Field Manual
20-32

Headquarters
Department of the Army
Washington, DC, 30 September 1992

MINE/COUNTERMINE OPERATIONS

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MINE/COUNTERMINE OPERATIONS

1. Change FM 20-32, 30 September 1992, as follows:

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2. A star(★) marks new or changed material.

3. File this transmittal sheet in front of the publication.

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PREFACE

This manual provides United States Armed Forces with technical guidance for conducting mine and countermine operations. It is to be used by all elements of the combined arms team, with special attention given to maneuver and engineer staff planning and coordination.

The guidance provided focuses on every level. It includes individual skills of emplacing and removing mines, team and squad tasks, platoon and company organization and planning, and battalion/task Force organization and coordination for successful obstacle reduction and breaching.

The provisions of this publication support existing doctrine established by FMs 5-34, 5-101, and 5-102. It also contains new and improved techniques for row mining, marking, reporting, and recording minefield; breaching simple and complex obstacles; and emplacing a standard-pattern minefield. This manual reflects new doctrine established in FM 5-100 and FM 90-13-1.

FM 20-32 mirrors the following International Standardization Agreements (STANAGs) between North Atlantic Treaty Organization (NATO) forces.

- STANAG 2036 Land Minefield Laying, Recording, Reporting and Marking procedures
- STANAG 2990 Principles and Procedures for the Employment in Land Warfare of Scatterable Mines with a Limited Laid Life
- STANAG 2889 Marking of Hazardous Areas and Routes Through Them

The proponent for this publication is Headquarters, Department of the Army Training and Doctrine Command (TRADOC). Forward comments and recommendations on DA Form 2028 to Commandant, US Army Engineer School, ATTN: ATSE-DME-MWF, Fort Leonard Wood, Missouri 65473-5000.

Unless this publication states otherwise, nouns and pronouns do not refer exclusively to men.

Part One. Conventional Mine Operations

CHAPTER 1
CONVENTIONAL MINES

This chapter provides the mechanics of conventional mines and the characteristics and descriptions of antitank (AT) and antipersonnel (AP) conventional mines and antihandling devices (AHDs). Conventional mines are hand-laid mines that require manual arming. Conventional mine laying is labor-, resource-, and transport-intensive. Soldiers emplace conventional mines within a defined, marked boundary and lay them individually or in clusters. They record each conventional mine location so mines can be recovered. Soldiers can surface lay or bury conventional mines and may place AHDs on the mines.

MECHANICS OF MINES

Characteristics and Functioning

A mine used in warfare is an explosive device designed to destroy or damage equipment or personnel. Equipment targets include ground vehicles, boats, and aircraft. A mine may be detonated by the action of its victim, by the passage of time, or by controlled means. There are two types of conventional mines: AT and AP. Mines generally consist of the following parts (Figure 1-1, page 1 -2):

- Firing mechanism or other device (sets off the detonator or igniter charge).
- Detonator or igniter charge (sets off the booster charge).
- Booster charge (may be attached to the fuze/igniter train or be part of the main charge).
- Main charge, in a container (usually forms the body of the mine).
- Outer casing (contains all the above parts).

Components and Initiating Actions

The purpose of firing mechanisms is to prevent a mine from exploding until it makes contact with, or is influenced by, its target.

Once a mine has been armed, the firing mechanisms may be actuated by the following methods (Figure 1-2, page 1-3):

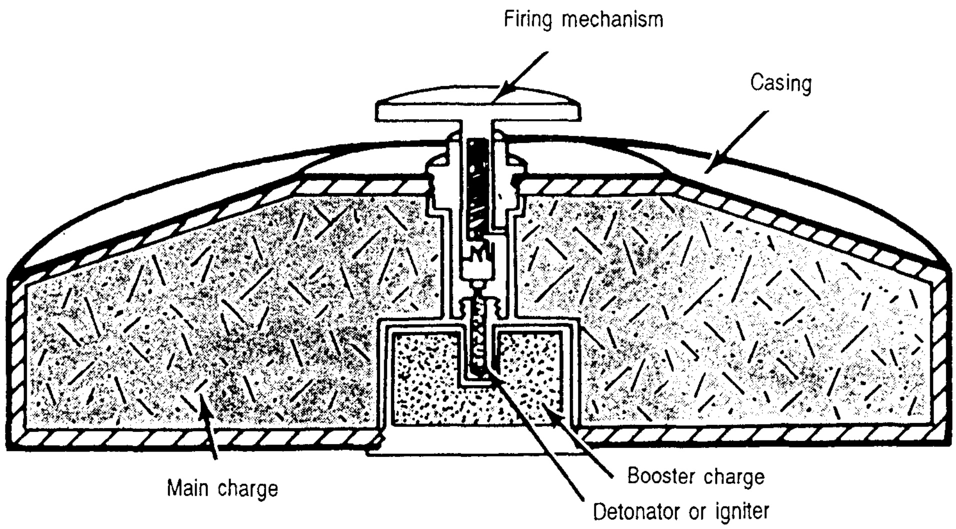


Figure 1-1. Mine components

- Applying pressure.
- Pulling a trip wire.
- Releasing tension or breaking a trip wire.
- Releasing pressure.
- Passage of time (time-delay mechanism).
- Impulses.
  - Electrical.
  - Vibration.
  - Magnetic.
  - Electromagnetic frequency.
  - Audio frequency.

For a mine to be armed, the igniter must be put in position and the mechanism properly set. In addition, the safety device must be disengaged (usually by removing a safety pin).

The fuze is the initial component in the firing chain. It has a low explosive power but is highly sensitive. The fuze is actuated by an initiating action. Although mines are issued with a standard fuze, alternate fuzes are issued separately for some mines.

The four main fuzes are as follows (Figure 1-3, page 1-4):

- Mechanical.
- Chemical.
- Friction.
- Electrical.

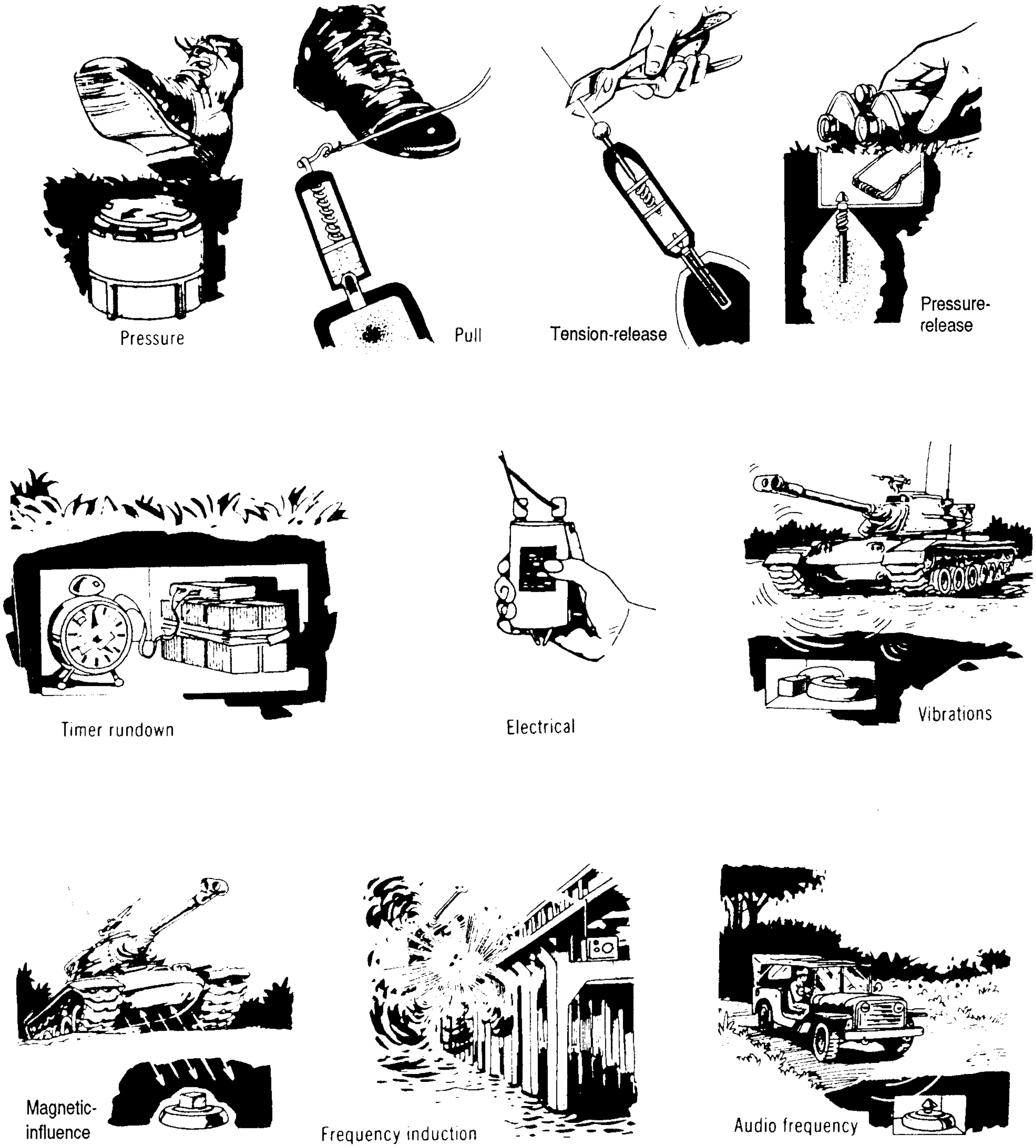
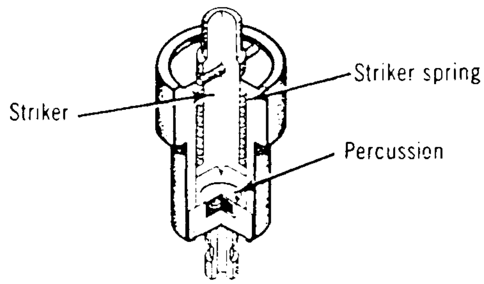
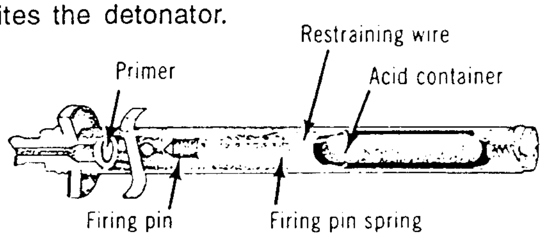


Figure 1-2. Methods of actuating mines

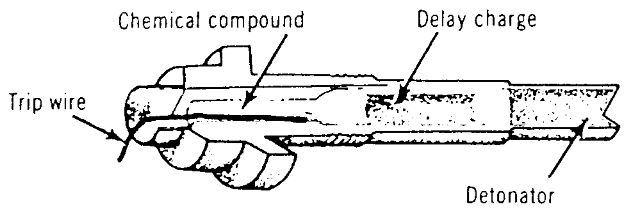
Mechanical. A spring drives a striker against a percussion cap, which fires the detonator.



Chemical. A small container of a chemical compound is broken by the initiating action. The chemical compound reacts with another substance to generate heat which ignites the detonator.



Friction. The initiating action ignites substances inside the fuze by friction. The flame fires the detonator.



Electrical. The initiating action closes an electrical circuit which detonates an electrical detonator.

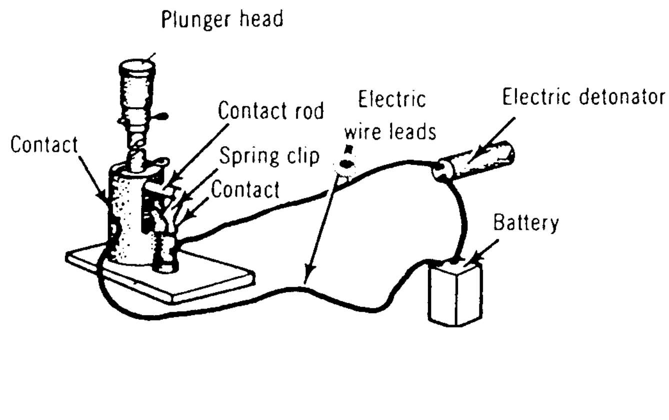


Figure 1-3. Four main types of fuzes used to pass the initiating action on to the rest of the firing chain

ANTITANK MINES

AT mines are designed to immobilize or destroy tracked and wheeled vehicles and the vehicles' crews and passengers.

Types of Kills

AT mines produce either a Mobility Kill (M-Kill) (Figure 1 -4) or a Catastrophic Kill (K-Kill) (Figure 1-5).

An M-Kill destroys one or more of the vehicle's vital drive components (for example, breaks a track on a tank) and immobilizes the target. The M-Kill does not always destroy the weapon system and crew. The weapon system, though immobilized, may continue to function. In a K-Kill, the weapon system or crew is destroyed; therefore, the vehicle can no longer perform its intended mission.

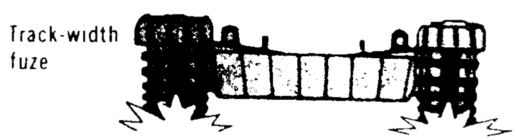


Figure 1-4. M-Kill

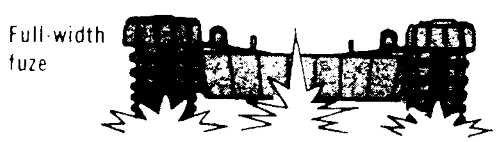


Figure 1-5. K-Kill

Types of Sensing

AT fuzes fall into the following three categories: track-width, full-width, and wide-area.

Track-width (Figure 1-4). Usually pressure-actuated, requiring contact with the wheels or tracks of a vehicle. This fuze normally produces an M-Kill.

Full-width (Figure 1-5). Activated by several methods: acoustics, magnetic, tilt-rod, radio frequency, and vibration. Tilt-rod or magnetic-influence fuzes are the most common. They are designed to be effective across the entire target width. When a full-width fuze is activated solely by contact with the wheels or tracks of the target vehicle, it usually causes an M-Kill. Most of the energy is absorbed by the wheels or tracks.

Wide-area (Figure 1-6). Designed to produce an M-Kill when a target vehicle activates the fuze with acoustic and seismic signals. An infrared-sensored sublet is launched and acquires the target.

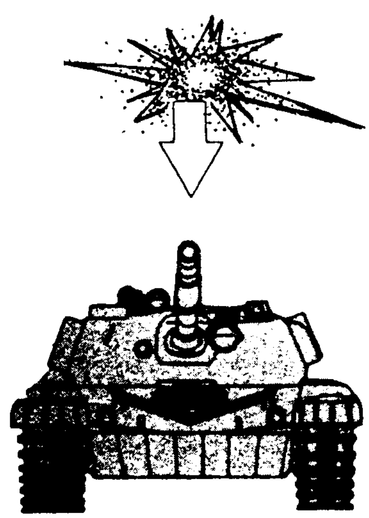


Figure 1-6. Wide-area fuze

Types of Warheads

The different AT mines are also distinguished by their warheads (blast or shaped charge).

A blast AT mine derives its effectiveness from the force generated by high explosive (HE) detonation. It usually produces an M-Kill when the blast damages the track or vehicle, but a K-Kill is also possible.

Self-forging fragmentation (SFF) mines use a direct-energy (shaped charge Miznay-Schardin (M-S) effect) warhead designed to penetrate the armor on the vehicle's underside, or on its side for horizontal-effect mines. It usually causes a K-Kill because spalling metal from the vehicle created by the blast of the mine or secondary explosions kill the crew.

The following conventional AT mines are used by the Army (Figure 1-7 and Table 1-1):

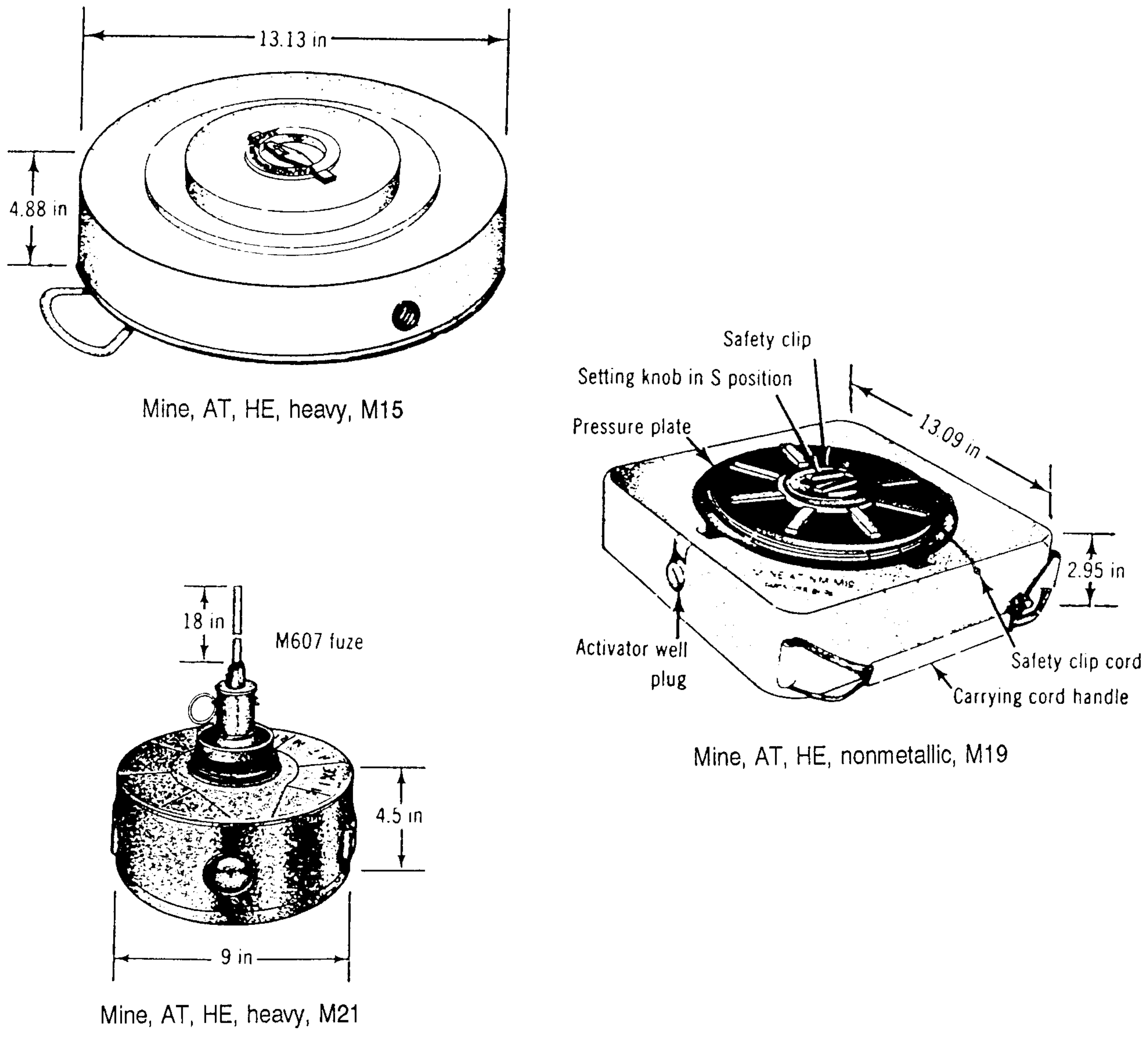


Figure 1-7. Conventional AT mines

★ *Table 1-1. Conventional AT mine characteristics*

Mine	Safe Arm Time	Fuzing	Warhead	AHD	Explosive Weight	Mine Weight	Mines Per 5-Ton Dump
M15	NA	Pressure	Blast	Yes	22 lb	30 lb	112
M15 w/M624 Fuze	NA	Tilt Rod	Blast	Yes	22 lb	30 lb	112
M19	NA	Pressure	Blast	Yes	21 lb	28 lb	128
M21	NA	Tilt Rod	Shaped Charge	Yes*	11 lb	17 lb	128

*Conventional antihandling devices will not couple with this mine; however, a booby trap using the M142 multipurpose firing device can be configured under the emplaced mine.

M15 AT (with or without tilt rod). The M15 mine is 13 1/8 inches in diameter and 4 7/8 inches high. It weighs 30 pounds and contains 22 pounds of Composition B explosive. The primary fuze well is on the top center of the mine. Secondary fuze wells are on the side and bottom. When the M603 fuze is employed on the primary fuze, the M 15 is a track-width mine that is activated with 350 to 750 pounds on the pressure plate. This produces an M-Kill. When the M624 fuze (with tilt rod) is employed on the primary fuze well, the M 15 is a full-width mine that is activated by deflection of the tilt rod. Depending on the armor, this produces an M-Kill or possibly a K-Kill.

M19 AT (plastic). The M19 mine is a non-metallic square mine that measures approximately 13 by 13 by 3 inches. It weighs 28 pounds and contains 21 pounds of Composition B explosive, a tetryl booster pellet, and an M606 integral pressure fuze. When the setting knob on the pressure plate is in the **S** (safe) position, the mine cannot function by action of the main fuze. After the safety clip has been removed and the setting knob turned to the **A** (armed) position, a force of 350 to 500 pounds on the pressure plate depresses the Belleville spring and begins the firing chain. A standard firing device may be used with the M2 activator in any of the secondary fuze wells on the side and bottom of the mine. When the Ml 9 is employed, it is hard to detect because of its plastic construction. It produces an M-Kill with a blast effect.

M21 AT (with or without tilt rod). The M21 mine is 9 inches in diameter and 4 ½ inches high. It weighs 17 pounds with 11 pounds of Composition H6. The mine is activated by 4 pounds of pressure against a 2l-inch-long rod on the M607 fuze. It uses an M-S (directed energy) plate to produce a K-Kill. The M21 with tilt rod must be buried or staked (use two stakes, one on each side of the carrying strap) to avoid enemy vehicles tipping the mine over. Without the tilt rod, the mine is activated by 290 pounds of pressure on the M607 fuze and produces an M-Kill by blast effect.

ANTIPERSONNEL MINES

AP mines are designed to kill or wound soldiers.

Types of Kills

AP mines can either kill or incapacitate their victims. Other soldiers must tend to the victim, which temporarily takes them out of the fight.

Types of Sensing

AP mines can be fuzed by pressure or trip wire or can be command-detonated.

- Pressure fuzes usually activate an AP mine when a soldier steps on the fuze.
- Trip wires activate an AP mine when a soldier disturbs barely visible wires. The exploding mine can kill or incapacitate him or other soldiers in the immediate vicinity.
- Command-detonated mines are activated by a soldier when he detects enemy in the blast area of the mine and detonates the mine to kill or incapacitate enemy soldiers.

Types of Warheads

The three types of warheads are: blast, bounding fragmentation (frag), and directed frag.

The blast AP mine is designed to cripple the foot or leg of the soldier who steps on it. It can also burst the tires of a wheeled vehicle that passes over it.

When the bounding frag AP mine is activated, it throws a canister into the air. The canister bursts and scatters shrapnel throughout the immediate area (Figure 1-8).

The directed frag AP mine propels fragments in the general direction of enemy soldiers.

The following conventional AP mines are used by the Army (Figure 1-9 and Table 1 -2):

M14 AP blast mine. The M 14 is a nonmetallic, blast mine consisting of a main charge (1 ounce of tetryl), a plastic body, and an integral plastic fuze with a steel firing pin. It is cylindrical in shape, 2 3/16 inches in diameter, and 1 9/16

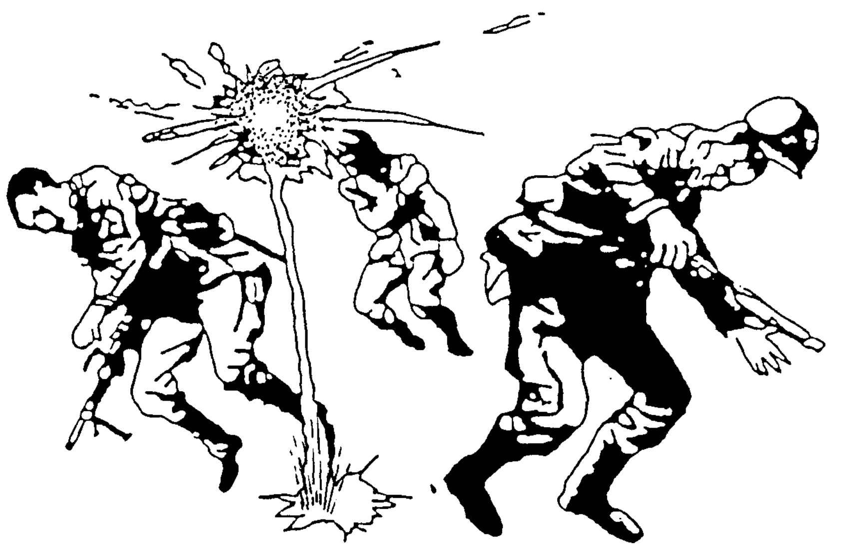


Figure 1-8. Bounding frag AP mine

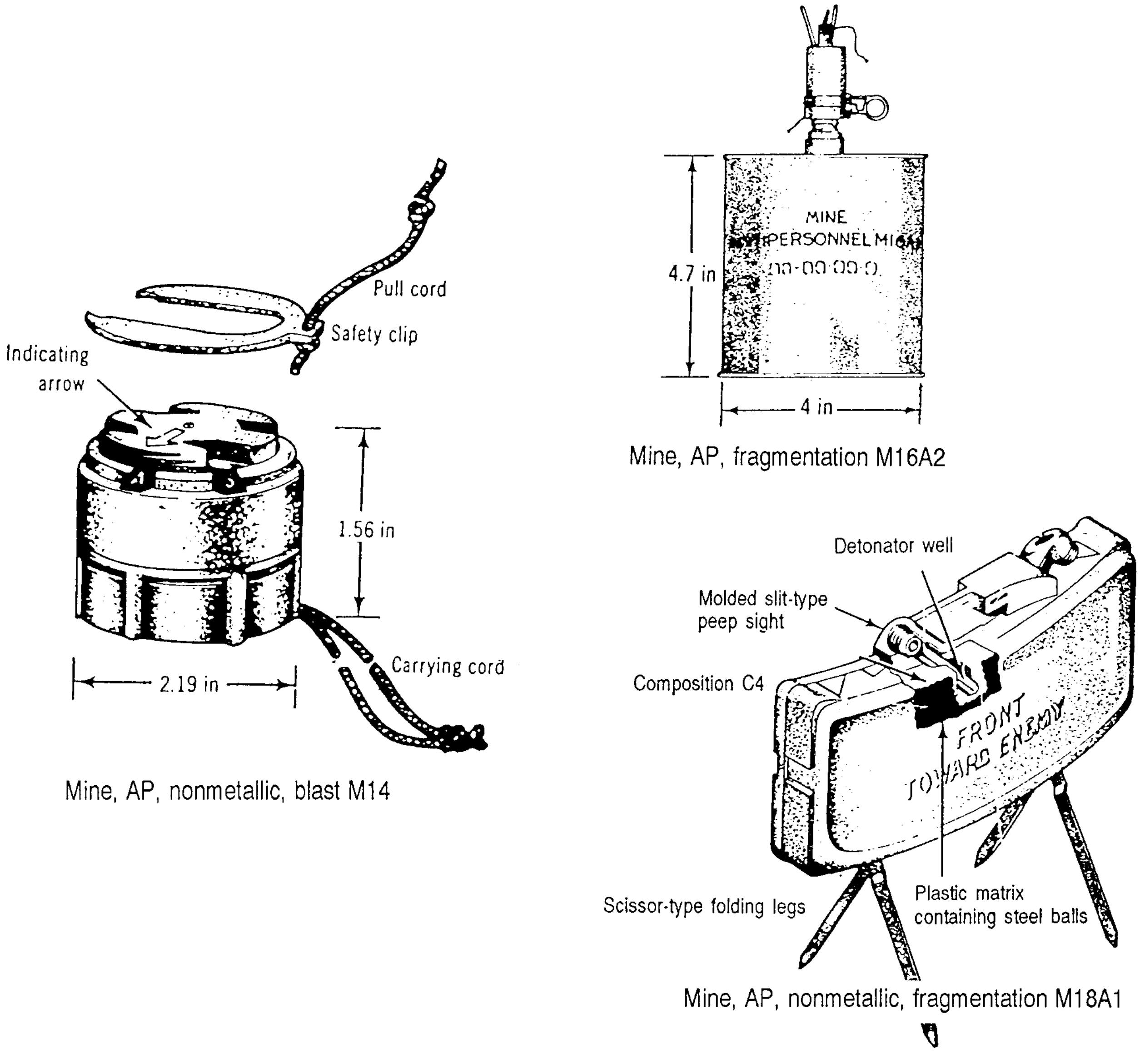


Figure 1-9. Conventional AP mines

Table 1-2. Conventional AP mine characteristics

Mine	Safe Arm Time	Fuzing	Warhead	AHD	Explosive Weight	Mine Weight	Mines Per 5-Ton Dump
M14	NA	Pressure	Blast	No	1 oz	3.3 oz	6,480
M16A1	NA	Pressure Trip Wire	Bounding Frag	Yes	1 lb	8 lb	672
M18A1	NA	NA	Directional Frag	No	1.5 lb	3.5 lb	1,782
M86 (PDM)	25 sec	NA	Bounding Frag	100%	21 gr	1 lb	NA
NOTE: The M86 (PDM) mine self-destructs in 4 hours.							

inches high. It weighs 3 ½ ounces. The pressure plate has an indented yellow arrow that points to the **A** (armed) or **S** (safe) position on the top of the fuze body. A force of 25 to 30 pounds depresses the pressure plate, causing the Belleville spring to drive the firing pin into the detonator Although the M14 is not. designed to kill, it can incapacitate. It is difficult to detect because of its plastic construction.

