NAVWEPS OP 2219

VT FUZES FOR BOMBS

AND

FIN-STABILIZED ROCKETS

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CONTENTS

ILLUSTRATIONS

TABLES

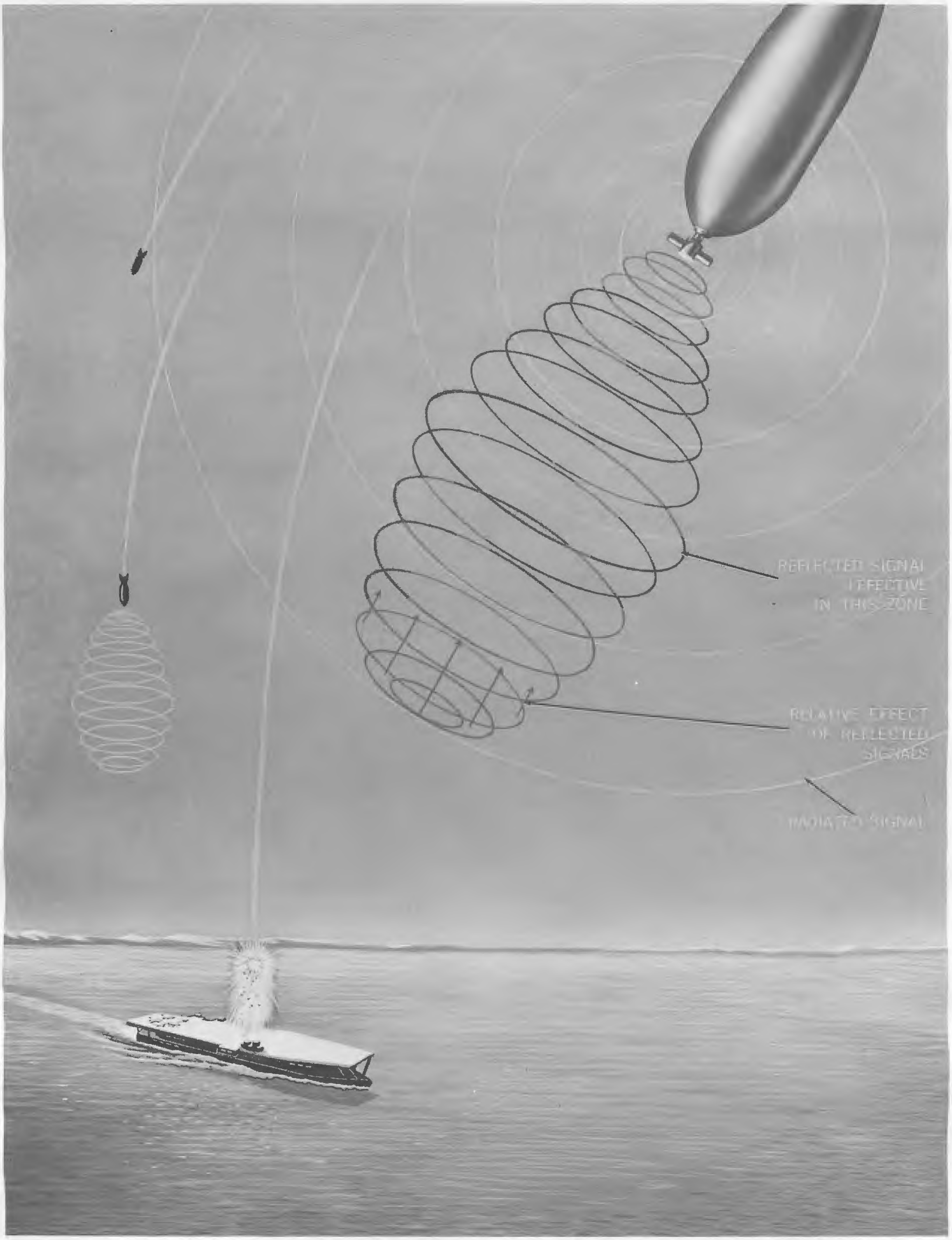


Figure 1–1. VT-Fuzed Bomb.

Chapter 1

GENERAL INFORMATION

Scope

This publication covers general and specific information about VT fuzes for bombs and fin-stabilized rockets. It provides a single source of reference for naval personnel handling bomb and fin-stablized rocket VT fuzes. The instructions contained herein apply to currently issued VT fuzes and, since the publication is issued in looseleaf form, pages can be superseded easily by more recent information. A list of obsolete and obsolescent VT fuzes is given in appendix A.

General Description

The term "VT fuzes" is used by all United States Armed Services to designate the various types of proximity, or influence, fuzes for projectiles, rockets, and bombs. The symbol "VT" has no significance as an abbreviation; it was devised for uses such as shipment orders, stock cards, and loaders' lists. All VT fuzes are nose fuzes.

VT fuzes are used in air-to-ground or air-to-air operations where air bursts at distances of 20 to 120 feet from the target increase the effectiveness of the bomb or rocket. These fuzes are not suitable for use against targets which require penetration and detonation within the target for effective destruction, figure 1–2.

The three basic types of VT fuzes for bombs and fin-stabilized rockets can be identified readily by their external appearance. The ring type has a heavy metal ring around its arming vane. This type is used for both bomb and rocket fuzing. The bar type has two metal bars extending radially, like handles, from the fuze nose. This type is used for bomb fuzing only. The choice of the ring or bar type for bomb fuzing is determined by the tactical situation involved. The third type is ogival with no external components and resembles an artillery projectile fuze. This fuze is used with certain aircraft rocket heads for both air-to-air and air-to-ground operations.

Description of External Components

The major external components of ring-type and bar-type bomb and fin-stabilized rocket fuzes are as follows: fuze body, arming vane, antenna ring or bar, vane-locking pin and spring, or vane-locking arm and spring, booster, and safety pin, figures 1–3, 1–4, and 1–5.

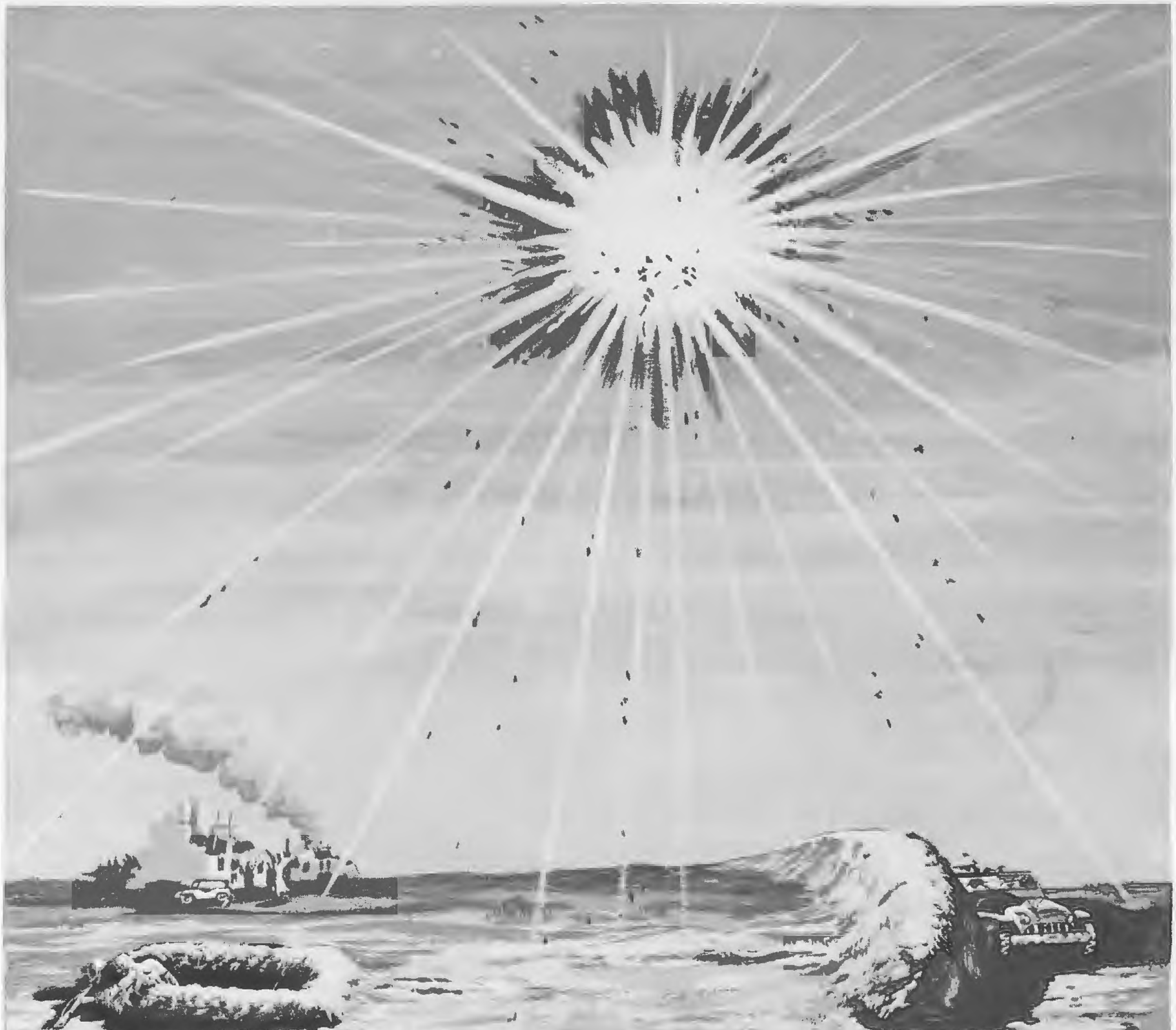
Fuze Body. The fuze body consists of two steel cylinders. The larger cylinder, approximately 3.4 inches in diameter, houses the VT element. Two wrench lugs are mounted upon this cylinder. The smaller cylinder contains the booster, detonator, firing condenser, and the 2.00-inch—12NS fuze threads. The mechanical arming mechanism is enclosed by both sections of the body.

The overall length of all ring and bar type VT fuzes is approximately 10.4 inches. These fuzes have approximately the same thread size. Because ring type fuzes are used in both bombs and rockets, care must be taken that bomb and rocket ring fuzes are not mistakenly interchanged. The ogival fuze is approximately 9.16 inches long.

Arming Vane. The arming vane is a steel or plastic propeller which drives the internal mechanism through a drive shaft. The ring type fuze has a multifinned (usually 10 fins) vane. The bar type fuze has an arming vane that consists of three fins.

Antenna Ring or Bar. The antenna ring is a heavy metal ring around the arming vane. The outside diameter of the ring is approximately 3.8 inches. Upon the ring is mounted the vane locking pin with its spring, the cotter pin, and the seal. The antenna ring contains four holes, any one of which may be used for mounting the vane *locking pin.* The bar type fuze has two 4-inch metal bars extending radially from the head of the fuze, and the vane

GROUND BURST



AIR BURST

Figure 1–2. Comparison of Ground and Air Bursts.

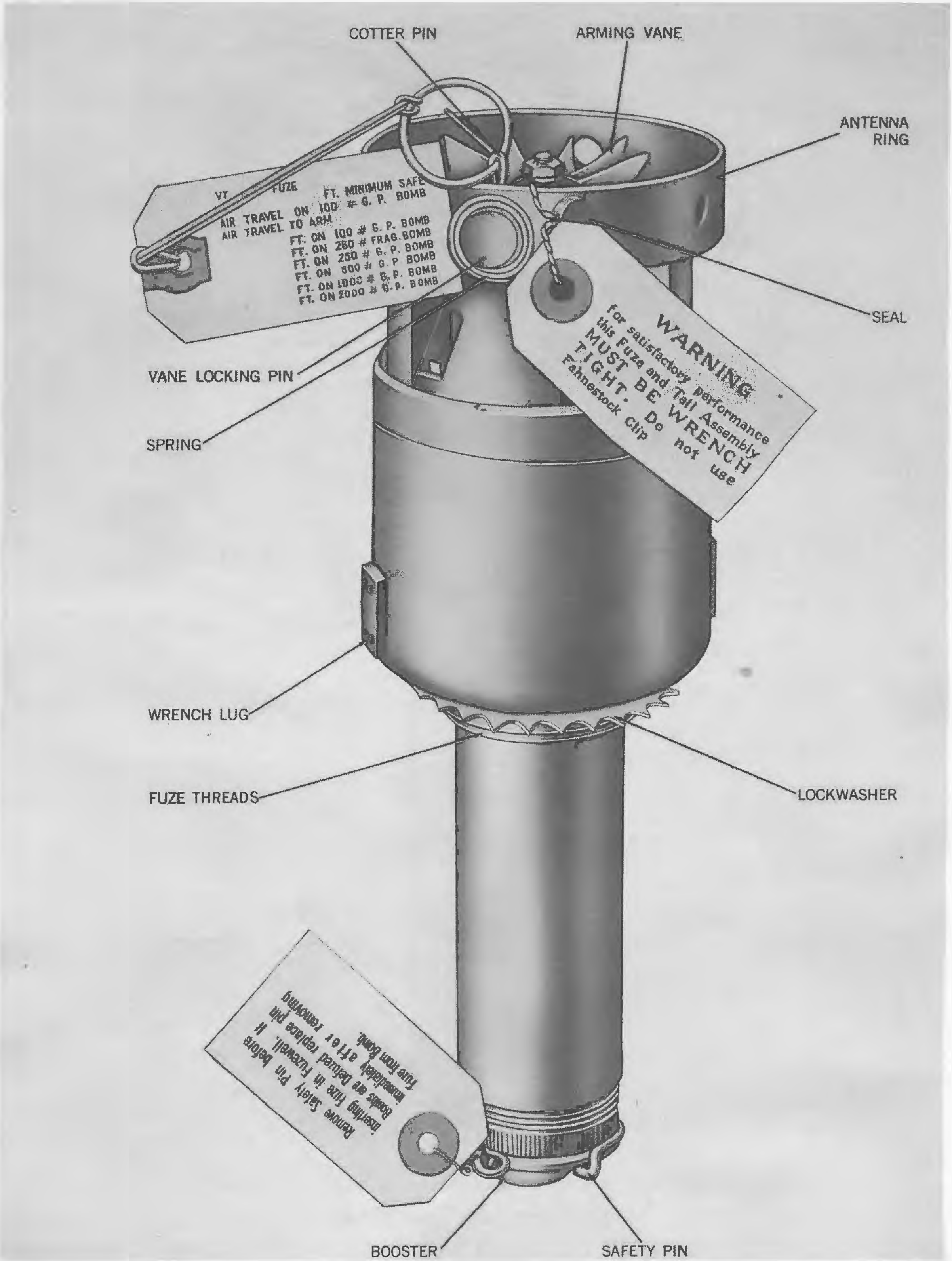


Figure 1–3. Ring Type VT Fuze.

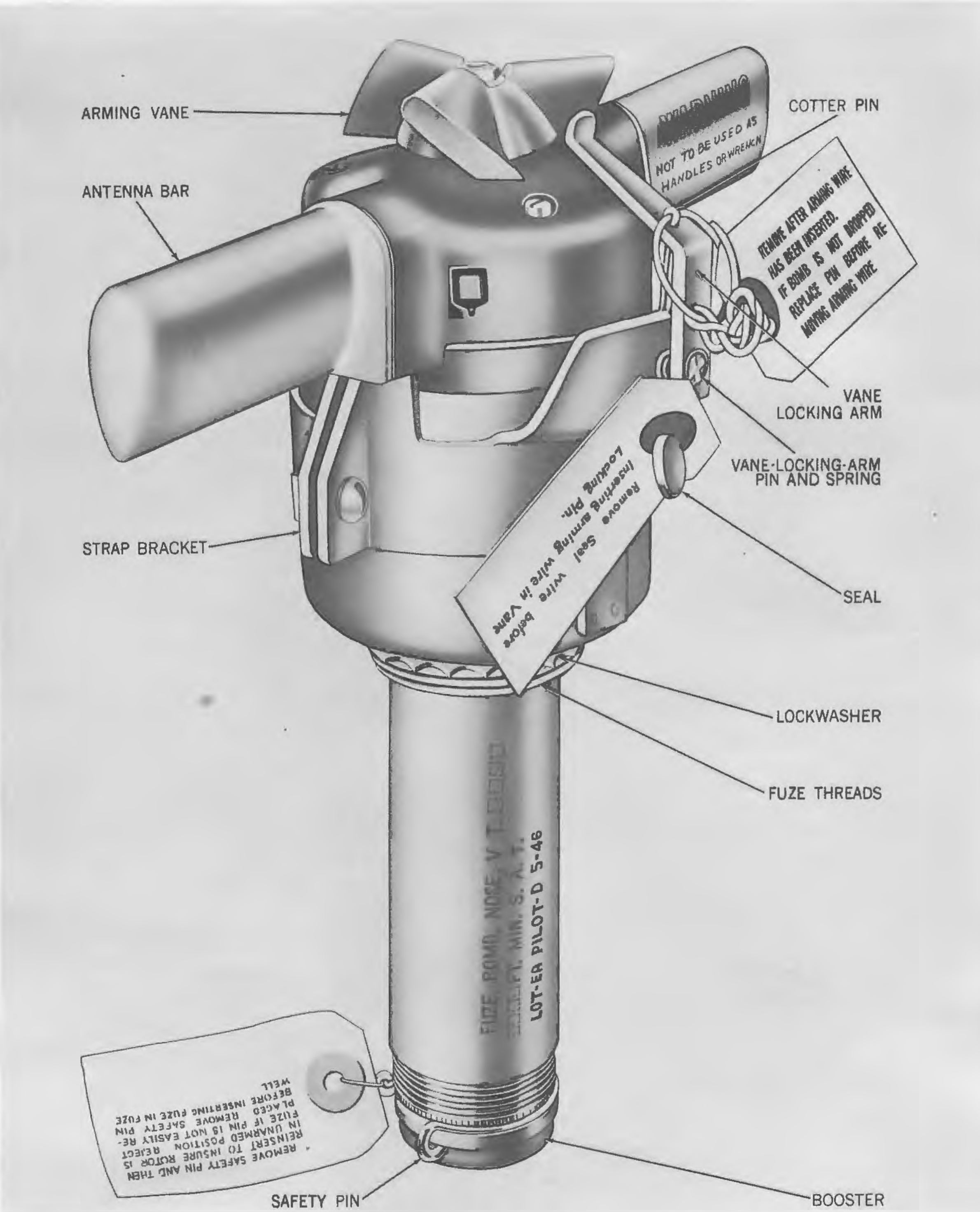


Figure 1–4. Bar Type VT Fuze.

locking arm mounted in a strap bracket on the fuze body. The diameter of the bar type fuze, measured across the bars, is approximately 10.0 inches.

Vane-Locking Pin or Arm. The vane-locking pin (for the ring type fuze) and vane-locking arm (for the bar type fuze) are removable devices mounted on the antenna ring and strap bracket respectively. The vane-locking pin is forced through its mounting against the force of a spring and is held in place by a cotter pin and an arming wire which are inserted through holes in the pin. In this position, the vane-locking pin blocks rotation of the arming vane. The vane-locking arm is assembled in a similar manner to the strap bracket. The cotter pin is removed and the vane-locking pin or arm is held in place by an arming wire when the fuze is installed in the ammunition in aircraft.

Booster. The booster is an assembly of a booster cup and a retainer sleeve. The booster cup, which contains the explosive charge, fits into the sleeve which is threaded into the bottom of the fuze. The booster contains a safety pin groove in which the safety pin rests before removal.

Safety Pin. The safety pin consists of a straight portion of wire (approximately 2 inches long) which extends through the booster cup into the arming mechanism, and a curved portion which clips around the outside of the booster. The presence of the safety pin indicates the unarmed condition of the electrical firing circuit.

Thumbscrew. Certain bomb fuze models were designed to allow for a normal setting of fuze sensitivity. This feature is accomplished by the addition of a sensitivity-setting thumbscrew on the fuze.

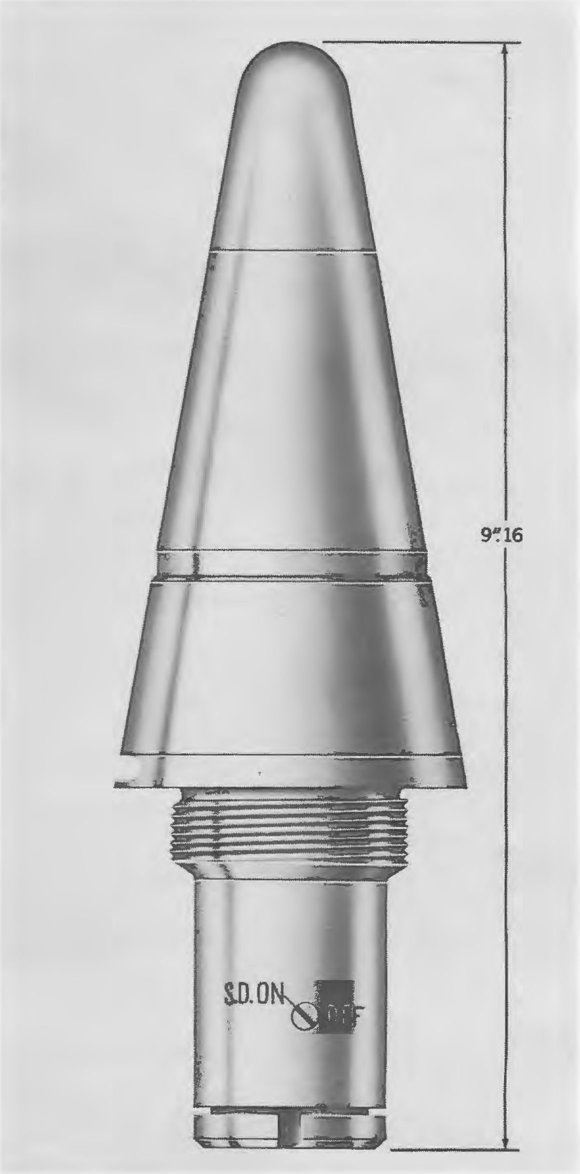


Figure 1–5. VT Rocket Fuze T2061.

Description of Internal Components

The internal components of ring and bar type (but not ogival) VT fuzes for bombs and fin-stabilized rockets are identical except that an additional delay arming element, an inertia weight lever, is added to the rocket fuze. The internal components of these fuzes may be separated generally into two groups—mechanical and electrical.

The mechanical arming mechanism of fin-stabilized rocket VT fuzes is identical to that for bombs, figure 1–6, except for the additional delay arming element shown in figure 1–7. A description of the internal components will be found in the discussion of the functional operation of the fuzes.

The electrical circuit of VT fuzes consists of an antenna, transmitter-receiver, power supply, firing condenser, and a detonator circuit. A complete description of these elements is not included in this publication.

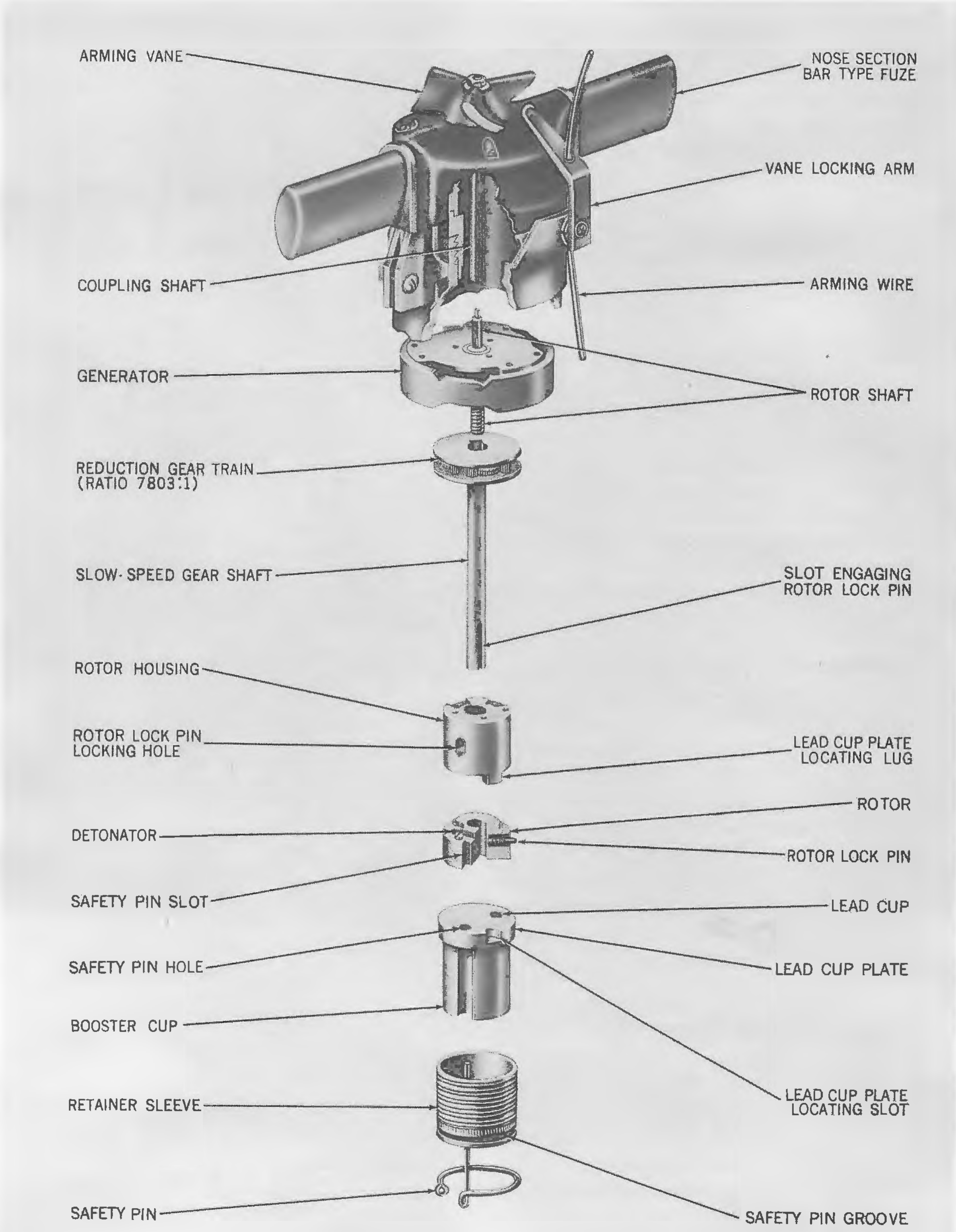


Figure 1–6. Arming Mechanism of Bomb VT Fuze.

