (series) electronic bomb fuze, 1-16
FMU-140/B dispenser proximity fuze, 1-22
FMU-143E/B electric tail fuze, 1-16
Full-scale practice bombs, 1-47
laser guider training round (LGTR), 1-48
Full-scale practice bombs (BDU-45), 13-15
guided-bomb unit (GBU) assembly, 13-17
Fuze terminology, 1-1
Fuzes, 2-13
acceleration-deceleration fuzes, 2-15
impact firing fuzes, 2-15
mechanical time fuzes, 2-15
proximity fuzes, 2-15

G

Guided bomb units, 1-36
airfoil group, 1-36
GBU-12, GBU-16, and GBU-10, 1-36
GBU-24B/B, 1-37
Guided missile launchers, 3-21
LAU-115, 3-27
LAU-116/A, 3-27
LAU-117/A, 3-28
LAu-118/A, 3-28
LAU-127, 3-30
LAU-132, 3-30
LAU-7/A, 3-22
LAU-92/A, 3-28
LAU-93/A, 3-30

H

Hand-manipulated signaling devices, 4-1
Mk 13 Mod 0, 4-3
pyrotechnic pistols, 4-1
Mk 79 Mod 0, 4-3
Hazards of electromagnetic radiation to ordnance (HERO), 11-31
HERO-safe ordnance, 11-32
HERO-susceptible ordnance, 11-32
HERO-unsafe ordnance, 11-32
HERO emission control (EMCON) bill, 11-32
Hoisting bars, 9-8

I

Identification, 7-4
color coding, 7-5
lettering, 7-4
Intermediate maintenance, 6-18

L

Lightning protection systems, 12-19
Linkless ammunition loading system, 7-6
components, 7-6
Loaders, 9-43
LUU-2B/B, 4-7

M

M20 and M20A1 sensing element proximity fuze, 1-21
M61A1 automatic gun, 6-1
barrels, 6-3
breech-bolt assembly, 6-3
clearing sector assembly, 6-3
clearing solenoid assembly, 6-3
firing contact assembly, 6-3
guide bar, 6-3
lubricator assembly, 6-7

M61A1 automatic gun-Continued
mid-barrel clamp assembly, 6-2
muzzle clamp assembly, 6-2
rear housing assembly, 6-6
recoil adapters, 6-3
rotor assembly, 6-5
M904E2/E3/E4 mechanical impact nose fuze, 1-3
arming delays, 1-4
delay element, 1-4
functional description, 1-6
physical description, 1-4
Magazine and magazine area security, 12-20
Magazine inspection, 11-16
daily visual inspection, 11-16
magazine temperature log, 11-18
Magazine/magazine area inspections, 12-20
frequency of inspections, 12-21
general inspection requirements, 12-21
report of inspections, 12-21
temperature control considerations, 12-21
Magazine security, 11-19
Magazines, 12-4
keyport, 12-5
Mechanical fuzes, 1-1
Mine components, 5-8
Missile classification, 3-1
CATMs, 3-2
DATMs, 3-2
NATMs, 3-2
PGWs, 3-2
Mk 25 Mods 2 and 3 marine location marker, 4-9
launching methods, 4-11
Mk 339 Mod 0 and Mod 1 mechanical time fuzes, 1-6
functional description, 1-10
physical description, 1-9
Mk 344, 1-15
Mk 346 Mod 0 mechanical long-delay tail fuze, 1-10
arming assemblies Mk 3, 4, and 5 Mods, 1-11
description, 1-10
identification of a fully or partially armed fuze, 1-12
operation, 1-11
Mk 376, 1-15
functional operation, 1-16
Mk 31 safety device, 1-16
Mk 43 Modd 0 target detecting device, 1-20
Mk 58 Mod 1 marine location marker, 4-12
launching methods, 4-12
Motors, 2-2
igniter, 2-3
inhibitors, 2-2
motor tube, 2-2
nozzle and fin assemblies, 2-6
propellants, 2-2
stabilizing rod, 2-3

O

Operational aircraft mines, 5-11
Mk 55 mine, 5-11
Mk 60 captor mine, 5-13
Mk 62,63, and 64 quickstrike mines, 5-13
Mk 65 quickstrike mine, 5-13
Ordnance certification, 11-1
definitions, 11-1
revocation of certification, 11-4
Organizational maintenance, 6-18