M16 AP frag mine. The M 16 is a bounding frag mine consisting of a combination mine fuze (M605), propelling charge, and projectile that are contained in a sheet steel case. The mine is 4 inches in diameter and 7 5/8 inches high (with the fuze), and it weighs 7 7/8 pounds. The principal differences between the M 16 and the A1 and A2 versions are in the construction of the detonators and boosters. The casualty radius for the M 16 and M16A1 is 27 meters; and for the M 16A2, it is 30 meters. Pressure of 8 to 20 pounds acting on one or more of the three prongs on the M605 fuze or the pull of 3 to 10 pounds on a trip wire activate the mine.

M18A1 AP frag mine. The M18A1 Claymore mine is a directional frag mine that contains 700 steel balls and 1 ½ pounds of Composition C4 explosive. The mine can be detonated by command or trip wire. It is activated by electric or nonelectric blasting caps inserted into the detonator well. When the mine detonates, it projects a fan-shaped pattern of steel balls in a 60-degree horizontal arc and covers a casualty radius of 100 meters, at a maximum height of 2 meters. The forward danger radius for friendly forces is 250 meters. The backblast area is unsafe in an unprotected area 16 meters to the rear and sides of the mines. All friendly personnel within 100 meters to the rear and sides of the mine should be in a covered position to be safe from secondary missiles. When employing the M18A1 mine with other mines, separate the mines by the following minimum distances:

- 50 meters in front of or behind M18A1 mines.
- 3 meters between M18A1 mines that are placed side by side.
- 10 meters from nearest AT or frag AP mines.
- 2 meters from nearest blast AP mines.

M86 pursuit-deterrent munition (PDM). The PDM is a manually activated mine with a hand grenade release firing mechanism (Figure 1-10). It has a self-delay arming time of 25 seconds and deploys up to seven trip wires. It possesses a 4-hour self-destruct time and is issued as a Class V munition.

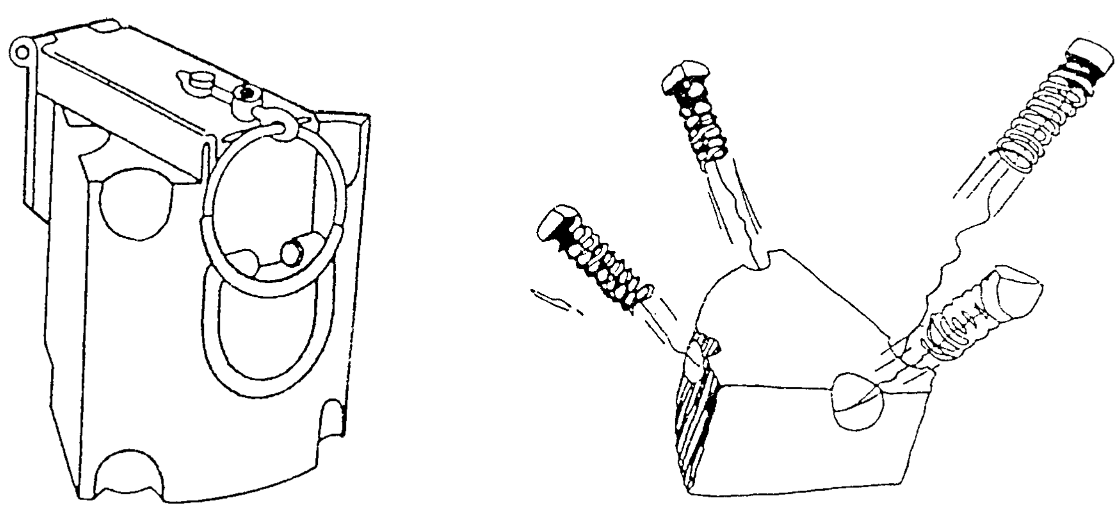


Figure 1-10. Pursuit-deterrent munition (PDM)

ANTIHANDLING DEVICES

★ AHDs perform the function of a mine fuze if someone attempts to tamper with or remove the mine. An AHD usually consists of an explosive charge connected to or placed next to the mine. It can be a manufactured device attached to the mine body. It can also be activated by a wire attached to a retaining pin that fires the device when the mine is moved.

★ Some mines are provided with extra fuze wells, making it easier to install AHDs (Figure 1-11). The AHD may also be placed beneath the mine (unattached to the mine) (Figure 1-12). Mines with AHDs are sometimes incorrectly called *booby-trapped* mines.

★ The followtng US AHDs are used (Figure 1-13, page 1-12):

- M1 pull firing device.
- M3 pull tension-release firing device.
- M5 pressure-release firing device.
- M1A1 pressure firing device.
- M142 multipurpose firing device.

These devices use a spring-loaded striker with a standard base and function in one or more of the following modes: pressure, pressure-release, tension, and tension-release. When firing devices are employed with certain AT mines, they require the use of the M 1 or M2 activator. These firing devices and activators are described in Appendix A.

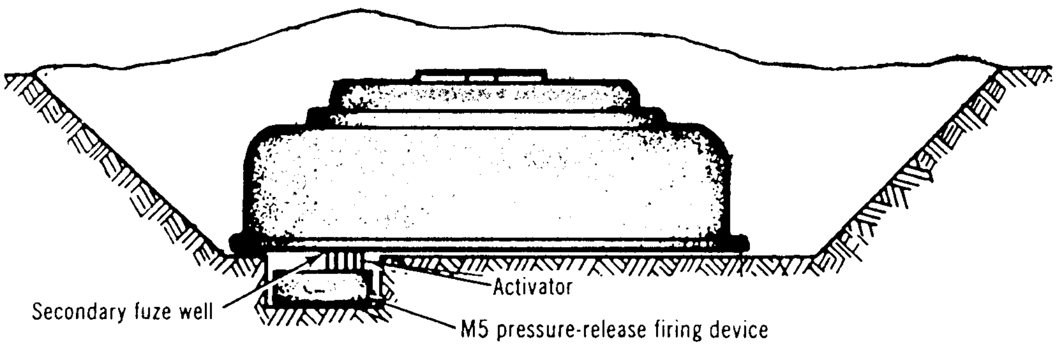


Figure 1-11. AHD incorporating a release mechanism

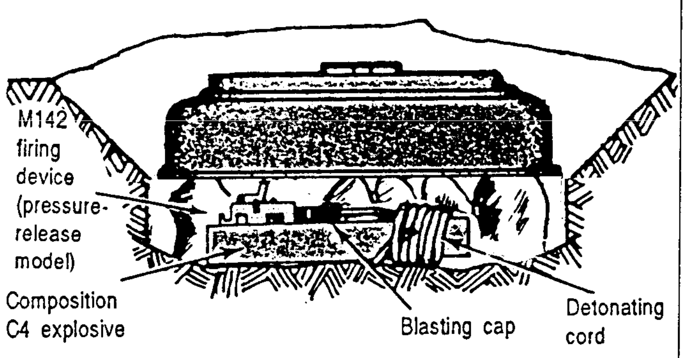


Figure 1-12. AHD not attached to mine

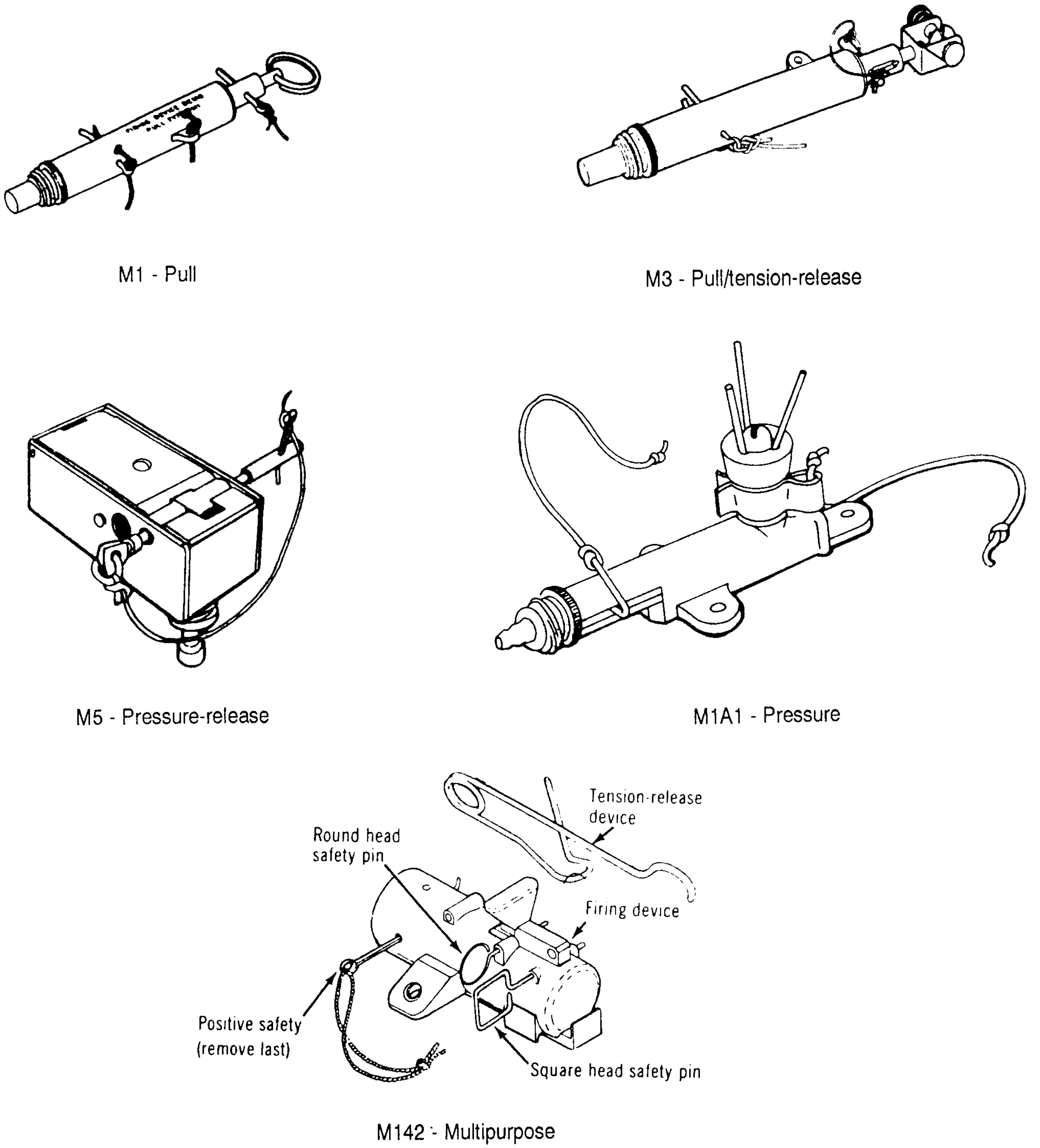


Figure 1-13. US AHDs

CHAPTER 2
MINE WARFARE PRINCIPLES

This chapter provides guidance to staff personnel who must plan the employment of minefield to support tactical operations. It defines the three types of minefields—protective, tactical, and phony. The remainder of the chapter provides guidance on employment of tactical minefields—specifically their functions, designs, and integration principles.

MINE WARFARE POLICY

Mines are explosive devices emplaced for the express purpose of killing, destroying, or otherwise incapacitating enemy personnel and / or equipment. They can be employed in quantity within a specified area to form a minefield, or they can be used individually to reinforce nonexplosive obstacles. They may also be emplaced individually as booby traps to demoralize an enemy force. A minefield is an area of ground containing mines emplaced with or without a specific pattern, or it is an area of ground without any mines (a phony minefield). Minefields may contain any type, mix, or number of AT and / or AP mines. Minefields are used to—

- Produce a specific effect on enemy maneuver, thereby creating a vulnerability that can be exploited by friendly forces.
- Cause the enemy to piecemeal his forces.
- Interfere with enemy command and control.
- Inflict damage to enemy personnel and equipment.
- Protect friendly forces from enemy maneuver.

TYPES OF MINEFIELDS

There are three general types of minefields—*protective, tactical,* and *phony*. Minefield type is determined by the battlefield purpose. Protective, tactical, and phony minefields all have different purposes on the battlefield. As a result, they are employed differently and target the enemy in a unique way that supports the overall concept of operation. Protective obstacles are employed to protect a defending force from an enemy assault. Tactical obstacles, on the other hand, directly attack the enemy's maneuver in a way that gives the defending force a positional advantage. Phony minefields deceive the enemy as to the exact location of real minefields. Phony minefields cause the attacker to second-guess his decision to breach and may cause him to wastefully expend his breach assets. Phony minefields may be employed in conjunction with tactical or protective minefields.

It is important to distinguish the difference between the type of minefield and the means of emplacement. Volcano, Modular Pack Mine System (MOPMS), standard pattern, and row mining are not types of minefields. They are just some of the means used to emplace tactical or protective minefields. They may also be the method of emplacement replicated by a phony minefield. For example, tracked vehicles may drive in a phony minefield to give it the same signature as a minefield emplaced by row mining.

Protective Minefields

Protective minefields, like other protective obstacles, are employed to protect the defending force from the enemy's final assault. Protective obstacles are key components of survivability operations. Protective minefields are normally employed and emplaced at the small unit level (platoon and company/team). The authority to emplace protective minefields is normally delegated to the company/team commander. In some cases, protective minefields are laid on short notice by units using mines from their basic load or local stock, such as in a hasty defense. More commonly, protective minefields are used as part of a unit's deliberate defense. The mines are laid so they are easy to detect and recover by the laying unit.

An important aspect of protective minefields is the requirement to recover them before leaving the area. This is often overlooked and is difficult to control because they are emplaced at the small unit level. When a unit is being relieved in place by an adjacent unit, protective obstacles are turned over to the relieving unit. This implies that protective obstacles are recorded and reported as any obstacle. Again, the decentralized emplacement of protective obstacles makes consolidating reports and records difficult and requires command involvement.

Much like final protective fires (FPF), protective minefields provide the defender with close-in protection during the enemy's final assault. Protective minefields serve two purposes. They impose a delay on the attacker to allow the defender time to break contact, and they displace to another battle position or break up the enemy's assault to complete its destruction. The composition of protective minefields is driven by the vulnerability of the defender.

- The greatest close combat threat to a defending tank company/ team is dismounted infantry. Protective minefields in this case consist predominantly of AP mines to limit enemy dismounts to close with the armor defender.
- The greatest threat to an infantry defense is a tank force. Protective minefields in this case consist predominantly of AT mines to reduce the enemy's ability to close quickly onto the infantry's position.

Neither AP nor AT mines are used in isolation. The preponderance of the mine composition is designed against the most severe close combat threat and the likelihood of that threat.

A protective minefield may take many forms. It may be only a few mines in front of a platoon, or it may be a standard pattern minefield around an airfield. Protective minefields are used in both close and rear operations and are classified as either hasty or deliberate.

- ★ Hasty protective minefields are used as part of a unit's defensive perimeter. They are usually laid by units using mines from their basic load. If time permits, mines should be buried to increase their effectiveness; but they may be laid on top of the ground in a random pattern. AHDs and nonmetallic mines are not used, so the minefield can be easily recovered. Mines are employed outside the hand grenade range but within the range of small caliber weapons. All mines are picked up by the emplacing unit upon leaving the area, unless enemy pressure prevents mine retrieval or the minefield is being transferred to a relieving commander. The brigade commander has the initial authority to employ hasty protective minefields. This authority may be delegated to the battalion commander or to the company commander on a mission basis.

Procedures for recording a hasty protective minefields are contained in Chapter 5.

★ • Deliberate protective minefields are used to protect static assets (vital sites): logistical sites, communication nodes, depots, airfields, missile sites, air defense artillery (ADA) sites, and permanent unit locations. The typical deliberate protective minefield is the standard pattern minefield. A row minefield can also be used for a deliberate protective minefield. Deliberate protective minefield are usually emplaced for extended periods of time and can be transferred to another unit. Two techniques for emplacing deliberate protective minefields are discussed in Chapter 3, Standard Pattern Minefield, and Chapter 4, Row Mining.

Tactical Minefields

Tactical minefields are employed to directly attack enemy maneuver and to give the defender a positional advantage over the attacker. Tactical minefields may be employed by themselves or in conjunction with other types of tactical obstacles. They attack the enemy's maneuver by disrupting his combat formations, interfering with his command and control, reducing his ability to mass fires against the defender, and reducing his ability to reinforce. The defender masses fires and maneuver to exploit the positional advantage created in part by tactical obstacles.

Tactical minefields add an offensive dimension to the defense. They are the commander's tool for recapturing and maintaining the initiative normally afforded the attacker. Combined with fires, tactical obstacles force the attacker to conform to the defender's plan.

Tactical minefields are not only used in the defense. They may also be emplaced during offensive operations to protect exposed flanks, isolate the objective area, deny enemy counterattack routes, and disrupt enemy retrograde. This chapter further discusses the principles behind designing, integrating, siting, and emplacing tactical minefields

Nuisance minefields. Nuisance minefields are a form of Tactical minefields. They are mainly used to impose caution on enemy forces and to disrupt, delay, and, sometimes, destroy follow-on echelons. Once nuisance minefields are emplaced, they do not necessarily need to be covered by observation or direct fire. Nuisance minefields are usually of irregular size and shape. They can be a single group of mines or a series of mined areas. They can be used to reinforce existing obstacles and can also be rapidly emplaced on main avenues of approach. Both conventional and scatterable mines may be used in nuisance minefields

Phony Minefields

Phony minefields are areas of ground that are altered to give the same signature as a real minefield and thereby deceive the enemy. Phony minefields serve two primary functions. First, they confuse the attacker's breach decision cycle and cause him to second-guess his breach decisions. Second, they may cause the attacker to wastefully expend breach assets to reduce mines that are not really there.

The success of phony minefields depends on the enemy's state of mind. The bluff succeeds best when the enemy is mine-conscious and has already suffered the consequences of a mine encounter. A fear of mines can quickly evolve into paranoia anti break the moment urn of the enemy's attack. Therefore, phony minefields are normally employed in conjunction with real minefields and seldom employed by themselves. Once the enemy has become mine-conscious, phony minefields may produce considerable tactical effects with very little investment in time, labor, and material. Phony minefields may also be used to extend the frontage or depth of live minefields when mines or labor are in short supply or time is restricted. Phony minefields may be used to conceal minefields gaps through live minefields. However, there is no guarantee that phony minefields will achieve their purpose.

There are two mission-essential tasks inherent in the employment of a phony minefield. First, the phony minefield must completely replicate a live minefield in every detail using a specific method of emplacement as a model. This becomes the deception story, and every aspect of the phony minefield must support the deception story. For example, if the deception story is a buried row minefield, the depth, frontage, and marking must be similar to other employed buried row minefields. The ground should be disturbed as for live mine laying, and tracks should be made on the ground in the same pattern as other minefields to give the ground the same signature. Occasional empty mine crates, discarded fuzes, or other mine-laying supplies add to the deception.

The second mission-essential task is to never compromise the deception story. Once emplaced, the phony minefield must be regarded by friendly forces as live until the tactical situation no longer warrants maintaining the deception. This can be extremely painful for the friendly unit. There is great temptation to drive through, rather than around, a known phony minefield, particularly if it is intended to be a gap between live minefields. However, one vehicle observed by enemy reconnaissance driving through a phony minefield compromises its effectiveness.

Live mines are never laid in a phony minefield. A minefield designated as phony implies that the area contains no live mines. Emplacing even a single live mine within a phony minefield makes it a live minefield no matter how low the density. Empty tins and such may be laid in a phony minefield, but it is seldom worthwhile. Minefield marking and covering fire should be the same as for a live minefield. Employment authority and reporting requirements are the same as for the minefield being simulated.

Protective Versus Tactical Minefields

As discussed, minefields can be *tactical* or *protective* obstacles. Tactical and protective obstacles have different purposes with regard to the enemy's maneuver. This difference causes them to have a particular relative place on the battlefield. Tactical obstacles attack enemy maneuver and are placed on the battlefield where the enemy maneuvers from march, prebattle, and attack formations. Protective obstacles are used to protect the force from the enemy's final assault onto the force's position. Protective obstacles are close to defensive positions and are tied in with the FPF of the defending unit (Figure 2- 1).

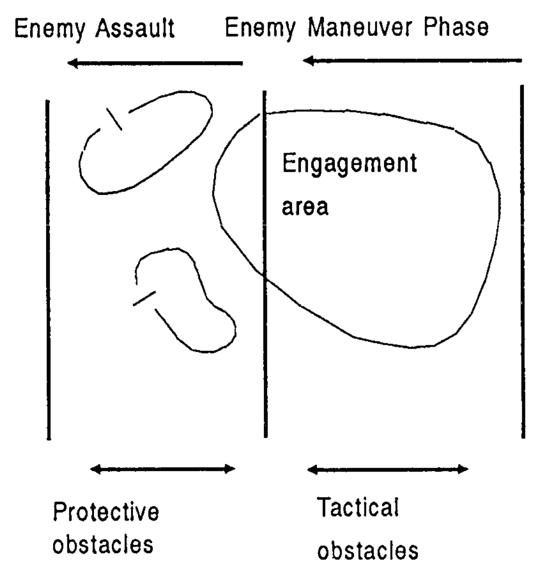


Figure 2-1. Tactical versus protective obstacles

TACTICAL MINEFIELD EFFECTS AND DESIGNS

Tactical minefields are designed, sited, emplaced, and integrated with fires to produce four specific tactical obstacle effects: disrupt, turn, fix, and block (Figure 2-2). Each obstacle effect has a specific impact on the enemy's ability to maneuver, mass, and reinforce. They also increase the enemy's vulnerability to friendly fires. Obstacle effects support the friendly scheme of maneuver by manipulating the enemy in a way that is critical to the commander's intent and scheme of maneuver. Minefield design is the means by which the emplacing unit varies minefield width, minefield depth, mine density, mine composition, use of AHDs, and an irregular outer edge (IOE) to best achieve one of the four tactical obstacle effects. Modifying these variables is at the heart of tactical minefield employment principles.

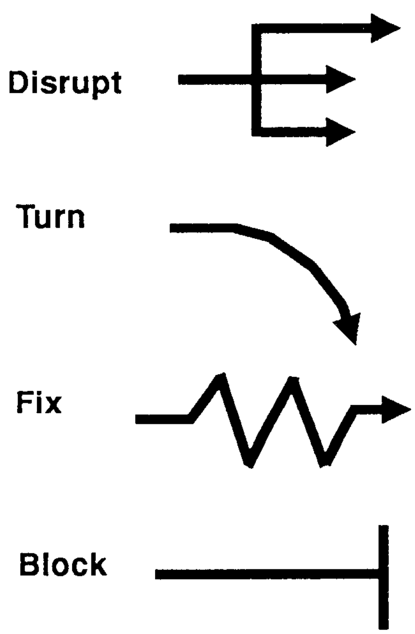


Figure 2-2. Tactical minefield intent

Tactical Minefield Variables

First, it is important to understand how the variables relate to minefield effects. Figure 2-3, page 2-6, helps clearly define some of the terms used to discuss minefield variables.

Front. Minefield frontage is that dimension of minefield that defines how much of the attacking enemy formation is affected by the minefield. The front of an individual minefield is based on the desired minefield effect (disrupt, turn, fix, and block) and the attack frontage of an enemy company. The frontage of an attacking enemy depends largely on the type enemy force (armored, motorized, or dismounted infantry) and norms by which their army fights. For armored warfare, the frontage of an individual minefield is based on effecting a doctrinal company attack frontage of 500 meters (13 to 18 combat vehicles). Frontages may vary and require a study of the enemy force and terrain. Groups of individual minefields are employed to affect battalion and larger formations to achieve a larger frontage. For example, a battalion consisting of 52 to 72 combat vehicles has a frontage of 1,500 meters and requires more minefields.

Depth. Minefield depth is based on the amount of breaching assets we want the enemy to exhaust to reduce a lane. The standard should start with 100 meters and increase in depth if denying the enemy use of a mobility corridor (MC) is the intent (turn or block).

Density. Minefield density is an expression of how many mines are contained in the minefield. It is expressed in either linear or area density. Linear density is an expression of the average number of mines within a 1-meter path through the minefield's depth anywhere along the front. In Figure 2-3, page 2-6, the minefield contains 100 mines with a minefield front of 200 meters. The linear density is 0.5 mine per meter front (100 mines / 200 meters of front). Area density is the average number of mines in a l-square-meter area anywhere in the minefield. The minefield contains 100 mines within a 20,000-square-meter

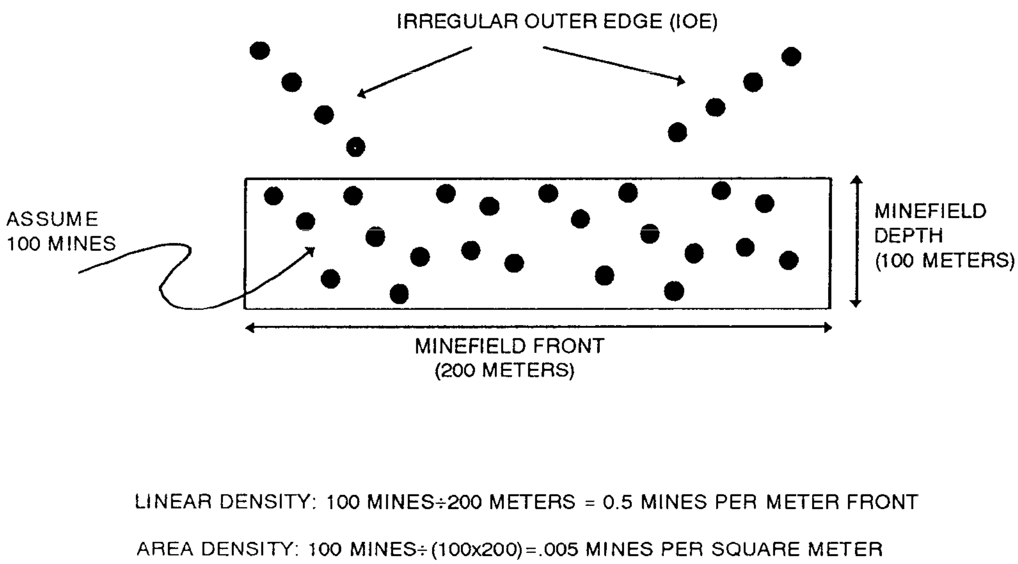


Figure 2-3. Minefield variables

area. The area density is .005 mine/square meter (100 mines/(200-meters X 100 meters)). Area density is normally used to express only the density of scatterable minefields.

Mine composition. This variable includes effective use of different types of mines. By using full-width kill mines, the probability of kill increases for the minefield. AP mines are used where the enemy is expected to conduct a dismounted breach.

AT mines. If the enemy is an armored force, tactical obstacles are predominantly AT heavy. The two options for minefield composition are full-width and track-width fuzed mines. Track-width mines (M15s) have a lower probability of kill (M-Kill or K-Kill) compared to full-width fuzed mines (M21s). The ratio of full-width versus track-width in a minefield depends on the kill required. In general, a track-width minefield does not adequately affect the enemy's maneuver.

AP mines. AP mines target dismounted soldiers. Their composition in tactical minefields depends on the threat and the enemy's breaching assets. Based on current technology, the majority of breaching operations are accomplished by mechanical or explosive means. If the minefield intent is to exhaust the enemy's breaching assets, AP mines would be integrated to attack his dismounted breach ability.

Probability of encounter and kill. The probability of encounter and kill are measures of a minefield's lethality. Probability of encounter is a measure (expressed in percent chance) that a vehicle blindly moving through a minefield will detonate a mine. The probability of mine encounter is a function of mine density, type of mine, and type of enemy vehicle. In short, the more dense a minefield the higher the probability is of encountering a mine. Probability of encounter also depends on the fuze capability of the mines emplaced. Tilt-rod and magnetic-fuzed mines will detonate if they are encountered anywhere along the width of the enemy vehicle. Pressure- fuzed mines only detonate if a vehicle's track or wheel actually runs over them.

Probability of encounter is affected by the type of enemy vehicle. The smaller the width or track signature of the vehicle, the less likely it will encounter and detonate a mine. Finally, probability of kill is measured (in percent chance) that the vehicle is no longer mission-capable (M-Kill or K-Kill) because of mine effects. It is a function of the combined probability that a vehicle will encounter a mine and the probability that the mine effect will produce either an M-Kill or a K-Kill.

Figure 2-4 illustrates the relationship between density and probability of mine encounter for light versus heavy tracked vehicles and pressure versus full-width fuze-capable mines. Figure 2-4 also provides general guidance for varying density to yield the necessary probability of encounter to construct minefields with disrupt, fix, turn, or block effects. Varying density and probability of encounter to achieve these effects is discussed in more detail later in this chapter.