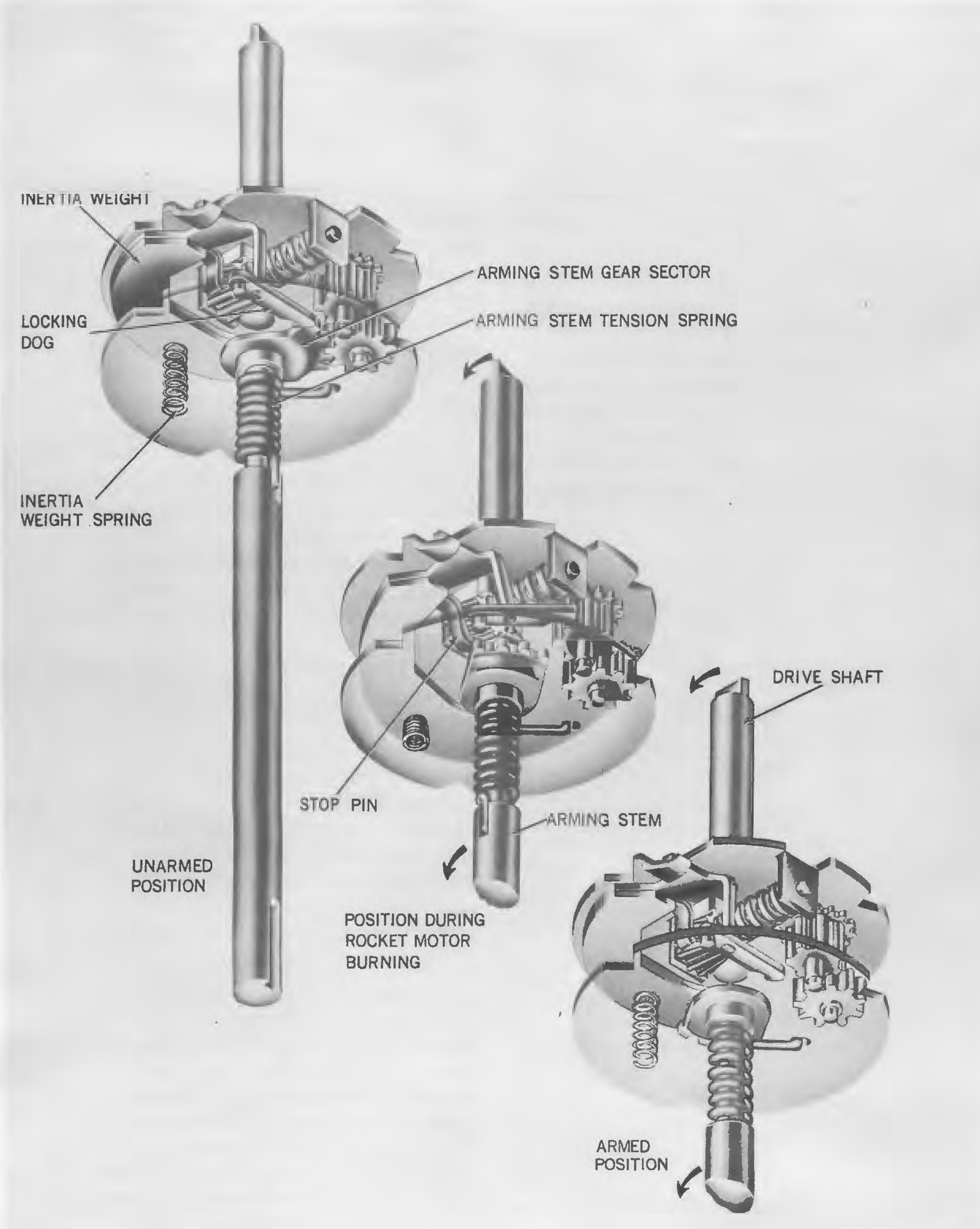


Figure 1–7. Delay Arming Mechanism of Fin-Stabilized Rocket VT Fuze.

Operation

VT fuzes cause detonation of a rocket or bomb at the most advantageous distance from the target. They are essentially radio transmitting and receiving units which, in free flight, transmit radio signals and receive signals reflected by the target. At the proper time, the reflected signals cause an electronic switch to close and fire an electric detonator. In contrast with impact and time fuzes, which are controlled by impact or by the distance traveled along the trajectory, the VT fuze is controlled solely by its proximity to the target.

VT fuzes for bombs and fin-stabilized rockets have essentially the same method of functioning except that the fin-stabilized rocket VT fuze has an additional delay arming element in its mechanical arming operation. The bomb VT fuze may or may not have a separately assembled delay arming device.

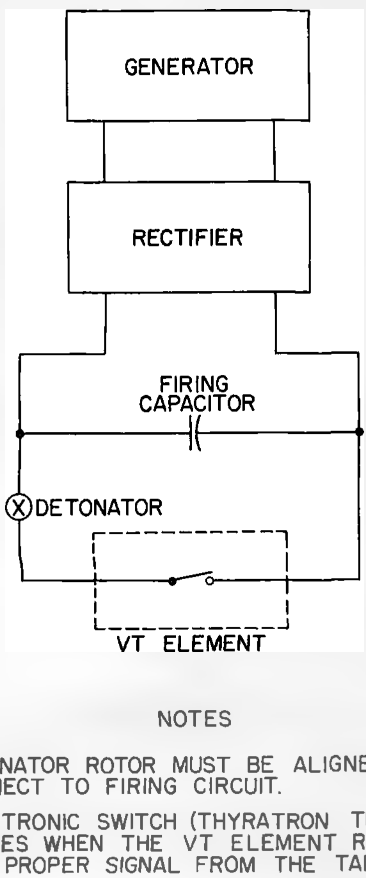


Figure 1–8. VT Fuze Firing Circuit.

Steps in Functioning. The following steps are common to the functioning of both bomb and fin-stabilized rocket VT fuzes.

1. When the bomb is dropped or the rocket launched, the vane locking pin or arm is withdrawn by spring action, freeing the vane for rotation.
2. The vane rotation is transmitted to the generator and, by suitable couplings, to the gear train and arming mechanism of the fuze.
3. After the required arming cycle, the detonator aligns with the booster and, in this position, is electrically connected to the firing circuit.
4. The detonator rotor is locked in the armed position and is simultaneously disconnected from the gear mechanism.
5. The vane continues to rotate, driving the generator which maintains the firing condenser charge and supplies the required voltage to all parts of the fuze. (The condenser charges immediately after the detonator terminals make contact. After 0.7 to 1.4 seconds, the condenser has stored sufficient energy to cause detonation.)
6. Upon approaching the target, under the proper conditions, the VT element activates the firing circuit, discharging the firing condenser through the electric detonator, initiating the explosive train, figure 1–8.

Bomb VT Fuze. The vane locking pin is discarded by spring action after the withdrawal of the arming wire. When used, an arming delay delays this function for a specified length of bomb air travel.

The coupling consists of a coupling shaft, rotor shaft, reduction gear train, and a slow-speed gear shaft. The reduction gear ratio is 7803:1.

The arming of the bomb VT fuze occurs after a required number of revolutions of the arming vane. The detonator rotor is rotated by the slow-speed gear shaft and, when armed, the detonator lines up with the booster lead-cup hole. Two terminals on the detonator rotor, the detonator firing-terminal screws, connect with two contacts in the rotor housing, thereby completing the electrical arming of the fuze.

The locking of the detonator rotor is accomplished by a rotor lock pin. When the detonator is aligned, the lock pin, under pressure of its spring, snaps outward into the locking hole, releasing the rotor from the slow-speed gear shaft and locking it in the armed position.

Generator operation and VT element operation apply to the ring or bar bomb fuze as well as to the fin-stabilized-rocket ring fuze. Sufficient voltage to fire the detonator can be supplied to the firing condenser by the generator only if the generator is driven at a speed corresponding to a velocity of approximately 80 knots.

Fin-Stabilized Rocket VT Fuze. In these fuzes, other than the ogival type, the vane-locking pin is discarded after withdrawal of the arming wire. An additional element, the hinged inertia weight, holds the gear train from rotating until the sudden acceleration forces the weight back against its spring, thus freeing the gear train. The acceleration occurs at the instant the rocket is launched.

The arming cycle of the fin-stabilized rocket VT fuze is more complicated than for the bomb VT fuze because of the different forces involved.

After approximately 100 vane revolutions, the gear sector on the arming stem has rotated 25 degrees clockwise to move clear of the gear train. As the gear sector clears the gear train, the tension spring snaps it 75 degrees clockwise, where it is detained by the stop pin on the hinged inertia weight.

Since the arming stem and detonator rotor are locked to the gear sector, they also move 25 degrees by vane rotation and 75 degrees by spring action. The vane, disconnected from the arming stem, continues to rotate during this operation.

As acceleration ceases when the propellant stops burning, the spring forces the hinged inertia weight forward, pulling the stop pin and freeing the gear sector. The tension spring snaps the gear sector 90 degrees clockwise into the armed position.

Locking of the detonator rotor is performed by the rotor lock pin which, when the detonator is aligned, snaps in a hole in the rotor housing, locking the detonator in the armed position and at the same time withdrawing from the keyway in the arming stem.

Auxiliary Devices

Under certain operating conditions, auxiliary devices are used to protect the launching air-

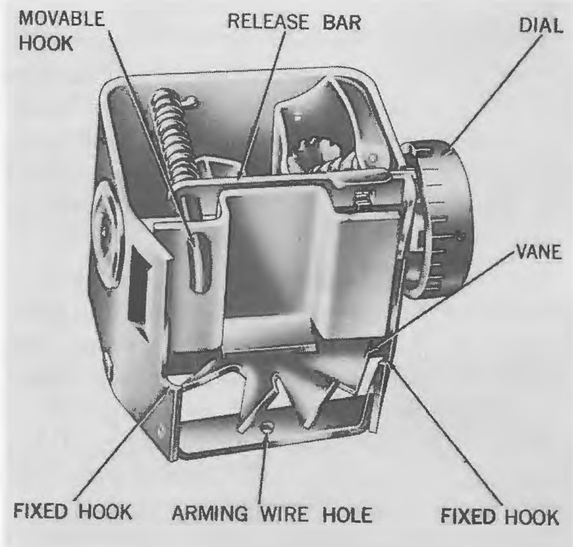


Figure 1–9. Arming Delay, Air Travel.

craft and nearby friendly aircraft from damage resulting from early fuze functioning. When bombs are to be dropped at high altitudes (10,000 feet or higher), there will be more probability of early fuze functioning and possible damage to friendly aircraft flying at lower altitudes. The arming delay, air travel, was designed to prevent this situation. VT-fuzed bombs have exploded while suspended externally from aircraft traveling at speeds greater than 260 knots. Extensive tests have proved that upon accidental release of the arming wire loop from the aircraft bomb arming control with the subsequent whipping effect of this free end in the slip stream, the effective end of the arming wire will work out of the vane-locking pin or vane-locking arm and result in vane rotation and fuze arming. The auxiliary safety device was designed to prevent this occurrence.

Arming Delay, Air Travel.

DESCRIPTION. The arming delay, air travel, figure 1–9, is an accessory device which may be attached to the fuze to delay the start of the arming operation until a preset air travel distance has been completed. This device contains an air vane, a reduction gear train, a setting dial, and a latch for attaching the assembly to the antenna ring or strap bracket of the fuze. The latch consists of two fixed hooks and one movable hook. The movable hook is attached to a spring-actuated release bar which is held in the latched position by the flange of the setting dial. The setting dial is mounted on one end of a geared shaft which is held engaged with the gear train by a spring. With this device, a distance of 20,000 feet (approximately 790 feet for each division on the arming delay dial) may be added to the minimum safe air travel (MIN S.A.T.) of the bomb.

OPERATION. The arming delay, air travel, is secured to the fuze so as to hold the vane-locking pin or arm in place. Premature functioning of the fuze is prevented by an arming wire, which passes through a hole in the frame and keeps the air vane from rotating. When the bomb is released and the arming wire withdrawn, the mechanism is operated by the flow of air through the air vane. The rotation of the air vane acts through the reduction gear train to rotate the setting dial. When the preset air travel is completed, the spring-actuated release bar is released and the device is released from the fuze. When the arming delay is forced away from the fuze, the vane-locking-pin spring or vane-locking-arm spring simultaneously ejects the locking pin or arm so that the fuze arming vane is free to turn.

Auxiliary Safety Device.

DESCRIPTION. The auxiliary safety device is a perforated plate which is mounted on the bomb to provide a guide for a second arming wire. The arming wire is held in place on the fuze by a safety clip which rests against the perforated plate. The other end of the arming wire is permanently attached to the aircraft arming control mechanism for the duration of the mission. The auxiliary safety arrangement for both types of fuzes is shown in figure 1–10.

The design of the bar type fuze permits use of a Fahnestock (safety) clip on the arming wire forward of the vane-locking arm without danger of the clip becoming jammed in the arming vane when the bomb is released. For this reason, it is not necessary to use the perforated plate, and additional safety for bar type fuzes may be had by installing the second arming wire directly to the second vane locking arm. The use of the second arming wire adds to the safety of the aircraft in the following ways.

1. The Fahnestock clip increases the force required to withdraw the arming wire.

2. The second vane-locking pin or arm increases the safety of the fuze.

3. When the arming control mechanism is set on SAFE, making it possible for the arming wire loop to come out, protection against fuze arming is maintained by the second arming wire, which is attached permanently to the aircraft.

4. The bomb may still be dropped safe.

OPERATION. The addition of an auxiliary safety device and an additional arming wire to a VT-fuzed bomb does not change the operation of that fuze. These devices simply add safety to the normal arming wire function.

General Characteristics

These are the characteristics that are common to all bomb and fin-stabilized rocket VT fuzes.

Sensitivity. The sensitivity of a VT fuze depends on the general shape of the bomb or rocket in which it is installed as well as the particular fuze model. The sensitivity patterns for VT-fuzed bombs are shown in simplified form in figure 1–11. The pattern shown for the ring type fuze applies also to the fin-stabilized rocket VT fuze.

Ring type fuzes are more sensitive to passing potential targets; that is, they receive the strongest return signals from objects abreast of them. For this reason, they are affected by the angles at which they approach the target. The approach angle depends on the altitude, air speed, and angle of approach of the launching aircraft when the bomb or rocket is released.

Bar type fuzes (for bombs only) are most strongly affected by targets directly in their paths; they are practically independent of any striking angle effect. The sensitivity of some bomb VT fuze models can be varied by adjustment of the knurled-head thumbscrew. For target conditions where a low burst height will result in relatively greater damage, the reduced-sensitivity (thumbscrew in place) bar type fuze model is often used.

Reliability. Development of VT fuzes has reached a point where more than 80 percent (as high as 85 percent for some bomb fuzes) can be expected to function properly upon approaching the target. Fuzes which fail to function effectively may function after arming but before approaching the target (earlies), or may not function at all (duds).

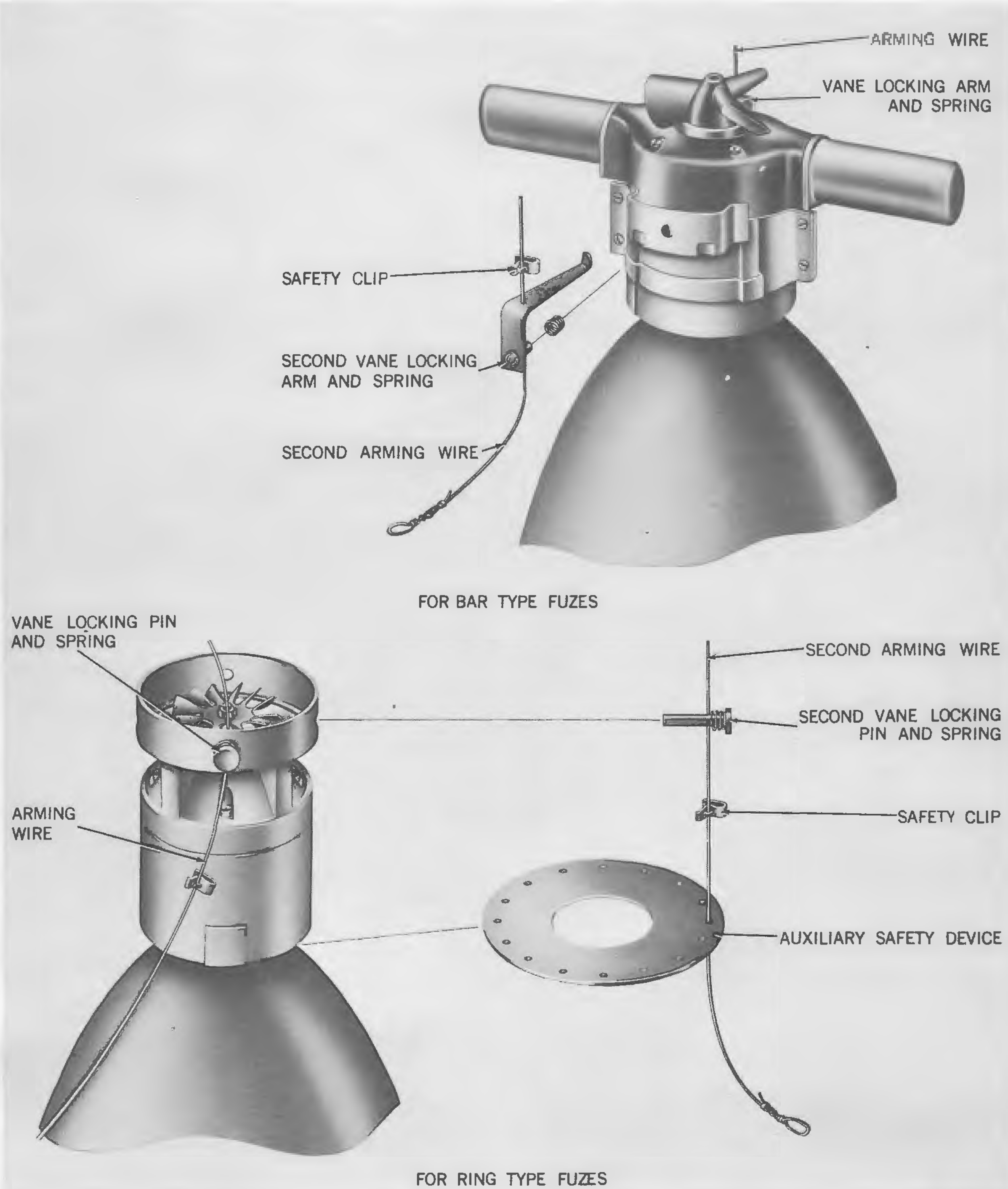


Figure 1–10. Auxiliary Safety Arrangement.

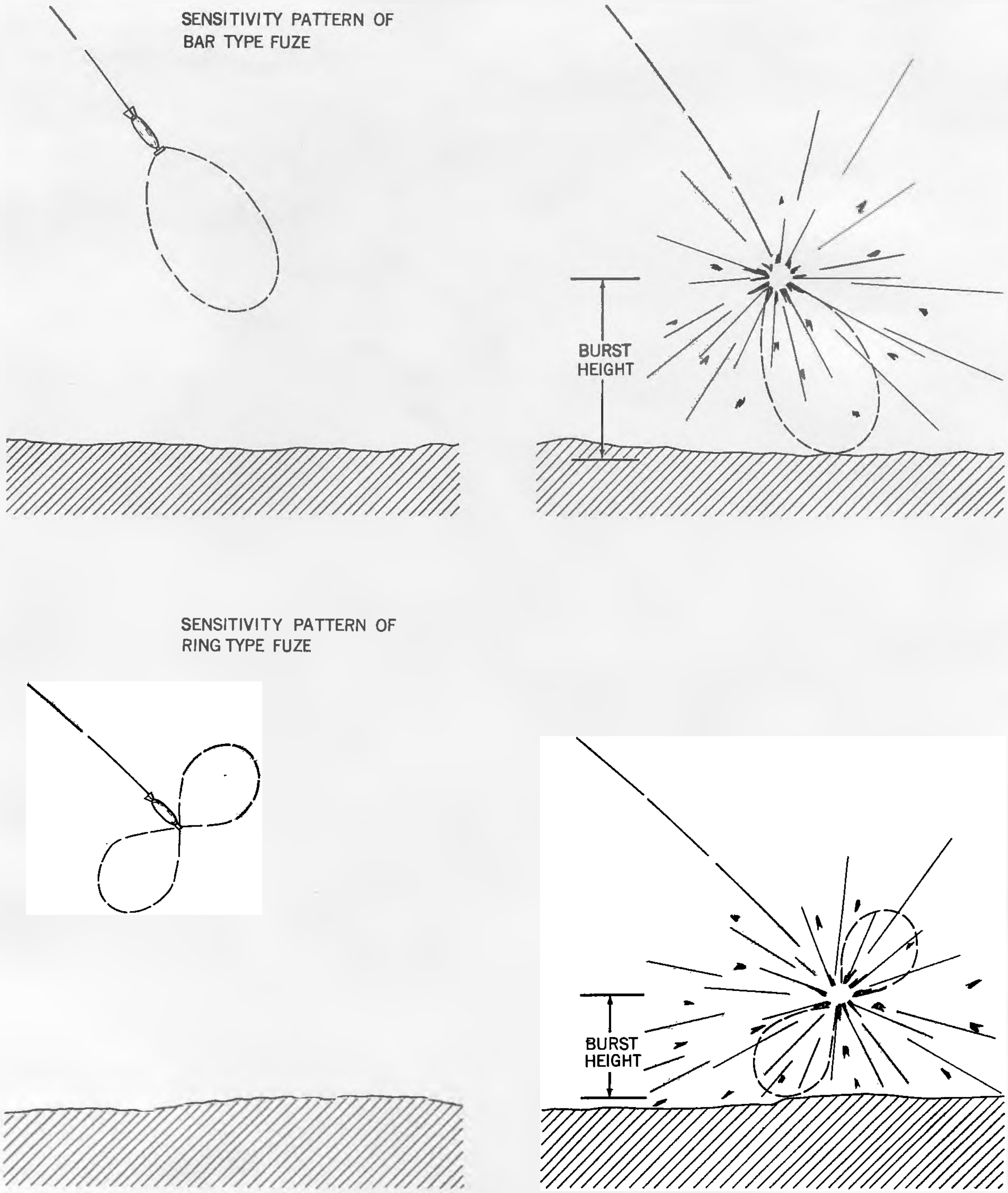


Figure 1–11. Sensitivity of Ring and Bar Type VT Fuzes.

Earlies involve malfunctioning after the fuze is fully armed, and therefore do not endanger the releasing aircraft unless the precautions given in this publication are ignored. The delay arming of the fuze is specifically designed to insure that functioning of the fuze cannot occur until the bomb or rocket is far enough from the aircraft to prevent damage to the aircraft even if the fuze detonates at the moment of arming.

With respect to duds, VT-fuzed rocket heads have a built-in base fuze which will detonate, with a slight delay, upon impact. A tail fuze of the AN–M100A2 series is recommended for a VT-fuzed bomb which uses box fins; an M172, M184, or M185 tail fuze is recommended for a VT-fuzed bomb which uses conical fins.

Malfunctions. The nature of the VT fuze is such that it may be some time before further development eliminates the tendency of some of them to function too soon. Therefore, earlies must be expected. Under clear weather conditions, the number of earlies should not exceed 15 percent of the fuzes used. An excessive number of earlies (more than 25 percent) may result from use under adverse weather conditions or from faulty handling and installation procedures. In those cases in which an excessive number of earlies cannot be attributed to adverse weather or faulty handling and installation, the fuze lot(s) involved should be suspected of reduced quality in performance (but not in safety) and appropriate reports should be made to the Bureau of Naval Weapons.

Personnel handling VT-fuzed bombs and fin-stabilized rockets should be careful to prevent possible causes of malfunctioning. Generally, improper functioning of VT-fuzed ammunition will be caused by one or more of the following:

1. Improper inspection before installing fuze.
2. Improper installation of fuze.
3. Fuze installed in wrong bomb or rocket assembly.
4. Adverse conditions of temperature, weather, climate, and vibration.
5. Release altitude incorrect (altitude too high or too low).
6. Insufficient intervalometer spacing in VT-fuzed bomb releases.