P

P-3 aircraft, 15-20
bomb bay configuration, 15-22
bomb bay system, 15-21
weapon system, 15-21
Parachute packs, 5-10
Practice bomb signal cartridges, 4-14
CXU-3/B and CXU-3A/B, 4-15
CXU-4/B, 4-15
Mk 4 Mod 3 signal, 4-15
Practice bombs, 1-45
Principles of rocket propulsion, 2-1
Projectiles, 7-2
fuze M505A3 point-detonating (PD), 7-2
M220 target practice-tracer cartridge, 7-3

Projectiles-Continued
M242 high-explosive incendiary-tracer cartridge, 7-3
M254 dummy cartridge, 7-2
M51A1B1/M51A2 dummy cartridges, 7-2
M54A1 high-pressure test cartridge, 7-3
M55A2 target practice cartridge, 7-3
M56A3 high-explosive incendiary cartridge, 7-3
tracer, 7-2
Pyrotechnics, 4-1

Q

Quantity-distance (Q-D) requirements, 12-5

R

Record keeping and reporting, 8-10
Target Discrepancy Book, 8-11
target expenditure reporting, 8-12
target logbooks, 8-11
Target Performance Reports, 8-12
Rocket and rocket fuze terminology, 2-1
Rocket components, 2-2
rocket assembly procedures, 2.75-inch, 13-25
rocket assembly procedures, 5.0-inch, 13-23

S

S-3 aircraft, 15-22
bomb bay system, 15-28
S-3 configurations, 15-28
search store system, 15-24
Service guided missiles, 3-9
AGM-122A, 3-18
AGM-65E, 3-15
AGM-84, 3-9
AGM-88A, 3-16
AIM-119B, 3-16
AIM-120, 3-13
AIM-54C, 3-14
AIM-7F/M, 3-9
AIM-9, 3-11
Service rocket assemblies, 2-18
2.75-inch FFAR and LSFFAR, 2-18
5.0-inch FFAR, 2-20
Skids, weapons transporters, and associated adapters, 9-18
Slings, 9-12
Snakeye fin assemblies, 1-29
BSU-85/B air inflatable retarder, 1-32
BSU-86/B bomb fin, 1-35
MAU-91A/B fin assembly, 1-30
Mk 15 and Mods Snakeye fin assembly, 1-29
Sprinkler and alarm systems, 11-12
Stands, 9-5
Storage compatibility groups, 12-8
Subcaliber practice bombs, 1-45, 13-13
BDU-48 practice bomb, 1-46, 13-14
Mk 76 Mod 5 practice bomb, 1-45, 13-13
SUU-25 flare dispenser, 13-27

T

Test equipment, 16-1
AN/ALM-225, 16-5
AN/ALM-70A, 16-4
AN/ASM-184B(V)-1, 16-6
AN/ASM-464, 16-9
AN/ASM-496, 16-7
AN/AWM-42A, 16-3
AN/AWM-54, 16-2
AN/AWM-92, 16-12
AN/DSM-139, 16-5
AN/DSM-77, 16-9
multimeters, 16-1
TS-3279/ASM, 16-10
TS-3479/AWM-23, 16-10
TS-3519/DSM, 16-13
TS-4142/AWM-23, 16-10
TTU-304/E, 16-3
Tow cables and associated equipment, 8-1
Towed targets, systems, and equipment, 8-1
A/A47U-3A and A/A47U-4 tow target reeling machine-launcher systems, 8-1
rigid tow target, 8-1
textile tow targets, 8-1

Trailers, 9-40
Transaction reporting, 17-25
serial/lot item tracking (SLIT), 17-28
transaction reporting procedures, 17-25
Transaction reports, 17-30
corrected reports, 17-34
gains and losses by inventory reports, 17-28
receipts and issues for further transfer reports, 17-32
reconciliation reports, 17-34
Trucks, 9-32

W

Walleye guided weapon, 3-18
Walleye I, 3-19
Walleye I ERDL, 3-20
Walleye guided weapon–Continued
Walleye II, 3-20
Walleye II ERDL, 3-20
Warheads, 2-8
AT/APERS warhead, 2-10
flare warheads, 2-12
flechette warheads, 2-11
GP warhead, 2-11
HE-FRAG warheads, 2-8
HEAT warheads, 2-10
practice warheads, 2-12
smoke warheads, 2-12
Weapons onload/offload, 11-30
explosive anchorage, 11-30
pier side, 11-30
transfer of ammunition at sea, 11-31

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