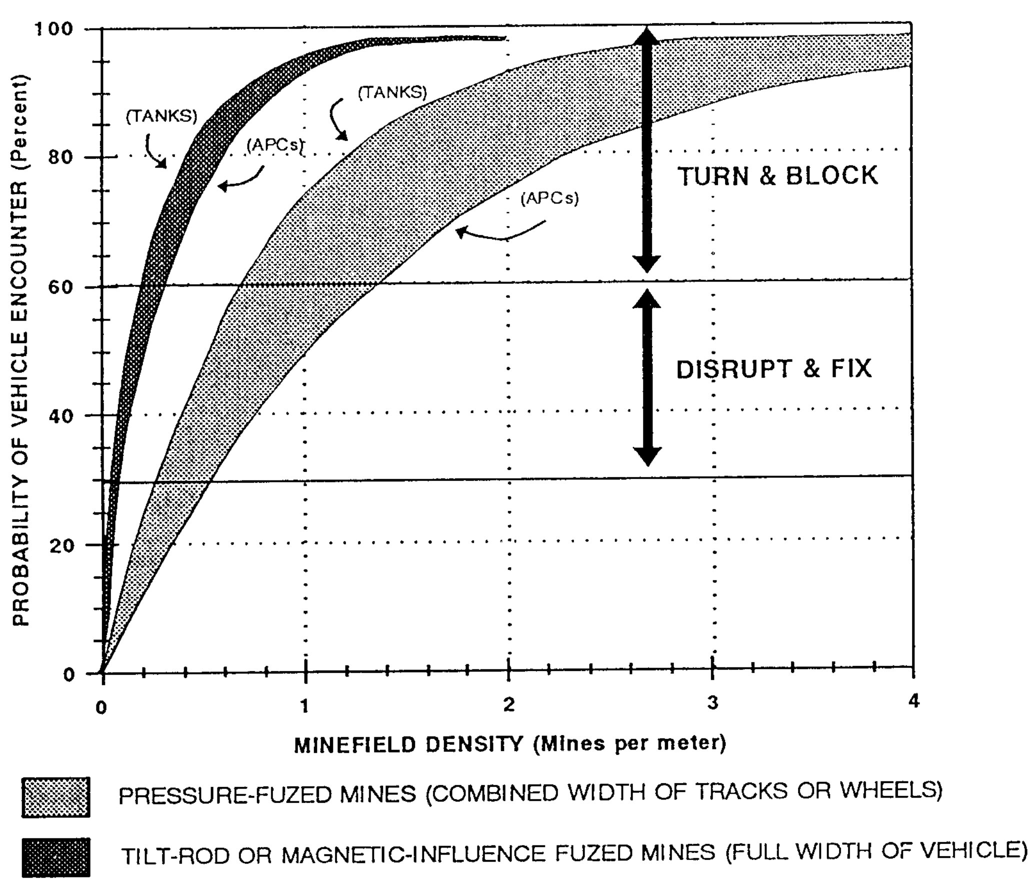


Figure 2-4. Vehicle mine encounter probability versus minefield density

AHDs. Emplacing AHDs on mines is time-intensive. AHDs are added to a minefield to protect it from covert and dismounted breaches and to demoralize the enemy attempting to clear minefields.

IOE. An IOE is a strip or multiple strips of mines normally extending toward the enemy from the first (enemy side) row of mines. An IOE is employed to break up the otherwise regular pattern of a minefield. It is used to confuse the enemy as to the exact limits of the minefield, particularly its leading edge. An IOE adds an unknown quality to a minefield that makes enemy breach or bypass decisions more difficult. The effect the IOE has on enemy actions may increase the overall lethality of the minefield.

Tactical Minefield Design

Modifying the above minefield variables to achieve the desired obstacle effect is a challenge for the engineer, both technically (resourcing and designing) and tactically (supporting the maneuver scheme). Figures 2-5 through 2-8, pages 2-9 through 2-12, provide guidelines for varying minefield depth, frontage, density, and composition to best achieve disrupt, fix, turn, and block effects.

The guidelines are not fixed rules. They are simply considerations or parameters to use when designing tactical minefields regardless of emplacement t method. They apply to conventional mine-laying techniques as well as employment of scatterable mine dispensers. They give the engineer the flexibility to design and emplace tactical minefields based on mission, enemy, terrain, troops, and time available (METT-T) (particularly resources available and terrain) and still achieve the required effect. These *norms* are also the basis for developing the standard minefield packages and emplacement procedures outlined throughout the remainder of this manual. Chapter 3 is dedicated to the standard pattern minefield, Chapter 4 outlines procedures for row mining using conventional mines, and Chapter 6 discusses the characteristics and emplacement procedures for each of the scatterable mine systems. Each chapter describes standard disrupt, fix, turn, and block packages particular to that method of emplacement or dispensing system.

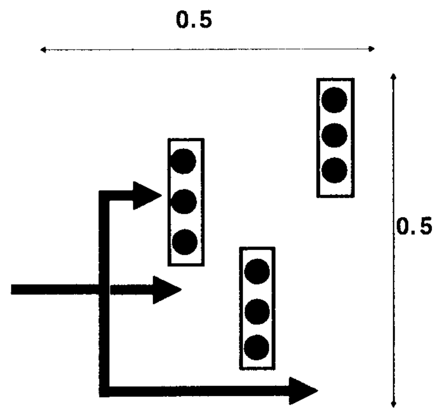
One of the new norms introduced below is the minefield resourcing factor. Each tactical obstacle effect has a specific resourcing factor. In short, this numeric value helps determine the amount of linear tactical-obstacle effort needed to achieve the desired effect. The resource factor is multiplied by the width of the avenue of approach (AA) or MC to get the total amount of linear obstacle required. The linear effort is then divided by the minefield frontage norm for the specific effect (rounded up) to yield the number of individual minefields required in the obstacle group.

Disrupt. A disrupt effect breaks up the enemy's formations, causes premature commitment of breach assets, interrupts command and control, alters timing, and causes a piecemealed commitment of attacking units (Figure 2-5). Disrupt minefields should not be time-, manpower-, or resource-intensive. They are used forward of or within engagement areas (EAs).

To achieve a disrupt effect, normally only half of the enemy's AA is attacked with minefields or other tactical obstacles. In order for a minefield to disrupt an enemy company (frontage of 500 meters), half the formation has to react to the minefield. The typical width of a disrupt minefield is 250 meters. To disrupt an enemy battalion, three individual disrupt minefields (750 meters of minefield) are combined to attack half his frontage. The standard depth for a single disrupt minefield is 100 meters. When designing a disrupt effect to attack an enemy battalion, three disrupt minefields are arrayed in a box (group) with a width and depth about half the size of the frontage. The resource factor for a disrupt group is 0.5. This factor, multiplied by the width of the AA, provides the amount of linear minefield required for a disrupt effect. An alternative disrupt group is three point obstacles along the AA when the avenue is narrow.

Disrupt minefields should be designed with approximately 50 percent probability of mine encounter to achieve the desired disrupt effect

Resource factor	0.5 (3 point obst) x AA
Group dimensions	W=0.5 x AA; D=0.5 x AA
Probability of kill	50%
Frontage	250 m
Depth	100 m
AT Mines	Yes (Pressure/tilt)
AP Mines	No
AHD	No
IOE	No



★ ***Figure 2-5. Disrupt minefield***

(Figure 2-4, page 2-7). The disrupt minefield should contain ‘predominantly track-width AT mines. Full-width mines, which increase the probability of mine encounter, are used at the leading edge of the minefield. This should cause the enemy to commit his breaching assets.

AHDs may be added to disrupt minefields to frustrate the enemy's breaching and clearing operations. However, adding AHDs may be too resource-intensive for the return in effect. Normally, AHDs are not added to disrupt minefield emplaced with conventional mines. Most scatterable mine systems have some form of inherent AHD requiring no additional effort. An IOE is not required to deceive the enemy on minefield orientation or to increase the probability of kill.

★ **Fix.** This is the most misunderstood obstacle effect. The term does not mean to stop an enemy advance. A fix effect slows the enemy within a specified area, normally an EA, so that he can be destroyed with fires (Figure 2-6, page 2- 10). The primary use of the fix effect is to give the defender time to acquire, target, and destroy the attacking enemy throughout the depth of an EA or AA. A fix effect may be used to generate the time necessary for the force to break contact and disengage as the enemy maneuvers into the area (typically used for delays). Fix minefields in the group must be employed in depth, causing the enemy formation to react and breach repeatedly. Fixing groups must span the entire width of the AA.

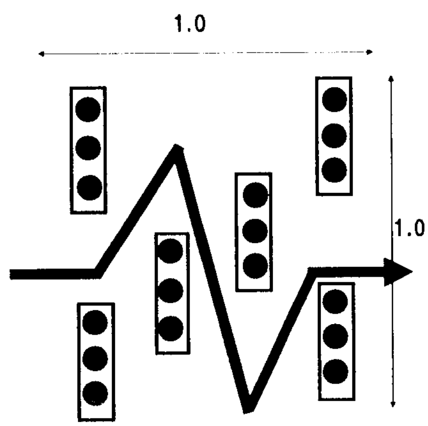
Individual fix minefields must not appear too difficult to breach. The enemy should be enticed into the area. The obstacles should not be made to look impenetrable. The concept is to employ multiple individual minefields that each attack only a portion of a deployed company formation. Therefore, the fix minefield frontage is 250 meters. It takes on the characteristics of a disrupt minefield (with two changes) with a similar density, mine composition, and probability of encounter (Figure 2-4). AHDs are not required because the application of massed direct and indirect fires complicate the enemy's breaching effort. An IOE is added to further delay the enemy and confuse the attacker on the exact orientation of individual minefields. This also serves to increase the effective lethality of the minefield. The majority of mines are track-width AT. The most lethal AT mines (full-width) are used in the IOE and the leading edge of the minefield.

While individual minefields are designed to attack only portions of an enemy company formation, the fix group as a whole is resourced, arranged, and sited to attack the entire front of an enemy battalion. Figure 2-6 depicts a fix group effect on an attacking enemy battalion. In this case, six fix minefields are arrayed in an area the full width of the battalion AA (1,500 meters) by 1,500 meters deep. Accordingly, the resource factor for a fix minefield group is 1: the amount of linear minefield that should be resourced equals the width of the AA.

Turn. A turn effect manipulates the enemy's maneuver in a desired direction (Figure 2-7). One technique or a combination of three techniques aid in achieving the turn effect. First, in order to entice the enemy to maneuver in the desired direction rather than breach the obstacle, the obstacle must have a subtle orientation. Second, the bypass must be easily detected in order to entice the enemy to it. Finally, the point where the turn is to be initiated is anchored by no-go terrain or heavily fortified friendly forces.

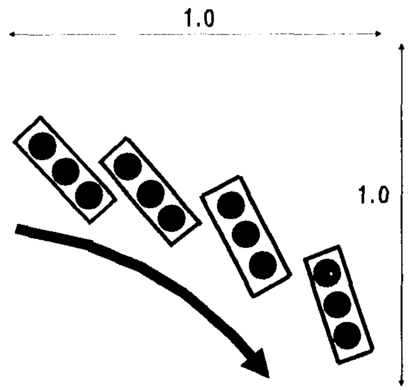
The standard turn minefield has a width of 500 meters and a depth of 300 meters. One turn minefield affects the entire width of an enemy company's frontage. It must be deep enough to cause multiple applications of line-charge breach assets. In short, the minefield must discourage any attempts to breach and entice the enemy to bypass rather than reduce. Figure 2-7 depicts a turn effect on an attacking battalion. Three standard turn minefields are arrayed in a group 1,500 meters wide (1.0 x width of battalion frontage) by 1,500 meters deep. The orientation (angle) of the minefields may mean a fourth minefield is required to effect the entire frontage. This is considered

Resource factor	1.0 x AA
Group dimensions	W=1.0 x AA; D=1.0 x AA
Probability of kill	50%
Frontage	250 m
Depth	120 m
AT Mines	Yes (Pressure/tilt)
AP Mines	No
AHD	No
IOE	Yes



★ *Figure 2-6. Fix minefield*

Resource factor	1.2 x AA
Group dimensions	W=1.0 x AA; D=1.0 x AA
Probability of kill	75%
Frontage	500 m
Depth	300 m
AT Mines	Yes (Pressure/tilt)
AP Mines	No
AHD	No
IOE	No



★ ***Figure 2-7. Turn minefield***

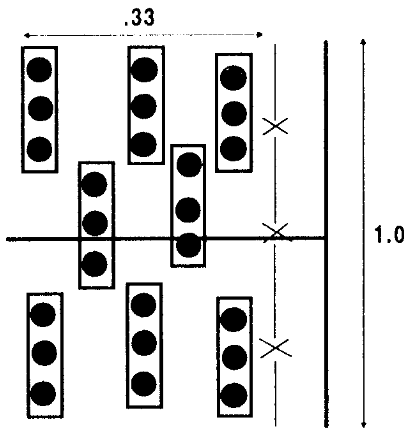
in the resource factor (1.2) for a turn obstacle group. This factor, multiplied by the width of the AA, equals the amount of linear minefield required for this turn effect.

As shown in Figure 2-4, page 2-7, turn minefield must be extremely lethal and achieve approximately 80 percent probability of encounter. In other words, an enemy vehicle attempting to breach or bull through the minefield must pay the consequences. This forces the small unit commander to make an immediate decision—breach or bypass. A lethal minefield, covered with intense fires with an easily detectable bypass, reduces breach decisions to instinct; and the enemy will choose the bypass (turn). To produce this lethality, the majority of mines should be full-width AT. Full-width mines in the first rows the enemy encounters and the depth of the minefield either exhaust the enemy's breaching assets or convince him to bypass early. AHDs are not required since the enemy force will seldom commit to dismounted breach when faced with intense direct and indirect fires. An IOE should not be used; the enemy must be able to determine the orientation of the minefield and the bypass.

Block. A block minefield is designed specifically to stop an enemy's advance along a specific AA or allow him to advance at an extremely high cost (Figure 2-8, page 2- 12). Blocking obstacles are complex and integrated with intense fires: block minefields do not stop an attacker by themselves. Individual blocking obstacles are employed successively in a relatively shallow area. As soon as the enemy breaches one blocking obstacle, it is critical that he encounters another, thus denying him to project combat power and maintain momentum. Blocking obstacles must defeat the enemy's breaching effort, both mounted and dismounted, as well as his maneuver. The block effect must span the entire width of the AA and must not allow a bypass.

The typical block minefield is 500 meters wide and 300+ meters deep (includes an IOE). Figure 2-8 depicts a block effect on an attacking bat-

Resource factor	2.4 x AA
Group dimensions	W=1.0 x AA; D=.33 x AA
Probability of kill	100%
Frontage	500 m
Depth	300+ m
AT Mines	Yes (Pressure/tilt)
AP Mines	Yes
AHD	Yes



★ *Figure 2-8. Block minefield*

★ talion. Note how individual minefields are arrayed to affect the entire width of the AA but in a relatively shallow depth (only one-third the width). Eight block minefields are required in this is example to achieve the necessary group depth and width. The block group is understandably more resource-intensive. The resource factor is 2.4 (multiplied by the width of the AA equals linear minefield required). As mobility corridors become more narrow, blocking minefield groups may become impossible to fit within the condensed depth. Simply expand the group's depth to accommodate the required number of individual minefields.

★ The lethality of the block minefield (80 percent or higher) is similar to the turn minefield (Figure 2-4, page 2-7). The lethality of the group is considerably higher, since there are enough minefields in the group to cover over twice the widt h of the AA. This lethality is produced by a density slightly greater than 1 mine/meter of front and use of predominantly full-width AT mines.

The block minefield must be capable of defeating both mechanical and dismounted breach efforts. Therefore, AP mines and AHDs are used to target dismounted breaching. An IOE again confuses the attacker as to the exact minefield limits and complicates his employment of mechanical breaching assets. The depth of the block minefield requires employing multiple line charges.

The above minefields are not standard solutions to every situation. The terrain could dictate a decrease or increase in the effort required. Incorporating other reinforcing obstacles (AT ditches, road craters, wire, or a family of scatterable mines (FASCAM)) aid in attacking the different breach assets. Experience provides the best basis for designing minefields.

TACTICAL OBSTACLE INTEGRATION PRINCIPLES

Echelons of Obstacle Control

Tactical obstacle planning occurs at every level, and each level uses different graphic control measures (Figure 2-9). This ensures obstacle plans are well-synchronized and are mutually supporting from corps down through battalion. In some cases, corps may also designate obstacle zones to division. Normally, divisions use obstacle zones, brigades use obstacle belts based on the division zones, and task forces (TFs) use obstacle groups based on obstacle belts.

A specific obstacle effect (disrupt, turn, fix, or block) may be assigned to obstacle control measures. This enables the commander to direct the overall effect obstacles within the designated zone, belt, or group must achieve to support his plan. At division level, assigning specific effects to obstacle zones is optional. However, at brigade and battalion level, the commander must assign specific effects to belts and groups, respectively. This ensures subordinate commanders emplace tactical obstacles that support the maneuver and fire plans. Assigning a specific obstacle effect to

OBSTACLE CONTROL MEASURE	ECHELON	SPECIFIC OBSTACLE EFFECT	SIZE ENEMY AVENUE OF APPROACH/ MOBILITY CORRIDORS ARMORED	LIGHT vs. ARMOR	PLANNING GUIDANCE
ZONE	CORPS OR DIVISION		DIV/BDE	BDE/BN	TO DESIGN ZONES REQUIRES ANTICIPATING BELTS AND INTENTS
BELT	BRIGADE		BDE/BN	BN/CO	TO DESIGN BELTS REQUIRES ANTICIPATING GROUPS AND INTENTS
GROUP	TASK FORCE		BN/TASK FORCE	CO/PLT	DESIGN BASED ON INDIVIDUAL OBSTACLE NORMS
INDIVIDUAL OBSTACLE	COMPANY/ TEAM		CO/TEAM	PLT	

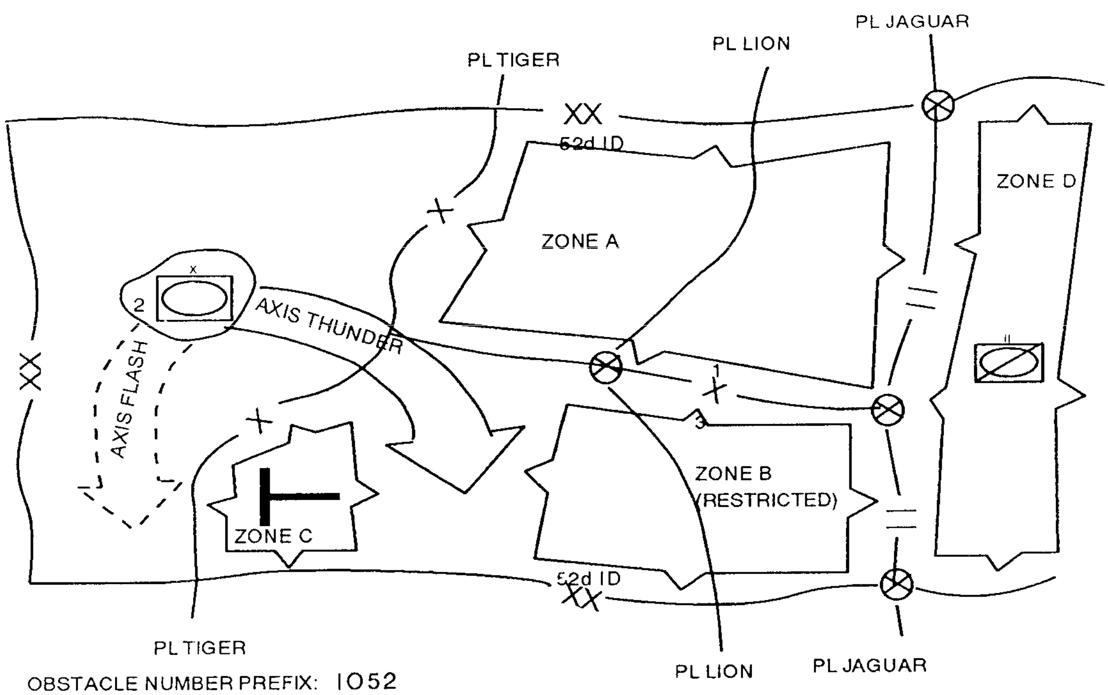
(Shaded box) ASSIGNING SPECIFIC OBSTACLE EFFECTS IS MANDATORY

(Open box) ASSIGNING SPECIFIC OBSTACLE EFFECTS IS OPTIONAL

★ *Figure 2-9. Echelons of obstacle control and effect* a control measure becomes obstacle intent giving the obstacle effect, target, and location. Obstacle intent provides a direct link between the obstacle plan and scheme of maneuver, commander's intent, and fire plan (direct and indirect). Obstacle intent is vital at brigade and below and becomes the foundation of obstacle group development and design at the TF level.

Each echelon uses obstacle control measures to limit/authorize emplacement of tactical obstacles by their subordinate units. Protective obstacles are the only obstacles that can be employed outside designated obstacle zones, belts, and groups.

At division, the commander uses obstacle zones to limit/authorize subordinate brigades where they can emplace tactical obstacles (brigades may only emplace tactical obstacles within obstacle zones). They plan obstacle zones to give maximum flexibility to maneuver brigades and to preserve the freedom of division counterattack forces and reserves (Figure 2-10). The division commander assigns an obstacle zone (a specific effect) only when he feels it is imperative to supporting the scheme of maneuver. The division staff also considers the plan for future operations when designating obstacle zones.



OBSTACLE NUMBER PREFIX: 1O52

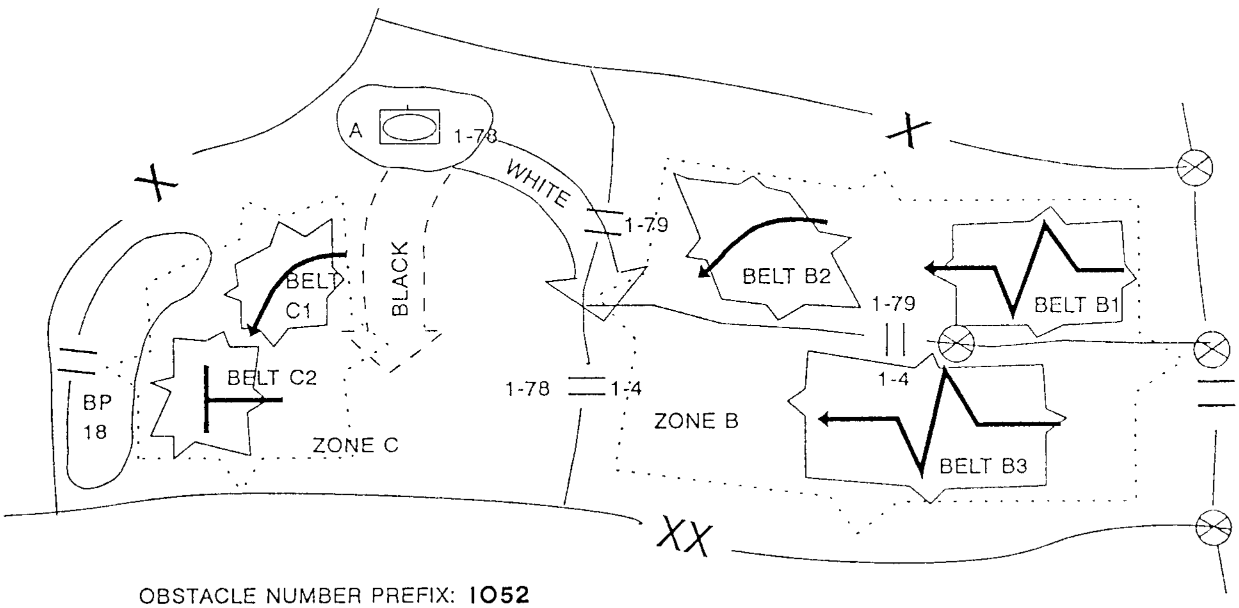
UNIT	ZONE	PRIORITY	REMARKS
1ST BDE	A	3	
3D BDE	B	2	NO SCAT MINES WITH SD AFTER H+2
3D BDE	C	1	BLOCK INTENT
CAV SQDN	D	4	

Figure 2-10. Obstacle zones

The brigade refines obstacle zones into belts (Figure 2-11). Like the division, the brigade uses belts to limit the location of tactical obstacles. This is normally the first level at which the commander assigns an intent to the obstacle plan. It gives TF commanders the necessary guidance on the overall effect of obstacles within a belt. It does not designate that all obstacle groups within the belt must be the same effect. It simply means that the sum effect of groups within the belt must achieve the assigned belt effect. This serves to synchronize the obstacle effort within the brigade, particularly between adjacent TFs.

Belts are planned to attack enemy regiments based on an analysis of enemy battalion AAs and MCs. Brigades allocate maneuver companies based on the motorized rifle battalion (MRB) MCs and organize TFs to defeat the motorized rifle regiment (MRR). Obstacle belts and their intents are directed against MRR MCs. This provides the appropriate level of guidance while preserving the TF's need to refine the obstacle intent based on how they will fight their allocated companies.

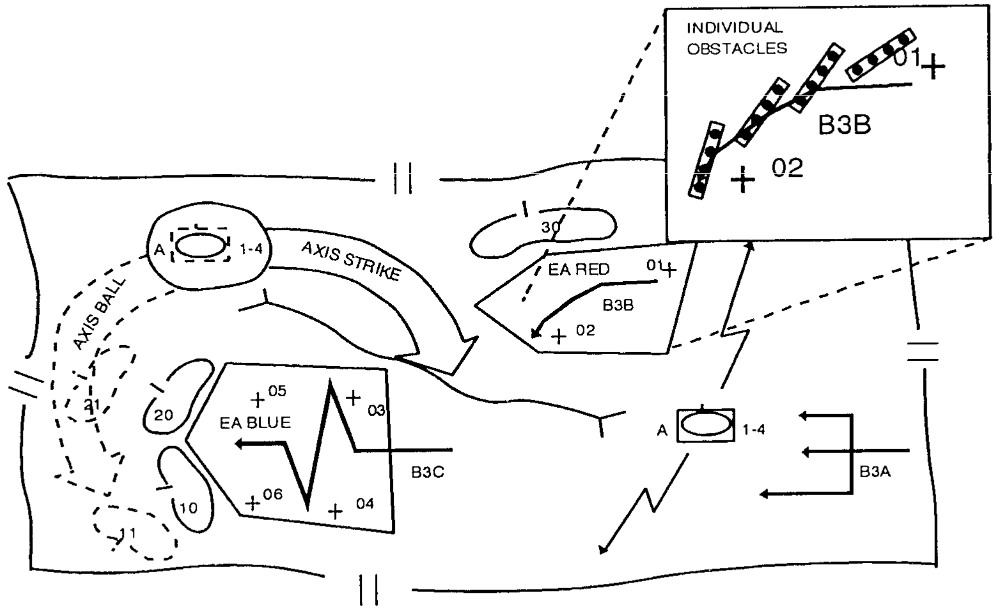
TFs use obstacle groups as the basis for their obstacle planning (Figure 2-12, page 2- 16). TFs allocate platoons against motorized rifle company (MRC) MCs and task-organize them into company/teams to defeat MRBs. Likewise, direct fire plans are designed based on the maneuver of MRBs and independent MRCs.



OBSTACLE NUMBER PREFIX: 1O52

UNIT	BELT	INTENT	PRIORITY	REMARKS
1-78	C1	TURN	2	
1-78	C2	BLOCK	1	
1-79	B1	FIX	5	NO LD SCAT MINES; SCAT MINES MUST SD BY H+2.
1-79	B2	TURN	3	SAME AS ABOVE
1-4	B3	FIX	4	SAME AS ABOVE

Figure 2-11. Obstacle belts



UNIT/BP	GROUP (1052)	INTENT	PRIORITY	REMARKS
CO A/SCREEN	B3A	DISRUPT	3	ALL GROUPS RESTRICTED: - NO LONG DURATION SCAT MINES. - SHORT DURATION MUST BE EMPLACE BY H-3.
TM B/BP 30	B3B	TURN	1	
TM D/BP 10	B3C	FIX	2	

Figure 2-12. Obstacle groups

Therefore, obstacle groups are used to attack the maneuver of MRB-size forces. Groups are designed specifically to support the direct fire plan of the TF. The TF designates groups rather than obstacles because the location of individual obstacles hinges on siting at the company/team level. The group effect or obstacle intent drives obstacle siting and is therefore more important to convey to commanders. There can be more than one type obstacle group to support the overall intent of an obstacle belt. This is because the belt is designed based on the brigade maneuver scheme and without knowing the TF direct fire plan or maneuver scheme. Groups are developed once the fire plan is established.

Fratricide Prevention

The modern tendency toward maneuver warfare and the disappearance of the linear battlefield places repositioning forces at an increased risk of fratricide by minefield. Obstacle control and use of graphic obstacle control measures is vital in preventing minefield fratricide at every echelon. Obstacle control is further facilitated by positive command and control of all sustainment traffic, tactical repositioning, obstacle turnover, well-established and disseminated traffic plans with traffic control, and strict adherence to minefield marking procedures (discussed later in this chapter).