The information that follows applies to VT-fuzed bombs only.

Fuze malfunctioning results in either early detonation or a dud. It may be difficult to determine from the releasing aircraft which type of malfunction occurs. However, certain characteristics which can be observed either from the aircraft or in photographs make identification possible. Reports by combat crews, giving numbers and types of malfunctions, assist ground crews in taking preventive measures. When observed from the releasing aircraft, earlies may be recognized by the following indications:

1. Irregular timing sequence of detonations in train.
2. An unusually short time lapse between release and detonation.
3. Bursts resulting in other than typical surface fragmentation patterns, figure 1–12.

Occurrence of dud fuzes may be largely compensated for by using a tail fuze on each bomb to minimize the chances of an undestroyed VT fuze falling into unauthorized hands. Observed from the releasing aircraft when a tail fuze is used, the failure of the VT fuze is indicated by the characteristic circular pattern and crater that results from the nondelay burst of the tail fuze.

Fuze Testing. VT fuzes are tested before acceptance and issue. Only one method of testing VT fuzes for bombs and fin-stabilized rockets is practicable under field conditions. This involves testing each fuze lot for operational efficiency by dropping a representative group of sample fuzes. The sample fuzes should be taken from as many different boxes as possible.

Tests should be conducted over water or level terrain, if possible, in order to assess fuze performance under uniform conditions. Burst heights over water will be about double those over normal soil.

Interchangeability. VT fuzes for bombs are physically (but not tactically, since they function before impact) interchangeable with Bomb Nose Fuze AN–M103A1 and are satisfactory for interchangeable use in all bomb sizes listed in table 1–1. However, best results are obtained, with respect to burst heights, when the recommended fuze-bomb combinations are followed. These are given in the tables for the particular fuze models in chapter 2.

VT fuzes for fin-stabilized rockets are not interchangeable with other rocket nose fuzes since the VT fuze requires a larger cavity than the other fuze. VT fuzes must be used only with the specific rocket assemblies given in chapter 4.

Figure 1-12. Surface Fragmentation Patterns for VT-Fuzed Bombs.

Effects of Adverse Conditions. Conditions which affect bomb and fin-stabilized rocket VT fuze operation include temperature, weather, climate, and vibration.

Temperature. Normal safety and operating characteristics of VT fuzes are not adversely affected when used or stored within the temperature ranges of −65 degrees to 165 degrees F. However, in the case of VT-fuzed fin-stabilized rockets, the operating temperature of the rocket assembly must be kept within a certain temperature range, depending on the rocket motor used, for satisfactory performance.

Weather. Tests of the operation of VT fuzes indicate that they are not adversely affected by sunlight, darkness, light rain, or fog (haze); however, heavy rain, hail, clouds, and snow are liable to cause an excessive number of early functions.

Climate. Warm, humid conditions will cause rapid deterioration of all exposed VT fuzes, whether installed in a bomb or rocket. When packed in their original shipping containers, fuzes may be stored practically indefinitely. The sealed metal containers should not be opened until the fuzes are required for installation in bombs or rockets. Fuzes removed from unexpended bombs and rockets should be placed in their containers and sealed.

Vibration. Excessive vibration of any component of the complete round during flight will cause an increase in the number of early functions. For this reason, the fuze must be installed wrench-tight and the complete assembly checked to insure that all parts are tight to prevent vibration during flight. The principal causes of vibration are: fin assemblies which are bent, loose, improperly seated, or poorly fabricated; fuzes which have damaged vanes or which are loose in the fuze seat; and for VT-fuzed bombs, missing lockwashers and excessive bearing wear from release at high altitudes without the use of an arming delay.

Functional Characteristics

Because of the different functional requirements of bomb and fin-stabilized rocket VT fuzes, their functional characteristics are not similar and must be considered separately. These characteristics are those which may be varied by personnel (by choice of fuze model, use of auxiliary devices, variation of launching conditions, and so forth) to meet particular tactical situations.

Bomb VT Fuzes. The functional characteristics of bomb VT fuzes are those which determine the operation of the fuze, and hence the VT-fuzed bomb, after release from the aircraft.

TRAIN SPACING. VT fuzes are designed to respond to sudden changes in their surroundings. An armed fuze may function because of bursting of a nearby bomb. This affects the minimum train spacing that can be used with VT-fuzed bombs. Minimum train spacing is the recommended minimum distance traveled by the aircraft between consecutive bomb releases; it must be greater for large bombs because their bursts are of greater magnitude than those of small bombs.

An intervalometer spacing of 50 feet or more for 100- and 250-pound general-purpose bombs and 220- and 260-pound fragmentation bombs, or of 100 feet or more for 500-pound or larger general-purpose bombs, gives satisfactory results. Intervalometer spacing for bombs filled with chemicals may be about 50 percent less than for corresponding bombs loaded with high explosives. Smaller intervalometer spacings than these may result in an excessive number of early fuze functions.

ARMING TIME. VT fuzes cannot function until they are fully armed. The greater the distance the bomb falls while the fuze is arming, the safer is the aircraft and the fewer are the earlies. There is no restriction on air speed at the time of release. For a given safe air travel, the separation distance in horizontal flight, figure 1–13, varies approximately inversely as the square of the release speed. The higher the speed, the closer the bomb will be to the aircraft when the fuze is armed. Separation distances for various conditions of horizontal and dive bombing are given in chapter 5.

Whenever operating conditions dictate reduction in the risk of damage to aircraft by early fuze functioning, use of the arming delay is recommended. This device increases the fuze safe air travel, thereby providing greater separation distance between the aircraft and the region of fuze arming. Added increments of arming delay safe air travel require higher minimum release altitudes for the various bomb-fuze combinations under the listed release conditions to insure completion of arming so that fuzes can function at effective burst heights over the target. (See chapter 5.)

It is advisable to use an arming delay when releasing VT-fuzed bombs from high altitudes (10,000 feet and higher) because there is less probability of early functioning if the fuze arming is delayed by safe air travel. For release altitudes up to 10,000 feet, all fuzes described herein may be expected to perform according to the design characteristics discussed in "General Characteristics" with respect to early functions.

In general, VT-fuzed bombs will have approximately the same ballistics as bombs fuzed with AN–M103A1 nose fuzes when released at altitudes not higher than 10,000 feet. At higher altitudes, unknown changes may be expected in bomb ballistics.

HEIGHT OF BURST. It is inevitable that small differences will exist between the many corresponding component parts of fuzes; hence, many small differences exist in assembled fuzes of the same type. Consequently, there are variations in the actual heights at which individual fuzes function and, in general, fuzes of the same type do not detonate at the same height even when all other conditions are identical. Figure 1–14 shows the variations in burst height to be expected with a typical group of VT fuzes.

The two types of bomb fuzes (ring and bar type) differ in behavior as well as in appearance. In general, the height of normal burst of both types depends upon a number of independent factors—target reflectivity, target approach conditions (bomb striking angle and speed), manufacturer's tolerances in fuze parts, fuze-bomb combinations, and others. Under combat conditions, freedom of control is feasible on the fuze-bomb combination only.

Bar type fuzes generally produce slightly higher bursts than ring type fuzes, figure 1–11, and are less apt to show a variation in burst height as the bomb type is varied. The bar type fuze gives higher burst heights for steep angles of approach to the target; the ring type

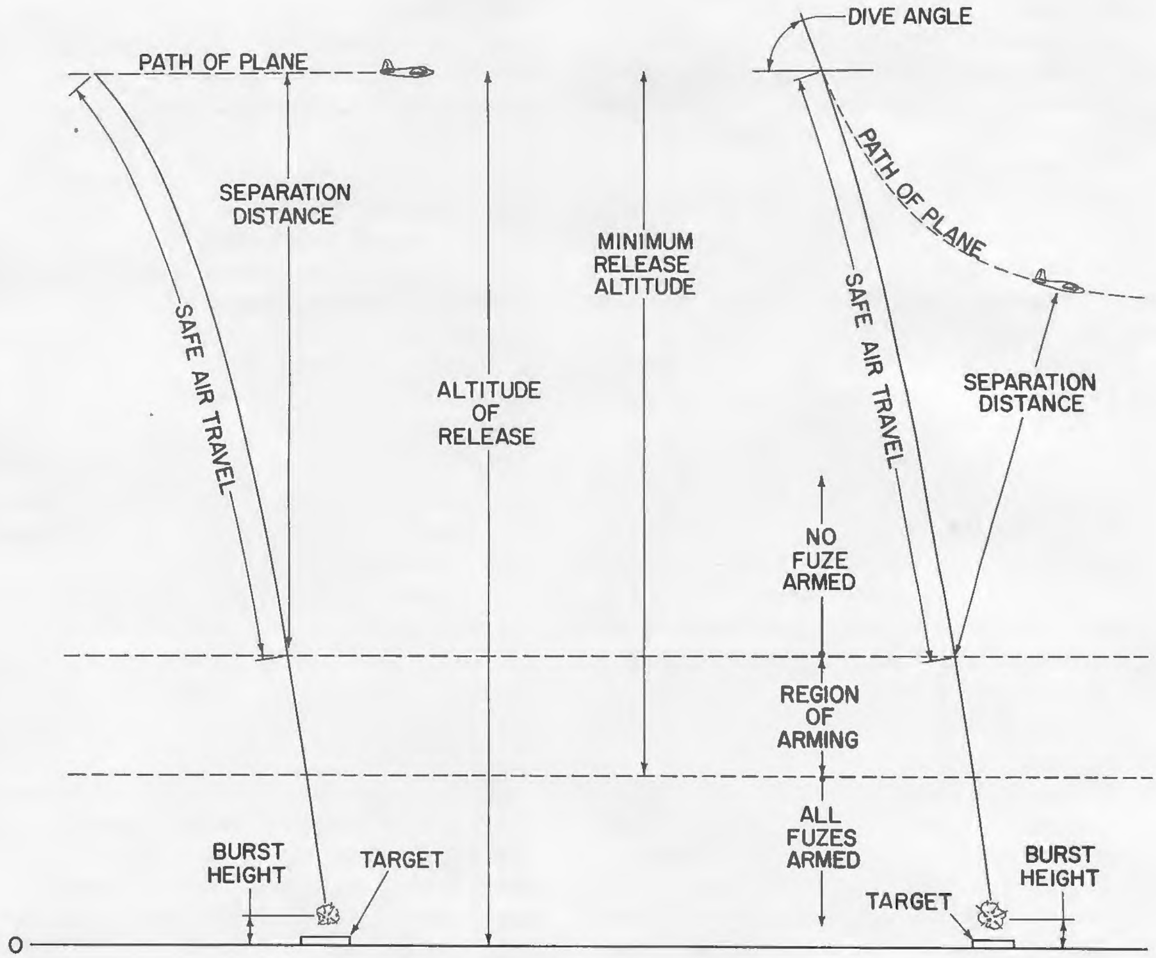


Figure 1–13. Functional Characteristics of VT-Fuzed Bombs.

fuze produces higher burst heights for shallow angles of approach. The ring type fuze is excellent for defoliating trees because of its sensitivity to tree tops; it is also best for rooftop bursts against tall city buildings. The bar type fuze tends to pass tall trees or buildings and burst on approach to the ground surface. Either type of fuze, when used over average land and under the conditions covered by these instructions, will burst in a majority of releases within 20 to 125 feet from the target.

Average burst height over sea water is about twice as great as over average land for both types of fuzes. Burst heights are about two-thirds as high over arid land and ice or snow as over average land. A mass of tall trees or large buildings will increase the burst heights over land in their vicinity, but the increase in burst height will be somewhat less than the height of the objects, the degree of influence being dependent on the density of the objects. For the best burst height results, it is advisable to use the fuze-bomb combinations shown in the tables of chapter 2 for individual fuze models. When used in improper bombs, the ring type fuze will usually give very low bursts of 3 to 10 feet.

Ideally, the selection of the VT-fuze-bomb combination for use against any specific target is dictated by the burst height required to inflict maximum damage on that target. Under operational conditions, however, the desirable burst height is seldom known. For the bombs listed in this publication, close to maximum

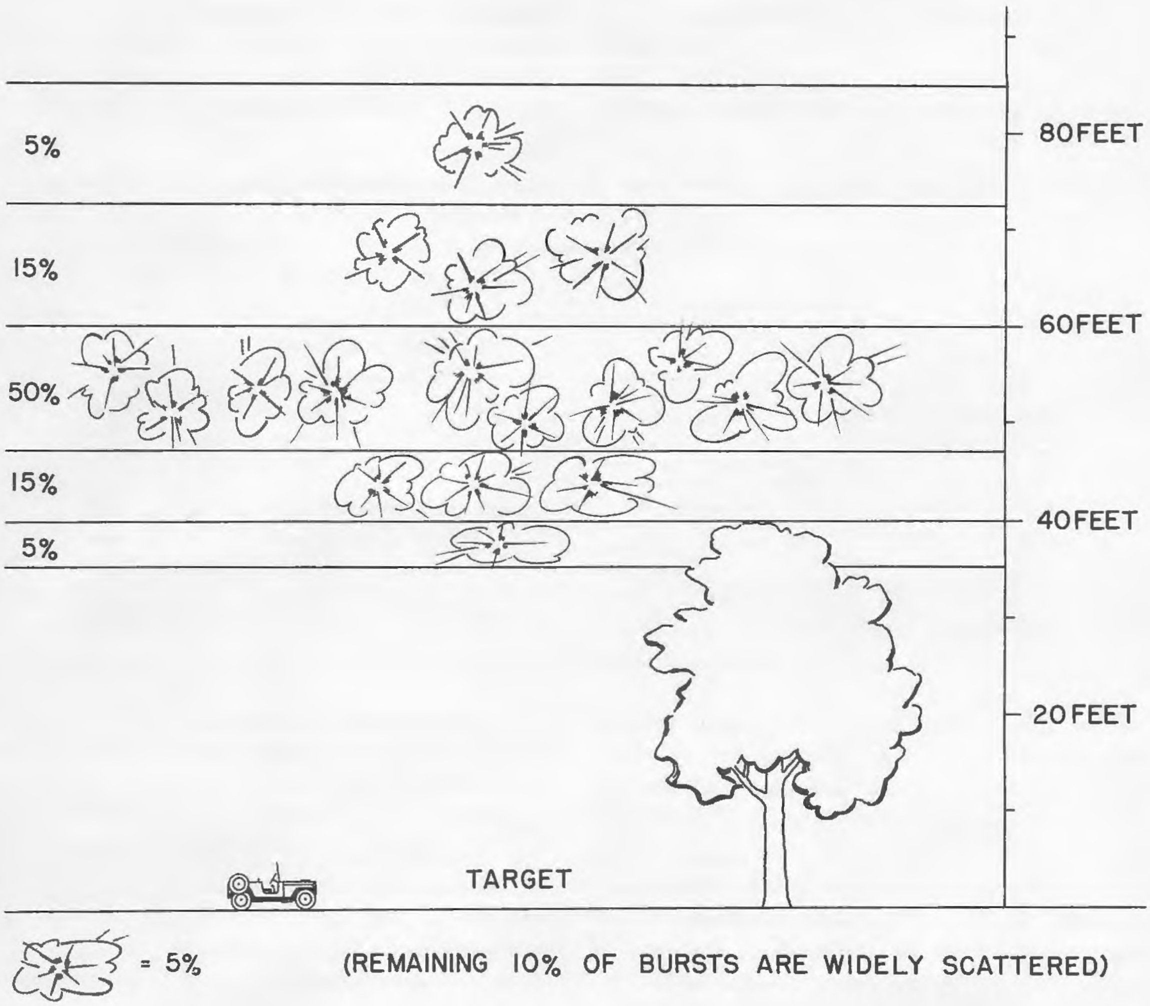


Figure 1–14. Dispersion of Bursts in Height for VT-Fuzed Bombs.

damage on a wide variety of tactical targets is obtained from bursts ranging from 20 to 125 feet. Attempts to exercise rigid control of burst height by restricting the fuze, bomb, and release conditions are not advisable. An arbitrary choice, dictated by operational conditions, of any of the VT fuzes, bombs, and release conditions is usually satisfactory.

However, for target conditions where a low burst height results in relatively greater damage, such as to unshielded personnel and material deployed in open terrain, use of the reduced-sensitivity (thumbscrew in place) bar type fuze is recommended.

SAFE AIR TRAVEL. The fact that the arming vane must turn at least 1000 revolutions before the fuze is fully armed means that, after the vane is released, the bomb must travel a certain distance through the air before the fuze can function. This distance, measured along the bomb trajectory, is called safe air travel (S.A.T.) and is shown in figure 1–13. Safe air travel specifically means the distance along the trajectory that the bomb travels in the unarmed condition. It does not necessarily mean that the releasing aircraft is safe from a detonation occurring immediately after the operation is completed (this refers to the separation distance).

Manufacturers' tolerances in parts and assemblies cause variations of as much as 1850 feet in the safe air travel of fuzes that are presumably identical. Each lot of VT fuzes is tested in the 100-Pound General-Purpose Bomb AN–M30 to evaluate the MIN S.A.T. The MIN S.A.T.—that air travel before which no fuze in the lot will arm when used with the 100-pound general-purpose bomb—is marked on each fuze. On bombs of larger sizes, the minimum air travel required for arming will be greater than the MIN S.A.T. marked on the fuze by the percentages listed in table 1–1.

Table 1–1. Minimum Safe Air Travel and Minimum Recommended Separation Distances for VT-Fuzed Bombs

Bomb Series	Percentage Increase to be Added to Fuze MIN S.A.T.	Minimum Recommednded Separation Distance (Ft)
100 lb, GP, AN–M30	None	500
250 lb, GP, AN–M57	8. 0	500
250 lb, GP, Mk 81 Mod 1	8. 0	500
220 lb, FRAG, AN–M88	2. 0	650
260 lb, FRAG, AN–M81	2. 0	650
500 lb, GP, AN–M64	15. 0	650
500 lb, GP, Mk 82 Mods 0 and 1	15. 0	650
1000 lb, GP, AN–M65	32. 0	750
1000 lb, GP, Mk 83 Mods 2 and 3	32. 0	750
2000 lb, GP, AN–M66	58. 0	850
2000 lb, GP, Mk 84 Mods 0 and 1	58. 0	850

Separation Distance. The separation distance, figure 1–13, is the straight line distance between the releasing aircraft and the bomb at the instant the safe air travel has been completed. This corresponds approximately to the vertical drop when the bombs are released in horizontal flight. Separation distance varies with aircraft speed and altitude at the time of release. The determination of separation distance is important from the standpoint of safety and performance.

Safety. After a VT fuze is armed, it may detonate on the first target that comes within its range of influence. This target may be the releasing aircraft, other friendly aircraft, enemy aircraft, or a ground object. Thus, it is vitally important that the minimum separation distance at which arming occurs be sufficient to provide adequate clearance not only for the releasing aircraft but for any friendly aircraft at lower altitudes. The permissible minimum separation distance between an armed fuze and the releasing aircraft is specified by operations authorities.

Table 1–1 gives the recommended minimum separation distances under armed fuze conditions for the various sizes of bombs with which VT fuzes are used. These recommended minimum distances are based on what is conventionally called a 1-percent risk. That is, it may be expected that, with bombs bursting at the listed separation distances, there will be at least one fragment penetration in each 25 square feet of horizontal aircraft surface in one out of each 100 bomb releases. This fragment will strike with sufficient force to penetrate a 1-inch thickness of pine board and may be capable of causing a casualty.

Performance. It is important that bombs be released at altitudes not less than the minimum release altitudes given in the tables of chapter 5. If bombs are released at lower altitudes, the VT fuzes may be in the unarmed condition upon impact and may not function. In this situation, the tail fuze installed in the bomb to insure detonation, having a shorter arming distance than the VT fuze, will govern safety.

Minimum Release Altitude. The minimum release altitude is defined as the release altitude required to make arming of the fuze before impact reasonably certain. It is the minimum vertical distance that the bomb must travel before arming is assured, and is measured from the horizontal line of flight of the releasing aircraft. The values of minimum release alti-

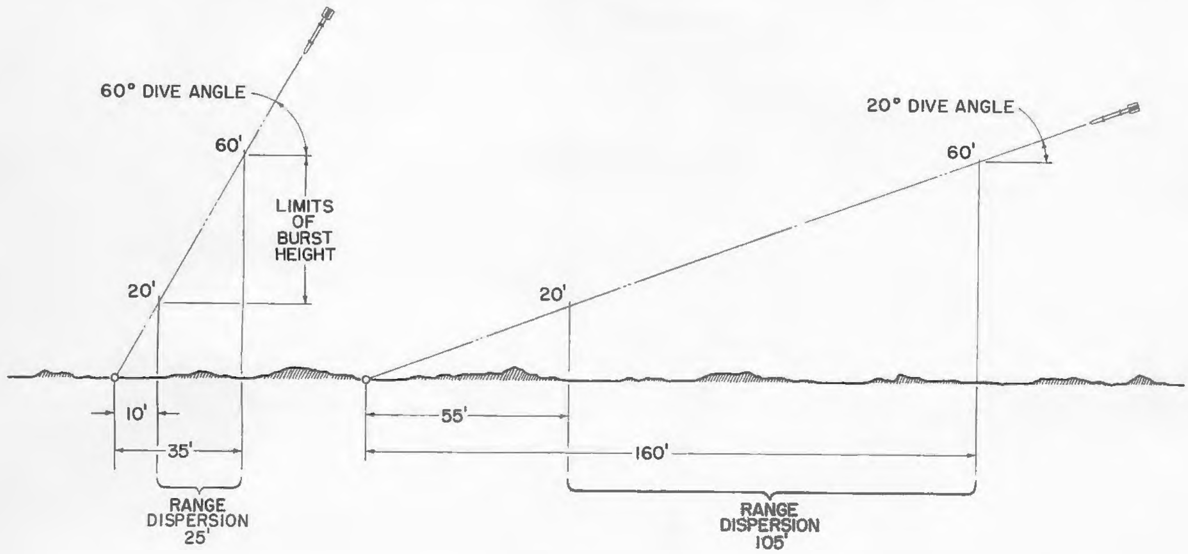


Figure 1–15. Variation in Range Dispersion for 20-Degree and 60-Degree Dive Angles.

tude (see tables in chapter 5) allow sufficient air travel to insure that at least 95 percent of the fuzes will be armed.

Fin-Stabilized Rocket VT Fuzes. The functional characteristics of fin-stabilized rocket VT fuzes are those which determine the operation of the VT fuze and VT-fuzed fin-stabilized rocket after release from the aircraft.

Height of Burst. The average fuze is specifically designed to function 30 to 40 feet above ground when fired from an aircraft in a 40-degree dive. However, fuzes may function within 15 to 60 feet above ground (double that over water) because of variations in the nature of the gound and between individual fuzes. Terrain irregularities, trees, and metallic targets will cause bursts to occur at slightly greater heights than would occur over level terrain. Also, because of the nature of the VT fuze, a lower dive angle will give a higher burst height, figure 1–11. A variation in burst height will cause a dispersion in range which may be serious if the rocket is fired while the aircraft is in a very shallow dive.

Figure 1–14 shows that with a 20-degree dive angle, a fuze functioning at 20 feet from the ground will be 55 feet short of the target, while a fuze functioning 60 feet from the ground will be 160 feet short of the target. When the dive angle is increased to 60 degrees with burst heights of 20 to 60 feet, the errors in range are only 10 to 35 feet respectively. Therefore, the dive angle should be as steep as practicable, preferably above 30 degrees, when using a VT fuze on a fin-stabilized rocket.

Minimum Release Range. Since the VT fuze is an influence type fuze, a minimum release range is used to insure that the fuze will not arm until it is a sufficient distance from the firing aircraft to prevent damage to the aircraft in case of an early burst. This delay is involved in the fuze arming function and in charging of the firing condenser.

For the sake of performance, however, it is necessary to release VT-fuzed fin-stabilized rockets at a sufficient range to insure that they are armed upon approaching the target.

Minimum release range is shown in figure 1–16. The absolute minimum distance in front of the firing aircraft at which some of the fuzes will arm depends upon the speed of the aircraft and the rocket motor temperature. (See "Release Data for Fin-Stabilized Rocket VT Fuzes," chapter 5.)

Aiming Correction. Since the VT fuze produces an air burst, the rocket must be aimed so that it will pass over the target at the height at which the fuze is expected to function. This can be done by leading the target a distance depending upon the dive angle of the firing

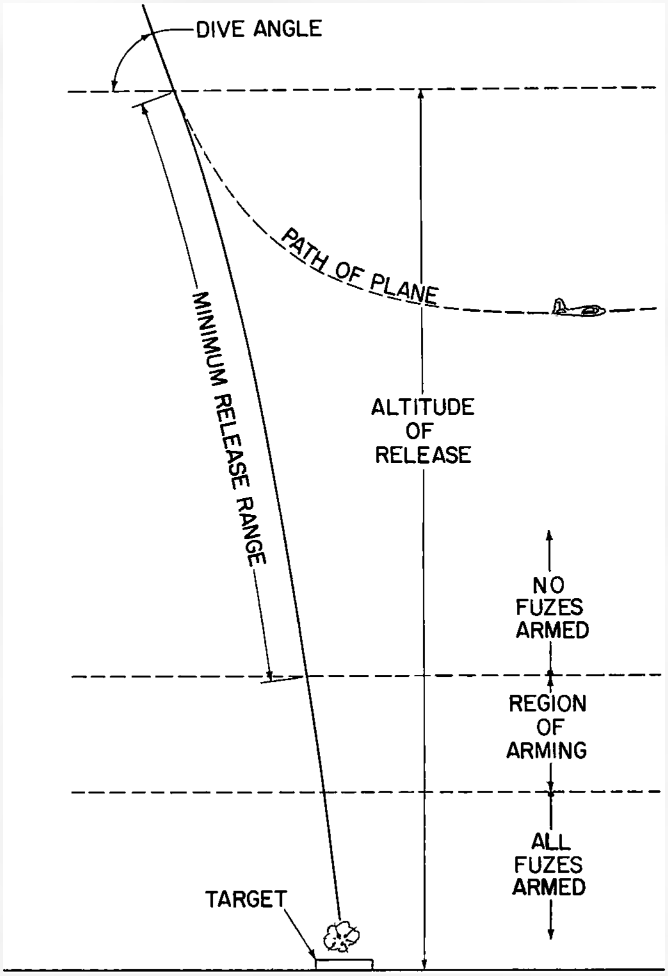


Figure 1–16. Functional Characteristics of VT-Fuzed Fin-Stabilized Rockets.

aircraft. Generally, the aiming correction decreases as the dive angle increases. (See chapter 5.)

Installation and Removal

Bomb VT Fuze. The bomb VT fuze is shipped completely assembled and ready for installation. The fuze is installed in the bomb and, if required by tactics or safety, an arming delay or other device is added. The following instructions are basic for installation of VT fuzes in bombs and apply to both ring and bar type fuzes. Special installation instructions are given in chapter 2.

Preliminary Inspection. The bomb and fuze must be inspected prior to installation of the fuze. Bombs with bent or damaged fins should not be used. Fin assemblies should be as tight as possible. When standard box fins are to be used on the bomb, use heavy gage .060- to .075-inch metal fins, identified by the marking of -A1 in the model designation, and Fin Locknuts M1, M2, and M3 equipped with set-screws. When conical fins are used, insure that the coupling tube and fin locknuts are wrench tight. The fuze well should be inspected to see that it is free of dirt, rust, and other foreign materials.

The VT fuze must be inspected to make certain that the arming vane locking pin or arm is undamaged and that the safety pin is present. If the seal wire is broken or missing, the fuze should be considered damaged and should not be used. Damaged fuzes should be destroyed in accordance with instructions under "Disposal."

INSTALLATION PROCEDURE. Refer to figure 1–17.

1. Remove the safety pin from the booster cup.

2. Slip the lockwasher, figures 1–3 and 1–4, over the base of the fuze. In the case of ring type fuzes slip a perforated plate of the auxiliary safety device over the base of the fuze and then follow with the lockwasher. Insert fuze and screw it into the fuze well by hand.

3. Tighten the fuze as much as possible by applying a Fuze Wrench T4, figure 1–18, to the wrench lugs. If no T4 wrench is available, use the most suitable fuze wrench on hand. Do not hammer either the fuze or the wrench handle. Do not use the bars of the bar type fuze as levers or handles unless otherwise noted on the fuze. Do not strike or twist the bars of the bar type fuze in any way.

NOTE: Use of bars to tighten the fuze is not recommended. Experience has shown that it is difficult to tighten the fuze sufficiently by means of the bars alone, and that undue strain on the bars may loosen or spring them, thus altering their electrical characteristics.

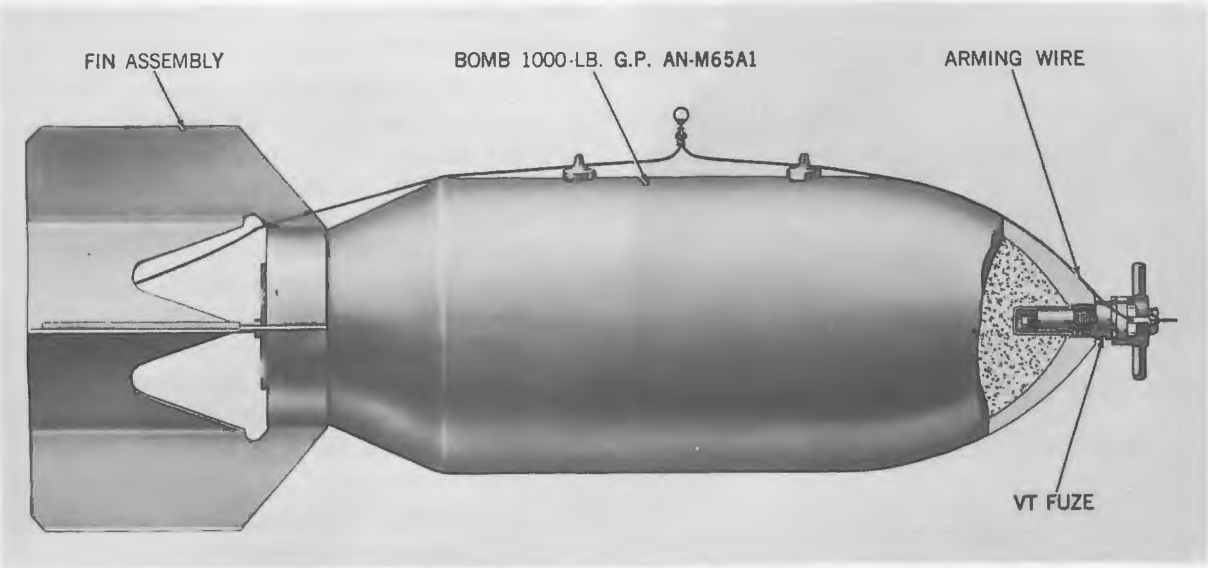


Figure 1–17. Complete Round, VT-Fuzed Bomb.

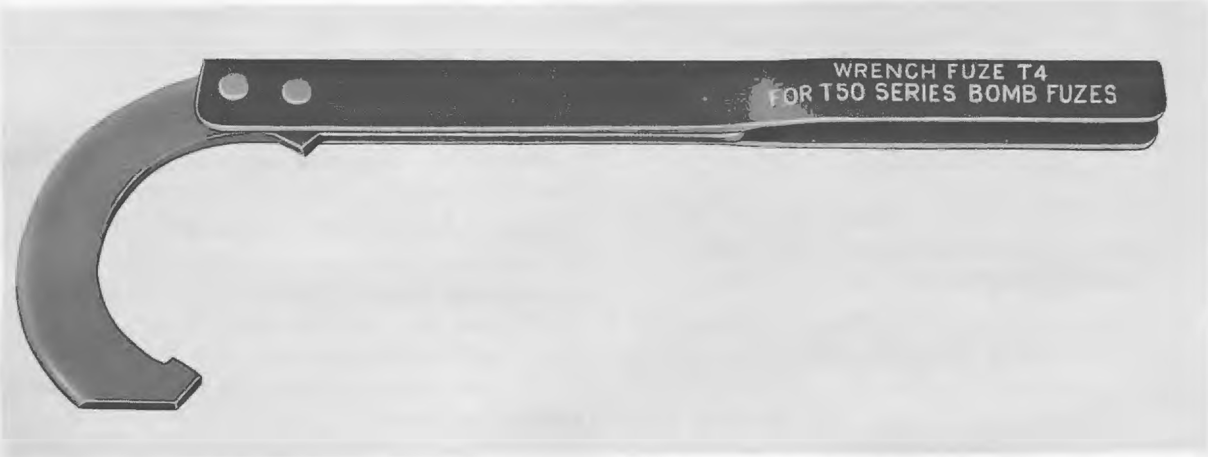


Figure 1–18. VT Fuze Wrench, Model T4.

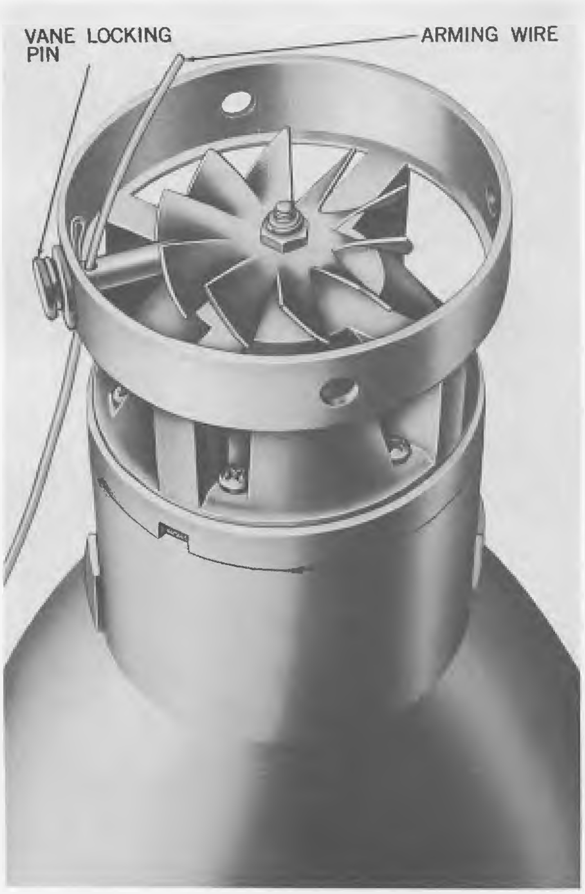


Figure 1–19. Ring Type VT Fuze on Bomb.

4. Cut the seal wire and remove it.

5. If necessary, carefully remove the cotter pin and move the vane locking pin or arm, originally furnished with the fuze, to the hole in the ring or the strap bracket which will most nearly place it and the second arming pin or arm of the auxiliary safety device in line with the bomb suspension lug.

WARNING

Do not allow the arming vane to be turned more than two or three turns during this operation.

6. Replace the cotter pin and prepare to attach the arming wire or other device to the bomb assembly.

7. Thread the end of the arming wire through the front bomb suspension lug, through a hole in the perforated plate in the case of ring type fuzes, and finally through the hole in the vane locking pin or arm through which the seal wire was inserted, figures 1–19 and 1–20. On bar type fuzes, the arming wire must also be threaded through the cotter pin hole in the branch of the vane-locking-arm which prevents rotation of the vane.

8. When the bomb has been placed in the bomb rack of the aircraft and one arming wire swivel has been engaged in the bomb shackle, the other permanently attached to the aircraft, pull the wires through the fuze to remove any excess slack between the fuze and swivels. The wire ends should protrude not more than three inches in front of the bomb nose. Any excess should be cut off and burrs should be removed from the ends of the wires.

NOTE: Under normal operating conditions, the force of the vane-locking-pin spring or vane-locking-arm spring is sufficient to hold the arming wire firmly in place during flight after the cotter pin has been removed. However, if the arming wire will be exposed to the slip stream at high speeds, additional precautions are required (see "Precautions"). On bar type fuzes only, a Fahnestock clip must be placed on the wire forward of the vane locking arm.

CAUTION: Instances have occurred of Fahnestock clips interfering with the arming vanes when used forward of the antenna ring. Therefore do not use this type of clip on arming wires assembled to ring type VT fuzes except when used with the auxiliary safety device.

9. Remove the cotter pin.

Removal. When aircraft return with VT-fuzed bombs, the fuzes should be examined for damage. Undamaged fuzes are replaced in their original shipping containers and the containers are resealed with friction tape. Damaged fuzes are to be disposed of in accordance with current disposal instructions.

Use the following procedure when removing fuzes from bombs.

1. Replace the cotter pin in the vane locking pin or arm.

2. If an arming delay is attached to the fuze, remove it by pressing the stud (on type M1) or bar (on type M1A1) toward the fuze, and, holding the bar across the open end, turning the dial until the dial slot is in line with the bar. Release the arming delay and slide it back along the arming wire.

3. Pull the arming wire from the vane locking pin or arm.

4. Insert a seal wire through the hole in the pin vacated by the arming wire and twist the ends around the ring or strap bracket.

5. Loosen the fuze with Fuze Wrench T4 until it can be unscrewed by hand. If the fuze has not been installed too tightly, its removal may be facilitated by tightening it further to flatten the lockwasher before loosening it for removal.

6. Remove the fuze from the fuze well. If the lockwasher is in serviceable condition, keep it with the fuze for further use. If the lockwasher is unserviceable and spare lockwashers are available, dispose of it. If necessary, unserviceable lockwashers may be reconditioned for further use by twisting the teeth with hand pliers.

7. If the fuze was received with a booster safety pin, reinsert the safety pin through the groove in the side of the booster.

8. Replace the fuze in its shipping con-

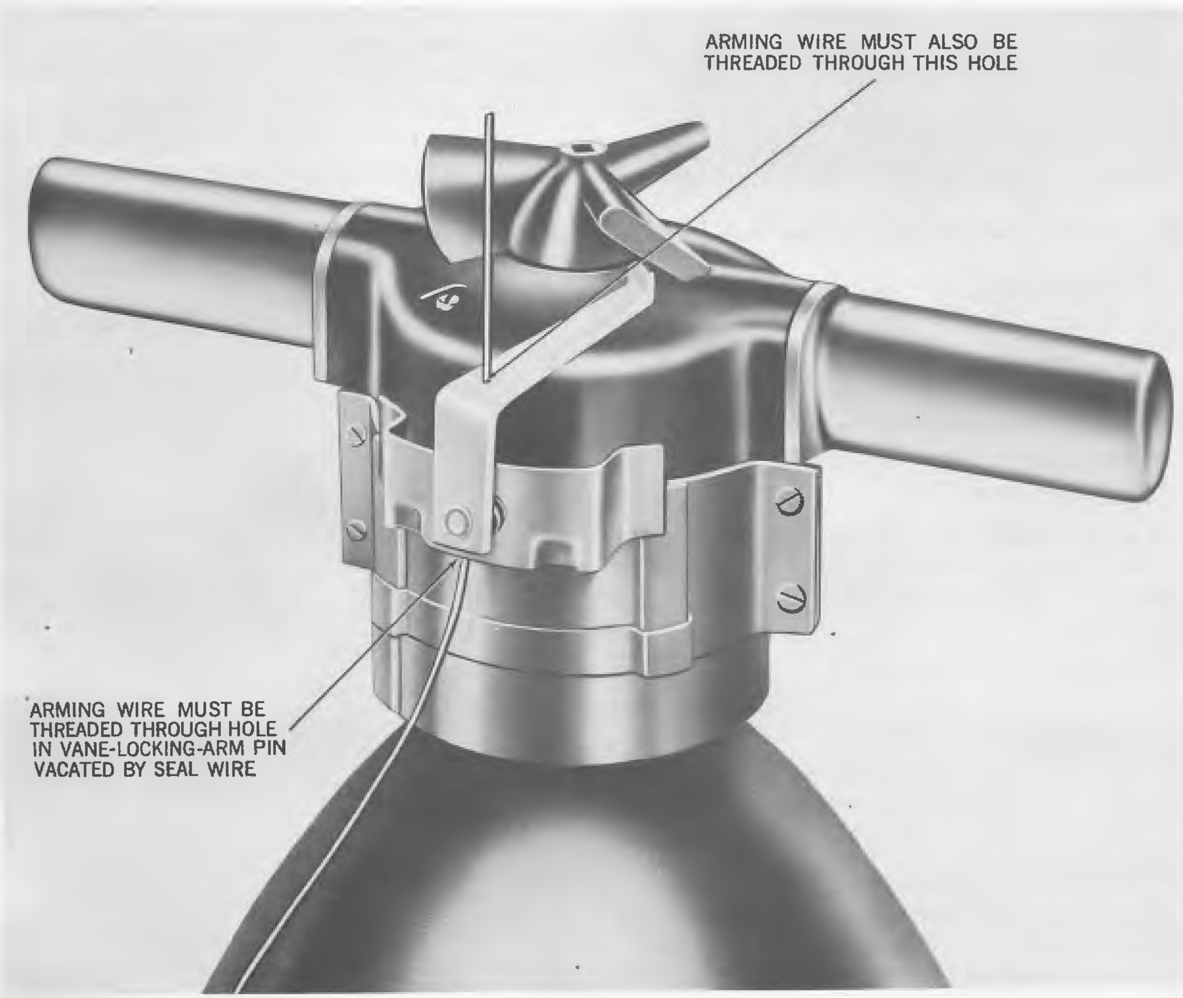


Figure 1–20. Bar Type VT Fuze on Bomb.

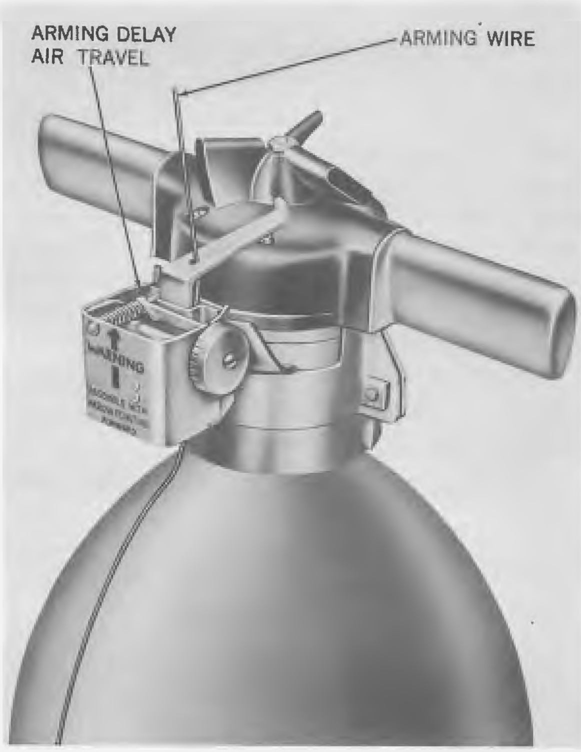


Figure 1–21. Arming Delay on Bar Type VT Fuze.

tainer and reseal the container as tightly as possible with friction tape.

WARNING

Under no circumstances should bomb VT fuzes be disassembled by operating personnel.

Arming Delay, Air Travel. A preliminary adjustment of the arming delay, air travel, is necessary before this device is installed on the bomb fuze.

Preliminary Adjustment.

1. Place the arming delay, vane down, dial to the right, on a flat surface.
2. Free the release bar, being careful to prevent injury by spring action. The release bar may be freed by holding it down and rotating the dial shaft.

Installation Procedure. Refer to figures 1–21 and 1–22.

1. Thread the free end of the arming wire through the front bomb suspension lug, the small hole in the strap bracket on the vane end of the arming delay, and the hole in the vane locking pin or arm from which the seal wire was removed. On bar type fuzes, the arming wire also must be threaded through the cotter pin hole in the branch of the vane locking arm which prevents rotation of the vane.
2. Place the arming delay, with its vane toward the bomb tail, so that the channel is over the vane locking pin or arm and the hooks of the delay engage the bottom of the fuze ring or strap bracket.
3. Turn the bar back into place through the slot in the dial, engaging the movable hook over the upper edge of the ring or strap bracket.
4. Press the stud or release bar, depending on the type of arming delay used, and turn the dial to the desired setting. Release the stud or release bar.
5. When the bomb has been placed in the bomb rack of the aircraft, and the arming wire swivel loop has been engaged in the bomb shackle, pull the arming wire through the fuze to remove excess slack between the fuze and swivel. If necessary, trim the wire protruding in front of the fuze to a length of 3 or 4 inches. Remove any burrs from the end of the wire.
6. Remove the cotter pin from the fuze.

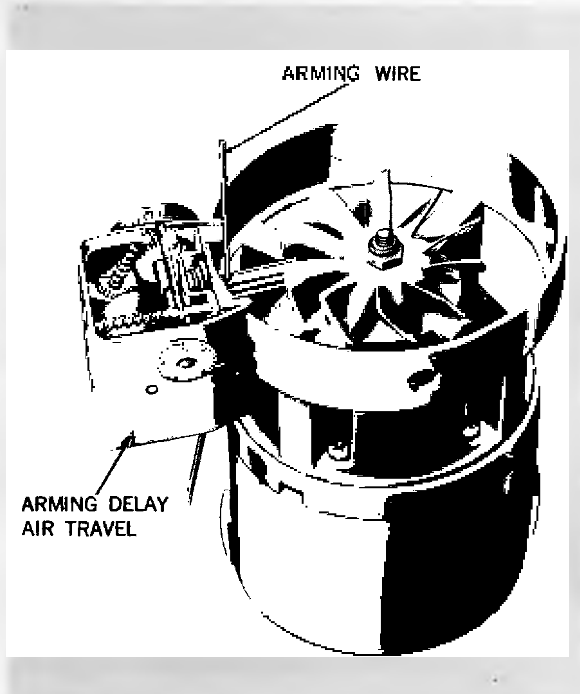


Figure 1–22. Arming Delay on Ring Type VT Fuze.

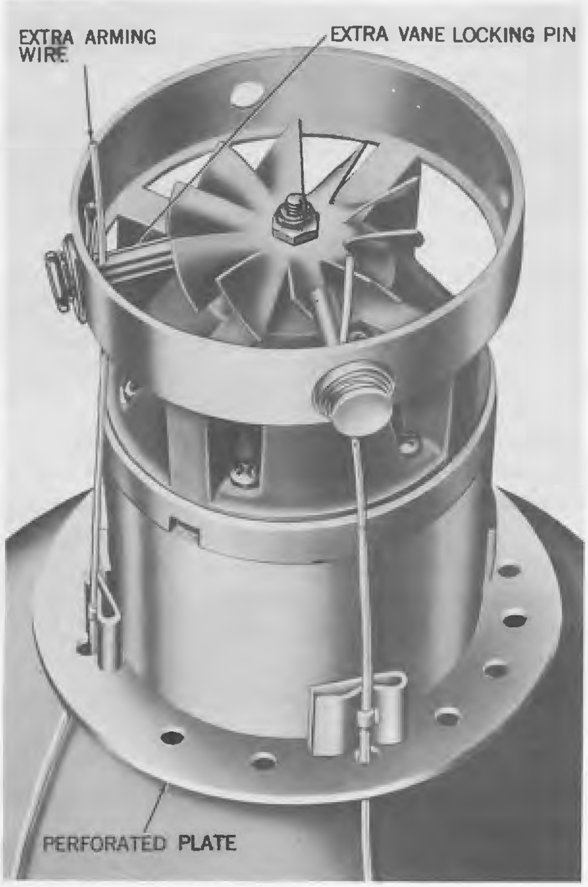


Figure 1–23. Auxiliary Safety Arrangement for Ring Type VT Fuze.

Auxiliary Safety Arrangement for Ring Type Fuzes. An auxiliary safety arrangement is required for ring type fuzes. It consists of an additional vane locking pin and spring, an additional arming wire assembly, and a circular arming wire plate.

On certain bombs the clearance for threading an arming wire through a hole in the circular plate is too small. Accordingly, modification shall be performed immediately by any activity having custody of Circular Plate, FSN 1325–038–4750–X087, by means of either of the following methods:

1. Drill four new holes three-sixteenths of an inch in diameter, 90 degrees apart, centered on a 4.637-inch diameter circle.

2. Elongate four of the existing holes which are 90 degrees apart with a file or a drill to within 0.08 inch of the outside circumference of the plate.

Installation Procedure.

1. Install the perforated plate, preferably between the lockwasher and the fuze, figure 1–23.

2. Attach one Arming Wire Assembly Mk 1 (0.064-inch diameter) from the arming control mechanism to the fuze, being careful to pass the wire through the forward bomb suspension lug.

> NOTE: In certain F4U type aircraft, the arming control mechanism is mounted forward of the lugs. In this case, the wire should not pass through the suspension lug.

3. Install the second arming wire assembly by attaching the loop end permanently to the aircraft structure.

4. Install the extra vane locking pin and spring on the fuze antenna ring, inserting a cotter pin in the hole nearest the antenna ring. Additional vane locking pins, springs, and circular arming wire plates should be drawn in amounts corresponding to the number of ring type fuzes available if they are not on hand.

5. Pass the two arming wires through separate holes in the perforated plate, taking care to align them with the locking pin holes in the fuze antenna ring.

6. Install one Fahnestock clip on each arming wire. Then pass the wires through the holes in the vane locking pins as shown in figure 1–23.

7. Remove the cotter pins from the vane locking pins.

8. When required by operating conditions, an arming delay may also be used. When making the installation, the arming wire attached to the arming control mechanism should be assembled with the arming delay.

9. Three Fahnestock clips must be used on each arming wire when ring type VT-fuzed bombs are carried on F9F Bomb Racks Mk 55, which have arming wire controls modified in accordance with BuAer dispatch 062125Z July 1950.

WARNING

> All three clips on each arming wire must be placed between the perforated plate and the vane locking pins.

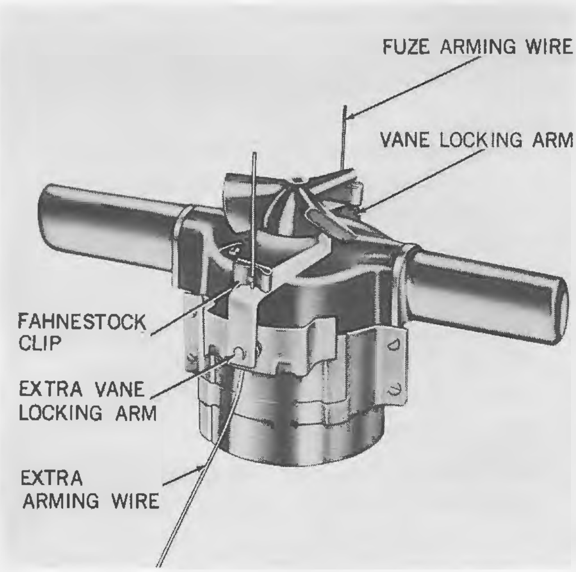


Figure 1–24. Auxiliary Safety Arrangement for Bar Type VT Fuze.