Supporting the Maneuver Plan

The goal of the obstacle-planning process is to achieve the commander's intent through optimum obstacle emplacement. A step-by-step approach is provided for the obstacle-planning process. The process begins by taking what the Intelligence Officer (US Army) (S2) knows about the enemy, analyzing the commander's intent for use of his available weapons, and then integrating tactical-obstacle effects to support the plan. The focus of the obstacle-planning process is at the TF level where the TF engineer plans obstacle groups.

Situational analysis. Obstacle planning begins with the situational template (developed by the S2). Knowing the AA, the lateral MCs, the no-go/slow-go/go terrain locations, and the enemy's probable course of action are essential to start the process. Figure 2-13, page 2-18, shows an example of a template which the engineer needs. AA Alpha is initially a regimental AA which splits into two battalion-size AAs. The commander has designated an EA (EA Red) where the MRR AA splits into two MRB AAs. Note how the commander has arrayed his forces to mass fires on EA Red.

Direct fire analysis. The next step is to understand the maneuver scheme and organization of fires. The location of the target-reference points (TRPs), trigger lines, and weapon systems helps determine exactly where the direct-fire systems are massed. Figure 2-14, page 2-19, shows a sample direct-fire plan. By analyzing direct fires, it is easy to see the area where the fires are massed. This is typically the desired location for killing the enemy. Based on analysis of the direct-fire plan, the engineer will plan obstacle groups which manipulate the enemy into areas where fires are massed.

Obstacle intent integration. Based on the TF commander's intent, obstacle group effects are recommended (Figure 2-15, page 2-20). The engineer starts by giving obstacle effects/groups a battlefield placement to support the maneuver plan. Normally, groups are allocated against MRB-size MCs, which are doctrinally 1,500 meters wide. A company/team is allocated to defeat an MRB. Therefore, the placement of obstacle groups is actually driven by company/team fire responsibility. As the engineer decides what type of group to use, it is important to keep in mind the type of weapons covering them to ensure compatibility.

Note the placement of obstacle groups in Figure 2-15 and their effects. First, the engineer must manipulate the right MRB into the EA and keep it off Team C's flank. The turn obstacle-group effect, combined with a heavy volume of AT fires from Team C at the turning point, achieves this. In EA Red, particularly where the TF fires are massed, a fixing group slows the enemy and increases the effects of the fires. Block groups between Team A and Team B and between Team B and Team C stop advance of the lead MRBs. Protective obstacles in front of all three team positions reinforce the blocking groups and protect the teams from the enemy's final assault.

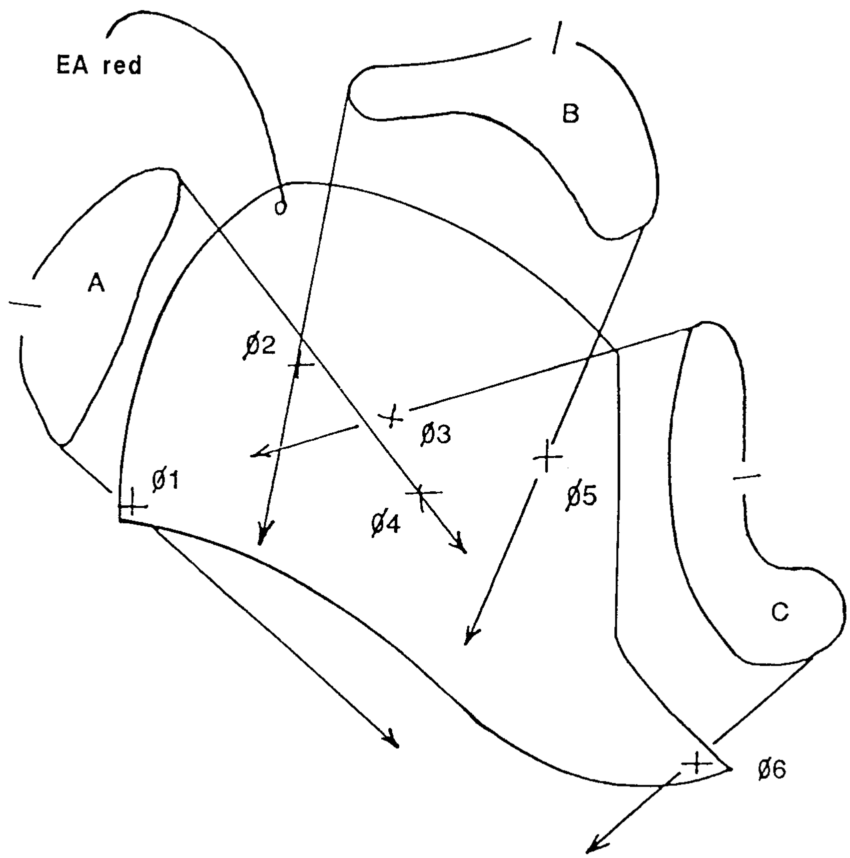
Obstacle effect priorities. The engineer must designate which obstacle effects are most critical to the maneuver plan. This will identify the priority for resourcing and effort. Align tactical-obstacle-effect priorities with the TF direct-fire main effort. In this case, the first priority is to turn the enemy where the fires are massed. Second, it is the block tactical obstacle effect to keep the enemy in the EA in order to destroy him. The fix-obstacle effect is the last priority. While it enhances the TF fires in EA Red, it only slows the enemy. The block effects are a higher priority because they stop the enemy from exiting the EA.

Obstacle design/resourcing. Obstacle design begins by resourcing the groups based on MC widths and the desired effect. The TF engineer resources the obstacle groups according to obstacle group priorities. The total amount of linear minefield required in a particular group is equal to the width of the MC multiplied by the resource factor for the obstacle effect. Use Figure 2-11, page 2-15, to resource the obstacle groups.

Turn group. The turn group is intended to affect an MRB. The MC for an MRB is 1,500 meters. The resource factor for a turn effect is 1.2 (Figure 2-7, page 2-11). The amount of linear

Figure 2-13. Situational template

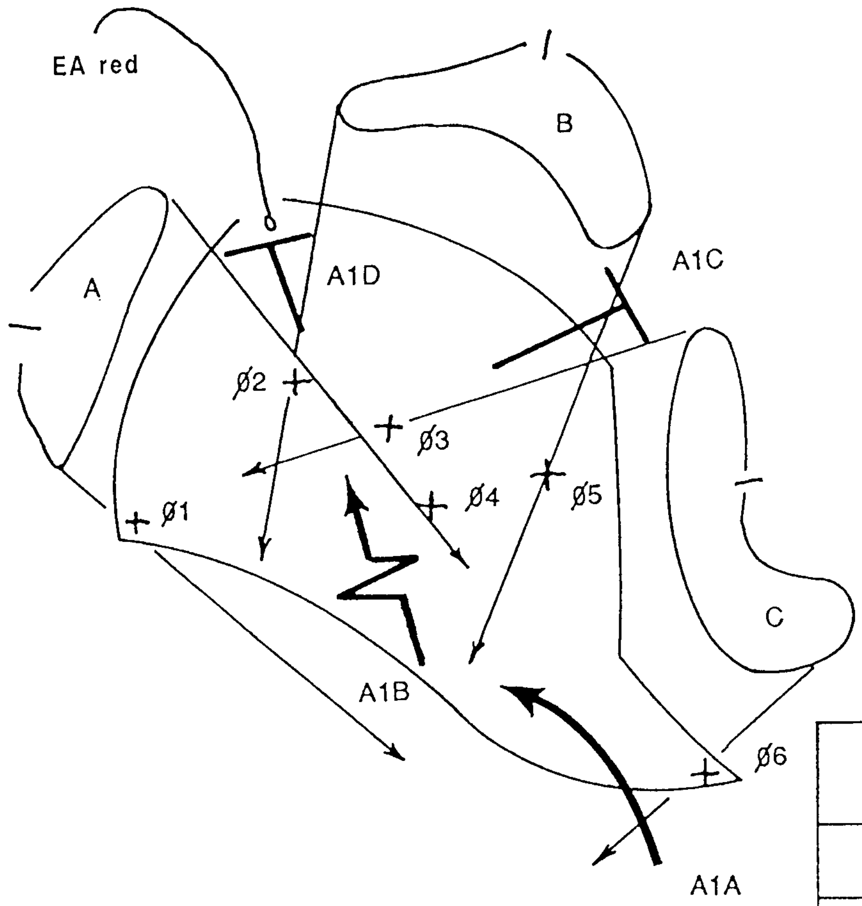
Direct Fire Plan



	Orients TRP
TM A	Ø1 - Ø4
TM B	Ø2 - Ø5
TM C	Ø3 - Ø6

Figure 2-14. Obstacle group planning - direct fire plan

Scheme of Obstacle Overlay



	Orients TRP
TM A	Ø1 - Ø4
TM B	Ø2 - Ø5
TM C	Ø3 - Ø6

Obstacle group	Intent
A1A	Turn
A1B	Fix
A1C	Block
A1D	Block

Figure 2-15. Obstacle group planning - scheme of obstacle overlay

minefield required to emplace this turn group is 1,800 meters. Individual turn minefields are 500 meters wide. Round up the linear minefield amount to equal individual minefield increments. This turn group requires four turn minefields. Chapter 4 provides the actual total mine requirements, by type, to resource this group.

Fix group. The fix group effects an MRB on an MC of 1,500 meters. Multiplied by the resource factor of 1 (fix), 1,500 meters of fix minefield are required. Fix minefields are 250 meters wide; resources are provided to emplace six minefields

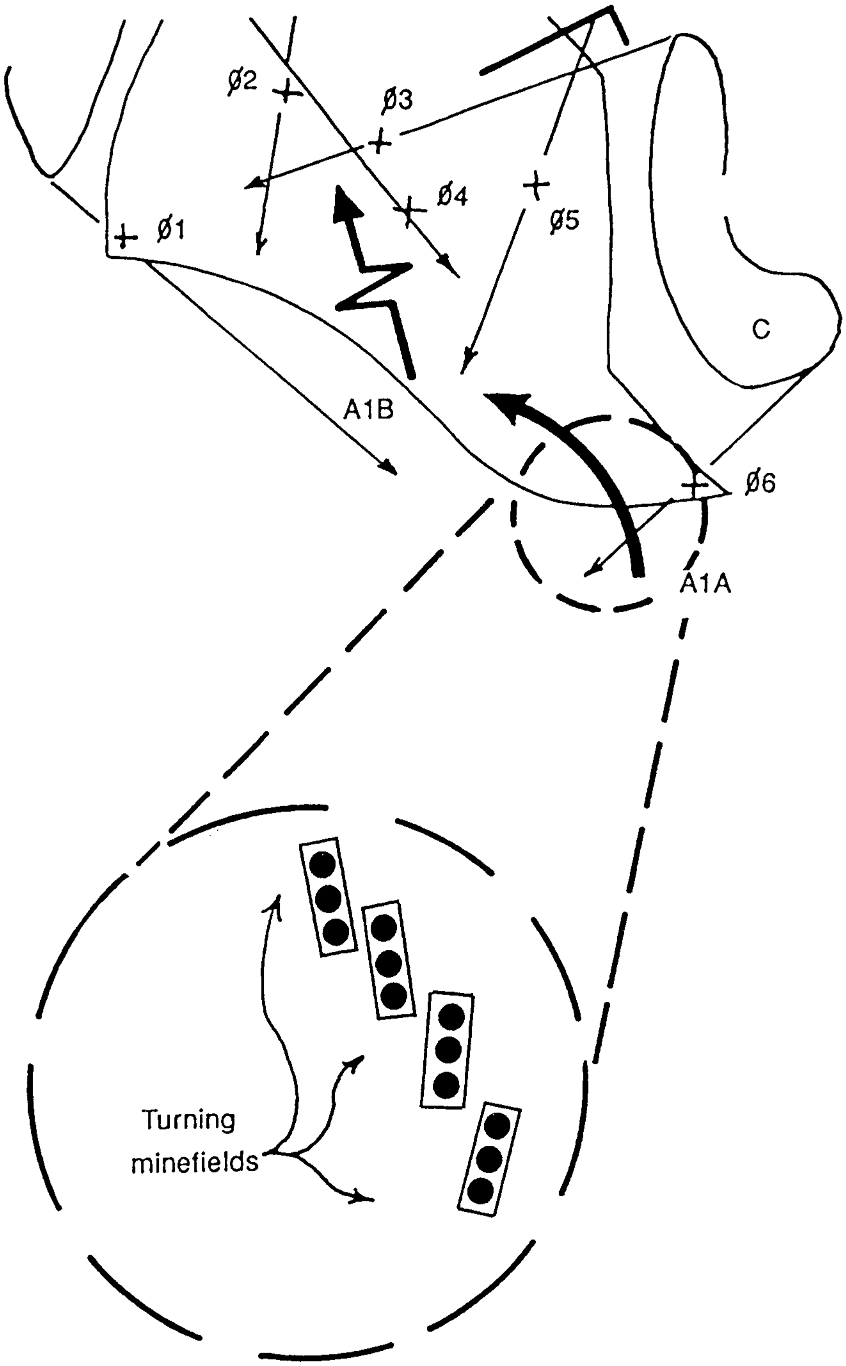
Block groups. Both block groups affect MRBs with MCs 1,500 meters wide. The width of the MC multiplied by the resource factor of 2.4 (block) equals 3,600 meters. Block minefields are 500 meters wide. Each block group is resourced with enough mines and material to emplace eight block minefields.

Once obstacle groups are resourced, the engineer designs individual obstacles using the intent graphics as a guide. The design of individual obstacles may be conducted at the engineer platoon level if there has not been sufficient reconnaissance at the TF level to lock in the direct fire plan and obstacle plan. In this case, the platoon leader may be given the obstacle groups and may have allocated the resources necessary. He designs the individual obstacles based on ground reconnaissance and coordination with company/ team commanders. The next section of this chapter provides guidance on siting and emplacing tactical minefields at the engineer platoon and maneuver company/ team level.

The TF commander may conduct a TF reconnaissance to establish company/team fire responsibilities, site supporting individual obstacles, and establish other fires responsibilities (field artillery (FA) or attack helicopter). The commander may choose to do this at critical places within the TF sector. The TF engineer is a key player in this reconnaissance. Siting in individual obstacles, which make up a planned group, follows the same procedures discussed at the engineer platoon and company/team level. Reconnaissance and coordination is conducted with the TF staff and the company/team commander in the company/team area of operations. The reconnaissance party reviews AAs and MCs affecting the company/ team area. The company/team commander identifies his direct fire plan and responsibilities and points out the location of his TRPs and EA. He verifies the company/team task organization and location of key weapons. Based on the scheme of obstacles overlay, the engineer platoon sites in the effect of the obstacle group. The TF engineer has someone drive the trace of the proposed individual obstacles. The TF commander, company/team commander, and TF engineer verify the location of individual obstacles and their integration with the direct-fire plan. Other fire responsibilities are verified at this time. Figure 2-16 shows the relative location and arrangement of individual obstacles within the turning obstacle group.

Mobility requirements identification. After designing obstacle groups and individual obstacles, the engineer identifies mobility requirements (obstacles which need lanes). Lanes are normally required for tactical repositioning and sustainment traffic. After coordination with the TF staff, lane requirements are identified and command and control procedures are established. Lane marking is discussed later in this chapter.

Scheme of obstacles overlay. The scheme of obstacles overlay is the final and most important product of the obstacle planning process. It illustrates to commanders at company/team level where obstacle groups will be located on the battlefield and their effect on the enemy's maneuver. As a minimum, the overlay must show obstacle groups, effect graphics, and lane locations. If individual obstacles have already been identified, they are also shown on the overlay.



Obstacle group	Intent
A1A	Turn
A1B	Fix
A1C	Block
A1D	Block

Figure 2-16. Obstacle planning - minefield siting

SITING AND EMPLACING TACTICAL MINEFIELDS

This section outlines principles for siting tactical minefields to support the maneuver company. These principles apply to all methods of emplacement—standard pattern, row mining, and scatterable mine systems. The focal point of the discussions on siting is the coordination that must occur between the emplacing engineer (normally the engineer platoon leader) and the maneuver company commander. Coordination between the engineer platoon and the maneuver company is perhaps the most vital component of effective obstacle integration. Obstacles are directly integrated with weapon effects, capability, and fire plan at this level. There are two subcomponents of tactical obstacle siting—coordination with the maneuver commander and siting the minefield.

Coordination with the Maneuver Company/Team Commander

Effective coordination with the maneuver company / team commander who will fight the obstacle(s) is essential to realizing the full potential of minefields as a combat multiplier. In short, the emplacing engineer becomes the maneuver company / team commander's team engineer for the mission. The engineer and the maneuver commander must work closely to ensure complete integration of the minefield in all aspects of the company plan. But before the emplacing engineer can conduct effective coordination, he must have certain tools or information from the TF order that serve as common ground between the emplacing engineer and the maneuver commander. These drive the integration of tactical obstacles into the fire plan and ensure they attack their intended enemy target in a way that supports the scheme of maneuver.

Below is a list of minimum tools or information that the emplacing engineer must have in order to conduct coordination with the maneuver company commander. A brief discussion of each is included, focusing on how that tool or information relates to tactical obstacle siting.

Modified combined obstacles overlay MCOO. The MCOO is a product from the intelligence preparation of the battlefield (IPB) process that graphically depicts the maneuverability of the terrain. It depicts slow-go and no-go terrain relative to the type enemy force. It also defines AAs and MCs the enemy may use for his attack. Since tactical obstacles attack the enemy's maneuver and must compliment the existing terrain, the MCOO is vital to obstacle siting. It helps ensure that obstacles correctly address enemy AAs and MCs. It also helps select how and what part of the enemy formation will be directly attacked by obstacles and the effect the obstacles will have on the enemy's maneuver.

Situation template. The situation template is developed by the maneuver battalion S2 during the IPB. It depicts his estimate of how the enemy will attack, in terms of size and type units, and the formations they will use. At battalion level, the situation template norreally depicts down to enemy battalions but may include special company-size forces such as a forward security element. Tactical obstacles are employed to produce specific effects on specific enemy targets. Therefore, the situation template helps the engineer and maneuver commander site and emplace obstacles in a way that attacks the right target. The situation template may also depict the likely routes for enemy reconnaissance elements. This helps the engineer and maneuver commander analyze requirements for reconnaissance and surveillance (R&S) patrols that defeat enemy attempts to reconnoiter the obstacles and reduce their effectiveness before the enemy attack. The type formations the S2 expects the enemy to use during the entire course of the attack is also vital information. The situation template should identify when the enemy is in march, prebattle, and attack formations. The enemy formation may impact on the necessary frontage of obstacle groups and their effectiveness in achieving the intended effect on enemy maneuver.

Commander's intent. The emplacing engineer and maneuver commander must have a common understanding of the maneuver battalion commander's intent. The battalion commander's intent is his vision of the battle. It normally briefly outlines what actions the unit must do to accomplish the mission. The commander's intent may include key aspects of the plan that the commander wants to emphasize to subordinates to synchronize the actions of subordinates toward a single purpose. The engineer must understand the commander's intent and how it relates to integrating obstacles. The engineer should constantly reflect on whether the obstacles he is emplacing support the commander's overall in-

Maneuver graphics and fire plan. In order to fully support the scheme of maneuver, the engineer must have and understand the maneuver graphics on the battalion's operations overlay. The maneuver graphics use symbols to depict the missions of each subunit within the battalion. Maneuver control measures such as battle positions, sectors, phase lines, passage lanes/points, and counterattack axis are vitally important to understanding the plan and integrating tactical obstacles. The maneuver graphics may include direct fire control measures that direct how and where combat forces will mass, shift, and lift fires to destroy the enemy. Direct fire control measures include EAs, trigger lines, and TRP and unit boundaries. In short, they dictate the direct fire responsibilities of each subordinate. Understanding the direct fire plan and organization of the engagement are fundamental to integrating obstacles with fires. The maneuver graphics also give the engineer an appreciation for how tactical obstacles supporting one unit must complement the adjacent units. This is particularly true of adjacent EAs or plans requiring any tactical repositioning of forces.

Execution matrix. The execution matrix summarizes the tasks to be performed by all combat units within the battalion. The matrix arranges subunit tasks by unit and phase of the operation. It allows the battalion commander to synchronize the actions of all units to achieve unity of effort. The emplacing engineer should have a copy of the execution matrix and know how to read it. Different units use different forms of matrices and abbreviated terms. Before conducting coordination with a maneuver commander, the emplacing engineer should review the execution matrix and ensure he understands all the subunit tasks of the company he is supporting. The execution matrix is an excellent tool for quickly verifying the maneuver company's assigned tasks as well as those of adjacent units.

Obstacle overlay. At maneuver-battalion level, the obstacle overlay depicts the location of brigade-directed belts, TF obstacle belts, and any directed obstacles within the battalion sector. Any obstacle restrictions attached to an obstacle-control measure (belt or group) that preclude the employment of certain type obstacles are annotated on the overlay. The obstacle overlay normally contains a matrix showing the obstacle group number, priority, and maneuver unit responsible to receive obstacle turnover and overwatch the obstacle with fires. Obstacle overlays are graphic obstacle-control measures that define the general location and the effect to be achieved by individual obstacles. The obstacle overlay does not normally depict individual obstacle locations unless they are directed obstacles. The location of individual obstacles within a group is determined during the siting process between the emplacing engineer and the maneuver company commander. When overlaid on the maneuver graphics and situation template, the obstacle overlay should depict the essential elements of obstacle integration—the enemy targeted by the obstacle, the location of the obstacles on the battlefield, the unit covering the obstacle, and the directed link between obstacle effects and the fire plan.

Fire support plan. The emplacing engineer should be familiar with key elements of the fire support plan. He must understand the general scheme of fires and how it supports the scheme of maneuver, commander's intent, and scheme of obstacles. Normally, the emplacing engineer does not need the entire fire support overlay depicting the location of targets. However, he should know the location of fire support targets directed by battalion to cover obstacles. The emplacing engineer should know who has the priority of fires for each phase of the battle. The emplacing engineer should know the location and type of

- Review and get updates on the tentative fire support plan.
- Allocation of fires to the company.
  - Artillery or mortar targets.
  - Priority targets (what type) and any FPF.
- Plan for covering obstacles and their effects with indirect fires.
- Indirect fire control measures to synchronize direct fires, indirect fires, and obstacles.
- Location of company FIST and platoon forward observers (FOs).
- Plan for registering fires. Deconflict with obstacle emplacement. Registration should occur after obstacles are sited but before emplacement.
- Review the company fire support execution matrix.
- Coordinate means for obtaining fire support if enemy contact is made during emplacement.

- Air defense.
  - Enemy air AAs during emplacement.
  - Update on changes to air defense warning and weapons status.
  - Location of air defense systems that can cover engineers emplacing obstacles.
  - Method of obtaining early air defense warning.
- CSS.
  - Tentative location of mine dump (if used) within the company position and routes from mine dump to obstacles.
  - Routes the company plans on using to conduct logistics package (LOGPAC) operations that must remain open.
  - Method of obtaining emergency Class III/V supplies, maintenance, and medical support from the maneuver company trains.
  - Manpower assistance at the mine dump.
- Command and control.
  - Location of commander during defensive preparation.
  - Frequency modulated (FM) net of the supported company and means of communication.
  - Unit boundaries affecting obstacle emplacement.
  - Time and place of company order, if required to attend.
  - Coordination that must occur with adjacent units.
  - Required reports on obstacle status and completion.
  - Lane marking materials discussed and understood throughout unit.
  - Time and method of obstacle turnover, to include lanes.

Siting the Minefield

Siting the minefield is wholly concerned with achieving synchronization between obstacle, its effect, and fires. It requires the complete involvement of the emplacing engineer and the maneuver commander. In short, siting is conducted to verify obstacle synchronization with fire control measures in light of the terrain. It represents the final adjustments to both obstacle location and fire control before emplacement.

In order to site obstacles, the defensive plan must be developed enough to meet certain conditions. First and foremost, the commander must have decided where he plans to mass fires and have marked the necessary fire control measures on the terrain. The location of these control measures must be clearly identifiable since they are the basis for obstacle siting. Second, the commander must have identified tentative locations for his key weapons within his position or sector based on where he wants to mass fires and weapons capability. Finally, the commander and the engineer must agree on the intent of the tactical obstacles (effect, target, and location) which is normally directed by battalion as an obstacle group(s) on the obstacle overlay.

Figure 2-17 illustrates how the engineer and the maneuver commander work together to site a turn and a fix obstacle group, respectively. Minefield siting takes the form of a mini rehearsal and concentrates on marking the obstacle group as a whole instead of marking

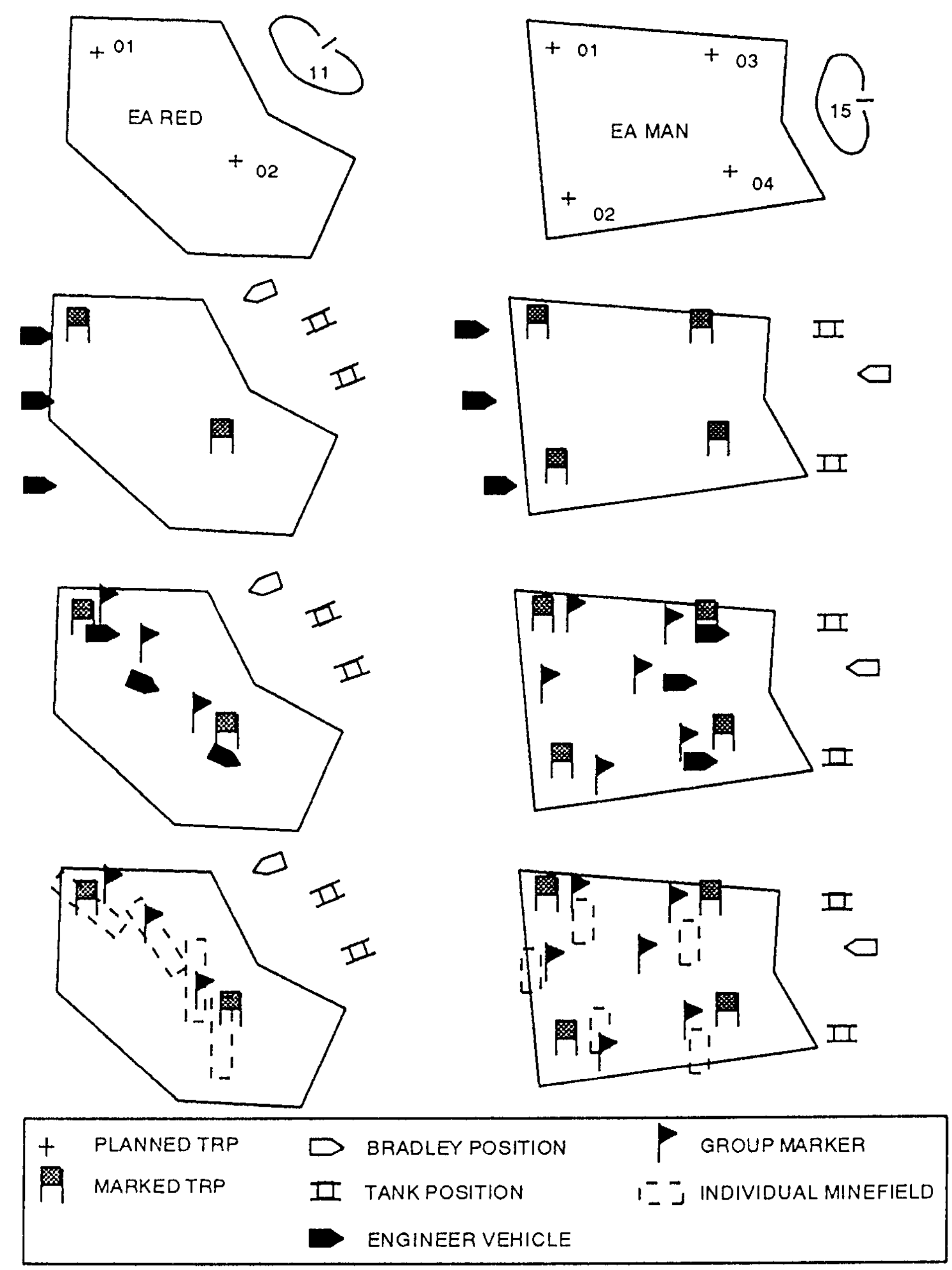


Figure 2-17. Minefield siting

each individual minefield. The engineer platoon moves into the EA to the enemy side of the obstacle group. The platoon deploys on a frontage that is similar to that expected of the enemy. The engineer platoon leader and the maneuver company commander collocate in the defensive position in the vicinity of the weapons covering the obstacle. As a technique, one or all of the tanks, Bradleys, or other crew-served weapons may occupy their position and contribute to the siting process. The engineer platoon, platoon leader, maneuver company/team commander, and other participants use a common FM net to communicate during siting.

The engineer platoon moves into the EA, simulating the enemy's attack but at slower pace. Once they are in the vicinity of the marked fire control measures, they place markers occasionally as they drive the trace of the obstacle group effect. The platoon remains oriented on key fire control measures marked in the EA to ensure obstacle location and effect are synchronized with fires. During the process, each participant verifies that he can cover the obstacle, notes the collocation of fire control measures and obstacles, and records the appropriate data on range cards if weapon positions are set. As the platoon drives the obstacle effect, siting participants must also identify dead space and any requirements to refine the location of the obstacle group of fire control measures. The rehearsal may also identify the need for additional fire control measures.

Once general limits anti orientation of the obstacle group are marked, the process may be repeated to verify changes or the process of marking individual obstacles can begin. To mark individual obstacles, the engineer platoon uses the group markers as a guide. As shown in Figure 2-17, page 2-27, group markers may lend themselves well as the start and end points of individual minefields, but this is not always the case. As the engineer platoon refines the group limits into the site of individual obstacles, the platoon can then begin the necessary site layout based on the method of minefield emplacement.

It is important to mention that siting must **not** be the last thing done in defensive preparations. In other words, the time and resources involved in emplacing tactical obstacles requires siting to begin as soon as, if not concurrent with, establishing the defensive position. It is imperative that the minefield be sited as soon as the maneuver commander has established the EA and identified tentative positions for key weapons. It is not necessary for all weapons to be emplaced and dug in before siting. Normally, well-marked fire control measures and one known position per maneuver platoon (not dug in) is all that is required to effectively site the obstacles.

EMPLACING INDIVIDUAL MINEFIELDS AND MINES

Based on the group effect, resources allocated, and engineer plan, the platoon leader determines the method of emplacement for individual minefields—row, standard pattern, or scatterable. The procedures for emplacing a standard pattern minefield, row minefield, and scatterable minefield are contained in Chapters 3, 4, and 6, respectively.

Determining Resources Required

★ The engineer platoon leader must determine the number of standard individual minefields needed to make up the group and ensure the allocation of required resources. The amount of linear minefield for a group is equal to the width of the AA multiplied by the resource factor. For example, the AA is 1,500 meters wide (Figure 2- 18). In this example, the tactical obstacle effect is to turn the enemy and the resource factor is 1.2. The linear minefield requirement is 1,800 meters. One turn minefield has a front of 500 meters (1,800/500 = 4 minefields (round up)). The number of mines and time required per minefield depends on the emplacement method.

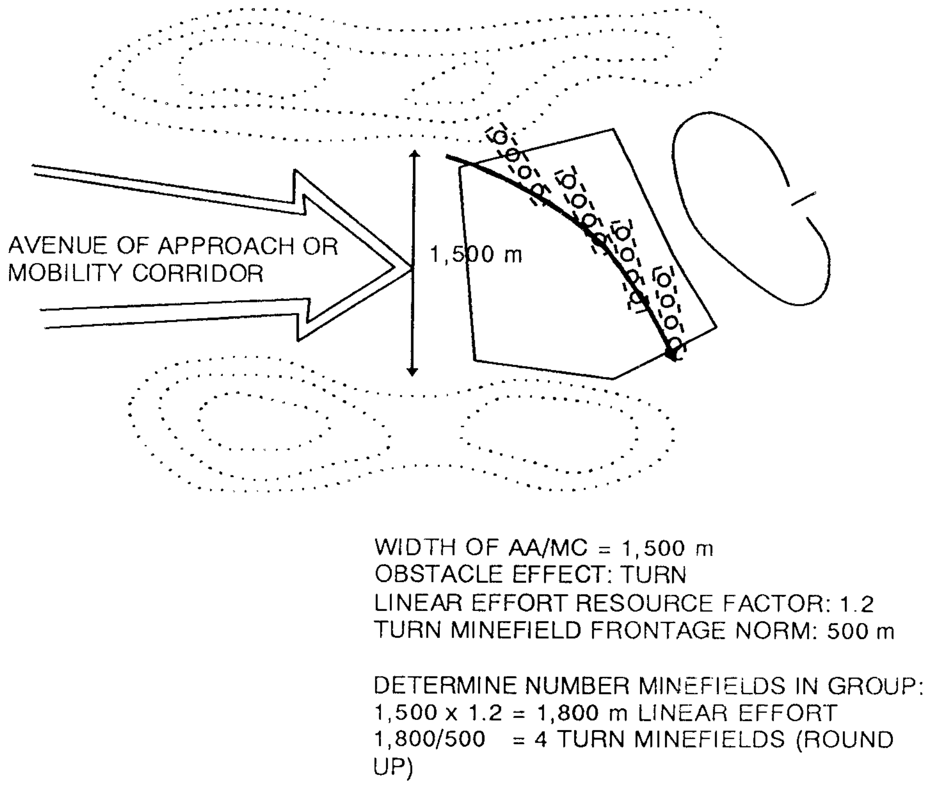


Figure 2-18. Example of minefield resourcing

Emplacing Mines

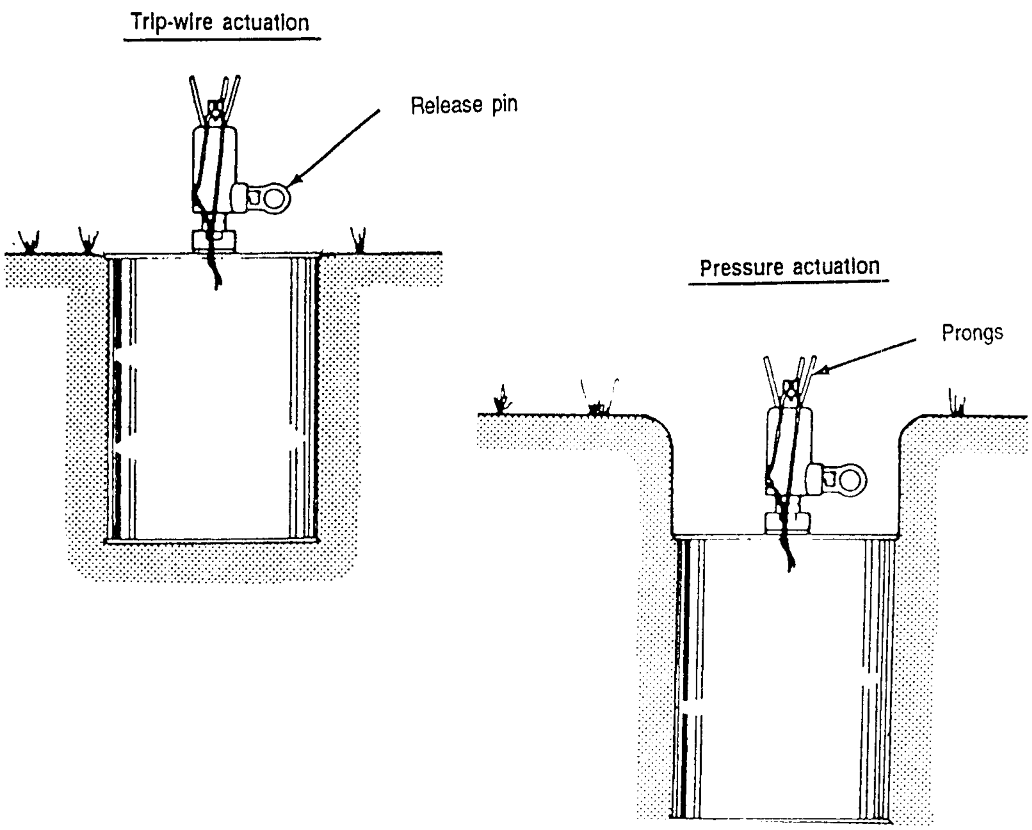
The method used to lay and conceal each type of mine depends on the method of mine operation, the type of ground in which the mine is to be laid, and the type of ground cover available for camouflage.

Hand laying is laborious and time-consuming (standard pattern), but it is more flexible than row mine laying and allows better mine concealment. Hand laying is well-suited for protective and nonstandard point minefields. It can be used in terrain where the nature of the ground makes row mine laying methods impractical.

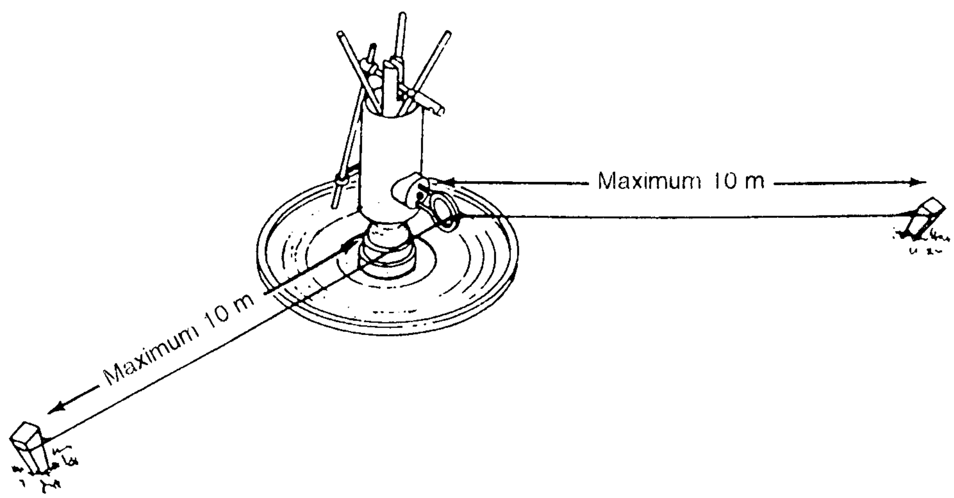
Whatever the mine emplacement technique, there are certain general rules that should be followed. To achieve their maximum effect, mines must be laid so they cannot be seen and so a vehicle's wheel or track or a person's foot exerts enough pressure to detonate them.

The following rules should be applied to achieve maximum effects of mines:

★ **Mines with prongs or studs.** Mines with prongs or studs should be buried flush with the ground so that only the tips of the mechanism are exposed (Figure 2-19, page 2-30). Mines buried in this manner are held firmly upright. The target exerts a direct downward pressure rather than a sideways thrust. These mines are protected from damage and are difficult to see. If buried more deeply, they become unreliable because the layer of spoil may prevent the mine mechanism from operating. If mines are activated by a trip wire, they should be buried so the trip wire is at least 2 to 3 centimeters above the ground (Figure 2-20, page 2-30).



★ *Figure 2-19. Prong or stud-operated igniter*



★ *Figure 2-20. Trip-wire operated igniter*

Bearing boards. Due to the high pressure required to activate AT mines, it may be necessary to place a board or other bearing plate under mines buried in soil with a low bearing pressure. Otherwise, mines may be forced down without detonating.

Concealment. When a hole is dug for a mine, the spoil should be placed in a sandbag to reduce evidence of laying. If a sandbag is not available, spoil should be heaped. After the mine is laid, camouflage all traces of digging. Where the ground cover is turf or other matted, root material, spoil that cannot be hidden should be removed. In the area where the mines are placed, sod should be cut out by using an X-, I-, or U-shape. The sod is then rolled back in place to camouflage the mine. Loose earth over mines will eventually consolidate, so immediately after laying, the mine location should look like a small mound (Figure 2-2 1). Care must be taken to ensure the mound is incon -

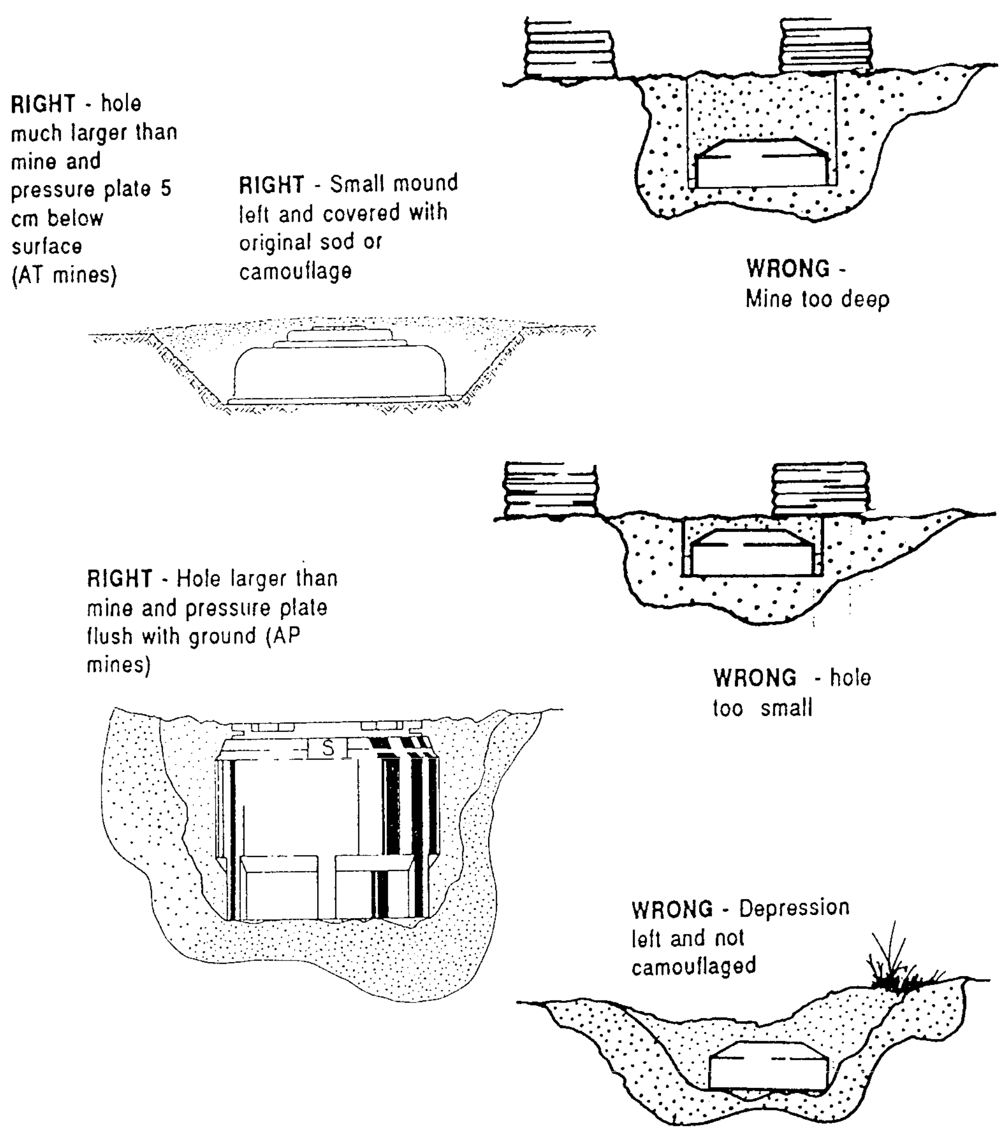


Figure 2-21. Burying and concealing mines

spicuous and blends with the surrounding area. A final check is made after concealing each mine so that faults can be corrected progressively. This is very important, because faults cannot be corrected later.

Mines with pressure plates. Mines with pressure plates will function when completely buried as long as the cushion of earth above them is not too thick. AT mines are normally buried with the top of the mine approximately 5 centimeters below ground level. AP mines are usually placed in a hole and only covered with camouflage material. If the hole is only slightly larger than the mine, the weight of the target may be supported by the shoulder of the hole, and the mine will fail to activate. Such bridging action can be avoided if the hole is dug much wider than the mine (Figure 2-22).

Mines with tilt rods. Tilt-rod fuzes normally require the body of the mine to be buried and the tilt-rod assembly to be clear of the ground (Figure 2-23). A tilt-rod fuze is preferred in areas where vegetation is sufficient to conceal the extension rod. Camouflage materials are carefully used to prevent premature detonation or interference with the normal functioning of the fuze. Extension rods are camouflaged before the mine is armed.

AT mines in standard pattern minefields should be buried. However, if conditions dictate, mines with a single-impulse fuze may be laid on the surface. Mines with double-impulse fuzes should always be buried because if they are laid on the surface, they are likely to be physically damaged when the first pressure is being exerted by a tracked vehicle. Also, buried mines have some resistance to countermeasures while surface-laid mines have none. Consideration must also be given to sympathetic detonation of AT mines, whether buried or surface-laid (Table 2-1).

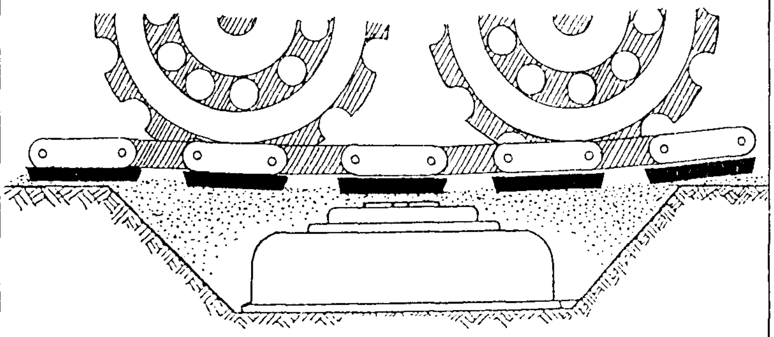


Figure 2-22. Buried mines

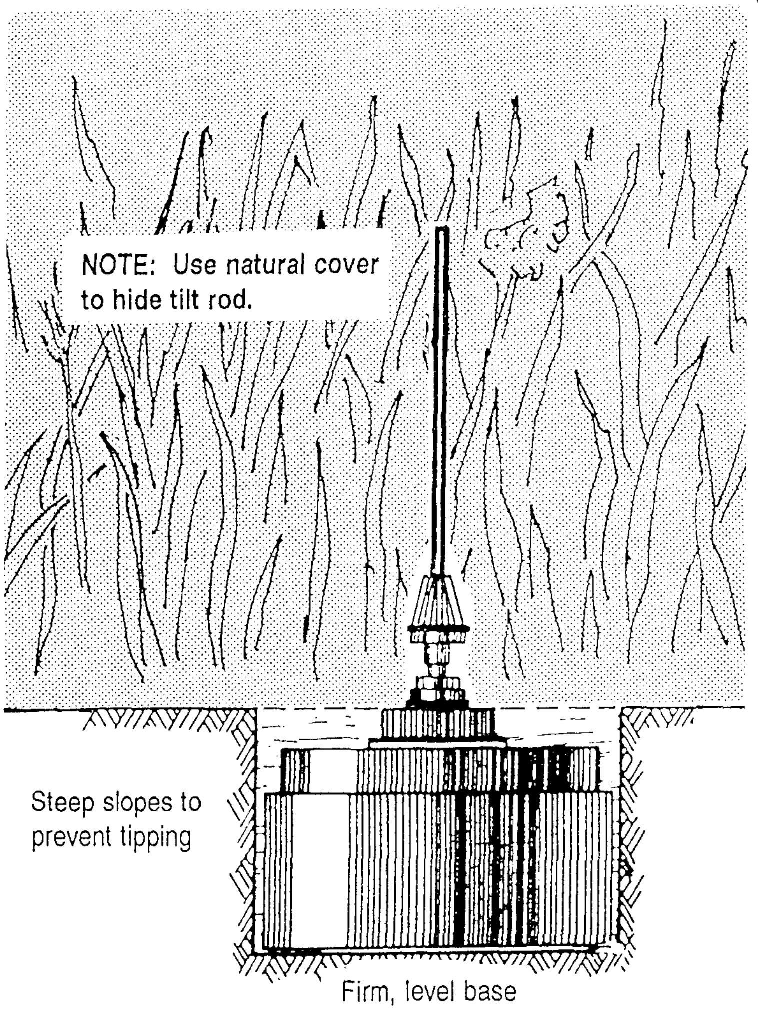


Figure 2-23. Buried mine with tilt-rod fuze

Table 2-1. Sympathetic detonation chart

	M16	M15	M19
Surface-laid	--	14 ft/4.2 m	25 ft/7.6 m
Buried flush	5 ft/1.5 m	8 ft/2.4 m	18 ft/5.5 m
Buried 2 in	--	5 ft/1.5 m	15 ft/4.8 m

Unless mines contain integral AHDs, the extra time to lay mines with AHDs may be unacceptable. If the enemy is known to have a limited breaching capability, time may be wasted on laying mines with AHDs.

In very rocky ground, the difficulty of burying mines and the necessity for surface laying will have a bearing on suitable mines. For example, small, blast-type AP mines are hard to detect and easy to camouflage. They are much easier to camouflage than larger, fragmentation mines. The AT mine used will make little difference because the mine size will always make camouflage very difficult.

Using maneuver assistance to emplace minefields. During large mine-laying operations, engineers seldom have sufficient man - power to carry out all minefield tasks. Other combat arms units must often provide work parties. Engineers must be capable of organizing, controlling, and supervising combined arms work parties. They must also instruct them in new equipment and techniques. Working parties may be integrated with engineers or given certain tasks which are within their capabilities.

When laying a standard pattern minefield, consider supplementing work parties with other combat arms soldiers to comprise the following:

- Class IV/V (mines) supply point or mine dump party. Used to uncrate, prepare, and remove empty boxes and residue.
- Laying party. Used to position mines within strips and dig holes.
- Marking party. Used to construct the perimeter fence and emplace mine signs.

The most time-consuming tasks when laying a row minefield are unpacking, preparing, fuzing, and loading mines. This is an ideal task for other combat arms soldiers and using them allows for more efficient mine-laying operations.

MINEFIELD SUPPLY OPERATIONS

At the maneuver-battalion level, sustaining mining operations is an extremely difficult task. Centralized throughput operations by corps or division stop at the battalion level. Mass quantities of mines are centrally received, broken down into useable packages, and then distributed throughout the sector based on the obstacle plan. At some point in the distribution plan, the maneuver battalion turns over control of the mines to engineers who then emplace them in tactical minefields. Mine warfare logistics at the battalion level can be complex, require prudent use of scarce haul and material handling equipment, and demand positive command and control.

This section describes some of the underlying principles in mine supply operations. It concentrates on the flow of Class IV/V (mines) through the battalion sector. The flow of obstacle materials within the maneuver battalion sector is a maneuver unit responsibility. However, it is effectively a shared responsibility between the engineer and the maneuver unit.

Key Mine Resupply Nodes

There are two critical mine resupply nodes within the battalion sector, each with a different function in the mine resupply process. They are the *Class IV/V (mines) supply point* and the *mine dump.* As discussed later, a mine dump is not always used and depends on the type of mine resupply technique used. The relative location of the Class IV / V (mines) supply point and mine dump are shown in Figure 2-24.

Class IV/V (mines) supply point. The Class IV / V (mines) supply point is the central receiving point of mines in the battalion sector. It is the point at which the maneuver battalion receives and transfers control of mines pushed forward by either corps and / or division throughput haul assets. The supply point is established and operated by the maneuver battalion and is centrally located to support all planned obstacle groups within the battalion sector. Where the tactical obstacle plan allows, the supply point should be located near the battalion combat trains to better facilitate command and control and the availability of equipment assets.

The focal point of the Class IV / V (mines) supply point operation is receiving, task-organizing, and uncrating the bulk of mines as they arrive on corps or division trucks. This implies that the supply point must have a dedicated Supply Officer (US Army) (S4) representative to track the flow of mines in and out of the supply point. The supply point should have dedicated materials handling equipment (MHE) to off-load the bulk quantities of mines and task-organize them into minefield packages. Mines will normally arrive at the supply point with like types on a single truck. Since minefields seldom use all one type mine, mines are task-organized into type minefield packages. This requires a dedicated engineer representative to ensure proper task organization of mines.

The most labor-intensive task at the Class IV / V (mines) supply point is the uncrating of mines. This requires dedicated manpower equipped with the tools needed to break shipping bands and uncrate the mines from their containers. Another important aspect of uncrating mines is tracking fuzes and booster charges. As the mines are uncrated, fuzes and booster charges are separated. However, the same number and

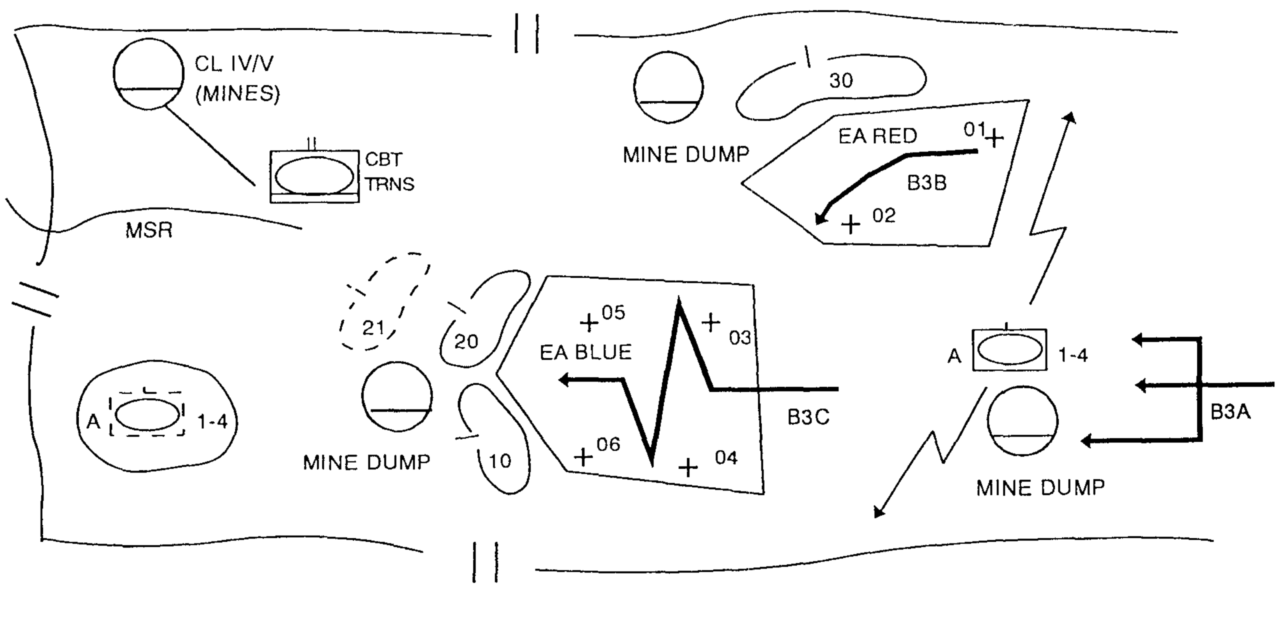


Figure 2-24. Mine resupply

type fuzes and boosters must be task-organized with minefield packages. This requires strict supervision; mistakes quickly lead to confusion and disastrous loss of emplacement time.

Because of the assets involved in the Class IV/V (mines) supply point, a battalion is normally capable of operating only one supply point at any given time. If the battalion sector is extremely wide or deep, several supply points may be planned, but only one can be operated at a time based on the commander's priorities for obstacle emplacement.

Mine dump. The second critical mine resupply node in the battalion sector is the mine dump. The mine dump is the most forward mine resupply node. It is the point at which mines are task-organized into mine strip packages, inspected, prepared, and loaded onto the emplacing vehicle. It is not a permanent supply point. A mine dump is not always used and depends on the method of minefield resupply. These techniques are discussed in more detail below. When used, one mine dump supports a single obstacle group. It is activated or deactivated upon initiation and completion of emplacing the obstacle group. Mine dump operations are primarily an engineer company or platoon responsibility. However, it is a good technique to augment mine dump operation with personnel from the maneuver company overmatching the obstacle group being emplaced. The mine dump may be located either in the vicinity of the maneuver company position or nearer to the obstacle group.

★ There are three critical tasks that must be accomplished at the mine dump. First, as minefield packages are transported to the mine clump, they are further task-organized into strip packages—complete with the right number, type, and mix of fuzes and boosters. For example, if the platoon is emplacing a standard disrupt row minefield, mines are task-organized into three strips. As the engineer platoon moves to the mine dump to resupply, each emplacing vehicle falls in on its designate strip to up-load. Second, the mines are prepared for emplacement. Pressure mines may be fuzed and transported from the mine dump. Fuzed mines will not be stacked more than two mines high/deep in the transport vehicle. Preparation includes loosening and greasing fuze and booster wells and checking to ensure proper functioning. Finally, the mines are transloaded onto the emplacing vehicles or delivery system.

Transportation of mines from the Class IV/V (mines) supply point to the mine dump is a supported maneuver battalion responsibility. However, it is normally shared between the engineer company and the maneuver battalion, since neither one has the haul capability to simultaneously service all active mine dumps.

Mine Resupply Rules

There are several principal rules that govern mine resupply.

- Mines should be uncrated at the Class IV/V (mines) supply point to preserve transportation assets going forward.
- Mines are task-organized into type minefield packages at the Class IV/V (mines) supply point.
- Mines are transported from the Class IV/V (mines) supply point uncrated full stock. This may require some modification to transportation assets.
- When a mine dump is used, transportation from the Class IV/V (mines) supply point to the mine dump is a shared engineer and supported maneuver unit responsibility.
- Mine fuzes and boosters are separated during uncrating at the Class IV/V (mines) supply point and task organized with each minefield package.
- Mines are inspected and prepared at the last supply node (Class IV/ V (mines) supply point or mine dump) before loading onto the emplacing vehicle or dispensing system.