Auxiliary Safety Arrangement for Bar Type VT Fuze. The installation of the second arming wire assembly and the additional vane locking arm and spring may be made after the fuze is installed in the bomb.

INSTALLATION PROCEDURE.

1. Install the second arming wire assembly by attaching the loop end permanently to the aricraft structure.

2. Attach the additional vane locking arm and spring to the free strap bracket on the fuze. Pass the free end of the arming wire through the hole in the vane-locking-arm pin and through the cotter pin hole in the branch of the vane locking arm which prevents rotation of the vane, figure 1–24.

3. Pull the arming wire through the fuze to remove any excess slack.

4. Attach a Fahnestock clip to the wire and slide it up to the vane locking arm. The wire end should protrude about 3 or 4 inches in front of the fuze. Any excess should be cut off and burrs should be removed from the end of the wire. No circular arming wire plate is required. Additional locking arms and springs should be obtained if not on hand.

Fin-Stabilized Rocket VT Fuze. The VT fuze for the fin-stabilized rocket is shipped as a complete unit ready for installation in the rocket head for which it is furnished. Complete installation of the fuze consists of preliminary inspection, installing the fuze in the rocket, and attaching the arming wire to the fuze.

PRELIMINARY INSPECTION. Inspect the rocket and fuze as follows. Refer to figures 1–25 and 1–26.

1. Check the fuze well to see that it is free of foreign material and that the threads are undamaged.

2. Remove the fuze from its container and inspect visually for a missing seal and defects, such as bent arming vanes, loose parts, dents, and the like.

WARNING

If the seal wire is missing when the fuze is originally removed from its container, destroy the fuze.

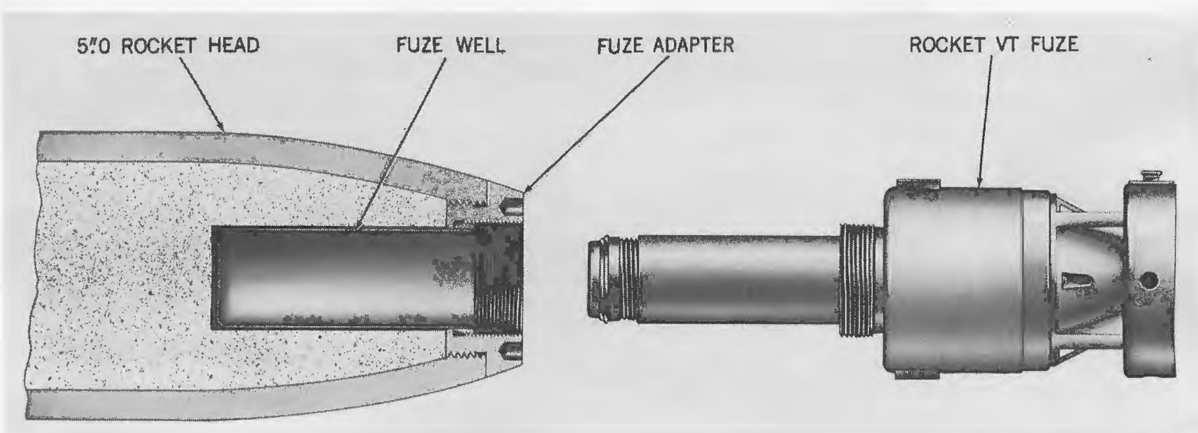


Figure 1–25. Installation of VT Fuze in a Fin-Stabilized Rocket.

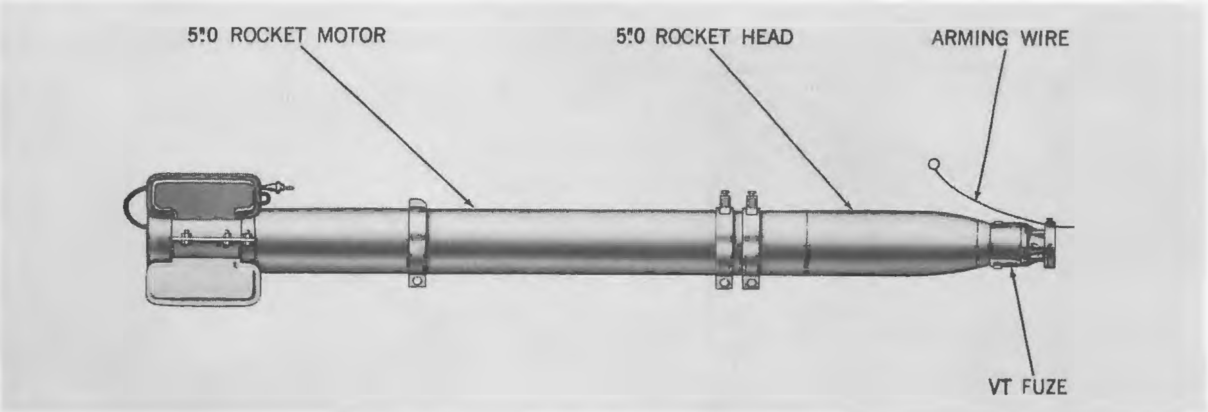


Figure 1–26. Complete Round, VT-Fuzed Fin-Stabilized Rocket.

3. Remove the booster safety pin from the booster and check to see that it is not sheared or bent. Reinsert the pin to make certain that the detonator rotor has not moved.

WARNING

If the pin does not go in place easily, the fuze should be destroyed.

INSTALLATION PROCEDURE. See figures 1–24 and 1–25.

1. Remove the safety pin from the booster and retain it so that it may be reinserted if the round is later disassembled.

2. Install the fuze wrench-tight in the nose cavity of the rocket head. Use Fuze Wrench M17, which is packed in the box of fuzes, prior to loading the rocket on the aircraft.

3. The complete rocket assembly must be checked to insure that all parts are tight. Any loose component of the rocket assembly may cause rocket detonation after arming but before approach to the target.

4. Remove the seal wire from the vane locking pin. The pin can be installed in any one of four holes located 90 degrees apart on the ring of the fuze. If it is necessary to realign the vane locking pin in order to properly insert the arming wire after the rocket is placed on the aircraft launcher, remove the cotter pin and reinsert the pin in the proper hole

WARNING

The vane must not be allowed to rotate during this procedure.

5. Insert the arming wire through the inboard hole of the vane locking pin so that it extends 3 or 4 inches beyond the fuze. A standard arming wire (BuOrd Dwg 422603) is used. Then remove the cotter pin from the outboard hole. These steps are performed after the round is loaded on the aircraft launcher.

CAUTION: Do not use Fahnestock clips with these fuzes.

REMOVAL. If the round is brought back unexpended, and is not to be used within 24 hours, the fuze should be removed in accordance with the following procedure.

1. Insert the cotter pin in the outboard hole in the vane locking pin; then remove the arming wire.

2. Unscrew the fuze, using the fuze wrench supplied.

3. Replace the safety pin in the booster. Do not use force.

WARNING

If the pin cannot be reinserted, destroy the fuze.

4. If the fuze is not to be used again immediately, replace it in the shipping container and seal the lid of the container with friction tape.

WARNING

Under no circumstances should fin-stabilized rocket VT fuzes be disassembled by operating personnel.

Figure 1–27. Marking of VT Fuze Shipping Containers.

Marking

Fuzes. Each VT fuze is stamped with complete nomenclature (Army or Navy Model No. or both), lot number, and date of loading. VT fuzes for bombs are also stamped with a specific MIN S.A.T. Warnings and instruction tags are attached to the cotter pin (in the vane locking pin), the sealing wire (in the vane locking pin), and the safety pin (in the booster). Bomb VT fuzes having a sensitivity-setting screw are marked with instructions for use of the screw. Bar type fuzes for bombs are marked on the bars with assembly instructions.

Shipping Containers. Each VT fuze shipping container is stamped with complete fuze nomenclature, the number of fuzes it contains, lot number, date of loading, and for bomb fuzes, the specific fuze MIN S.A.T., fuze rotor setting, and number and nomenclature of the arming delays it contains. Figure 1–27 shows the complete marking of VT fuze shipping containers.

Packing Boxes. Each box of fuzes is marked with complete fuze nomenclature, the number of fuzes included, the lot number, date loaded, weight, volume, shipping data, and for bomb fuzes, the MIN S.A.T., fuze rotor setting, and nomenclature of arming delays contained. Figure 1–28 shows the complete marking of VT fuze packing boxes. Fuzes produced or repacked since 1958 will have a Federal stock number in place of the AIC.

Packaging

Special precautions are taken to assure that VT fuzes are received in good operating condition. Each fuze is held in a shock-resistant mounting inside a hermetically sealed container. A lockwasher is shipped in its place on each bomb fuze. In addition to fuzes, almost all shipping boxes contain a fuze wrench.

Ring Type Fuzes. Ring type fuzes for bombs and fin-stabilized rockets are packed individually in sealed metal containers. Containers for bomb fuzes also include an arming delay for use with that fuze, figure 1–29. Nine fuze containers, together with a fuze wrench and instruction sheets, are packed in each shipping box, figure 1–30. Each shipping box has a shipping weight of approximately 70 pounds and requires 2.5 cubic feet of storage space.

When the fuzes are unpacked for use, the rubber, plastic, and metal mounting material should be removed before installing the fuzes. These packing elements should be preserved with the container in the event that it becomes necessary to repack the fuze.

Bar Type Fuzes. Bar type fuzes for bombs are packed in a hermetically sealed can that is approximately 16 inches high and 20 inches in diameter, figure 1–31. Each can contains four fuzes. Each fuze is mounted in a paper support which also holds an arming delay. A lockwasher is assembled to each fuze; four additional lockwashers are packed in the can. The shipping can has a shipping weight of 55 pounds and requires 3.5 cubic feet of storage space.

When the fuzes are unpacked for use, the packing material should be removed before installing the fuzes into bombs. The packing material and the shipping can should be preserved for repacking the fuzes.

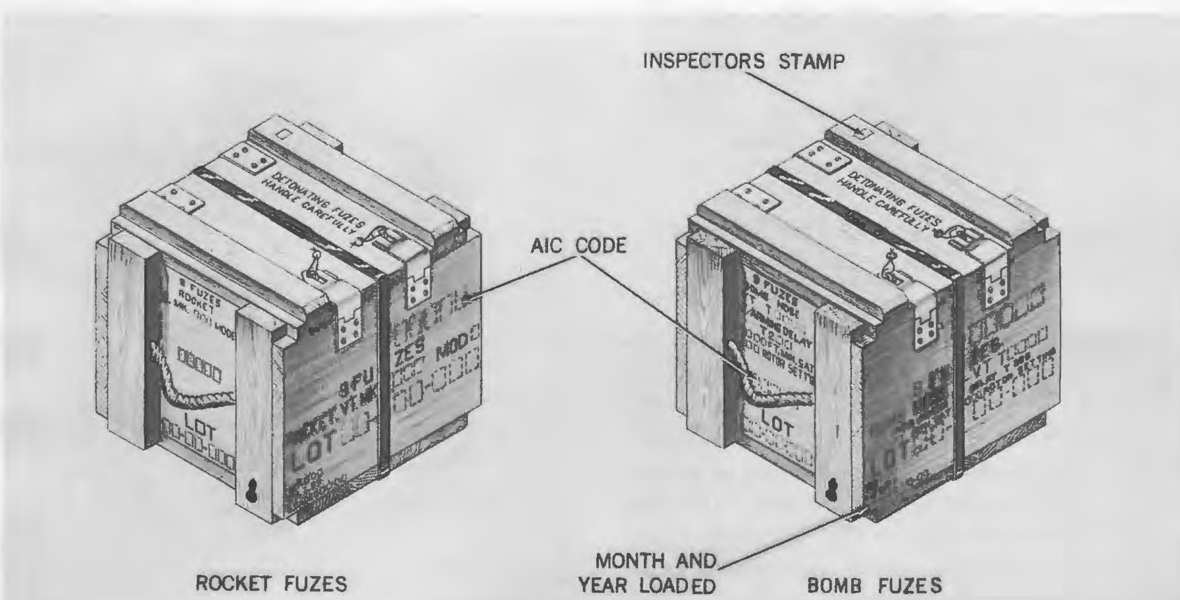


Figure 1–28. Marking of VT Fuze Packing Boxes.

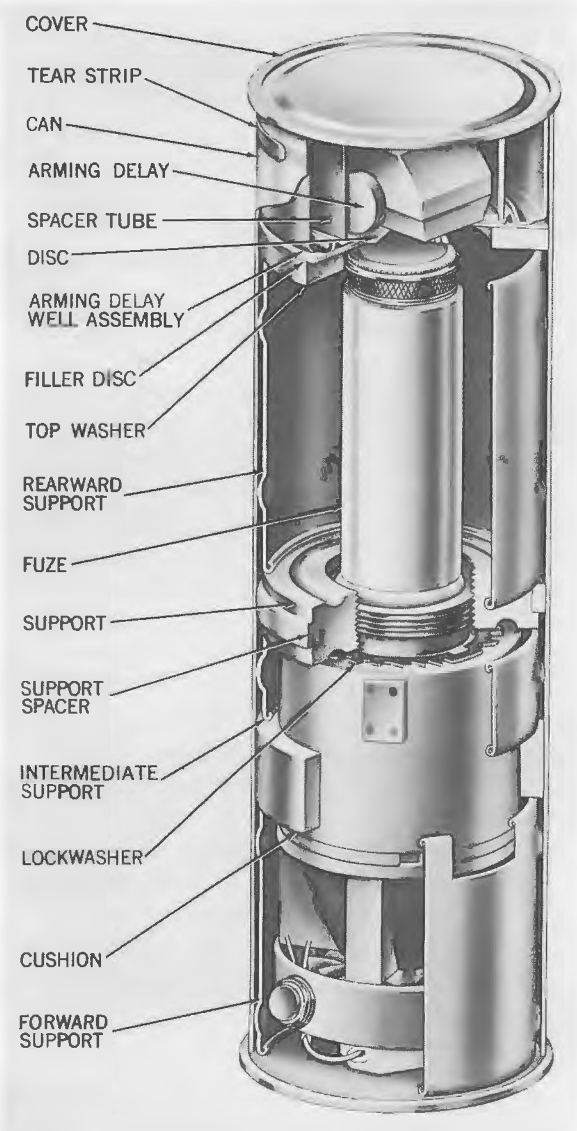


Figure 1–29. Ring Type VT Fuze Shipping Container.

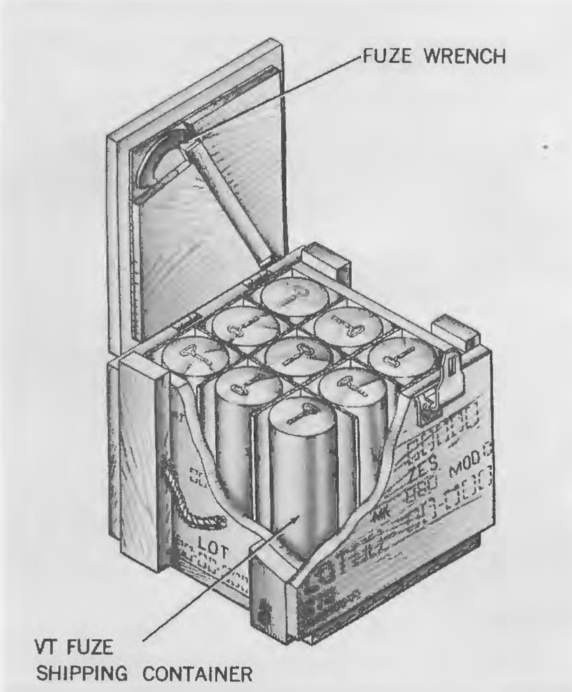


Figure 1–30. Ring Type VT Fuze Packing Box.

Arming Delays. In later packing configurations an arming delay is furnished with each bomb fuze with which it may be used. For older packs these must be supplied separately. For ring type fuzes, an arming delay is packed in a compartment in the top of each individual fuze shipping container. For bar type fuzes, the arming delay is held by the molded paper support which holds the fuze. Arming delays which are unpacked and not used should be stored in available empty VT fuze containers.

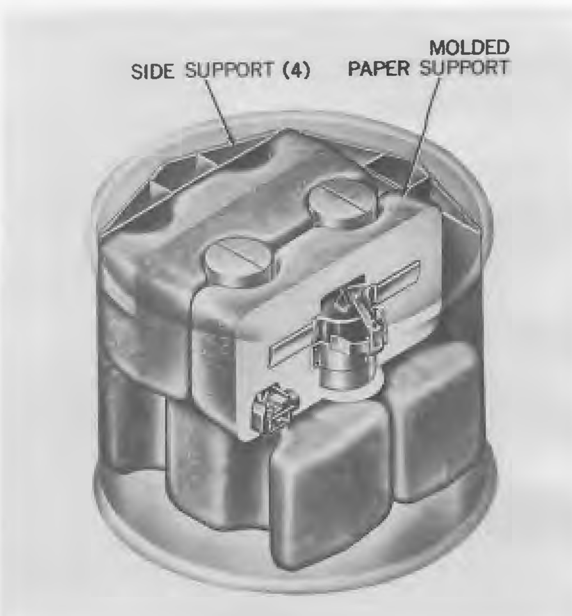


Figure 1–31. Bar Type VT Fuze Shipping Container.

Fuze packaging material should be removed from the containers and the containers filled to capacity with the unused arming delays. The fuze containers should then be sealed with friction tape. When the quantity of excess arming delays on hand is sufficient for shipping purposes, disposition instructions should be requested from NAD Crane.

Storage

The nature of the VT fuze requires particular storage procedures to insure maximum operational effectiveness and safety to handling personnel. Exposure to high humidity decreases the effective operation of any VT fuze. Thus, complete rounds of rockets and bombs should be assembled as shortly before use as practical, and proper storage of fuzes should be followed.

Packaged Fuzes. Packaged fuzes, sealed in their original shipping containers, may be stored for extended periods within the temperature range of —65 to 165 degrees F. The shipping containers, hermetically sealed and moistureproof, are impervious to high humidity.

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

Handling

Bomb and fin-stabilized rocket VT fuzes packed in shipping containers may be subjected to the same handling as any other fuze ammunition. Rough and abusive handling of unpackaged VT fuzes will not make the fuzes less safe; however, such handling will tend to increase the malfunction rate of the fuzes and should be avoided.

Damaged Fuzes. In general, damaged VT fuzes should be destroyed. The condition in which the fuze is found will determine the method of handling. In the case of the fin-stabilized rocket VT fuze, if the seal wire is broken when the fuze is originally removed from its container, the fuze must be considered damaged and destroyed.

Unarmed Fuzes. An unarmed VT fuze cannot function. Normally, dropping a packaged VT fuze a short distance (5 feet or less) will not injure it. Dropping an unpackaged fuze or VT-fuzed bomb or rocket may injure the fuze but will not render it unsafe. Unarmed VT fuzes cannot function and are entirely safe to handle and remove from bombs or rockets. However, the functioning of a damaged VT fuze cannot be predicted. Hence, damaged fuzes should be disposed of in accordance with instructions contained in the paragraphs on disposal of VT fuzes.

Armed Fuzes. An armed dud VT fuze may be sensitive to shock and jar for a period of one hour (fin-stabilized rocket VT fuze) or 24 hours (bomb VT fuze). Such a fuze may be sensitive to the approach of personnel only if the vane is still turning at high speed (equivalent to air speeds greater than 80 knots). Even though the fuze is badly crushed from impact, this danger may prevail.

WARNING

Do not handle an armed VT fuze for at least 24 hours (one hour for fin-stabilized rocket fuze) after impact. When this time has passed, it will be safe for necessary disposal operations. Do not remove the fuze from the bomb or rocket.

Fuzes Damaged in Landing and Takeoff Accidents. Where a VT fuze is damaged when a hung bomb or rocket is carried away in landing or separates from the aircraft during takeoff, it is unlikely that the vane will make sufficient turns and spin fast enough to fully arm the fuze. Such a fuze is not dangerous provided the vane has stopped turning or is restrained from turning before fuze arming has been completed. After the vane has been secured with any available lashing, dispose of the fuzed bomb or rocket immediately.

WARNING

Do not remove the fuze from the bomb or fin-stabilized rocket.

Deteriorated Fuzes. Fuzes which have deteriorated from exposure or improper handling will give an increased percentage of malfunctions, but are safe to handle and use, except in extreme cases. Deteriorated fuzes should be used only in cases of urgent necessity.

Disposal

Dud VT Fuzes. Disposal of dud VT fuzes should be performed only by authorized disposal personnel; it should never be attempted by unauthorized personnel. In handling and disposing of dud VT fuzes, it must always be remembered that the fuze may be armed and ready to function. In such condition, the fuze may detonate in response to any shock or jar. A dud fuze may be sensitive to the approach of personnel only if the vane is still turning at high speed. Sufficient time must be allowed for the firing charge to dissipate. After 24 hours (bomb fuzes) or 1 hour (fin-stabilized rocket fuzes), duds may be handled with comparative safety provided that the vane is locked. However, a complete explosive train is present and may function as a result of external violence, especially if the fuze has been deformed.

VT Fuze Material. The destruction of VT fuzes is required when they become unserviceable, damaged, armed, partially armed, extremely deteriorated, and, in the case of rocket fuzes, are found to be without a seal wire when unpacked.

The following methods of destroying a VT fuze are preferred in the order indicated.

1. Dump the VT fuze overboard in water over 500 fathoms deep and at least 10 miles from shore.
2. Destroy the VT fuze by explosives. When literature pertaining to VT fuzes is to be discarded, destruction by burning is required.

Safety Features

Regardless of target proximity or other conditions, the bomb and fin-stabilized rocket VT fuze cannot detonate the unit in which it is installed until its arming system has completed the arming operation. Certain external indications of arming of the fuze will also indicate to personnel a safe or unsafe condition with respect to the armed condition of the fuze.

Requirements for Arming. The arming operation of a VT fuze with vanes cannot begin until the vane locking pin or arm has been released by the withdrawal of the arming wire, thus freeing the vane to rotate. This operation is further delayed, in the case of VT-fuzed bombs, when an arming delay is used. In ring or bar type VT-fuzed fin-stabilized rockets, an additional handling safety feature is incorporated which delays the arming cycle until the rocket has been fired from the aircraft. To complete the arming of the fuze, the vane must turn a minimum of approximately 1000 revolutions. Even after the fuze is fully armed, the electrical firing circuit cannot function unless the arming vane is rotating at a speed equivalent to that which would be induced by an air stream of 80 knots or more.

Insurance against premature detonation is also provided by the following design features, figure 1–6.

1. Until the detonator rotor is fully aligned, the detonator is not electrically connected to the firing circuit.
2. Until aligned by the arming system, the detonator is separated from the booster charge by a heavy brass lead cup plate.
3. In most fuze models, a safety pin, inserted in the booster end, holds the arming assembly in a safe position until it is withdrawn at the time of installation of the fuze.

External Indications of Arming. Figures 1–3 and 1–4 show the external safety features of VT fuzes for bombs and fin-stabilized rockets. External evidence of a safe condition is furnished by the seal (seal wire) and/or safety pin.

Seal (Seal Wire). The arming vane is sealed at the factory so that it cannot rotate. This insures that the arming mechanism will remain in the safe position until the seal is removed.

WARNING

> If the seal of any fuze is found to be broken when received, the fuze should be handled with caution and inspected in accordance with the instructions for the safety pin.

Safety Pin. Most models of bomb and fin-stabilized rocket VT fuzes described in this publication are equipped with a safety pin which is inserted into the arming mechanism through a groove in the boosters. (Some older models of bomb VT fuzes do not have this feature.) The pin, which prevents movement of the arming mechanism, must be removed prior to fuzing the bomb. An important advantage of the safety pin is that it makes possible the checking for safety of the arming mechanism of the fuze whose seal has been removed. The presence of the pin, or the ability to reinsert it, gives positive indication that the arming components are in the unarmed position.

WARNING

If the safety pin cannot be reinserted, the fuze must be destroyed in accordance with disposal instructions.

VT-Fuzed Ammunition Released Safe. A VT-fuzed bomb or rocket is released safe when the arming wire is disengaged from the aircraft before release (by means of the arming control mechanism of the aircraft) so that it falls attached to the fuze. Since the arming wire does not release the vane locking pin or arm, or the arming delay vane when used on bombs, the fuze does not arm.

The VT-fuzed fin-stabilized rocket detonates upon impact because of the presence of the base fuze in the rocket head; upon impact, the VT-fuzed bomb is in an unarmed condition. An unarmed VT fuze will not detonate upon impact under ordinary circumstances; it may be dropped safe under the conditions permitted by the particular bomb in which it is installed. However, when the bomb is released at extreme altitudes, impact on hard ground, concrete surfaces, solidly constructed buildings, naval vessels, or even on normal ground, can result in detonation.

Precautions

These precautions apply particularly to the VT-fuzed bomb. The inspection of the arming wire before takeoff is applicable to the VT-fuzed fin-stabilized rocket as well.