The following are considerations for selecting a location for the Class IV/V (mines) supply point and/or mine dump:

Carrying capacity. The location of key supply nodes depends in part on the type, amount, and availability of haul assets. The carrying capacity plays a large role. In short, the more mines a vehicle can carry, the more turnaround time you can afford. The supply point can be from the obstacle group without affecting emplacement times. Table 2-2 provides the mine haul capacity for various types of vehicles.

Traffic circuit. Vehicles must be able to enter, load, unload, and exit without interfering with the loading and unloading of other vehicles.

Camouflage and cover. Protection from observation and thermal imaging is desired. Protec-

★ *Table 2-2. Class IV and V haul capacity*

Vehicle	Concertina Wire	M15 AT Mine	M19 AT Mine	M21 AT Mine	M16 AP Mine	M14 AP Mine	MOPMS Mine	Flipper Mine	Volcano Mine	MICLIC Reload
HMMWV, M998 2,500 lb 215 cu ft	2	51	34	27	55	56	15	11	1	*1
2½-Ton Truck 5,000 lb 443 cu ft	4	102	69	55	111	113	30	23	2	1
5-Ton Truck 10,000 lb 488 cu ft	7	204	138	109	222	227	61	46	5	3
5-Ton Dump Truck 10,000 lb ***135/291 cu ft	2/4	112/204	64/138	32/70	168/222	71/153	23/51	39/46	3/5	2/3
20-Ton Dump Truck 40,000 lb 754 cu ft	11	628	443	179	888	443	132	184	20	11
HEMTT Truck 20,000 lb 540 cu ft	8	408	277	128	444	317	94	92	10	7
12-Ton S&P 24,000 lb 875 cu ft	13	489	333	208	533	514	148	110	12	9
40-Ton Lowboy 80,000 lb 1,760 cu ft	27	1,466	1,035	419	1,777	1,035	308	368	43	27
M548 12,000 lb 529 cu ft	8	244	166	125	266	272	74	55	6	4
# Mines/ Wt/lb; Cube cu ft	40/ 1,180; 64	1/ 49; 1.2	2/ 72; 1.6	4/ 91; 4.1	4/ 45; .8	90/ 44; 1.9	21/ 162; 5.7	40/ 217; 3.4	240/ 1,850; 37.6	** 2,656; 64.8

For concertina = bundles; 1 bundle = 40 rolls * Overloads vehicle **Line charge + rocket *** Without/with sideboards

tion from artillery and air attack should be considered. Residue must be removed.

Defense. The site must be organized for defense against enemy patrols and saboteurs.

Time. Platoon leaders must take into consideration the time it takes to uncrate, inspect, grease, and fuze mines.

Operators. Soldiers must be specifically allocated to operate mine dumps. They will most likely remain there until the task is complete. The supply node may have to be collocated with or be near a source of manpower. Table 2-3 provides general guidance on how much manpower is required to sustain mine resupply operations.

Mine Resupply Methods

There are three methods for minefield resupply — *supply point, service station,* and *tailgate.* In each method, corps or division transport delivers Class IV/V forward to a designated Class IV/V point in each TF sector. The primary differences in each method are how mines are delivered from the Class IV/V point to the minefield group and whether or not a mine dump is activated in the resupply chain.

Supply point. The supply point technique revolves around the emplacing engineer platoon returning to the Class IV/V (mines) supply point each time it must reload laying vehicles or dispensers. Figure 2-25, page 2-38, illustrates the supply point method of resupply. The supply point technique does not activate a separate mine dump. In effect, it moves the normal tasks associated with a mine dump to the supply point. Mines are prepared and inspected at the supply point as they are loaded onto the emplacing vehicle or dispenser.

Several considerations may drive the use of supply point resupply. First, if there are no additional haul assets to transport mines forward from the Class IV/V (mines) supply point, the supply point method may be the only viable technique. Second, the obstacle group may be close enough to the supply point that any other method is less efficient.

There are several advantages and disadvantages to a supply point.

- Advantages.
  - Minimizes unloading and loading of mines.
  - Requires minimal augmentation of haul assets.
  - Allows manpower and equipment to be massed at a single supply point.
  - Streamlines command and control of mines, particularly fuzes and booster charges.
- Disadvantages.
  - Requires more movement of the platoon, which may take away from emplacement time.
  - Requires the platoon to move in and out of the mined area.

Table 2-3. Mine dump planning factors

Number of Personnel	Quantity of Mines
2-man team (2 minutes per mine)	25 mines/hour
Squad (8 soldiers)	100 mines/hour
Platoon	300 mines/hour; 3,600 mines/day
Company	10,800 mines/day
NOTE: Soldiers work 50 minutes per hour, 12 hours a day.	

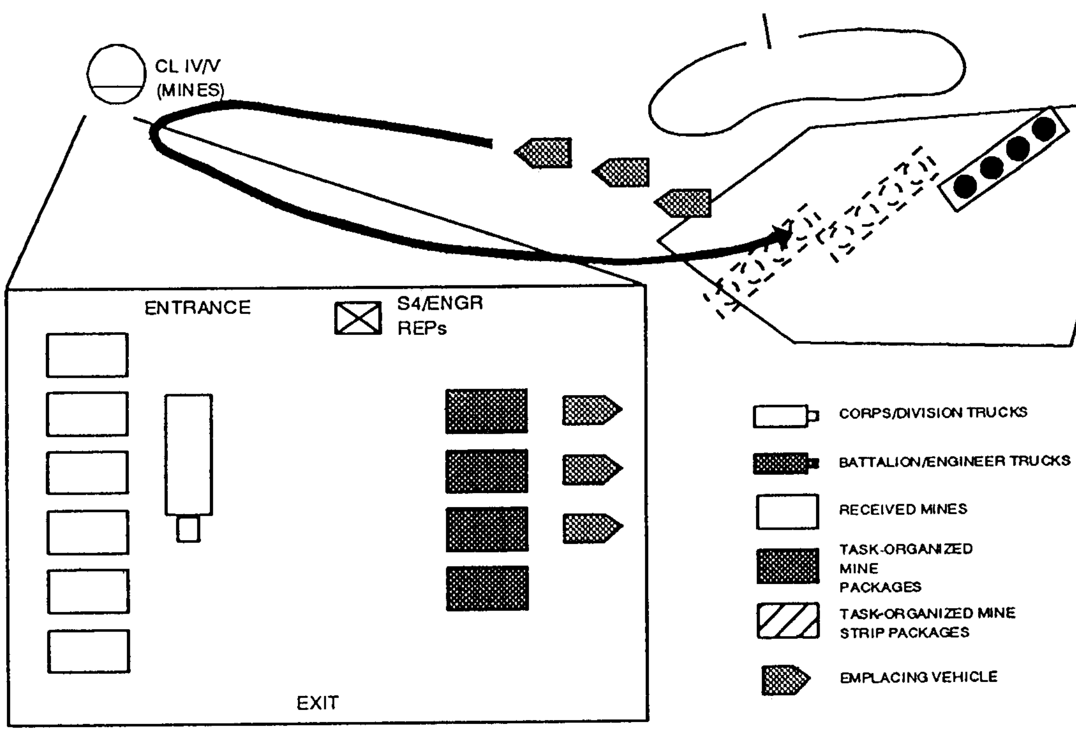


Figure 2-25. Supply point resupply method

- May disrupt the emplacement of individual minefields when emplacing vehicles cannot carry enough mines to start and complete the minefield. This causes emplacing vehicles to stop work, reload, and pick up where they left off.
- Requires a larger Class IV/V (mines) supply point capable of receiving mass quantities of mines and loading platoons simultaneously.
- Does not afford an opportunity to task-organize mines into strip packages.

Service station. The service station technique centers on the activation of a mine dump forward of the Class IV/V (mines) supply point. In the supply point method, mines are transported to a mine dump using a combination of battalion and engineer haul assets that are normally under the control of the emplacing engineer platoon sergeant (Figure 2-26). At the mine dump, mines are stockpiled and prepared by a mine dump party. Mines are further task-organized into strip packages to facilitate easy and correct loading of mines onto emplacing vehicles or dispensers. Fuzes and boosters are task-organized in the appropriate numbers, type, and mix for each strip. The emplacing platoon moves to the mine dump to resupply emplacing vehicles or dispensers. Once the obstacle group is emplaced, the mine dump is deactivated or moved to support another obstacle group.

There are several considerations for using the service station resupply method. First of all, it is used when the minefield group is located too far from the Class IV/V (mines) supply point to allow efficient turnaround. Since this method provides for prestocking mines forward, it is used when available haul assets have a relatively small capacity. This allows for frequent short duration resupply trips and stocking mines to keep pace with emplacement. It also streamlines emplacement since there is

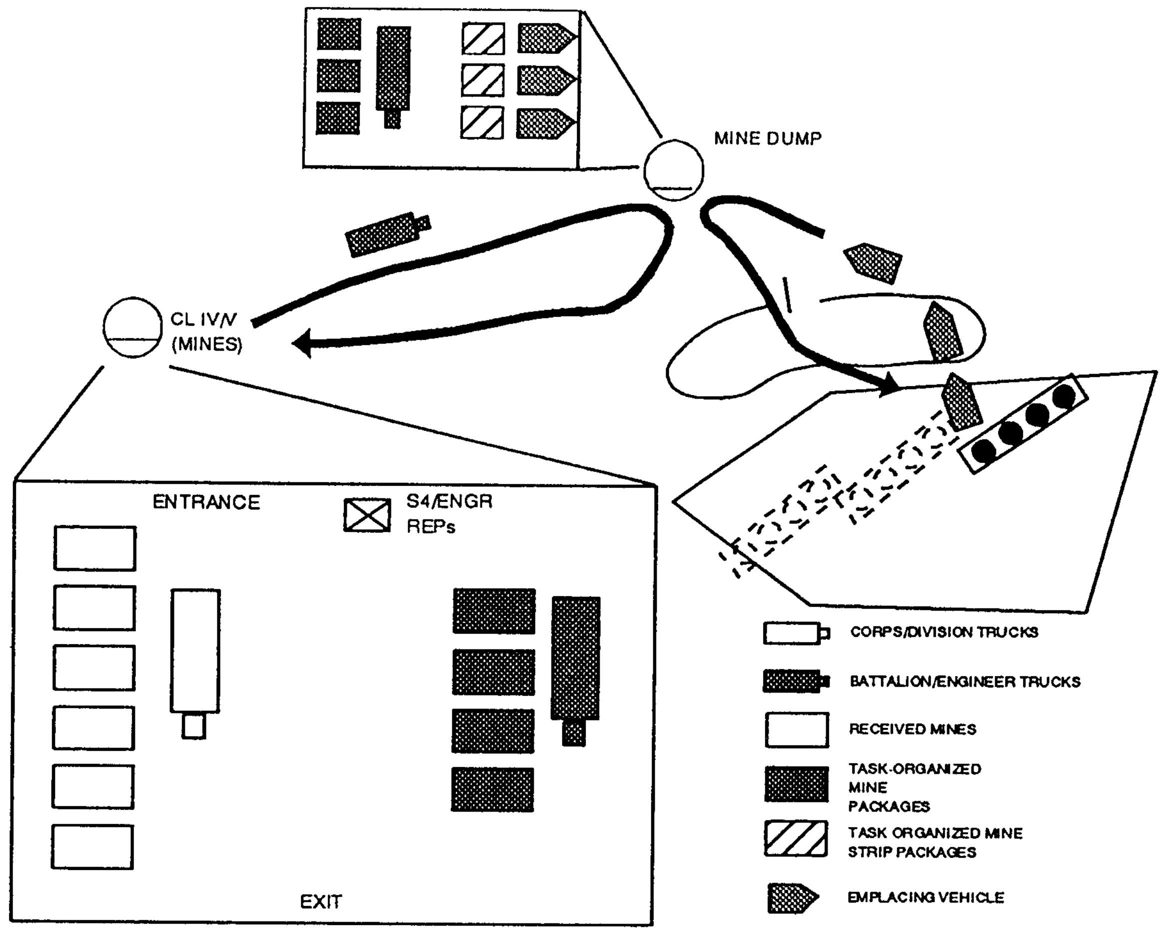


Figure 2-26. Service station resupply method

an opportunity to task-organize the mines into strip packages based on the emplacement method and type minefield. Finally, while it still requires the emplacing platoon to stop laying and resupply, it minimizes the distance and time the platoon must travel to reload. This further allows for a small party to be left at the minefield to assist in picking up where emplacement stopped.

There are several advantages and disadvantages to the service station resupply method.

- Advantages.
  - Allows for prestockage of mines to keep pace with emplacement.
  - Minimizes the distance and time the emplacing platoon must travel to reload.
  - Allows for task-organizing mines into strip packages.
  - May provide additional manpower and security if located near supported maneuver company.
- Disadvantages.
  - Requires additional loading and unloading of mines and handling of fuzes and booster charges.
  - May require augmentation with haul assets.

– Disrupts emplacement by requiring the emplacing platoon to stop emplacement, move to the mine dump, reload, and return to the minefield.

Tailgate. The tailgate resupply method transports mines directly from the Class IV/V (mines) supply point to the emplacing platoon on the minefield site (Figure 2-27). This technique does not use a mine dump. Mines are transported to the emplacing platoon using both maneuver battalion and engineer haul assets. At the minefield, mines are transloaded to emplacing vehicles or dispensers. As the mines are transloaded, they are inspected, prepared, and loaded for emplacement. These actions are performed by emplacing engineers rather than a separate party. If emplacing vehicles are not ready for resupply, the mines remain up-loaded at the mine site until they are called for.

Two overriding considerations drive the decision to use the tailgate resupply method. First, if minefield emplacement is being conducted during limited visibility, the tailgate method is the primary resupply method. It minimizes disruption of emplacement and chance of fratricide as engineers move back into a mined area after reloading. Second, the tailgate is the primary method used when establishing a hasty defense or when the situation is unclear and an attack can happen at anytime. Since mines remain loaded until transferred to the emplacing vehicle, the tailgate method enables engineers to quickly break contact without risking a loss of mines to the enemy. The tailgate resupply method is the norm for light forces.

There are several advantages and disadvantages to the tailgate resupply method.

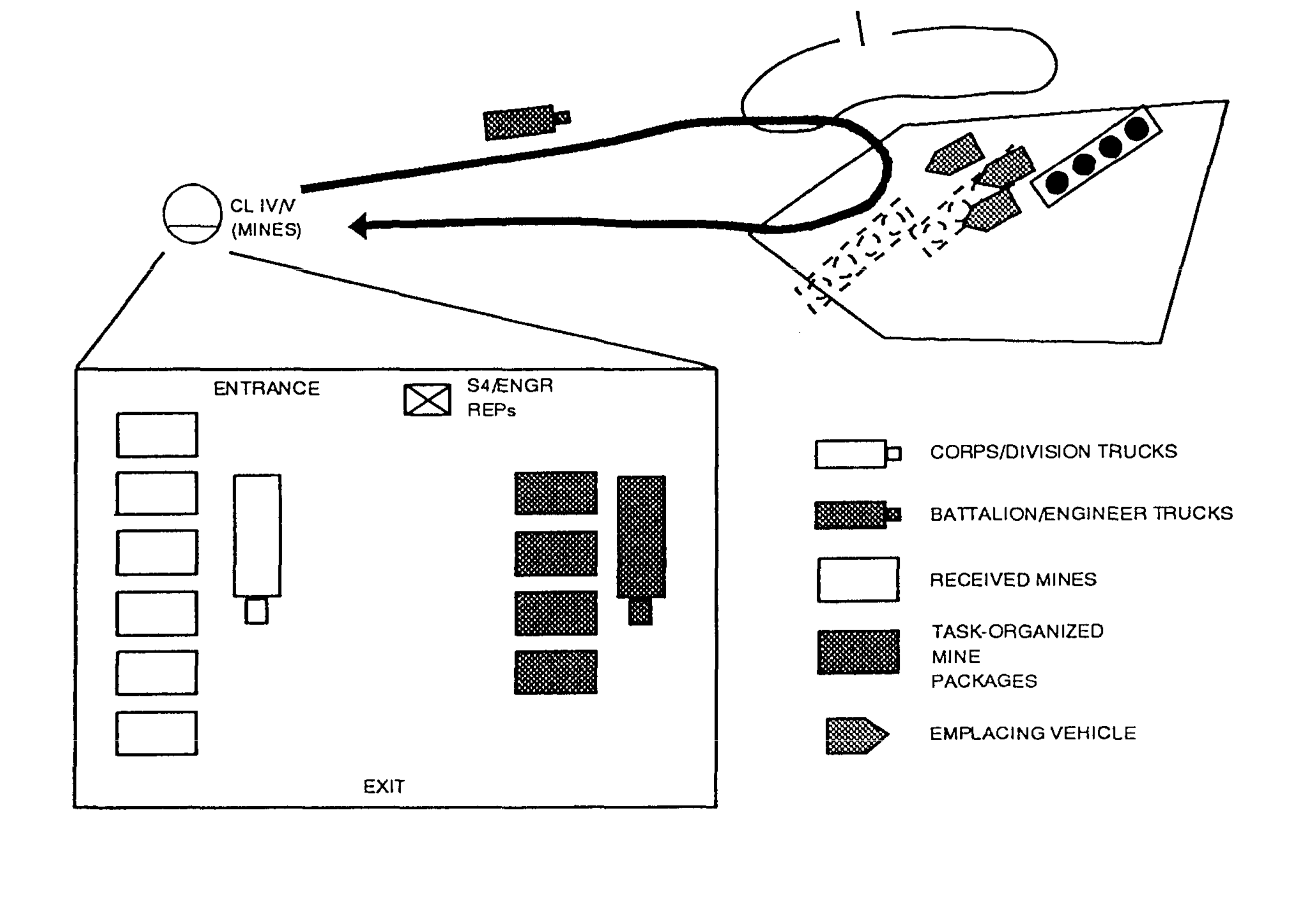


Figure 2-27. Tailgate resupply method

- Advantages.
  - Minimizes loading and unloading of mines and handling of fuzes and booster charges.
  - Allows engineers to rapidly break contact, in the event of enemy attack, without losing mines to the enemy.
  - Minimizes the movement of platoons in and out of the minefield (suitable for limited visibility).
  - Does not require a dedicated mine dump party.
- Disadvantages.
  - Requires augmentation by high-capacity transportation assets capable of offsetting the loss in turnaround time if the vehicle has to wait on-station at the minefield site.
  - May result in inefficient use of haul assets.
  - Complicates command and control in linking up mine transport assets with emplacing engineers as the engineers continue emplacement.
  - Task-organizing strip packages, mine inspections, and preparation are conducted concurrent with loading.

MINEFIELD MARKING

Marking Criteria

Minefields need to be marked to prevent fratricide. Marking minefields ensures that friendly soldiers do not accidentally enter a minefield. Marking minefields is a requirement under STANAGs and Geneva Convention agreements. When emplacing minefields behind the forward line of own troops (FLOT) (in the main battle or rear areas), mark the minefields on all four sides. This includes air-delivered Volcano minefields that are sited and emplaced before the enemy attack.

Remote antiarmor mine (RAAM)/area denial artillery munition (ADAM) and Gator minefields are the exceptions to the rule. To preserve the system's flexibility and the relative inaccuracy of emplacement, these minefields are not normally marked before emplacement unless the tactical situation permits. Marking the area where mines are to be emplaced by artillery or fixed-wing aircraft is not recommended. Mines could likely be emplaced outside the marked area.

Forward of the FLOT, minefields are not generally marked before emplacement. However, commanders must make every attempt to mark these minefields as soon as the tactical situation allows. The commander may decide to remove minefield marking if the minefield is abandoned and control of the area is to be turned over to the enemy. For scatterable minefields, the commander may choose to remove markings once the self-destruct time of the mines has expired; but the location of the minefield must still be recorded and forwarded to higher and adjacent units in the event some mines did not self-destruct.

Perimeter Marking

To mark a minefield, construct a perimeter fence. Start emplacing the perimeter fence before emplacing mines, preferably during site layout if the tactical situation permits. For conventional minefields, ensure the perimeter fence will be at least 15 meters outside the nearest mine or cluster. For scatterable minefields, the area inside the perimeter fence must include the safety zone particular to the method of emplacement (see Chapter 6 for more details).

Place warning signs for areas containing emplaced mines. Space the warning signs 10 to 50 meters apart depending on the terrain. If using pickets and barbwire to mark the minefield, ensure the wire is waist-high. If using concertina wire, use a one-roll height. Place additional strands of barbwire or rolls of concertina at the discretion of the commander (Figure 2-28, page 2-42).

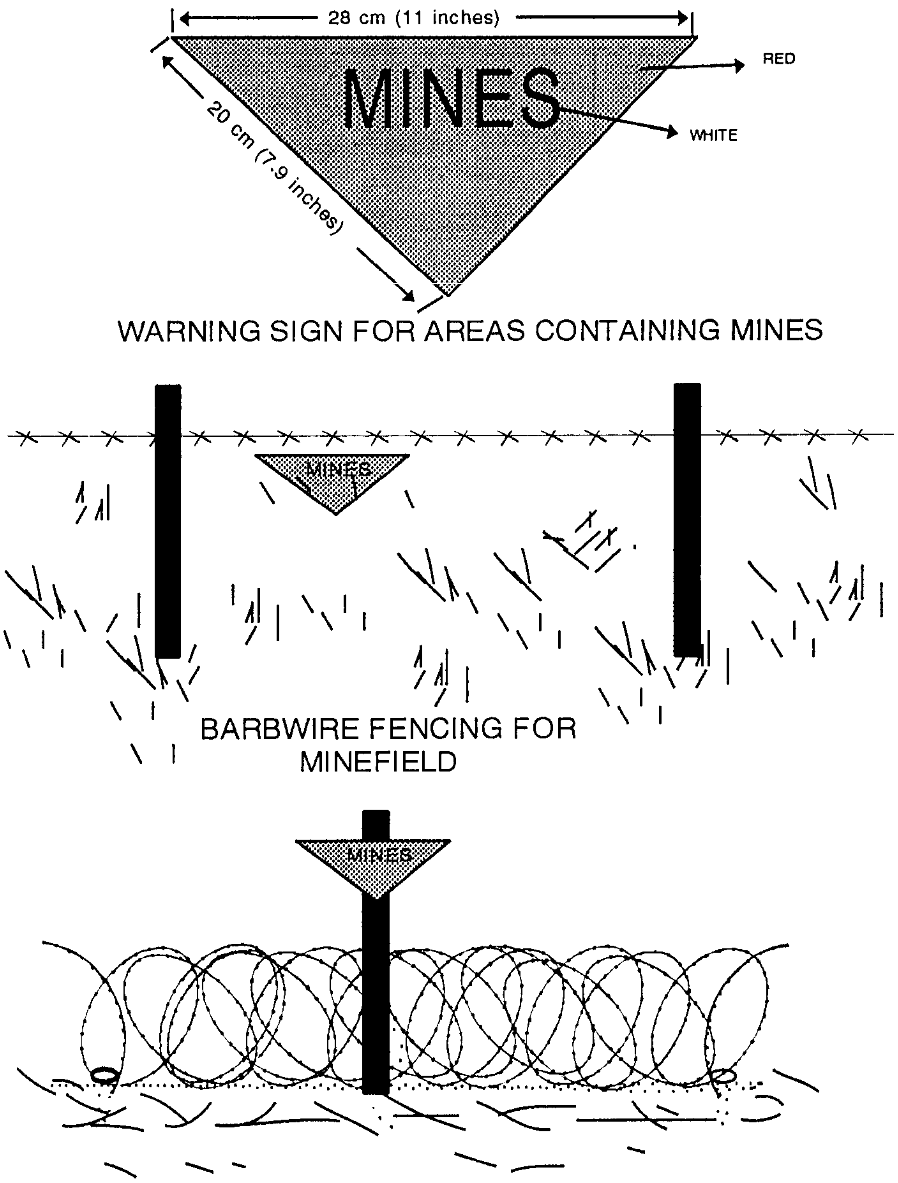


Figure 2-28. Minefield marking

Marking Techniques

The commander may decide to mark individual minefields in an obstacle group or to mark the group as a whole (Figure 2-29). Depending on the size and location of the minefields, either technique may have the advantage of using fewer resources or labor. Nor really, marking individual minefields in a fix obstacle group requires less resources than marking the group in its entirety. The opposite is usually true for disrupt, turn, and block obstacle groups. The decision to mark minefields or obstacle groups should not, however, be based solely on logistical considerations. The commander must consider the amount of tactical or sustainment movement required in and around the obstacle groups as well as his unit's capability to command and control forces. The following advantages and disadvantages to

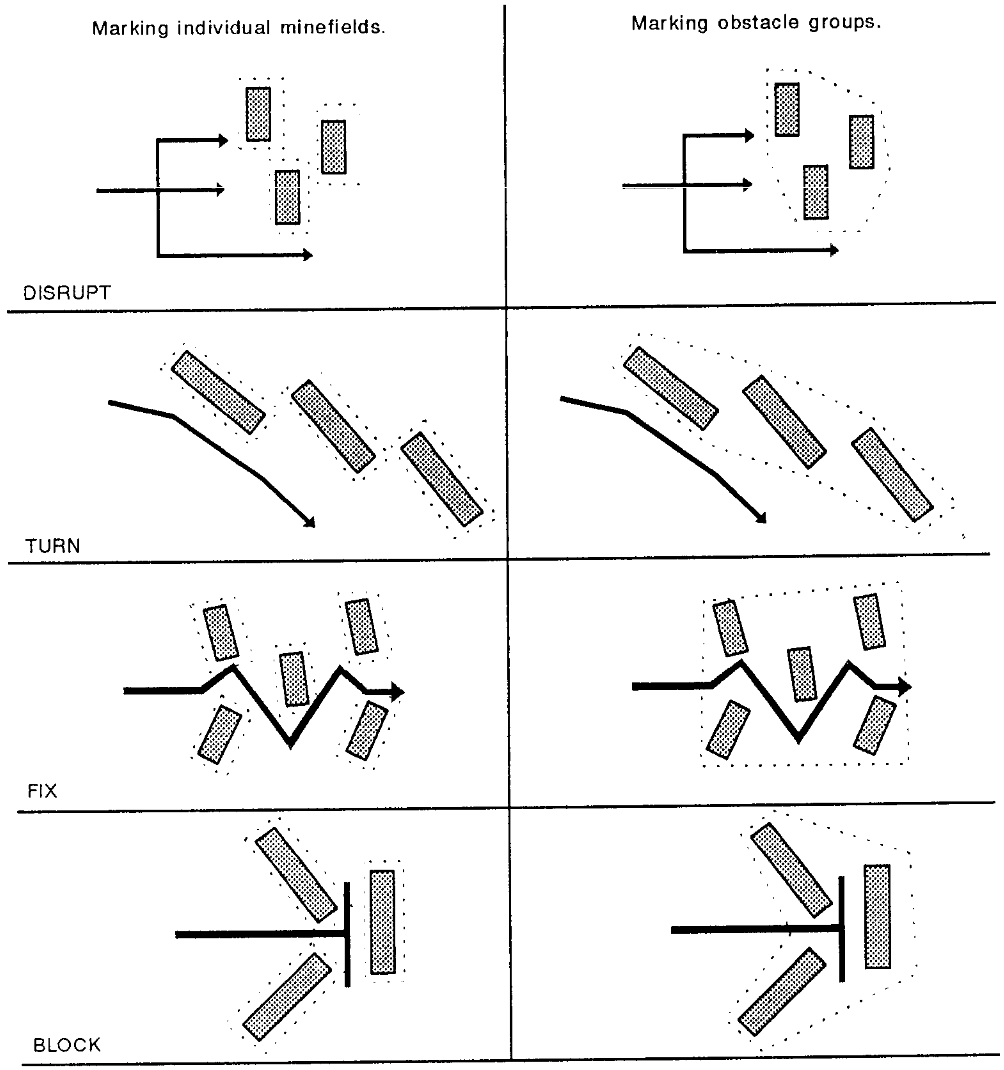


Figure 2-29. Marking of minefield obstacle groups

marking individual minefields versus marking the obstacle group are provided to help commanders make the best decision.

Marking individual minefields.

- Advantages.
  - Returning units forward of the minefields have more routes (tactical lanes or bypasses) through the obstacle group.
  - Tactical lanes need only pass through individual minefields.
  - Mine recovery is easier when individual minefields are marked.
- Disadvantages.
  - Obstacle may not provide the desired effect.
  - Enemy units can more easily bypass individually marked minefields in a fix or block obstacle group.

Marking entire obstacle group.

- Advantages.
  - Obstacle is more likely to provide desired effect.
  - The enemy cannot easily discern individual minefields and decide when to employ breach assets in a fix or block
- Disadvantages.
  - Friendly patrols cannot clearly see if the minefield is tampered with unless they are within the perimeter fence.
  - Tactical lanes need to pass through the entire obstacle group. Friendly units passing through the lanes will be slowed considerably.

MINEFIELD TURNOVER

Minefield turnover from the emplacing engineer unit to the overmatching unit is an inherent part of any minefield emplacement. Turnover is conducted whether or not there are lanes/gaps to be closed. Minefield turnover takes on the same significance as transfer of a minefield from one commander to another. Normally, minefield turnover is conducted between the engineer platoon/squad which emplaced the minefield and the maneuver company/team who has the responsibility for covering the obstacle with fires. Minefield turnover is a must; time and location for turnover is established during initial siting coordination.

Listed below arc several items the engineer platoon /squad leader must address with the overwatching company/team.

Intelligence.

- Provide an update on any enemy activity forward of the minefield.
- Discuss expected enemy reconnaissance efforts.

Maneuver.

- Discuss obstacle protection against enemy dismounted patrols. Recommend that the maneuver unit conduct security/patrols to protect the minefield during limited visibility.
- Discuss fire control measures.

Mobility/survivability.

- Discuss the obstacle's intended effect on enemy maneuver.
- Discuss minefield front and depth and walk/ride the minefield trace. Provide grid coordinates of the minefield trace.
- Discuss minefield composition.
- Discuss friendly minefield marking.
- Discuss lane or gap closure, if applicable. Confirm the signal or activity which initiates lane closure.
- Train units on how to close lanes. This may mean training the unit on emplacing conventional mines or using the MOPMS.

Fire support.

- Update the company FIST on grid coordinates for the minefield trace.
- Discuss indirect fires covering the minefield.

CSS. Provide mines/material required to close lanes/gaps. Ensure all necessary material is available and prepared.

Command and control.

- Sign over the minefield report.
- Report completion of turnover to higher engineer headquarters.
- Forward written minefield report.

MINEFIELD INSPECTION AND MAINTENANCE

Mines left in the ground for a long time may deteriorate and malfunction for one or more of the following reasons:

- Moisture may have entered the igniter or body of the mine and either neutralized the explosive or corroded the metal parts. Such actions may be aggravated by local factors (soil acidity or wide temperature swings).
- Frost or heat may have subjected the mine to mechanical strain and caused distortion.
- Insects or vegetation may have caused obstructions.
- Animals may have turned mines over or detonated them.

Technical inspections should only be made by experienced engineers or explosive ordnance disposal (EOD) personnel. When a minefield deteriorates below the operating level, additional mine strips/rows are added to restore its effectiveness. They are sited to the front or rear of the existing minefield to increase its depth. New mine strips/rows are treated as a separate, additional minefield.

Technical inspections of minefields are normally done at three-month intervals. They are done more frequently during extreme weather conditions.

CHAPTER 3
STANDARD PATTERN MINEFIELDS

Standard pattern minefield laying is laborious and time-consuming, but allows better mine concealment than row laying. Standard pattern minefields are well-suited for protective and nuisance minefields. They can be used in terrain where the nature of the ground makes row laying methods impracticable.

To achieue their maximum effect, mines must be laid so they cannot be seen and so a vehicle's wheel or track, or a person's foot, exerts enough pressure to detonate them.

The method used to lay mines depends on the method of mine operation, the type of ground in which the mine is to be laid, and the type of ground cover available for camonflage.

MINEFIELD COMPONENTS

Mine Strips

The mine strip is the foundation of a standard pattern, hand-laid minefield. If a mine strip was laid in one straight line, the enemy would be able to easily locate mines; therefore, mine strips are laid in several segments as shown in Figure 3-1, page 3-2.

When siting, laying, and recording mine strips, all measurements are expressed in meters or paces. Directions are recorded as magnetic azimuths, in degrees.

Mine Clusters

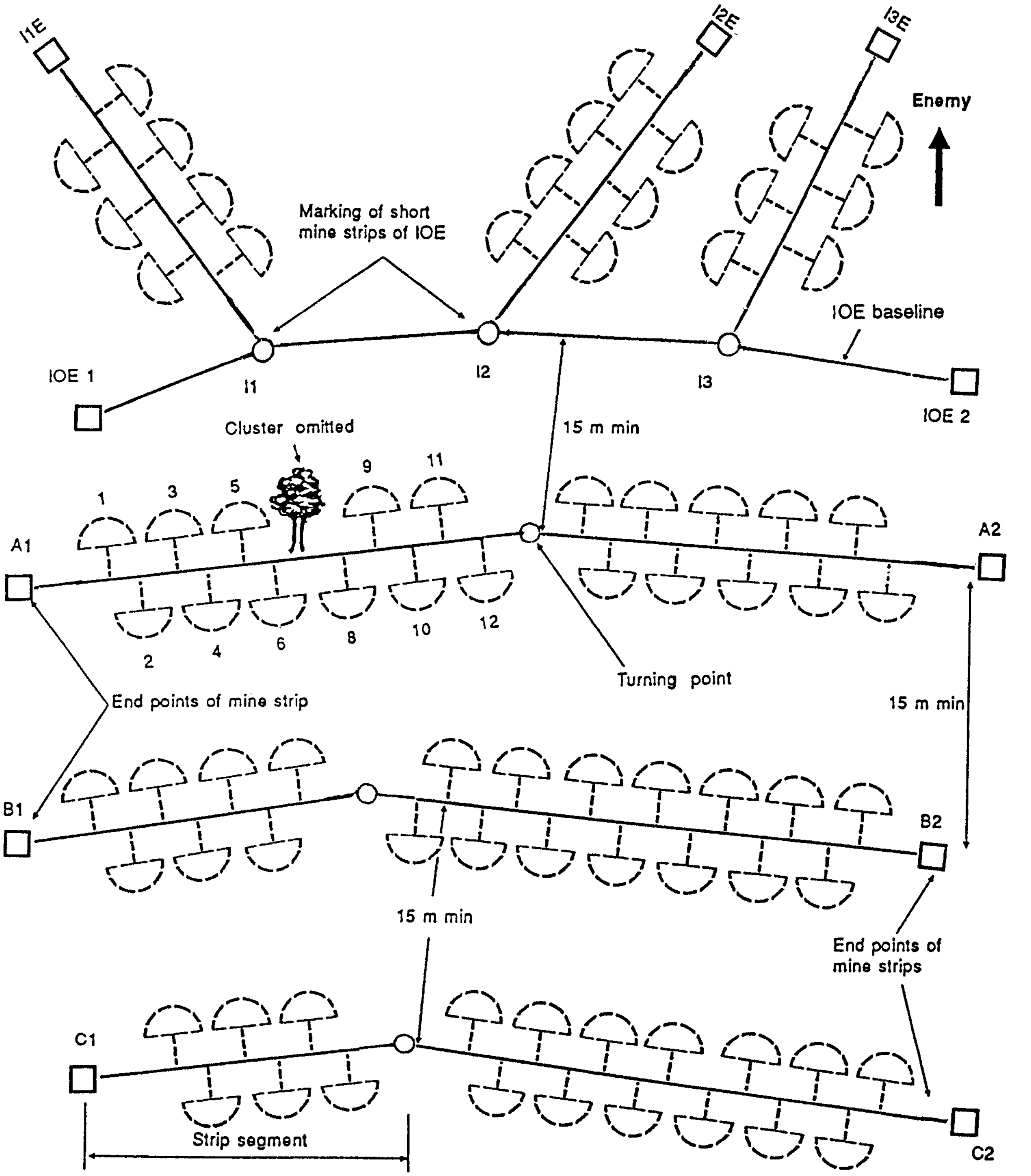
The cluster is the basic unit of a minefield. It may consist of one to five mines that are laid within a 2-meter-radius semicircle (Figure 3-2, page 3-3). When clusters are incorporated in a mine strip, they are numbered progressively and may consist of—

- One AT mine.
- One AT mine and one to four AP mines.
- Up to five AP mines.

Clusters are placed at 6-meter intervals, center to center, to form rows. Two parallel rows, 6 meters apart, form a mine strip. The arrangement of clusters in a mine strip is shown in Figure 3-3, page 3-3.

Rules for Positioning Clusters Within a Strip

The first cluster (Number (No.) 1) is placed on the enemy side of the strip centerline, 6 meters from the beginning-of-strip marker. Following clusters are numbered consecutively. Odd-numbered clusters are always on the enemy side of the strip centerline. The direction of laying follows the numbering; that is, from A1 to A2, B1 to B2, and so on.



NOTES:
1. The direction of laying is as per the number; that is, from A1 to A2, B1 to B2, and so on.
2. Odd-numbered clusters will always be on the enemy side of the strip.

□	End of row markers.
Δ	Landmarks.
○	Turnpoints. The next cluster cannot be any closer than 3 meters from that turnpoint.
◇	Turnpoint on the IOE baseline.

★ *Figure 3-1. Minefield layout*

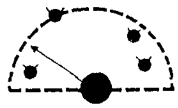
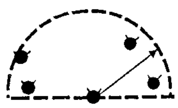
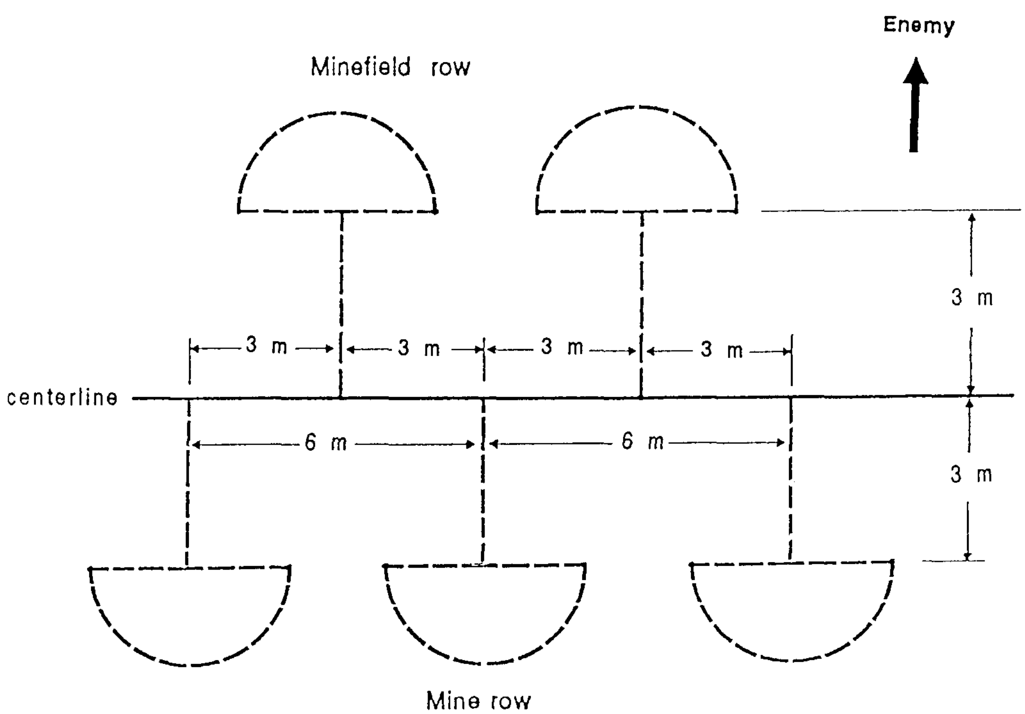
Individual laying of AT mine (to be at base of cluster).	
Cluster with one AT mine plus several AP mines within or on a 2 m semi-circle from the AT mine (AT mine must be base mine).	
Individual laying of AP mine (to be at base of cluster).	
Cluster with several AP mines within or on a 2 m semicircle of the central AP mine (most easily detected mine is to be base mine).	

Figure 3-2. Cluster compositions



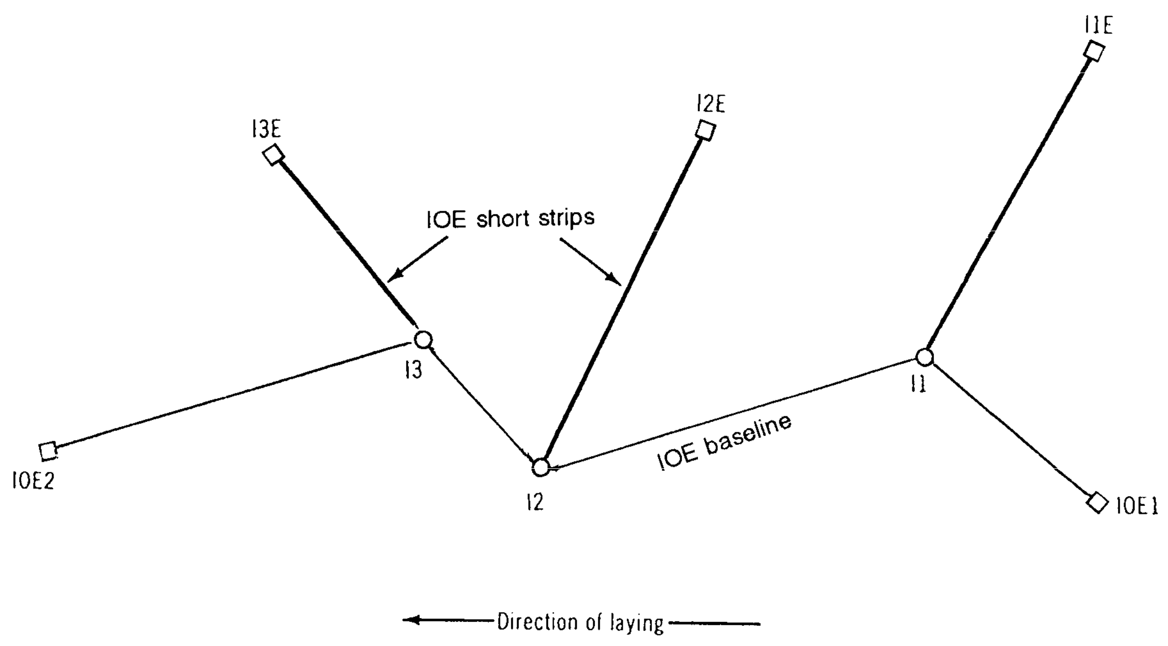
✱ Figure 3-3. Arrangement of clusters in a strip

The IOE is normally the first part of the minefield encountered by the enemy. It consists of a baseline from which short strips are extended (Figure 3-4). Short strips along the IOE deceive the enemy on the minefield's pattern, spacing, and size. IOE placement and composition are largely dictated by the time allowed for laying the minefield, terrain con - ditions at the laying site, and the tactical situation.

The IOE baseline extends from one end point (IOE 1) to another end point (IOE 2). The laying direction is indicated by end point markers. Laying always begins at IOE 1. Intermediate or turning points are marked in consecutive order beginning with 11. On the enemy side of the IOE baseline, short strips are extended from turning points at irregular angles. They are identified by turning point markers.

Turning points should be no more than 45° from the last azimuth. The length of short strips is not standard. At the end of each short strip, an end marking stake is driven into the ground. Stakes are marked in consecutive order beginning with I1E for recording purposes. No trip wires are used in the IOE, but AHDs may be employed.

AP mines actuated by trip wires are only placed on the enemy side of each regular strip. No more than one mine per cluster uses trip wires, and no more than two trip wires extend from the mine. Trip wires are angled toward the enemy and should be at least 2 meters from a cluster, minefield lane border, or minefield boundary. Trip wires are only used with AP fragmentation mines; they are not considered AHDs.

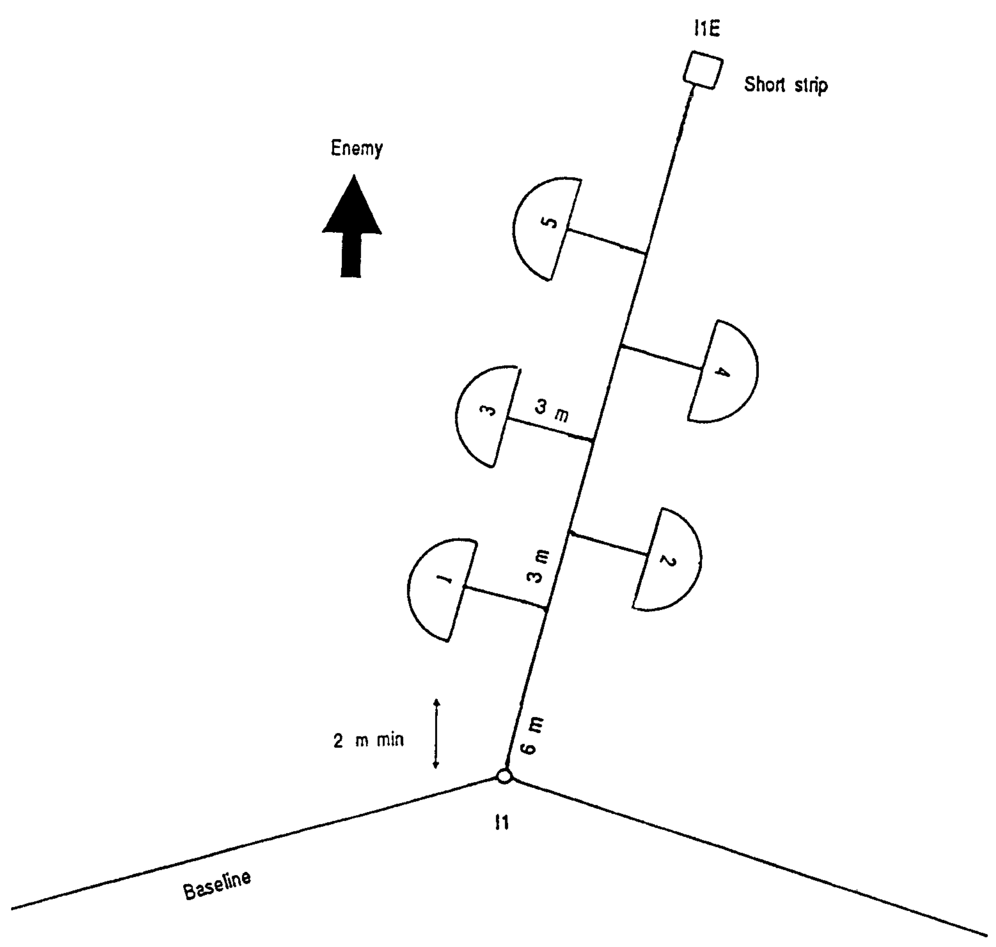


★ *Figure 3-4. IOE with short strips*

Standard Pattern Minefield Rules

- Clusters.
  - A cluster is a 2-meter-radius semicircle located 3 meters off the strip centerline.
  - There are two types of clusters: live and omitted. Live clusters contain mines.
  - A live cluster contains as many as five mines (only one can be an AT mine).
  - Omitted clusters do not contain mines, but they are numbered. They are reported on DA Form 1355 (Notes Section). (See Chapter 5.)
  - Clusters are omitted within lanes or gaps: in areas less than 2 meters from boundaries, lanes, or another cluster (including the IOE); and in areas where the terrain (trees and rocks) prohibits emplacement.
  - The base mine in a live cluster is the first mine laid. It is 3 meters from the strip centerline.
  - When a live cluster contains an AT mine, the mine is always used as the base mine. If an AT mine is not present, the largest, metallic AP mine is used as the base mine.
  - ★ The first cluster in a mine strip is located on the enemy side, 6 meters from the start of the regular strip marker.
  - The minimum distance between a cluster and a lane, gap, boundary, or another cluster is 2 meters (measured from the edge of the cluster).
  - Cluster composition is the number of mines, by type, in any cluster in a specific strip.
  - Cluster composition remains the same through the entire mine strip and is recorded on DA Form 1355 (Notes Section).
  - The types of AP mines may vary within a cluster.
  - The cluster boundary must be no closer than 15 meters to the minefield perimeter fence.
  - Clusters are numbered beginning with the first cluster on the enemy side. Therefore, odd-numbered clusters are always on the enemy side of the strip, and even-numbered clusters are on the friendly side.
- Mine strips.
  - There are two types of mine strips: regular and short. (Short strips are described under IOE rules below.)
  - A regular strip consists of a strip centerline and two rows of clusters (row 1, enemy side: row 2, friendly side).
  - Regular strips are marked and recorded. They are designated by letters (A, B, and so forth), with strip A being closest to the enemy.
  - Regular strips are sometimes referred to as lettered strips. A standard pattern minefield contains a minimum of three regular strips.
  - The minimum distance between strip centerlines is 15 meters; there is no maximum distance.
  - Safety tapes are used to ensure personnel installing trip wires do not move forward into armed clusters. A safety tape is used behind each regular strip. Safety tapes are 8 meters from the strip centerline (3 meters from the outer edge of a cluster).
  - Within a mine strip, the cluster composition must remain the same unless the cluster is omitted.
  - Marking of end points indicates the direction of laying (for example, A1 to A2).

- IOE rules.
  - – The IOE consists of a baseline from which short strips are extended at turning points.
  - – The IOE is located on the enemy side of the minefield.
  - – Short strips originate only from turning points along the IOE baseline.
  - – The number and length of short strips depend on the tactical situation and resources available to the emplacing commander.
  - – The number of clusters in the IOE is about one-third the number used in a regular strip.
  - – The first cluster along a short strip is placed on the enemy-side and can be no closer than 6 meters from the IOE baseline, and the cluster boundary can be no closer than 2 meters from the baseline (Figure 3-5). If the short strip is exactly parallel to the enemy direction of travel, the noncommissioned officer in charge (NCOIC) designates the enemy side of the strip.
  - – The IOE baseline is labeled at the beginning (IOE 1) and end (IOE 2) according to the direction mines are emplaced.
  - – Short strips are labeled at turning points (11) and at the end (I1E).



★ *Figure 3-5. Clusters on short strips*

- The IOE contains a safety tape, located 2 meters behind and following the IOE baseline.
- The IOE baseline is no closer than 15 meters to any point (strip centerline) on a regular strip; there is no maximum distance.
- An IOE short strip is no closer than 15 meters to another IOE short strip; there is no maximum distance.
- AHDs may be employed.

• Trip wire rules.

- Trip wires are not used in the IOE.
- Trip wires may be used in regular strips, but only one mine per cluster may be actuated by a trip wire.
- Trip wires are employed no closer than every third cluster.
- No more than two trip wires can be used on a mine.
- Trip wires are used only on the enemy side of the row/strip.
- Trip wires are not considered AHDs.
- Trip wires are located no closer than 2 meters to the border of a minefield lane, safety tape, cluster, another trip wire, IOE baseline, or minefield perimeter fence.
- Trip wires can only be used with AP fragmentation mines.

• Turning points.

- The last cluster before the turning point will have a distance of at least 3 meters.
- The first cluster after the turning point is laid on the opposite side of the strip centerline from the last cluster, and 3 meters from the last turning point.
- The angle of any given turning point cannot exceed 45° from the last azimuth. (This ensures a minimum distance of 2 meters between clusters in the same row.)

• General rules.

- The farthest extremities of a regular strip determine the minefield front. Minefield depth is measured from the friendly strip/row to the enemy strip/row and includes the IOE, if used.
- Strips can be laid left to right or right to left.
- Depth is determined by using the IOE.
- Back azimuths are not used to record the minefield.
- The minefield will have two landmarks located to the rear of the minefield (never to the extreme side or front).
- If landmarks are more than 200 meters away from the last regular strip or out of the direct line of sight, intermediate markers are used. Intermediate markers are placed no closer than 75 meters to the last end of the strip/row marker.
- Measurements may be in meters or paces (1 pace = ¾ meter). If paces are used, convert them to meters before recording on DA Form 1355.

• Minefield lanes. Minefield lanes are left for the use of dismounted patrols and vehicles (Figure 3-6, page 3-8).

- Lanes are sited before laying begins.
- Lane locations should not be obvious.
- Clusters are not laid within 2 meters of lane edges.
- Lanes are not straight, but are zig-zagged.
- Lanes cross the mine strip centerline at approximately right angles.
- Direction changes will not exceed 45°. (This ensures long vehicles will be able to negotiate turns, if necessary.)

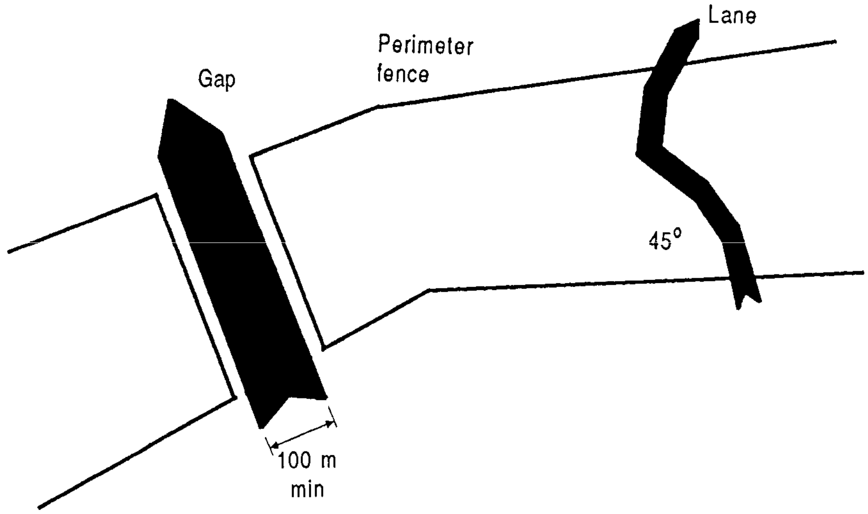


Figure 3-6. Lanes and gaps

- The number of lanes must be sufficient to ensure that no one lane is overused and turned into an obvious track.
- Sufficient mines are stockpiled so the responsible unit can seal lanes suspected of being located by the enemy.
- Recommended minefield lane widths are: footpath, 1 meter; one-way vehicle lane, 8 meters; and two-way vehicle lane, 16 meters.

• Minefield gaps. Minefield gaps are left so friendly forces can pass through in tactical formation. Their normal width is 100 meters or more. (See Figure 3-6.) The gap should closely resemble the rest of the minefield so it will not be discovered by the enemy. The ground within the gap should be disturbed with tracks to represent the passage of mine-carrying vehicles. Signs of mine laying (digging, scattered spoil, crates, and other evidence of activity) should be visible. The following points should be observed:

- Gaps are sited before laying begins.
- Gaps are located along recognizable features (fences, tracks, or creeks).
- Gaps should run straight through minefield; gaps will not contain bends.
- Sufficient mines must be stockpiled so the responsible unit can seal gaps when necessary.

STANDARD PATTERN MINEFIELD LOGISTICAL CALCULATIONS

In addition to allowing accurate recording, conventional minefield emplacement allows the unit to accurately calculate the number of mines required for a minefield based on its size and density.

To simplify the calculation process, the Minefield Requirements Computation Form has been developed (Figure 3-7, pages 3-10 through 3-12). This work sheet is provided to the platoon leader or sergeant as a step-by-step guide to the mathematics involved in the logistical computation process. Properly completed, the Minefield Requirements Computation Work Sheet provides the number of mines to order (by type), number of regular strips to be emplaced, strip cluster composition, estimated man -hours required to install the minefield, amount of fencing and marking material to order, number of truckloads required to carry the mines, and number of rolls of engineer tape to order.

Step-by-step procedures for completing the work sheet are shown in Figure 3-8, pages 3-13 through 3-18. Each step is explained in the example to facilitate the reader's understanding of the logic behind the calculations. For more information on standard pattern minefield rules and procedures, see page 3-5.

Strip Cluster Calculation

Accuracy is the main requirement of a standard pattern minefield. The following cross-check system has been designed to enable the minefield officer in charge (OIC) to accurately record the number of mines laid.

- Compare the strip feeder report with the amount of pins and clips returned by the laying party.
- Compare the strip feeder report with the mine tally sheet.
- Check the strip feeder report with the following strip cluster computation.

Step 1. Add the total length of the strip as determined by the recording party.

EXAMPLE: 30 + 42 + 21 = 93 meters.

Step 2. The first and the last cluster in the strip are located 6 meters in from the end of strip markers. Subtract 12 from Step 1.

EXAMPLE: 93 - 12 = 81 meters.

Step 3. Clusters are not located on turning points. Multiply the number of turning points by 3 and subtract it from Step 2.

EXAMPLE: 81 - 3(2) = 75 meters.

Step 4. Divide Step 3 by the cluster spacing (that is, 3).

EXAMPLE: $\frac{75}{3}$ =25 clusters.

Step 5. Add one cluster, because when a line is divided, there is one more interval than spacing.

EXAMPLE: 25 + 1 = 26 clusters.

From these computations, the minefield OIC is able to cross-check the information on the strip feeder report. In this example, strip A should have a total of 26 clusters, less any omitted.

Platoon Emplacement Procedures

The platoon is the basic unit used to install a standard pattern minefield. Orders to the laying unit OIC specify the proposed location, the length, and the mine type and density. The platoon organization and equipment is shown in Table 3-1, page 3-18.

The OIC makes a map study and conducts a ground reconnaissance of the site if the situation permits. He determines locations for each mine strip, landmarks, fences, mine dumps, and approaches. Using the Minefield Requirements Computation Work Sheet (Figure 3-7, pages 3-10 through 3- 12), the OIC determines the required number of mines and other materials; arranges for mines to be drawn; and organizes the platoon into siting, laying, recording, and marking parties.

The siting party places boundary stakes or pickets as strip markers at the beginning and end of each mine strip and at points where strips change direction. The siting party lays tape on the centerlines of each strip, lane, and traffic path. After completing siting, it augments other parties.