Inspection of Arming Wire Before Takeoff. The accidental withdrawal of the arming wire from a VT-fuzed bomb during flight, which could conceivably occur with the item carried in an external rack or in a position of appreciable turbulence in the bomb bay, would cause the fuze arming vane to rotate, thereby resulting in arming the bomb fuze and subsequent detonation of the bomb in the bomb rack. In the case of rocket fuzes, it would cause the rotor system to jam, stripping its gears, so that the fuze would be a dud. Accidental withdrawal of the arming wire will not occur if the installation is properly made. It is essential that VT-fuzed bombs and rockets in suspensions of this kind be carefully inspected before flight to make certain that the arming wire is correctly installed.

Bomb Clustering. The clustering of VT-fuzed bombs is discouraged. If the increased loads made possible by clustering are required when VT fuzes are being used, only the bomb attached directly to the shackle should contain a VT fuze. Bombs suspended by the hook and cable assemblies of cluster adapters should not contain VT fuzes. When bombs contain VT fuzes under such conditions, the cables loosely attached to the bombs will invariably cause early functioning of the VT fuzes.

Bombs Carried Externally at Speeds Greater Than 260 Knots. Tests of properly installed arming wires on externally mounted bombs have shown that the arming wires can be depended on to remain in place without accidental withdrawal at all speeds up to 260 knots (300 miles per hour). For safety, VT-fuzed bombs should not be mounted where they will be subjected to air speeds greater than 260 knots unless an additional arming wire is used. An auxiliary safety device must be used with ring VT fuzes in this case and a maximum IAS of 400 knots observed.

Dive Bombing Restriction. Because of the nature of VT fuze operation, only one VT-fuzed bomb should be released in each dive approach to a target.

Chapter 2

BOMB VT FUZES

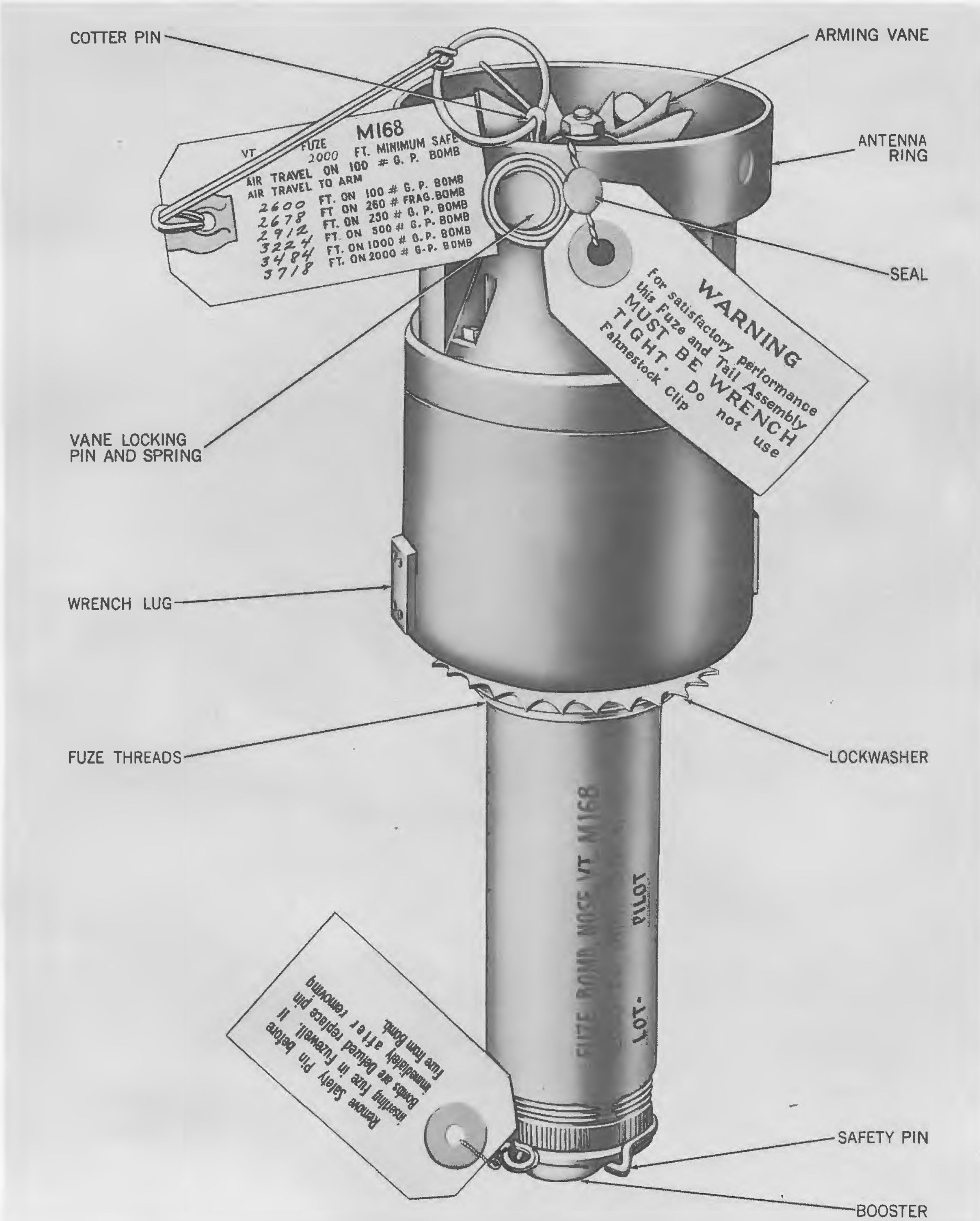


Figure 2–1. VT Fuze AN–M168 (M168) (T91E1).

VT FUZE AN–M168 (M168) (T91E1)

MIN S.A.T. (ft)	2000.
Burst Height Above Ground (ft)	30 to 60 when released below 8000 feet.
Dimensional Data:	
Weight	
Overall Length (in.)	10.4.
Body Diameter (in.)	3.4.
Material:	
Body	Steel.
Top	Plastic.
Ring	
Vane	Steel or plastic.
Tail Fuzes Used With:	
Box-Finned Bombs	AN–M100A2 series.
Conical-Finned (Low-Drag) Bombs.	M172, M184, or M185 series.
Bombs Used in	100 lb, GP, AN–M30, and AN–M30A1. 220 lb, FRAG, AN–M88. 250 lb, GP, AN–M57, AN–M57A1, and Mk 81 Mod 1. 260 lb, FRAG, AN–M81. 500 lb, GP, AN–M64, AN–M64A1, and Mk 82 Mods 0 and 1. 2000 lb, GP, AN–M66, AN–M66A1, AN–M66A2, and Mk 84 Mods 0 and 1.

Special Information

VT Fuze AN–M168 (M168) (T91E1) is the preferred ring type VT fuze for naval use.

Installation instructions are contained in "Installation and Removal," chapter 1.

Bomb VT Fuze T93, an Air Force fuze, may be used in the event of a shortage of VT Fuze AN–M168. The T93 fuze is designed to fire on approach to both ground and airborne targets. With respect to ground targets, burst heights for this fuze are the same as other ring type fuzes. The T93 fuze is conditioned to fire on approach to airborne targets by removal of a clearly marked thumbscrew on the fuze body. It is not intended that the air-to-air application of this fuze be used by Navy operating forces.

When the fuze is conditioned for air-to-air use, bomb detonations will take place after about 7500 feet of vertical fall from horizontal release, if the fuze has not been functioned by passing within the influence range of an aircraft target during the drop. In this respect, the fuze has self-destruction action. The vertical fall of 7500 feet will apply after the arming delay has functioned and separated from the fuze, if this device is used to obtain longer arming travel distance. DO NOT REMOVE THE KNURLED-HEAD THUMBSCREW. Once removed, it cannot be replaced without possible impairment of the fuze circuit. T93 fuzes from which thumbscrews have become detached accidentally, or fuzes with thumbscrews missing, shall be considered damaged and handled accordingly.

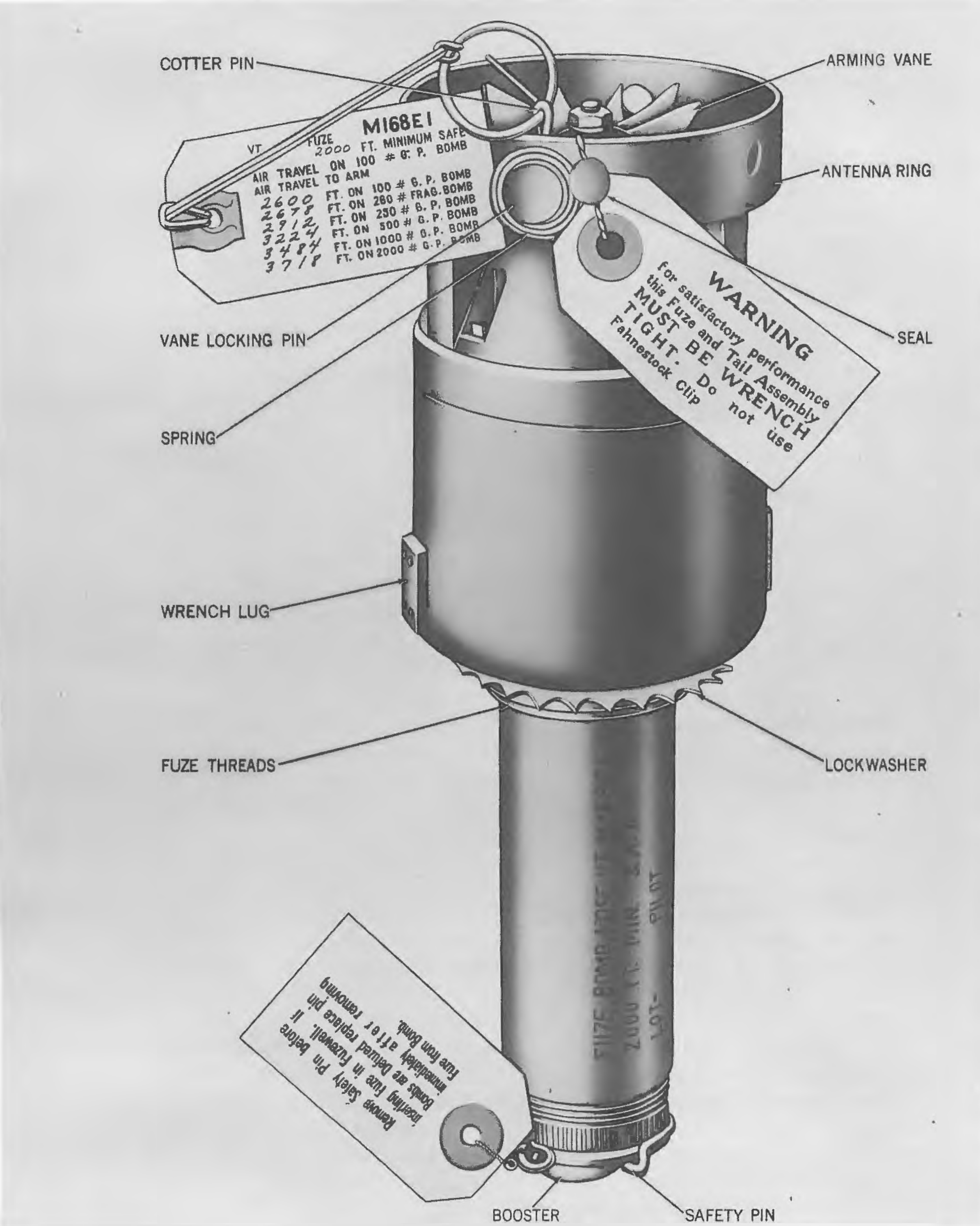


Figure 2–2. VT Fuze AN–M168E1 (M168E1).

VT FUZE AN–M168E1 (M168E1)

MIN S.A.T. (ft)	2000.
Burst Height Above Ground	
Dimensional Data:	
Weight	
Length	
Body Diameter	
Material:	
Body	Steel.
Top	Plastic.
Ring	
Vane	Steel or plastic.
Tail Fuzes Used With:	
Box-Finned Bombs	AN-M100A2 series.
Conical-Finned Bombs	M172, M184, or M185 series.
Low-Drag Bombs (with T45A4 adapter booster).	M194 series.
Bombs Used in	100 lb, GP, AN–M30 and AN–M30A1. 250 lb, GP, AN–M57, AN–M57A1, and Mk 81 Mod 1. 260 lb, FRAG, AN–M81. 500 lb, GP, AN–M64, and Mk 82 Mods 0 and 1. 1000 lb, GP, AN–M65, AN–M65A1, and Mk 83 Mods 2 and 3.

Special Information

VT Fuze AN–M168E1 (M168E1) is similar to the T93 model fuze except that the thumbscrew has been removed.

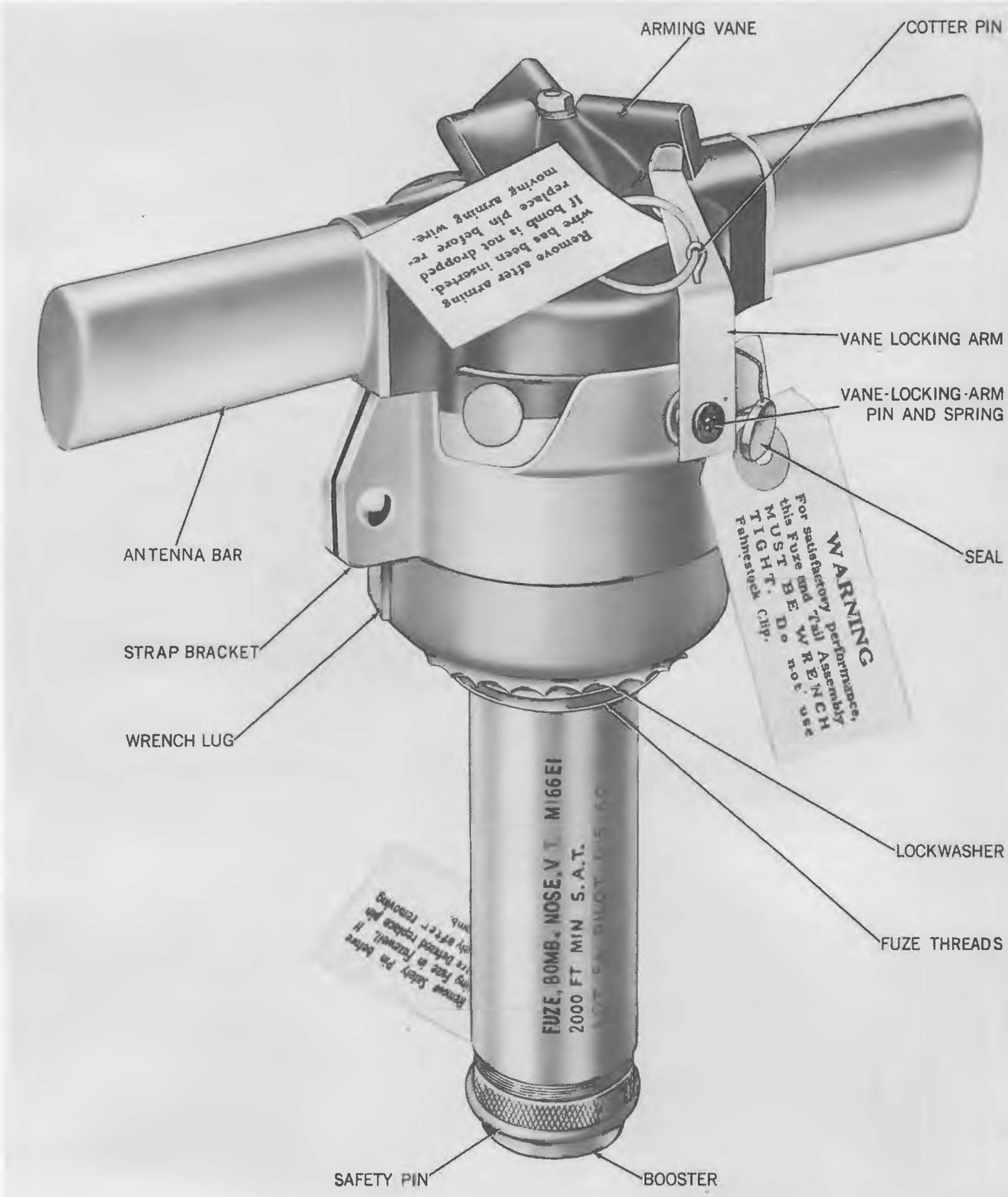


Figure 2–3. VT Fuze M166E1.

VT FUZE M166E1

MIN S.A.T. (ft)	2000.
Burst Height Above Ground:	
At Normal Sensitivity (ft)	50 to 125.
At Reduced Sensitivity (ft)	25 to 65.
Dimensional Data:	
Weight	
Overall Length (in.) (Across Bars)	10.4.
Body Diameter (in.)	10.0.
Material:	
Body	Steel.
Top	Plastic.
Bars	Aluminum.
Vane	Plastic.
Tail Fuzes Used With:	
Box-Finned Bombs	AN-M100A2 series.
Conical-Finned Bombs	M172, M184, or M185 series.
Low-Drag Bombs (with adapter Booster T45E4).	M194, M195, or M185 series.
Bombs Used in	100 lb, GP, AN–M30 and AN–M30A1.
	220 lb, FRAG, AN–M88.
	250 lb, GP, AN–M57, AN–M57A1, and Mk 81 Mod 1.
	260 lb, FRAG, AN–M81.
	500 lb, GP, AN–M64, AN–M64A1, and Mk 82 Mods 0 and 1.
	1000 lb, GP, AN–M65, AN–M65A1, and Mk 83 Mods 2 and 3.
	2000 lb, GP, AN–M66, AN–M66A1, AN–M66A2, and Mk 84 Mods 0 and 1.

Special Information

VT Fuze M166E1 is the preferred bar type fuze. This fuze contains a reduced-sensitivity-setting screw, located on the fuze body. With the thumbscrew in place, the burst height range is about half that of normal. The thumbscrew is removed for normal sensitivity.

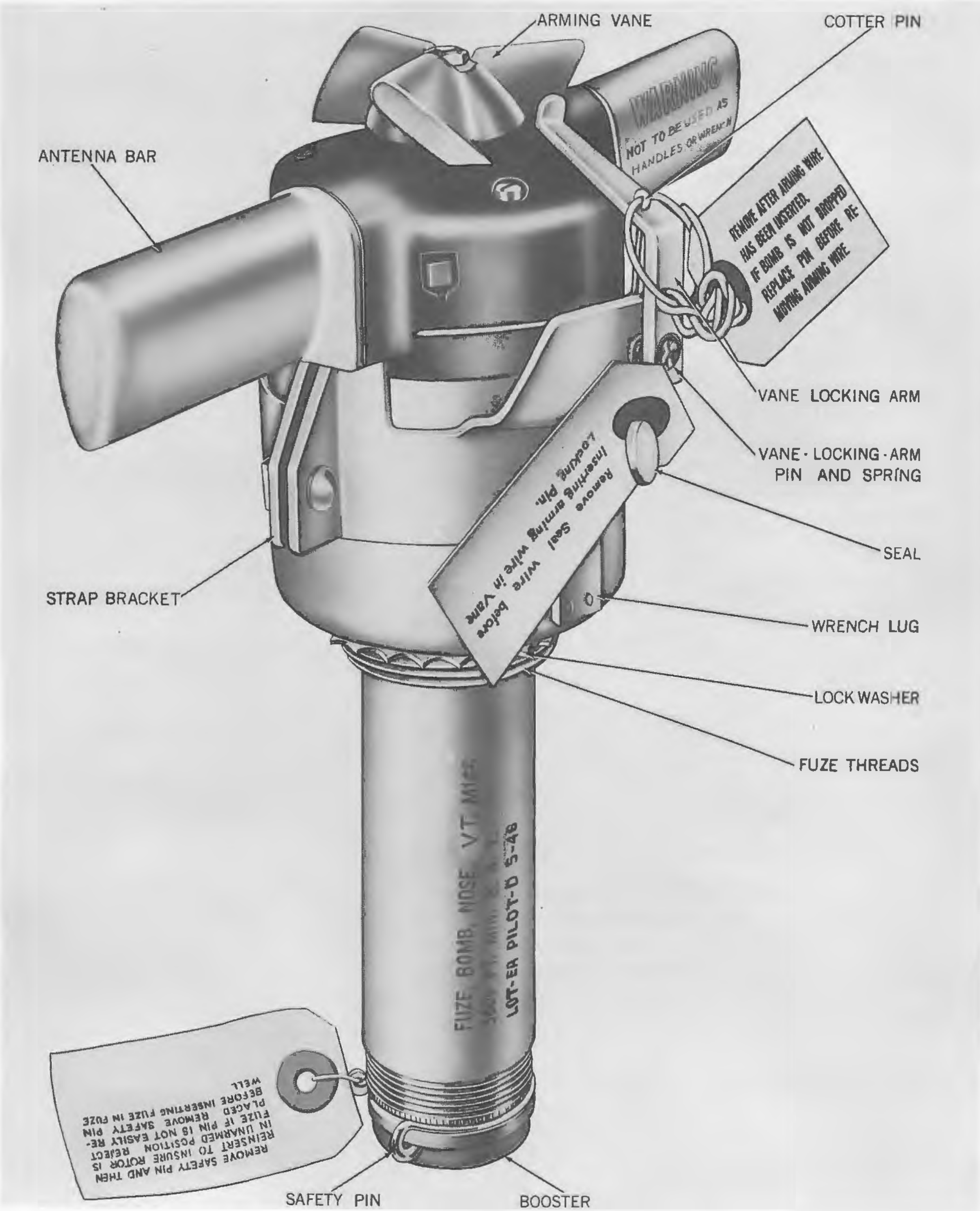


Figure 2–4. VT Fuze AN–M166 (M166) (T51E1).

VT FUZE AN-M166 (M166) (T51E1)

MIN S.A.T. (ft)	3600.
Burst Height Above Ground (ft)	40 to 60.
Dimensional Data:	
Weight	
Overall Length (in.)	10.4.
Body Diameter (Across Bars) (in.)	10.0.
Material:	
Body	Steel.
Top	Plastic.
Bars	Aluminum.
Vane	Plastic.
Tail Fuzes Used With:	
Box-Finned Bombs	AN–M100A2 series.
Conical-Finned Bombs	M172, M184, or M185 series.
Low-Drag Bombs (with adapter booster T45E4).	M194, M195, or M185 series.
Bombs Used in	100 lb, GP–AN–M30, and AN–M30A1. 220 lb, FRAG, AN–M88. 250 lb, GP, AN–M57, AN–M57A1, and Mk 81 Mod 1. 260 lb, FRAG, AN–M81. 500 lb, GP, AN–M64, AN–M64A1, and Mk 82 Mods 0 and 1. 1000 lb, GP, AN–M65, AN–M65A1, and Mk 83 Mods 2 and 3. 2000 lb, GP, AN–M66, AN–M66A1, AN–M66A2, and Mk 84 Mods 0 and 1.

Special Information

This fuze is not recommended for use in a bomb with less than a 10-inch diameter because of the possibility of damaging the bars of the fuze when the bomb is being loaded on the aircraft and when it is released. Damage to the bars will result in a malfunctioning of the fuze.

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Chapter 3

AUXILIARY DEVICES USED WITH BOMB VT FUZES

ARMING DELAY AIR TRAVEL, M1 (T2E1)

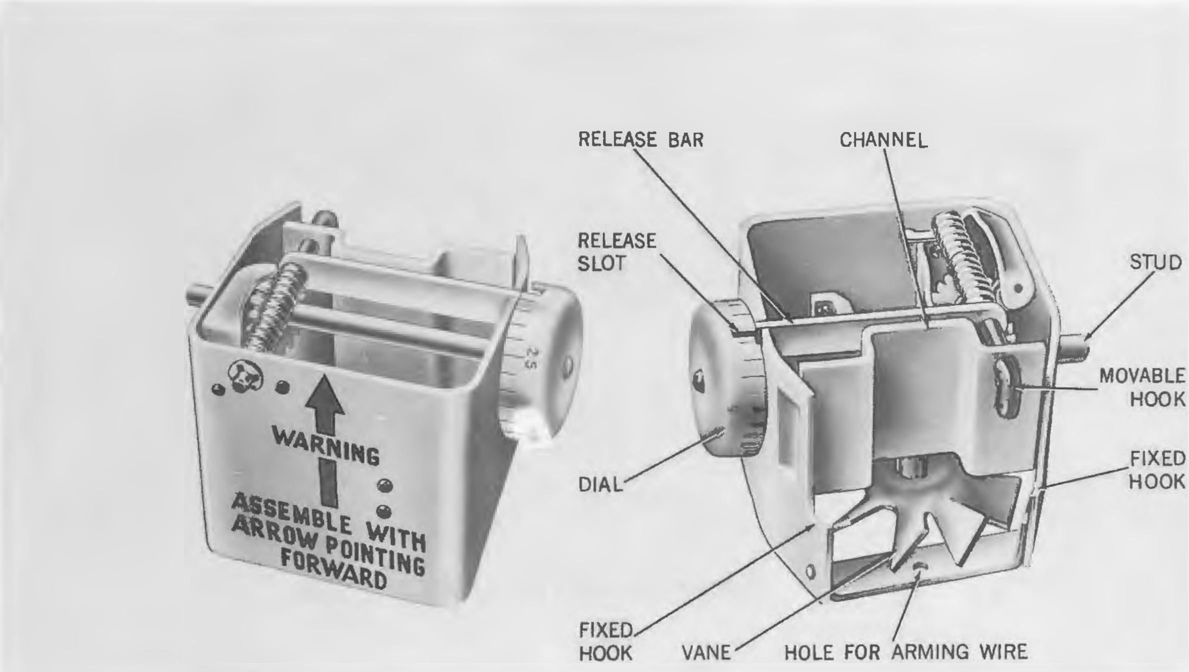

Figure 3–1. Arming Delay, Air Travel, M1 (T2E1).

Drawing Number	
Setting Range:	
Number of Divisions	27.
Total Range (ft)	20,000 (approx.).

Special Information

Arming Delay, Air Travel, M1 (T2E1) is currently issued with all bomb VT fuzes of wartime manufacture.

On this type of arming delay, the free end of the dial shaft protrudes through a slot in the housing and forms a stud which may be depressed to disengage the shaft and permit rotation of the setting dial.

This device adds approximately 790 feet per division to the safe air travel of the bomb, depending on the fuze-bomb combination.

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ARMING DELAY AIR TRAVEL, M1A1 (T2E2)

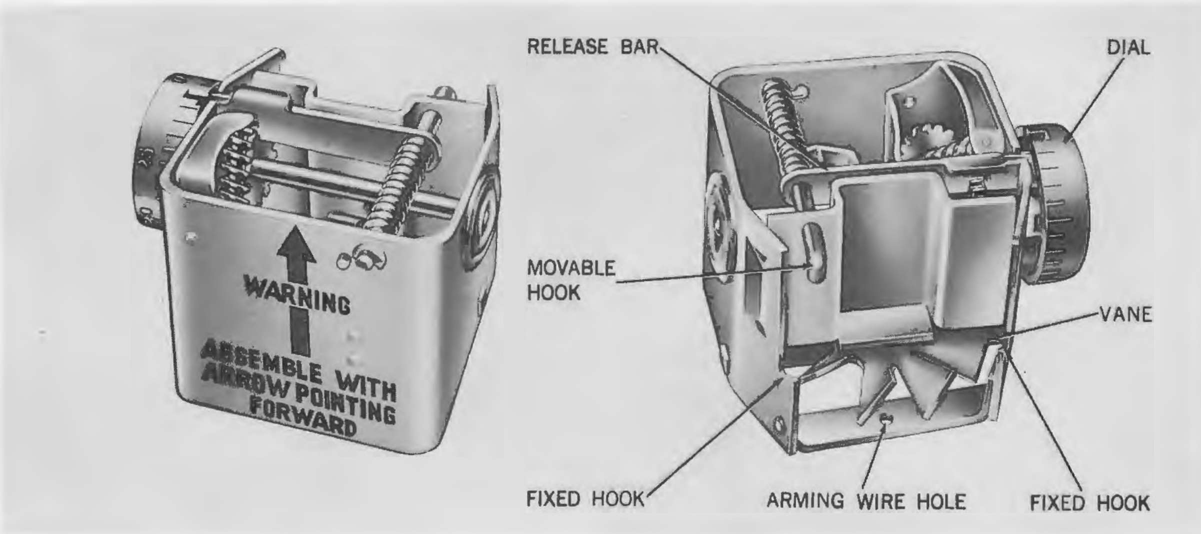

Figure 3–2. Arming Delay, Air Travel, M1A1 (T2E2).

Drawing Number	73–7–127.
Setting Range:	
Number of Divisions	27.
Total Range (ft)	20,000 (approx.).

Special Information

Arming Delay, Air Travel, M1A1 (T2E2) supersedes Arming Delay, Air Travel, M1 (T2E1).

To set the delay, it is necessary only to depress the setting dial to disengage it from the shaft so that it can be rotated to the desired setting.

This device adds approximately 790 feet per division to the safe air travel of the bomb, depending on the fuze-bomb combination.

Chapter 4

FIN-STABILIZED ROCKET VT FUZES

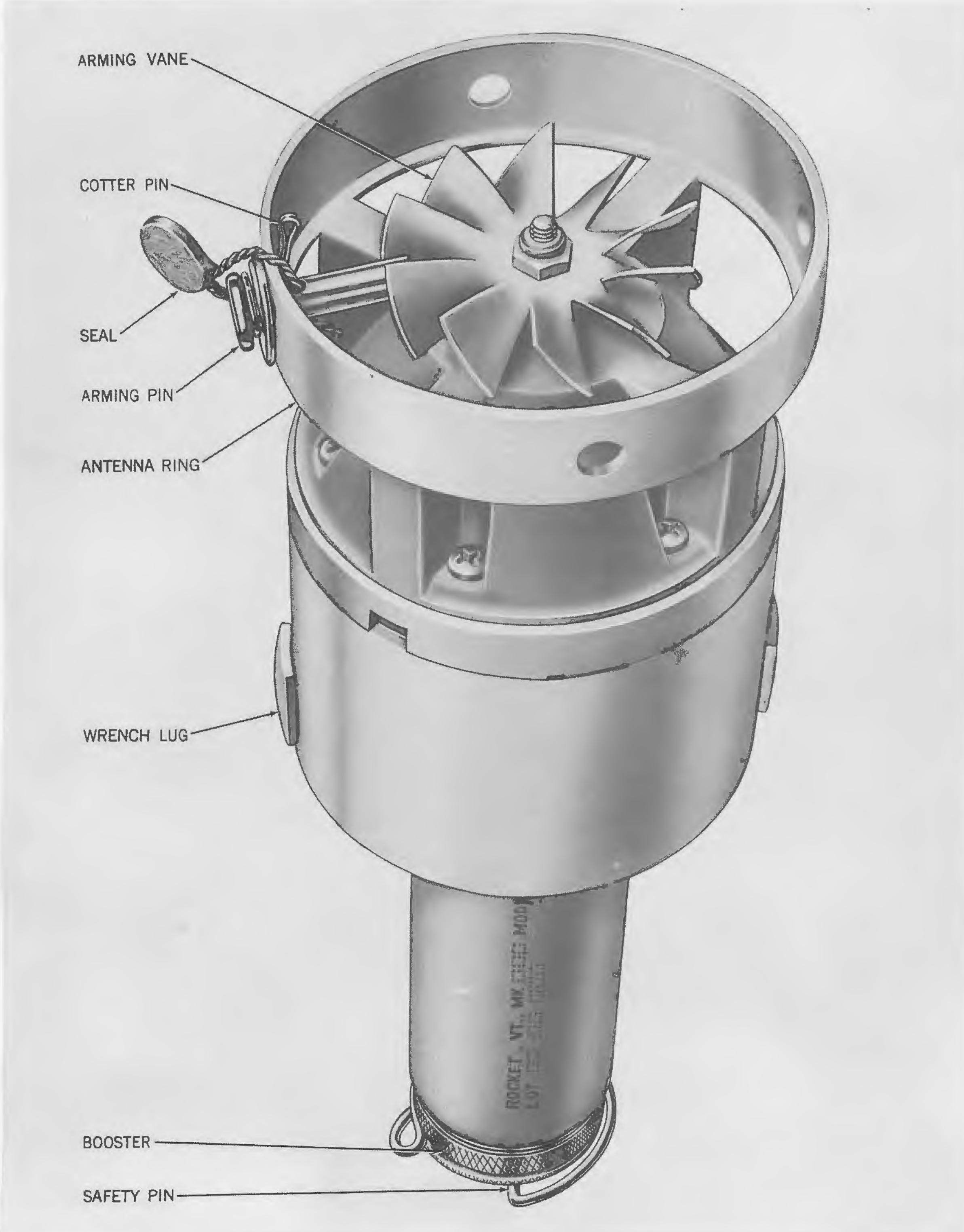

Figure 4–1. VT Fuze Mk 172 Mod 0.

VT FUZE MK 172 MODS 0, 1, and 2

Mark	172	172	172.
Mod	0	1	2.
Dimensional Data:			
Weight (lb)	4.5	4.5	4.5.
Overall Length (in.)	10.4	10.4	10.4.
Burst Height:			
Above Land (ft)	15 to 60		10 to 40.
Above Water (ft)	30 to 120		15 to 50.
Self-Destruction Features	None	None	None.
	Use BDF Mk 164 or Mk 165.	Use BDF Mk 164 or Mk 165.	
Rocket Assembly Used In.	5-Inch Rocket Mk 28 Mod 5 (VT, HVAR).	5-Inch Rocket Mk 28 Mod 5 (VT, HVAR).	

Special Information

Since this fuze is designed for air-to-ground firing, it is not recommended for use in rockets for air-to-air firing because the rockets would have to come very close (within 20 feet) to the target in order to function properly.

In appearance, the VT Fuze Mk 172 Mod 0 or 1 is almost identical to the Bomb VT Fuze T50. Care must be taken that they are not interchanged by mistake.

The VT Fuze Mk 172 Mod 0 or 1 requires a larger cavity than the Mk 149 or other rocket nose fuzes; therefore, it is not interchangeable with them.

VT Fuze Mk 172 Mod 0 is identical to VT Fuze M403.

VT Fuze Mk 172 Mod 1 is identical to VT Fuze M403E1.

VT Fuze Mk 172 Mod 2 is identical to VT Fuze M403E2.

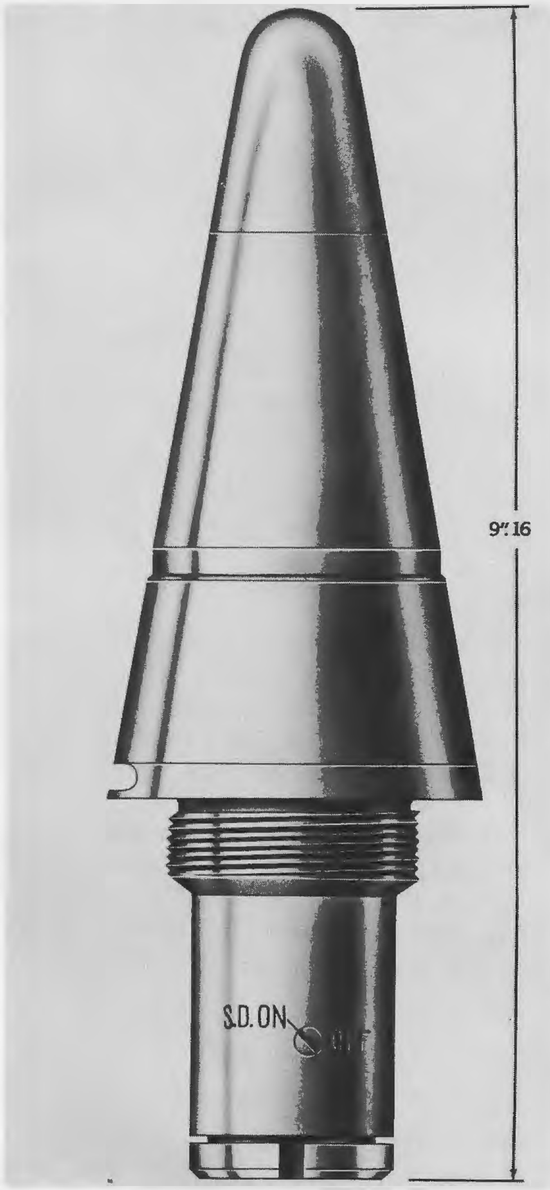

Figure 4–2. VT Rocket Fuze T2061.

NOSE (VT) ROCKET FUZE T2061 (AIR ARMING)

Nomenclature .... T2061.
Dimensional Data:
Overall Length (in.) .... 9.16.
Rocket Assembly Used In .... 5.0-inch Folding-Fin Aircraft Rocket (ZUNI).

Special Information

The VT T2061 is designed for use with Rocket Heads Mk 24 Mod 0 and Mk 32 Mod 0 in the 5.0-inch folding-fin aircraft rocket (ZUNI). The fuze is especially effective against aircraft.

Since this fuze is used with launcher packages, it has no external arming devices. Its electronic components are completely enclosed in a blunt-nosed ogival fuze head.

Chapter 5

RELEASE DATA

Tables 5–1 through 5–7 list release data for VT-fuzed bombs. The information contained in the tables is used by pilots and other personnel who determine the tactical use of this ammunition.

The data given in figures 5–1 and 5–2 are release data for use with VT-fuzed fin-stabilized rockets. The information must be used by pilots in determining the approximate trajectory of VT-fuzed fin-stabilized rockets.

Release Data for VT-Fuzed Bombs

Tables 5–1 through 5–7 list specific values of Safe Air Travel, Separation Distance, and Minimum Release Altitude for both horizontal and dive bombing with various combinations of bomb, VT fuze MIN S.A.T., and airspeed.

Safe Air Travel. Safe air travel is defined as the distance the bomb travels along its trajectory before the fuze arms. The distance is determined by the fuze MIN S.A.T. and the arming delay setting. For example, in table 5–1, for a fuze having a MIN S.A.T. of 2000 feet, with an airspeed of 250 knots, a dive angle of 50 degrees, and an arming delay setting of zero (or no arming delay), the safe air travel of the VT-fuzed bomb is given as 2000 feet. Increasing the arming delay setting to 1, 2, or 3 increases the safe air travel to 2750, 3450, or 4100 feet respectively. Changes in airspeed or dive angle do not affect the safe air travel. It can be seen, by comparing table 5–1 with the remaining tables, that the safe air travel for VT-fuzed bombs increases slightly with an increase in bomb size (weight).

Separation Distance. The separation distance listed in the tables is the distance that will exist between the bomb and the releasing aircraft at the end of a given safe air travel. The separation distances for dive bombing releases are based on information prepared by the Bureau of Aeronautics as the result of tests conducted to obtain typical pull-out data. The distances are based on the 95-percent flight path; that is, 95 percent of the time the separation distances can be expected to be greater than those tabulated.

The separation distance depends upon the dive angle (the path taken by the aircraft after release), the speed of the aircraft, and the arming delay setting. These three factors must be chosen so as to allow a safe separation distance. Table 1–1 listed the recommended minimum values of separation distances for various VT-fuzed bombs.

The distances printed in italics in the tables that follow are less than the recommended minimum values listed in table 1–1. For example, in table 5–1, for a fuze having a MIN S.A.T. of 2000 feet, with a true airspeed of 250 knots, a dive angle of 50 degrees, and an arming delay setting of zero (no arming delay), the separation distance listed is 410 feet, which is less than the recommended minimum. To release bombs under these conditions, the safety of the aircraft and its personnel must be compromised. The recommended minimum separation distance can be surpassed by choosing an arming delay setting of 1, which gives a separation distance of 860 feet. However, this will necessitate a higher release altitude (see column headed Minimum Release Altitude) which will adversely affect the accuracy of the bomb release.

Minimum Release Altitude. The minimum release altitude is defined as the lowest possible release altitude required to make arming of the VT fuze before impact reasonably certain. The values listed in the tables allow sufficient air travel to insure that at least 95 percent of the fuzes will be armed.

The minimum release altitude is determined by the safe air travel (fuze MIN S.A.T. and arming delay setting), the dive angle, and the speed of the aircraft; however, its value is noted only after the separation distance is chosen. The corresponding minimum release altitude must then be followed in order to allow sufficient time (air travel) for the fuze to arm. For example, in table 5–1, for a fuze having a MIN S.A.T. of 2000 feet, with an airspeed of 250 knots, a dive angle of 50 degrees, and an arming delay setting of 1, the minimum release altitude is given as 3630 feet. In order to insure than 95 percent of VT-fuzed bombs will be armed upon approach to the target, under the preceding conditions, the altitude of release must be at least 3630 feet. This release altitude allows a separation distance of 860 feet, which is adequate for safety purposes.

Tables 5–1 through 5–7, release data for VT-fuzed bombs, follow.

Table 5–1. Release Data for VT-Fuzed 100-Pound General-Purpose Bomb AN–M30A1

Determining Factors				Safe Air Travel (Feet)	Separation Distance (Feet)	Minimum Release Altitude (Feet)
Fuze Min S.A.T. (Feet)	True Airspeed (Knots)	Dive Angle (Degrees)	Arming Delay Setting			
2000	250	0	None	2000	*370*	1020
			1	2750	690	1490
			2	3450	1050	2030
			3	4100	1440	2620
		30	None	2000	510	2280
			1	2750	1040	2930
			2	3450	1600	3600
			3	4100	2120	4310
		50	None	2000	*410*	2900
			1	2750	860	3630
			2	3450	1430	4370
2000	250		3	4100	1990	5160
		70	None	2000	*360*	3300
			1	2750	810	4080
			2	3450	1380	4880
			3	4100	1970	5690
	350	0	None	2000	*200*	570
			1	2750	*410*	870
			2	3450	610	1230
			3	4100	860	1630
		30	None	2000	*250*	2080
			1	2750	550	2630
			2	3450	900	3240
			3	4100	1330	3880
		50	None	2000	*190*	2540
2000	350	50	1	2750	*420*	3500
			2	3450	720	4220
			3	4100	1100	4960
		70	None	2000	*160*	3250
			1	2750	*360*	4030
			2	3450	670	4830
			3	4100	1040	5630
	450	0	None	2000	*140*	*360*
			1	2750	*260*	550
			2	3450	*400*	790
			3	4100	580	1080
		30	None	2000	*140*	1940
			1	2750	*320*	2460
2000	450	30	2	3450	550	3000
			3	4100	830	3580
		50	None	2000	*100*	2740
			1	2750	*220*	3430
			2	3450	*380*	4120
			3	4100	620	4840
		70	None	2000	*60*	3250
			1	2750	*180*	4020
			2	3450	*340*	4800
			3	4100	570	5600

Table 5–1. Release Data for VT-Fuzed 100-Pound General-Purpose Bomb AN–M30A1—Continued

Determining Factors				Safe Air Travel (Feet)	Separation Distance (Feet)	Minimum Release Altitude (Feet)
Fuze Min S.A.T. (Feet)	True Air-speed (Knots)	Dive Angle (Degrees)	Arming Delay Setting			
3600	250	0	None	3600	1130	2330
			1	4350	1600	2920
			2	5070	2090	3550
			3	5750	2590	4230
3600	250	30	None	3600	1710	3950
			1	4350	2340	4640
			2	5070	2960	5350
			3	5750	3560	6080
		50	None	3600	1540	4750
			1	4350	2250	5500
			2	5070	2980	6280
			3	5750	3640	7050
		70	None	3600	1500	5280
			1	4350	2240	6060
			2	5070	3040	6850
			3	5750	3790	7660
3600	350	0	None	3600	660	1480
			1	4350	960	1830
			2	5070	1300	2300
			3	5750	1660	2830
		30	None	3600	970	3550
			1	4350	1510	4160
			2	5070	2050	4800
			3	5750	2600	5470
		50	None	3600	790	4580
			1	4350	1270	5300
			2	5070	1770	6040
			3	5750	2320	6770
		70	None	3600	730	5240
3600	350	70	1	4350	1220	6010
			2	5070	1770	6810
			3	5750	2360	7600
	450	0	None	3600	440	920
			1	4350	610	1220
			2	5070	900	1540
			3	5750	1180	1900
		30	None	3600	600	3280
			1	4350	940	3850
			2	5070	1320	4450
			3	5750	1740	5070
		50	None	3600	430	4470
			1	4350	730	5160
			2	5070	1110	5880
3600	450	50	3	5750	1480	6610
		70	None	3600	380	5200
			1	4350	670	5970
			2	5070	1020	6770
			3	5750	1410	7560

Table 5–2. Release Data for VT-Fuzed 250-Pound General-Purpose Bombs AN–M57A1 and Mk 81 Mod 1

Determining Factors				Safe Air Travel (Feet)	Separation Distance (Feet)	Minimum Release Altitude (Feet)
Fuze Min S.A.T. (Feet)	True Airspeed (Knots)	Dive Angle (Degrees)	Arming Delay Setting			
2000	250	0	None	2160	*420*	1100
			1	2970	770	1590
			2	3730	1170	2270
			3	4430	1600	2910
		30	None	2160	600	2490
			1	2970	1190	3190
			2	3730	1790	2960
			3	4430	2370	4690
2000	250	50	None	2160	*490*	3140
			1	2970	1040	3920
			2	3730	1630	4750
			3	4430	2270	5540
		70	None	2160	*470*	3560
			1	2970	950	4410
			2	3730	1600	5290
			3	4430	2280	6130
	350	0	None	2160	*230*	640
			1	2970	*430*	970
			2	3730	680	1380
			3	4430	950	1820
2000	350	30	None	2160	*300*	2240
			1	2970	630	2860
			2	3730	1050	3530
			3	4430	1530	4212
		50	None	2160	*230*	3040
			1	2970	500	3790
			2	3730	860	4580
			3	4430	1300	5370
		70	None	2160	*200*	3530
			1	2970	*450*	4370
			2	3730	810	5240
			3	4430	1270	6100
2000	450	0	None	2160	*150*	*410*
			1	2970	*280*	620
			2	3730	*450*	910
			3	4430	610	1210
		30	None	2160	*170*	2100
			1	2970	*370*	2670
			2	3730	640	3270
			3	4430	950	3890
		50	None	2160	*130*	2980
			1	2970	*270*	3700
			2	3730	*480*	4460
			3	4430	760	5230
2000	450	70	None	2160	*100*	3510
			1	2970	*230*	4340
			2	3730	*450*	5210
			3	4430	710	6050

Table 5–2. Release Data for VT-Fuzed 250-Pound General-Purpose Bombs AN–M57A1 and Mk 81 Mod 1—Continued

Determining Factors				Safe Air Travel (Feet)	Separation Distance (Feet)	Minimum Release Altitude (Feet)
Fuze Min S.A.T. (Feet)	True Air-speed (Knots)	Dive Angle (Degrees)	Arming Delay Setting			
3600	250	0	None	3890	1260	2570
			1	4700	1780	3210
			2	5480	2310	3910
			3	6210	2840	4630
		30	None	3890	1930	4290
			1	4700	2590	5040
			2	5480	3250	5820
			3	6210	3890	6620
3600	250	50	None	3890	1780	5140
			1	4700	2540	5950
			2	5480	3330	6720
			3	6210	4000	7550
		70	None	3890	1750	5700
			1	4700	2570	6490
			2	5480	3440	7340
			3	6210	4190	8210
	350	0	None	3890	740	1600
			1	4700	1070	2040
			2	5480	1440	2570
			3	6210	1820	3130
3600	350	30	None	3890	1150	3870
			1	4700	1720	4520
			2	5480	2320	5230
			3	6210	2890	5960
		50	None	3890	960	4980
			1	4700	1480	5730
			2	5480	2040	6520
			3	6210	2660	7320
		70	None	3890	900	5650
			1	4700	1460	6490
			2	5480	2060	7360
			3	6210	2700	8200
3600	450	0	None	3890	480	1040
			1	4700	700	1370
			2	5480	990	1720
			3	6210	1270	2130
		30	None	3890	710	3570
			1	4700	1080	4200
			2	5480	1510	4850
			3	6210	1980	5500
		50	None	3890	540	4830
			1	4700	900	5580
			2	5480	1300	6380
			3	6210	1720	7180
3600	450	70	None	3890	500	5620
			1	4700	830	6460
			2	5480	1250	7330
			3	6210	1690	8180

Table 5–3. Release Data for VT-Fuzed 500-Pound General-Purpose Bombs AN–M64A1 and Mk 82 Mods 0 and 1

Determining Factors				Safe Air Travel (Feet)	Separation Distance (Feet)	Minimum Release Altitude (Feet)
Fuze Min S.A.T. (Feet)	True Air-speed (Knots)	Dive Angle (Degrees)	Arming De-lay Setting			
2000	250	0	None	2300	*460*	1250
			1	3160	840	1810
			2	3970	1270	2450
			3	4710	1730	3140
		30	None	2300	680	2670
			1	3160	1320	3420
			2	3970	1960	4200
			3	4710	2580	5010
		50	None	2300	*560*	3350
2000	250	50	1	3160	1150	4200
			2	3970	1830	5040
			3	4710	2520	5850
		70	None	2300	*530*	3790
			1	3160	1110	4710
			2	3970	1760	5610
			3	4710	2560	6450
	350	0	None	2300	*250*	700
			1	3160	*470*	1070
			2	3970	740	1480
			3	4710	1020	1980
		30	None	2300	*350*	2400
			1	3160	*710*	3060
			2	3970	1180	3770
2000	350	30	3	4710	1670	4510
		50	None	2300	*280*	3240
			1	3160	*580*	4050
			2	3970	980	4890
			3	4710	1480	5730
		70	None	2300	*250*	3760
			1	3160	550	4670
			2	3970	950	5570
			3	4710	1470	6490
	450	0	None	2300	*180*	*450*
			1	3160	*300*	670
			2	3970	*470*	970
			3	4710	660	1300
2000	450	30	None	2300	*200*	2250
			1	3160	*430*	2860
			2	3970	720	3490
			3	4710	1060	4170
		50	None	2300	*150*	3170
			1	3160	*320*	3950
			2	3970	*590*	4740
			3	4710	890	5570
		70	None	2300	*130*	3750
			1	3160	*300*	4620
			2	3970	*550*	5520
			3	4710	840	6450

Table 5–3. Release Data for VT-Fuzed 500-Pound General-Purpose Bombs AN–M64A1 and Mk 82 Mods 0 and 1—Continued

Determining Factors				Safe Air Travel (Feet)	Separation Distance (Feet)	Minimum Release Altitude (Feet)
Fuze Min S.A.T. (Feet)	True Air-speed (Knots)	Dive Angle (Degrees)	Arming Delay Setting			
3600	250	0	None	4140	1370	2780
			1	5000	1920	3470
			2	5840	2490	4210
			3	6610	3050	4970
		30	None	4140	2100	4590
			1	5000	2810	5390
			2	5840	3500	6210
			3	6610	4190	7070
		50	None	4140	1980	5430
			1	5000	2800	6230
			2	5840	3600	7070
			3	6610	4270	7930
3600	250	70	None	4140	1970	6020
			1	5000	2870	6840
			2	5840	3750	7720
			3	6610	4490	8610
	350	0	None	4140	790	1720
			1	5000	1150	2210
			2	5840	1500	2770
			3	6610	1940	3360
		30	None	4140	1310	4120
			1	5000	1920	4830
			2	5840	2530	5590
			3	6610	3130	6350
3600	350	50	None	4140	1110	5290
			1	5000	1660	6130
			2	5840	2280	6900
			3	6610	2960	7710
		70	None	4140	1070	6020
			1	5000	1670	6920
			2	5840	2330	7780
			3	6610	3050	8650
	450	0	None	4140	*510*	1130
			1	5000	760	1450
			2	5840	1030	1850
			3	6610	1320	2290
3600	450	30	None	4140	800	3820
			1	5000	1190	4480
			2	5840	1670	5160
			3	6610	2180	5860
		50	None	4140	*640*	5150
			1	5000	1020	5970
			2	5840	1470	6790
			3	6610	1930	7660
		70	None	4140	*600*	5980
			1	5000	*970*	6880
			2	5840	1440	7800
			3	6610	1930	8720

Table 5-4. Release Data for VT-Fuzed 1000-Pound General-Purpose Bombs AN-M65A1 and Mk 83 Mods 2 and 3

Determining Factors				Safe Air Travel (Feet)	Separation Distance (Feet)	Minimum Release Altitude (Feet)
Fuze Min S.A.T. (Feet)	True Airspeed (Knots)	Dive Angle (Degrees)	Arming Delay Setting			
2000	250	0	None	2640	600	1550
			1	3630	1030	2290
			2	4550	1620	3060
			3	5410	2180	3890
		30	None	2640	920	3140
			1	3630	1680	3990
			2	4550	2440	4930
			3	5410	3140	5900
2000	250	50	None	2640	770	3880
			1	3630	1530	4850
			2	4550	2360	5750
			3	5410	3230	6700
		70	None	2640	720	4380
			1	3630	1510	5420
			2	4550	2380	6370
			3	5410	3310	7350
	350	0	None	2640	320	920
			1	3630	610	1370
			2	4550	960	1910
			3	5410	1320	2520
2000	350	30	None	2640	480	2810
			1	3630	970	3590
			2	4550	1600	4420
			3	5410	2210	5270
		50	None	2640	380	3760
			1	3630	810	4670
			2	4550	1360	5650
			3	5410	1950	6570
		70	None	2640	350	4340
			1	3630	770	5350
			2	4550	1350	6400
			3	5410	1970	7440
	450	0	None	2640	210	580
2000	450	0	1	3630	390	880
			2	4550	610	1250
			3	5410	880	1670
		30	None	2640	270	2630
			1	3630	590	3330
			2	4550	970	4100
			3	5410	1420	4880
		50	None	2640	220	3670
			1	3630	460	4550
			2	4550	810	5490
			3	5410	1220	6460
		70	None	2640	190	4320
			1	3630	430	5310
			2	4550	770	6360
2000	450	70	3	5410	1190	7450

Table 5–4. Release Data for VT-Fuzed 1000-Pound General-Purpose Bombs AN–M65A1 and Mk 83 Mods 2 and 3—Continued

Determining Factors				Safe Air Travel (Feet)	Separation Distance (Feet)	Minimum Release Altitude (Feet)
Fuze Min S.A.T. (Feet)	True Airspeed (Knots)	Dive Angle (Degrees)	Arming Delay Setting			
3600	250	0	None	4750	1750	3450
			1	5740	2390	4000
			2	6700	3110	5140
			3	7590	----	6050
		30	None	4750	2600	5390
			1	5740	3400	6010
			2	6700	4250	7290
			3	7590	5060	8270
		50	None	4750	2560	6220
			1	5740	3510	6830
			2	6700	4320	8140
			3	7590	5130	9190
3600	250	70	None	4750	2590	6830
			1	5740	3660	7480
			2	6700	4550	8840
			3	7590	5430	----
	350	0	None	4750	1030	2200
			1	5740	1480	2600
			2	6700	1970	3500
			3	7590	2470	4240
		30	None	4750	1730	4830
			1	5740	2450	5400
			2	6700	3180	6550
			3	7590	3900	7450
3600	350	50	None	4750	1500	6130
			1	5740	2200	6690
			2	6700	3020	7930
			3	7590	3830	8880
		70	None	4750	1490	6930
			1	5740	2230	7550
			2	6700	3120	8860
			3	7590	4020	9880
	450	0	None	4750	660	1440
			1	5740	980	1720
			2	6700	1330	2390
			3	7590	1690	2940
3600	450	30	None	4750	1070	4480
			1	5740	1610	4980
			2	6700	2210	6050
			3	7590	2870	6890
		50	None	4750	900	5960
			1	5740	1410	6590
			2	6700	1970	7840
			3	7590	2580	----
		70	None	4750	850	6880
			1	5740	1390	7600
			2	6700	1980	8950
			3	7590	2650	----

592872 O—61——6

Table 5–5. Release Data for VT-Fuzed 2000-Pound General-Purpose Bombs AN–M66A2 and Mk 84 Mods 0 and 1

Determining Factors				Safe Air Travel (Feet)	Separation Distance (Feet)	Minimum Release Altitude (Feet)
Fuze Min S.A.T. (Feet)	True Airspeed (Knots)	Dive Angle (Degrees)	Arming Delay Setting			
2000	250	0	None	3160	830	2170
			1	4340	1490	3040
			2	5450	2200	4030
		30	None	3160	1300	3860
			1	4340	2270	4920
			2	5450	3180	6050
		50	None	3160	1140	4710
			1	4340	2180	5760
			2	5450	3260	6880
		70	None	3160	1090	5250
			1	4340	2180	6370
			2	5450	3360	7530
	350	0	None	3160	460	1290
			1	4340	870	1910
			2	5450	1330	2630
		30	None	3160	710	3470
			1	4340	1430	4430
			2	5450	2230	5430
		50	None	3160	580	4530
			1	4340	1230	5660
			2	5450	2000	6740
		70	None	3160	550	5190
			1	4340	1200	6420
			2	5450	2010	7630
	450	0	None	3160	290	839
			1	4340	530	1240
			2	5450	880	1730
		30	None	3160	430	3220
			1	4340	890	4100
			2	5450	1460	5020
		50	None	3160	330	4410
			1	4340	730	5510
			2	5450	1250	6650
		70	None	3160	310	5160
			1	4340	700	6370
			2	5450	1210	7650
3600	250	0	None	5690	2350	4540
			1	6870	3240	5560
			2	8020		6660
		30	None	5690	3360	6620
			1	6870	4410	7750
			2	8020	5450	8930
		50	None	5690	3460	7450
			1	6870	4480	8640
			2	8020	5500	9880
		70	None	5690	3600	8560
			1	6870	4730	9340
			2	8020	5830	
	350	0	None	5690	1440	3010
			1	6870	2060	3830
			2	8020	2720	4690
		30	None	5690	2390	5960
			1	6870	3330	6990
			2	8020	4250	8050
		50	None	5690	2160	7290
			1	6870	3180	8360
			2	8020	4190	9490
		70	None	5690	2190	8200
			1	6870	3300	9340
			2	8020	4410	10540

Table 5–5. Release Data for VT-Fuzed 2000-Pound General-Purpose Bombs AN–M66A2 and MK 84 Mods 0 and 1—Continued

Determining Factors				Safe Air Travel (Feet)	Separation Distance (Feet)	Minimum Release Altitude (Feet)
Fuze Min S.A.T. (Feet)	True Airspeed (Knots)	Dive Angle (Degrees)	Arming Delay Setting			
	450	0	None	5690	950	2040
			1	6870	1390	2630
			2	8020	1860	3300
		30	None	5690	1580	5490
			1	6870	2340	6440
			2	8020	3200	7440
		50	None	5690	1360	7200
			1	6870	2100	----------
			2	8020	2890	----------
		70	None	5690	1330	8270
			1	6870	2100	
			2	8020	3280	

Table 5–6. Release Data for VT-Fuzed 220-Pound Fragmentation Bomb AN–M88

Determining Factors				Safe Air Travel (Feet)	Separation Distance (Feet)	Minimum Release Altitude (Feet)
Fuze Min S.A.T. (Feet)	True Airspeed (Knots)	Dive Angle (Degrees)	Arming Delay Setting			
2000	250	0	None	2040	370	1020
			1	2800	690	1490
			2	3520	1040	2040
			3	4180	1430	2630
		30	None	2040	530	2330
			1	2800	1050	2980
			2	3520	1620	3670
			3	4180	2150	4380
		50	None	2040	430	2960
2000	250	50	1	2800	880	3700
			2	3520	1450	4470
			3	4180	2030	5220
		70	None	2040	400	3370
			1	2800	830	4160
			2	3520	1410	5000
			3	4180	2020	5790
	350	0	None	2040	200	570
			1	2800	380	860
			2	3520	590	1220
			3	4180	840	1610
2000	350	30	None	2040	260	2100
			1	2800	550	2680
			2	3520	920	3290
			3	4180	1350	3930
		50	None	2040	210	2850
			1	2800	440	3570
			2	3520	750	4310
			3	4180	1130	5050
		70	None	2040	180	3330
			1	2800	400	4130
			2	3520	700	4950
			3	4180	1100	5750

Table 5–6. Release Data for VT-Fuzed 220-Pound Fragmentation Bomb AN–M88—Continued

Determining Factors				Safe Air Travel (Feet)	Separation Distance (Feet)	Minimum Release Altitude (Feet)
Fuze Min S.A.T. (Feet)	True Airspeed (Knots)	Dive Angle (Degrees)	Arming Delay Setting			
2000	450	0	None	2040	130	360
			1	2800	240	550
			2	3520	390	780
			3	4180	550	1060
		30	None	2040	150	1980
			1	2800	320	2500
			2	3520	560	3060
			3	4180	820	3640
		50	None	2040	110	2800
			1	2800	240	3490
			2	3520	420	4200
			3	4180	650	4920
2000	450	70	None	2040	80	3310
			1	2800	210	4110
			2	3520	390	4920
			3	4180	670	5710
3600	250	0	None	3670	1130	2340
			1	4440	1580	2900
			2	5180	2080	3540
			3	5860	2550	4210
		30	None	3670	1740	4000
			1	4440	2370	4700
			2	5180	2980	5430
			3	5860	3570	6180
3600	250	50	None	3670	1580	4850
			1	4440	2270	5540
			2	5180	3010	6300
			3	5860	3660	7060
		70	None	3670	1550	5390
			1	4440	2290	6130
			2	5180	3090	6910
			3	5860	3810	7740
	350	0	None	3670	650	1410
			1	4440	940	1810
			2	5180	1260	2300
			3	5860	1600	2810
3600	350	30	None	3670	1000	3600
			1	4440	1530	4230
			2	5180	2060	4870
			3	5860	2590	5560
		50	None	3670	840	4670
			1	4440	1310	5400
			2	5180	1810	6140
			3	5860	2340	6870
		70	None	3670	780	5330
			1	4440	1280	6130
			2	5180	1810	6940
			3	5860	2380	7760
3600	450	1	None	3670	420	910
			1	4440	600	1200
			2	5180	850	1510
			3	5860	1100	1870
		30	None	3670	610	3340
			1	4440	940	3910
			2	5180	1320	4520
			3	5860	1730	5130
		50	None	3670	470	4550
			1	4440	760	5250
			2	5180	1030	5980
			3	5860	1510	6740
3600	450	70	None	3670	430	5310
			1	4440	710	6090
			2	5180	1080	6900
			3	5860	1470	7740

Table 5–7. Release Data for VT-Fuzed 260-Pound Fragmentation Bomb AN–M81

Determining Factors				Safe Air Travel (Feet)	Separation Distance (Feet)	Minimum Release Altitude (Feet)
Fuze Min S.A.T. (Feet)	True Airspeed (Knots)	Dive Angle (Degrees)	Arming Delay Setting			
2000	250	0	None	2040	*370*	1010
			1	2800	680	1470
			2	3520	1030	2030
			3	4180	1410	2600
		30	None	2040	*530*	2320
			1	2800	1050	2980
			2	3520	1610	3660
			3	4180	2150	4370
2000	250	50	None	2040	*430*	2960
			1	2800	880	3690
			2	3520	1450	4470
			3	4180	2020	5200
		70	None	2040	*400*	3370
			1	2800	830	4160
			2	3520	1410	5000
			3	4180	2020	5790
	350	0	None	2040	*200*	*560*
			1	2800	*370*	850
			2	3520	*590*	1200
			3	4180	830	1590
2000	350	30	None	2040	*260*	2100
			1	2800	*550*	2670
			2	3520	910	3290
			3	4180	1340	3920
		50	None	2040	*210*	2850
			1	2800	*440*	3560
			2	3520	750	4310
			3	4180	1130	5050
		70	None	2040	*180*	3330
			1	2800	*400*	4130
			2	3520	710	4950
			3	4180	1100	5750
2000	450	0	None	2040	*130*	*350*
			1	2800	*240*	*540*
			2	3520	*380*	770
			3	4180	*530*	1040
		30	None	2040	*150*	1970
			1	2800	*320*	2490
			2	3520	*550*	3050
			3	4180	820	3640
		50	None	2040	*110*	2800
			1	2800	*240*	3490
			2	3520	*420*	4200
			3	4180	650	4920
2000	450	70	None	2040	*90*	3310
			1	2800	*210*	4100
			2	3520	*390*	4920
			3	4180	*620*	5710
3600	250	0	None	3670	1120	2330
			1	4440	1570	2880
			2	5180	2060	3510
			3	5860	2530	4180
		30	None	3670	1730	3990
			1	4440	2360	4690
			2	5180	2960	5420
			3	5860	3550	6160

Table 5–7. Release Data for VT-Fuzed 260-Pound Fragmentation Bomb AN–M81—Continued

Determining Factors				Safe Air Travel (Feet)	Separation Distance (Feet)	Minimum Release Altitude (Feet)
Fuze Min S.A.T. (Feet)	True Airspeed (Knots)	Dive Angle (Degrees)	Arming Delay Setting			
3600	250	50	None	3670	1570	4850
			1	4440	2260	5530
			2	5180	2990	6270
			3	5860	3640	7020
		70	None	3670	1540	5390
			1	4440	2280	6120
			2	5180	3070	6880
			3	5860	3800	7710
	350	0	None	3670	*640*	1390
			1	4440	930	1790
			2	5180	1240	2280
			3	5860	1570	2770
3600	350	30	None	3670	1000	3590
			1	4440	1520	4220
			2	5180	2050	4860
			3	5860	2570	5540
		50	None	3670	830	4660
			1	4440	1300	5400
			2	5180	1800	6140
			3	5860	2320	6850
		70	None	3670	780	5330
			1	4440	1270	6130
			2	5180	1810	6940
			3	5860	2370	7740
3600	450	0	None	3670	*410*	890
			1	4440	590	1180
			2	5180	820	1480
			3	5860	1070	1840
		30	None	3670	*610*	3330
			1	4440	930	3900
			2	5180	1310	4500
			3	5860	1690	5110
		50	None	3670	*470*	4540
			1	4440	760	5250
			2	5180	1120	5980
			3	5860	1490	6730
3600	450	70	None	3670	*440*	5300
			1	4440	720	6080
			2	5180	1080	6900
			3	5860	1460	7740

Release Data for VT-Fuzed Fin-Stabilized Rockets

Figures 5–1 and 5–2 furnish data required in determining aiming correction and minimum release range for a fin-stabilized rocket containing a VT fuze.

Aiming Correction. Since VT fuzes produce air bursts, it is necessary to aim the rocket so that it will pass over the target at the height at which the fuze is expected to function. This can be done by leading the target a distance that depends upon the dive angle of the launching aircraft. The correct distance to lead the target, in order to place the most fragments on it, for dive angles ranging from 20 to 60 degrees, is shown in figure 5–1. Curve (A) should be used when firing at targets on water; curve (B) should be used when firing at targets on land.

Minimum Release Range. Since the VT fuze is an influence fuze, precautions must be taken to prevent arming until the fuze is a sufficient distance from the launching aircraft to insure safety to that aircraft in case of an early burst. However, VT-fuzed rockets must be released at ranges sufficient to insure that fuzes are armed upon approaching the target.

The absolute minimum distance in front of the launching aircraft at which a VT fuze may be expected to arm depends on the rocket motor temperature, and varies from 340 yards at 0 degree F to 255 yards at 110 degrees F. The temperature of the rocket motor is considered to be the estimated temperature at the instant of launching the rocket.

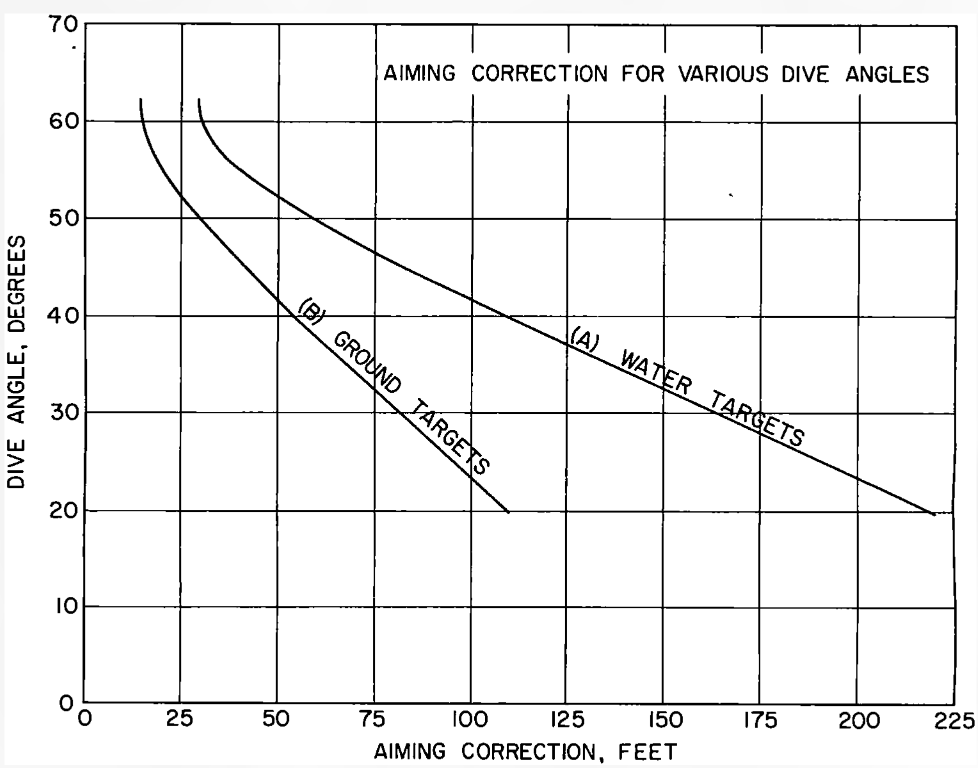

Figure 5–1. Aiming Corrections for Various Dive Angles.

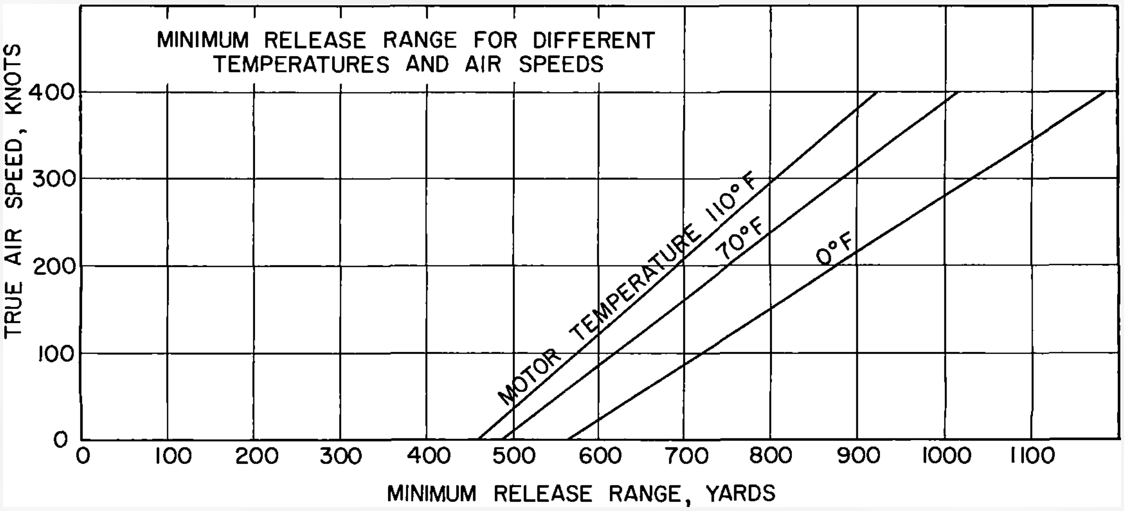

Figure 5–2. Minimum Release Range for Various Temperatures and Air Speeds.

Chapter 6

SAFETY PRECAUTIONS

Precautions for Bomb VT Fuzes

1. Do not allow the arming vane to be turned more than two or three turns during installation of the fuze in the bomb.
2. Under no circumstances shall bomb VT fuzes be disassembled by operating personnel.
3. Do not use a Fahnestock clip on arming wires assembled to ring type VT fuzes except when used with the auxiliary safety device.
4. When bombs with ring type VT fuzes are carried in F9F modified Mk 55 bomb racks, all three safety clips on each arming wire must be placed between the perforated plate and the vane locking pins.
5. When handling an armed dud VT fuze, do not touch the fuze for at least 24 hours after impact. When this time has passed, it will be safe for necessary disposal operations. Do not remove the fuze from the bomb.
6. When handling a VT-fuzed bomb damaged in a landing or takeoff accident, do not remove the fuze from the bomb.
7. When the seal of a VT fuze is found to be broken when received, the fuze shall be handled with caution and the booster safety pin should be inspected for an unarmed condition of the fuze.
8. When the booster safety pin cannot be reinserted during inspection, the fuze must be destroyed in accordance with disposal instructions.
9. Air safety device to be used on all external installations.
10. Maximum IAS for externally carried bomb VT fuzes 400 knots.

Precautions for Fin-Stabilized Rocket Fuzes

1. When the fuze is originally removed from its container and the seal wire is found to be missing, destroy the fuze in accordance with disposal instructions.
2. During inspection of the fuze prior to its installation in the fin-stabilized rocket, check to see if the booster safety pin goes into place easily. If it does not, destroy the fuze in accordance with disposal instructions.
3. Do not allow the arming vane to be turned more than two or three turns during installation of the fuze in the rocket.
4. Do not use Fahnestock clips with these fuzes.
5. When the booster safety pin cannot be reinserted after removal of the fuze from the rocket, destroy the fuze in accordance with disposal instructions.
6. Under no circumstances shall fin-stabilized rocket VT fuzes be disassembled by operating personnel.
7. When handling an armed dud VT fuze, do not touch the fuze for at least one hour after impact. When this time has passed, it may be assumed to be safe for necessary disposal operations. Do not remove the fuze from the rocket.

8. When handling a VT-fuzed fin-stabilized rocket damaged in a landing or takeoff accident, do not remove the fuze from the rocket.

9. When the seal of a fuze is found to be broken on receipt, the fuze shall be handled with caution and the booster safety pin shall be inspected for an unarmed condition of the fuze.

10. When the booster safety pin cannot be reinserted during inspection, the fuze must be destroyed in accordance with disposal instructions.

Appendix A

LIST OF OBSOLETE AND OBSOLESCENT BOMB AND FIN-STABILIZED ROCKET VT FUZES

Model Designation	Type	Remarks
T50E1	Bomb, Ring, 3600 ft MIN S.A.T.	Early developmental model of VT Fuze T89. No safety pin present in booster. Some of these may still be in stock. Obsolescent.
T50E3	Bomb, Ring, 3100 ft MIN S.A.T.	Modification of VT Fuze T50E1. The heavy antenna ring of some of these models did not permit the use of an arming delay. Obsolete.
T50E4	Bomb, Ring, 3600 ft MIN S.A.T.	Early developmental model of VT Fuze T90. No safety pin present in booster. The heavy antenna ring on some of these models does not permit the use of an arming delay. Some of these may still be in stock. Obsolescent.
T82	Bomb, Bar, 3600 ft MIN S.A.T.	This fuze had characteristics which were incorporated into VT Fuze M166. The design of this fuze was different because it contained an air-driven turbine (recessed in the fuze head) instead of an arming vane. Obsolete.
T89	Bomb, Ring, 3600 ft MIN S.A.T.	Developmental model of VT Fuze T91. Obsolete.
T90	Bomb, Ring, 3600 ft MIN S.A.T.	Developmental model of VT Fuze T92. Obsolete.
T91	Bomb, Ring, 2000 ft MIN S.A.T.	Developmental model of VT Fuze T91E1. Some of these may still be in stock. Obsolescent.
T92	Bomb, Ring, 2600 ft MIN S.A.T.	Permanently suspended from issue and use, although a few of these fuzes may still be found in depot stocks. Obsolete.

INDEX

C

D

E

F

G

H

I

L

M

N

O

P

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