MINEFIELD REQUIREMENTS COMPUTATION WORK SHEET

GIVEN

1. Desired density	AT _____	APF _____	APB _____
2. IOE representative cluster	AT _____	APF _____	APB _____
3. Front	_____ meters		
4. Depth	_____ meters		
5. Percentage of AHDs	_____		
6. Types of mines	AT _____	APF _____	APB _____
7. Type of truck/trailer	__________		
8. Lanes/gaps/traffic tapes	_____	_____	_____
9. Trip wire safety tapes	_____		

PART 1. NUMBER OF MINES

A. Front ÷ 9 = IOE live clusters _____ ÷ 9 = _____ (round up)

	AT	APF	APB
B. IOE representative cluster X number of IOE clusters = number of mines in IOE	_______ X _____ _______	_______ X _____ _______	_______ X _____ _______
C. Desired density X minefield front = mines in regular lettered strips	_______ X _____ _______	_______ X _____ _______	_______ X _____ _______
D. Subtotal of mines (lines B + C)	_______	_______	_______
E. 10% excess factor =	X 1.10	X 1.10	X 1.10
Total number of mines to order	_______	_______ (round up for each)	_______

PART 2. NUMBER OF REGULAR LETTERED STRIPS

A. Add desired density AT _____ + APF _____ + APB _____ = _____

B. 0.6 X line A above 0.6 X _____ = _____ (round up)

C. 3 X AT desired density 3 X _____ = _____

D. Number of regular letter strips required = highest number of lines B or C _____

PART 3. NUMBER OF AHDs

%AHDs X total number of AT mines _____

PART 4. STRIP CLUSTER COMPOSITION

A. Desired density

AT: 3 X _____ = _____ APF: 3 X _____ = _____ APB: 3 X _____ = _____

★ ***Figure 3-7. Blank Minefield Requirements Computation Work Sheet***

B. Cluster composition table

STRIP	AT	APF	APB	STRIP TOTAL (cannot exceed 5)
A	_____	_____	_____	_____
B	_____	_____	_____	_____
C	_____	_____	_____	_____
D	_____	_____	_____	_____
E	_____	_____	_____	_____
F	_____	_____	_____	_____
G	_____	_____	_____	_____
H	_____	_____	_____	_____
I	_____	_____	_____	_____
COLUMN TOTAL (cannot exceed desired density X 3 as computed in A above)	_____	_____	_____	_____

PART 5. NUMBER OF MAN-HOURS TO INSTALL MINEFIELD

Number of mines ÷ emplacement rate (mines per man-hour)

Number of AT mines: _____ ÷ 4 = _____ (round up)

Number of APF mines: _____ ÷ 8 = _____ (round up)

Number of APB mines: _____ ÷ 16 = _____ (round up)

_____ + _____ + _____ X 1.2 = _____ man-hours (round up)

PART 6. AMOUNT OF FENCING AND MARKING MATERIAL

A. Concertina wire

[(front X 2) + (depth X 2) + 160] X 1.4 = meters of concertina required

[(_____ X 2) + (_____ X 2) + 160] X 1.4 = _____ (round up)

Number of pickets = amount of concertina ÷ 15

_____ ÷ 15 = _____ (round up)

- OR -

B. Barbwire

[(front X 2) + (depth X 2) + 320] X 1.4 = meters of concertina required

[(_____ X 2) + (_____ X 2) + 320] X 1.4 = _____ (round up)

Number of pickets = amount of concertina ÷ 30

_____ ÷ 30 = _____ (round up)

★ *Figure 3-7. Blank Minefield Requirements Computation Work Sheet (continued)*

C. Number of signs = number of pickets = _____

PART 7. NUMBER OF TRUCKLOADS

AT mines

_____ cases/truck X _____ mines/case = _____ mines/truck

_____ mines required ÷ _____ mines/truck = _____ truckloads of AT mines

APF mines

_____ cases/truck X _____ mines/case = _____ mines/truck

_____ mines required ÷ _____ mines/truck = _____ truckloads of APF mines

APB mines

_____ cases/truck X _____ mines/case = _____ mines/truck

_____ mines required ÷ _____ mines/truck = _____ truckloads of APB mines

Total truckloads

_____ AT truckloads _____ APF truckloads + _____ APB truckloads =

_____ total truckloads required (round up)

PART 8. AMOUNT OF ENGINEER TAPE

A. Minefield boundaries depth X 2 = _____ X 2 = _____

B. Regular lettered strips front X number of regular strips = _____ X _____ = _____

C. IOE front X (number of IOE clusters X 3) = _____ + (_____ X 3) = _____

D. Lanes and gaps depth X 2 X number of lanes and gaps = _____ X 2 X _____ = _____

E. Traffic tapes depth X number of traffic tapes _____ X _____ = _____

F. Trip wire safety tape front X number of regular strips with trip wire _____ X _____ = _______

G. Subtotal (add lines A + B + C + D + E + F) _____ + _____ + _____ + _____ + _____ + _____ = _____ meters (round up)

H. Number of rolls to order line G X 1.2 _____ X 1.2 = ______ meters

_____ meters ÷ 170 meters/rolls = _____ rolls of tape (round up)

PART 9. DETERMINE SANDBAG REQUIREMENTS

A. Number of clusters in IOE (from 1A) = _____

B. Number of clusters in main field = number of clusters in IOE X 3 X number of regular strips (from 2D) = _____

C. Total number of clusters (add lines A and B) = _____

D. Number of sandbags = number of clusters X 3 sandbags/clusters (line C X 3) = _____

★ ***Figure 3-7. Blank Minefield Requirements Computation Work Sheet (continued)***

This information is normally determined by the engineer company commander or the staff engineer. It will be provided to the OIC or NCOIC of the emplacing unit during the mission briefing. In this example, the following guidance is given to the emplacing unit:

• Desired density	AT 1	APF 4	APB 8
• IOE representative cluster	AT 1	APF 2	APB 2
• Front	200 meters		
• Depth	300 meters		
• AHDs	10%		
• Type of mines	AT M15	APF M16A2	APB M14
• Truck/trailer type	5-ton dump		
• Lanes/gaps/traffic tapes	1 lane, 1 traffic tape (foot troops)		
• Trip wire safety tapes	3		

With this given information, the remainder of the form can be completed.

The regular strip has a cluster density of one cluster every 3 meters. The IOE has a cluster density of one-third that of a regular strip, or one cluster every 9 meters. Therefore, to obtain the number of clusters in the IOE, the length of the strip is divided by 9. Decimals are rounded up to the next higher whole number.

PART 1. NUMBER OF MINES

Step 1.

Front ÷ 9 = IOE live clusters (200 ÷ 9 = 23 (round up))

The representative cluster composition for the IOE clusters is established by the commander based on METT-T and is part of the given information. The number of clusters in the IOE is multiplied by the cluster composition to determine the number of mines, by type, in the entire IOE.

Step 2.

	AT	APF	APB
IOE representative cluster X	1	2	2
Number of IOE clusters =	23	23	23
Number of mines in IOE	23	46	46

The minefield front multiplied by the desired density determines the number of mines in the minefield.

NOTE: The desired density pertains only to the regular strips and does not take into account the number of mines in the IOE which were calculated in Step 2.

Step 3.

Desired density X	1	4	8
Minefield front =	200	200	200
Mines in regular lettered strips	200	800	1,600

The number of mines required for the IOE (Step 2) is added to the number of mines in the regular lettered strips (Step 3).

★ *Figure 3-8. Step-by-step procedures for completing the Minefield Requirements Computation Work Sheet*

Step 4. Subtotal of mines

(Steps 2 + 3) 223 + 846 = 1646

Ten percent is added to the total number of mines required to allow for damaged items and irregularities in terrain and strip length. This is accomplished by multiplying the total number of mines (Step 4) by 1.10. Decimals are rounded up to the next highest whole number.

Step 5.

10% excess factor =	1.10	1.10	1.10
Total number of mines to order	246	931	1811

These figures represent the total number of mines, by type, required for the entire minefield. When ordering by the case rather than by individual mines, the totals above should be divided by the number of mines per case and rounded up to the next whole case.

PART 2. NUMBER OF REGULAR LETTERED STRIPS

Step 1.

Add desired density AT 1 + APF 4 + APB 8 = 13

Each regular mine strip has a cluster every 3 meters and therefore has a density of one-third cluster per meter of front. A total density of 13 mines per meter of front in the previous example would equal 3 X 13 or 39 mines per 3 meters of front. Clusters may contain a maximum of five mines (only one of which may be an AT mine), so the resulting figure must be divided by 5. In short, to determine the minimum number of regular strips required, the total density must be multiplied by three-fifths (3 meters between clusters and five mines per cluster). For ease of calculation, three-fifths is converted to the decimal 0.6. Decimals are rounded up to the next highest whole number.

Step 2.

0.6 X Step 1 above 0.6 X 13 = 8 (round up)

The calculations to determine the minimum number of regular strips previously described are not suitable when the ratio of AT to AP mines is greater than 1:4. For example, if the desired density is 1-1-1, the total density is 3. The minimum number of strips then would be 3 X 3/5 = 1.8, rounded up to 2 strips. However, because of the restriction on the number of AT mines per cluster, it is not possible to obtain a density of 1 AT mine per meter of front with only 2 strips. A minimum of 3 regular strips will be required. The alternative means of determining the number of regular strips is found by multiplying the AT desired density by 3.

Step 3.

3 X AT desired density 3 X 1 = 3

The number of regular strips calculated by the first method and the alternative method are compared, and the higher figure is used as the minimum number of regular strips. The 8 determined by the *3/5 rule* is larger than the 3 determined by the alternative method. Therefore, the minimum number of regular strips in this example is 8.

Step 4.

Number of regular lettered strips required = highest number of Steps 2 or 3 = 8

PART 3. NUMBER OF AHDs

0.10 X 223 = 22.3 = 23 (round up)

★ *Figure 3-8. Step-by-step procedures for completing the Minefield Requirements Computation Work Sheet (continued)*

PART 4. STRIP CLUSTER COMPOSITION

The cluster composition table is prepared by the OIC of the laying unit to control the allocation of mines to a regular lettered strip. The cluster composition remains constant within a particular letter strip, but it may vary among different strips. As the mines are allocated by strip, no more than 1 AT mine can be placed in each representative cluster, and each cluster can have a maximum of 5 mines.

A tabular format is prepared to facilitate the distribution of mines by emplacement personnel. Note that at the top of the form, each component of the desired density is multiplied by 3. The number 3 is always used regardless of the minimum number of regular lettered strips because it is the number of mine strips required to give a minefield density of one mine per meter of front when a cluster contains only one mine of each type. Each mine strip has a cluster every 3 meters and therefore has a density of one-third mine per meter when a cluster contains one of each type of mine.

Step 1. Desired density

AT: 3 X 1 = 3 APF: 3 X 4 = 12 APB: 3 X 8 = 24

The resulting numbers are the maximum amount of mines that the sum of each column in the table cannot exceed. With an APF desired density of 4, for example, 3 X 4 = 12, and therefore the sum of the APF mines in the representative cluster composition for each of the regular strips cannot exceed 12.

Note that the total number of mines includes mines in the regular lettered strips as well as those in the IOE short strips. The laying rates for mines per man-hour are—

AT mines: 4 mines per man-hour

APF mines: 8 mines per man-hour

APB mines: 16 mines per man-hour

PART 5. NUMBER OF MAN-HOURS TO INSTALL MINEFIELD

The number of hours for each mine type is rounded up, summed, and a 20-percent excess factor is included by multiplying the total by 1.2. The resulting figure is the total number of man-hours required for emplacement and represents straight work time only. It does not take into account time for transportation to and from the emplacement site, meals, breaks, and limited visibility or NBC conditions. The commander's judgment and experience should be exercised in determining the time required for transportation, meals, and breaks. When working under limited visibility or NBC conditions, the total man-hours (after the excess factor has been included) should be multiplied by 1.5.

In this example, a total of 357 man-hours is required as determined below. Note each decimal is rounded up to the next highest whole number.

Number of mines ÷ emplacement rate (mines per man-hour)

Number of AT mines: 246 ÷ 4 = 62 (round up)

Number of APF mines: 961 ÷ 8 = 121 (round up)

Number of APB mines: 1811 ÷ 16 = 114 (round up)

PART 6. AMOUNT OF FENCING AND MARKING MATERIAL

Standard pattern minefields must be marked and fenced. The amount of fencing required depends on whether barbwire (two strands) or concertina is used. The amount of wire for a two-strand barbwire fence is calculated with the following formula:

[(front X 4) + (depth X 4) + 320] X 1.4

The formula for calculating single concertina is—

[(front X 2) + (depth X 2) + 160] X 1.4

★ *Figure 3-8. Step-by-step procedures for completing the Minefield Requirements Computation Work Sheet (continued)*

Step 1.

Concertina wire

[(front X 2) + (depth X 2 + 160] X 1.4 = meters of concertina required

[(200 X 2) + (300 X 2) + 160] X 1.4 = 1624 (round up)

Number of pickets = amount of concertina ÷ 15

1624 ÷ 15 = 109 (round up)

The number of pickets required is equal to the total amount of fence divided by 30 if barbwire is used, or 15 if concertina is used.

The number of minefield marking signs is equal to the number of pickets.

In this example, one-strand barbwire is used.

NOTE: These calculations determine the marking and fencing materials required for the minefield perimeter only. Additional materials may be required for lanes and gaps.

Step 2.

Barbwire

[(front X 2) + (depth X 2) + 320] X 1.4 = meters of barbwire required

[(200 X 2) (300 X 2) + 320] X 1.4 = 1848 (round up)

Number of pickets = amount of barbwire ÷ 30

Step 3.

Number of signs = number of pickets = 62

PART 7. NUMBER OF VEHICLES

The number of vehicles required depends on the type and amount of mines as well as the type of vehicles available. The total mines by type required is divided by the number of mines per vehicle to determine the number of vehicle loads required to transport the mines.

In this example, M15 AT mines, M16A2 APF mines, and M14 APB mines are hauled in 5-ton dump trucks (crated). (See Table 2-2, page 2-36.)

AT mines:

246 mines required ÷ 204 mines/truck = 1.20 truckloads of AT mines

APF mines:

931 mines required ÷ 888 mines/truck = 1.04 truckloads of APF mines

APB mines:

1811 mines required ÷ 13,770 mines/truck = 0.13 truckloads of APB mines

Total truckloads:

1.2 AT truckloads + 1.04 APF truckloads + 0.13 APB truckloads = 2.37 truckloads (round up) = 3 truckloads required

★ *Figure 3-8. Step-by-step procedures for completing the Minefield Requirements Computation Work Sheet (continued)*

PART 8. AMOUNT OF ENGINEER TAPE

An extensive amount of engineer tape is used to mark the initial layout of a standard pattern minefield. Engineer tape comes in 170-meter rolls and is used to mark the following portions of the minefield.

NOTE: In this example, only one lane and one roll of traffic tape are required.

Step 1.

Minefield boundaries depth X 2 = 300 X 2 = 600

Step 2.

Regular lettered strips front X number of regular strips = 200 X 8 = 1,600

Step 3.

IOE front + (number of IOE clusters X 3) = 200 + (23 X 3) = 269

Step 4.

Lanes and gaps depth X 2 X number of lanes and gaps = 300 X 2 X 1 = 600

Step 5.

Traffic tape depth X number of traffic tapes 300 X 1 = 300

Step 6.

Trip wire safety tape front X number of regular strips with trip wire 200 X 3 = 600

Step 7.

Total amount of tape for each portion of minefield = (Add Steps 1 through 6) = 600 + 1600 + 269 + 600 + 300 + 600) = 3969 meters

Step 8.

Add 20% excess total amount of engineer tape of MF X 1.2 3,969 X 1.2 = 4,762.8 = 4,783 (round up)

Step 9.

Total number of rolls total amount of engineer tape, in meters, from Step 8 ÷ 170 meters/rolls 4,763 meters ÷ 170 = 28.01 = 29 rolls

PART 9. NUMBER OF SANDBAGS

To determine the number of sandbags for the removal of spoil.

Step 1.

Number of clusters in IOE (Step 1, *Number of Mines*) = 23

Step 2.

Number of clusters in minefield = number of clusters in IOE X 3 X number of regular strips (Step 4, *Number of Regular Lettered Strips*)

23 X 3 X 8 = 552 (round up)

★ *Figure 3-8. Step-by-step procedures for completing the Minefield Requirements Computation Work Sheet (continued)*

Step 3.

Total number of clusters (add Steps 3 and 4) = 474

Step 4.

Number of sandbags = number of clusters X 3 sandbags/cluster

(Step 3 X 3) + 575 X 3 = 1725

Figure 3-8. Step-by-step procedures for completing the Minefield Requirements Computation Work Sheet (continued)

Table 3-1. Platoon organization and equipment

Personnel	Officer	NCO	EM	Equipment
Supervisory personnel	1	1		Officer: Map, lensatic compass, notebook, and minefield record forms NCO: Map, notebook, and lensatic compass
Siting party		1	3	Stakes or pickets, sledgehammers, engineer tape on reels, and nails to peg tape
Marking party		1	2	Barbwire on reels, marking signs, lane signs, wire cutters, gloves, sledges, pickets, and a picket pounder
Recording party		1	2	Sketching equipment, lensatic compass, minefield record forms, map, and metric tape
First laying party		1	6-8	Notebook for squad leader, picks, shovels, and sandbags
Second laying party		1	6-8	Same as first laying party
Third laying party		1	6-8	Same as first laying party
Totals	1	7	25-31	

One laying party is responsible for installing, arming, and camouflaging all mines on a strip or portion of a strip. Each laying party is then assigned additional strips.

The recording party obtains necessary reference data, prepares DA Form 1355 (see Chapter 5), and installs intermediate markers when needed. All distances are recorded in meters.

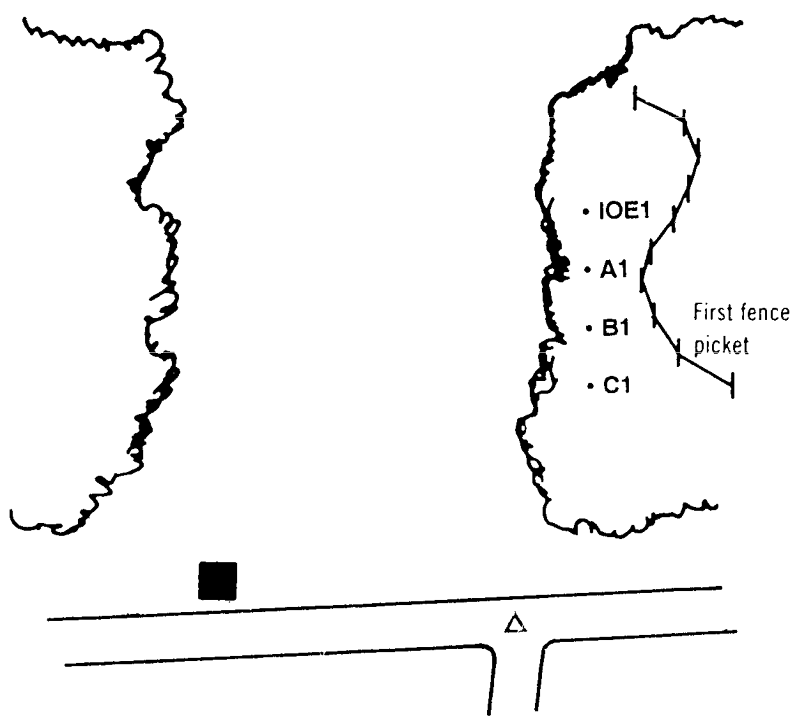
The marking party erects fences and signs to mark minefield boundaries and lanes. After completing marking, it augments other parties.

The platoon mine emplacement procedure is shown in Figure 3-9. In the illustration, the minefield is laid from right to left.

Platoon Mine Emplacement Procedures

The OIC arrives at the site with the siting and marking parties. He goes to the right or left (depending on direction of lay) rear boundary of the field. This part of the minefield is farthest from the enemy. The OIC indicates the starting point of the rear strip (this is strip C in a three-strip minefield), and the siting party drives a boundary stake to mark the location.

The OIC designates a starting point for the marking party at least 15 meters to the right of the boundary stake. He indicates where the minefield marking fence should be placed. The marking party immediately begins to install fence pickets, working in a counterclockwise direction.



★ *Figure 3-9. Platoon mine emplacement procedures*

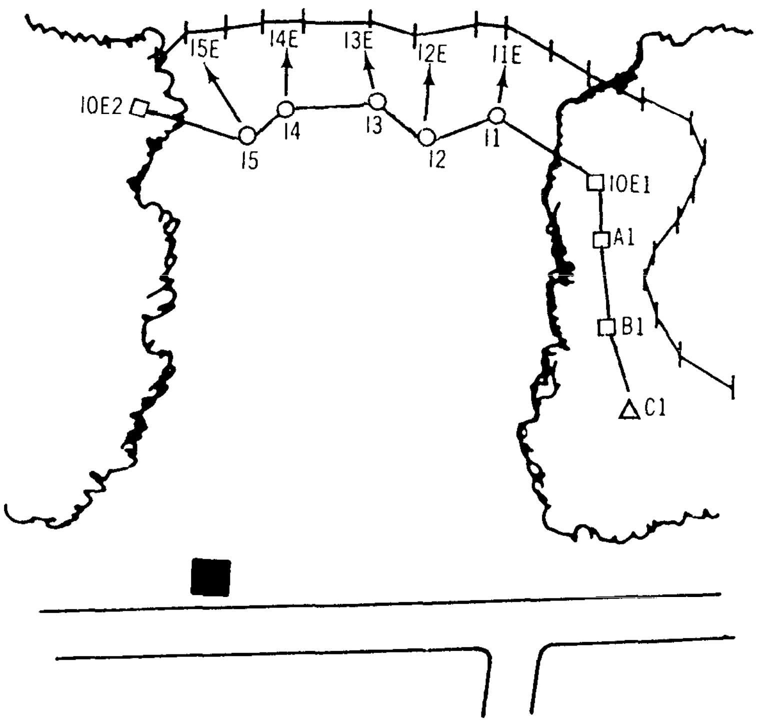
When all pickets are installed, the marking party encircles the field with a single strand of barbwire (at waist height) and fixes mine signs. The second strand is then emplaced if required.

From the boundary stake of strip C, the OIC moves in the direction of the enemy and establishes the starting point of strip B. Strip centerlines should not be parallel nor less than 15 meters apart. Two members of the siting party drive a strip stake at the starting point of strip B, and the remaining two members begin to lay tape between the two stakes. They fasten tape to the ground at frequent intervals to prevent its movement. This procedure is followed until the boundary stakes of the three regular strips (C, B, and A) and the IOE on the right-hand side of the minefield have been installed.

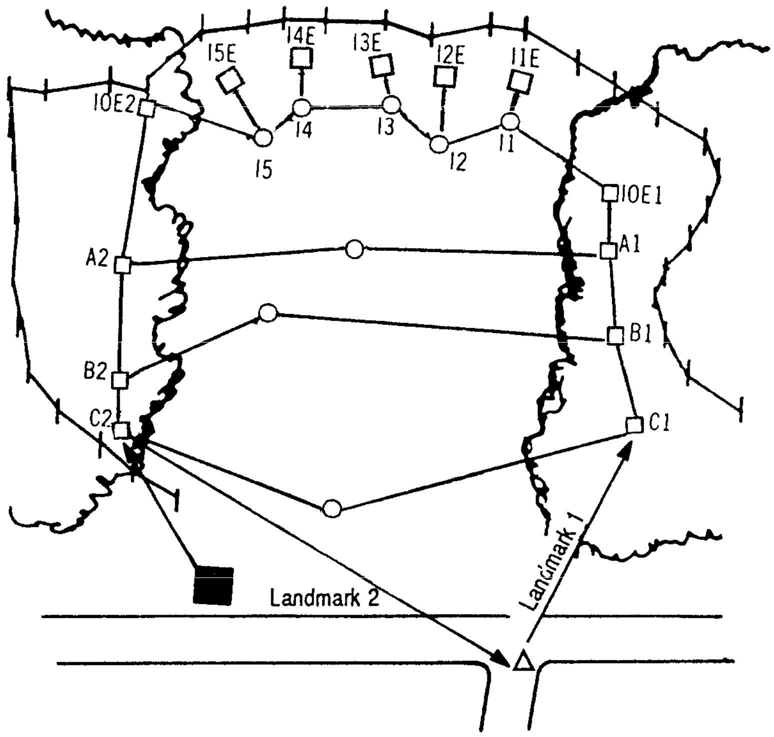
At the IOE boundary stake, the OIC gives the siting party a sketch of the minefield and instructions on siting the IOE baseline and the regular mine strip centerlines. The NCO and one other member of the siting party immediately begin setting stakes to indicate the IOE baseline. The centerline laying team lays the tape on the IOE baseline, leaving tape reels where tapes run out. At the same time, short strips extending from the IOE baseline are established. Each short strip ends with a stake that is designated as I1E, I2E, and so forth. Turning points are not used in short strips. (See Figure 3-10.)

Upon reaching the other IOE boundary, the NCO moves away from the enemy side, establishes the left boundary stake of strip A, stakes out strip A, and repeats until all strip centerlines are taped. All stakes are driven flush with the ground. (See Figure 3- 11.)

★ While the IOE is being taped, the recording party begins obtaining reference data for the Minefield Record. He starts from landmark 1 designated by the OIC and proceeds to C1 working behind the siting party. Once C2 has been sited, he proceeds from landmark 2 to C2 to establish distance and azimuth. Finally, he ties both C1 and C2 to both landmarks in the event one of the landmarks is removed/destroyed. The amount of detail obtained by the recording party depends on the tactical



★ *Figure 3-10. Short strips*



★ *Figure 3-11. Stakes driven flush into the ground*

classification of the minefield and any special orders. Aerial photographs taken of the minefield before the tracing tape is removed become valuable supplements to the Minefield Record.

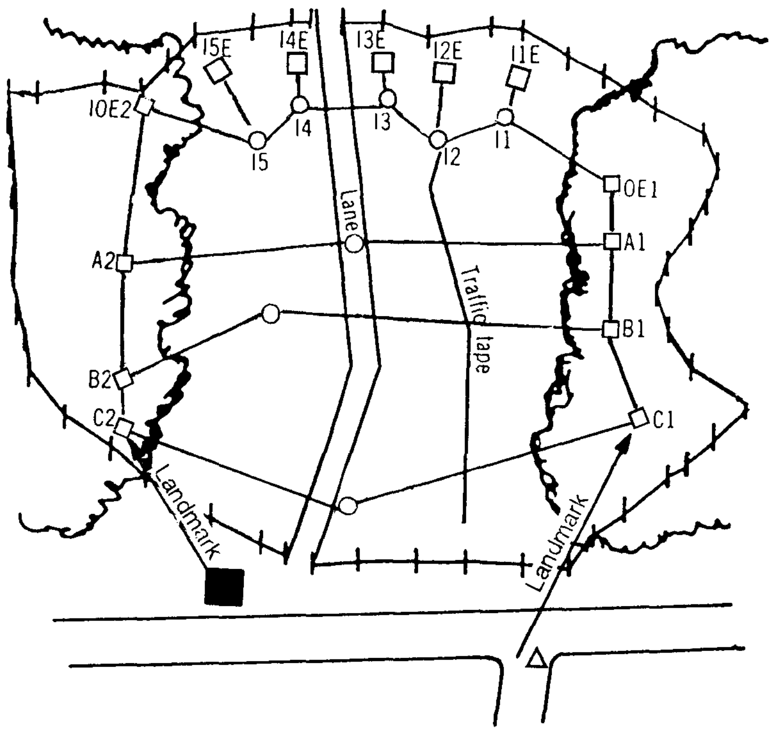
As soon as laying parties arrive at the site with mines, they establish mine dumps behind the field. AT mines are uncrated and stacked. Other types of mines are left in their crates with the crate lids removed. Fuzes and detonators are placed in separate boxes; fuze types are not mixed. Mine dumps are spaced a minimum of 150 meters apart.

When the siting party completes the centerline staking, it installs lane tapes and traffic tapes, respectively. Traffic tapes are used by mine-laying personnel to assist in camouflage and to reduce the amount of traffic on strip center-lines. Traffic tapes are laid approximately perpendicular to the minefield trace at about 100-meter intervals. Tapes to mark lanes for tactical vehicles and patrols are also laid out. (See Figure 3-12, page 3-22.)

Emplacement Along a Standard Minefield Strip

The laying party must know the cluster composition of the strip, the location of any omitted clusters (due to terrain features), and future lane locations. When the centerline tape for a regular strip has been installed, the NCOIC designates all party members (except two) as layers to emplace the mines in the ground. The remaining two soldiers (usually the most experienced) are designated as fuzers and are responsible for arming mines. Layers pick up the maximum load of mines to be used as base mines in the clusters. Fuzers carry all fuzes and detonators.

The NCO then moves to the right or left boundary stake of the strip (depending on which direction the minefield will be installed) and organizes the layers into one column to the rear of himself and directly on the strip centerline. He measures 6 meters along the centerline for the first cluster and, pointing perpendicular from the centerline and in the direction of the



★ *Figure 3-12. Lay out tapes to mark lanes for tactical vehicles and patrols*

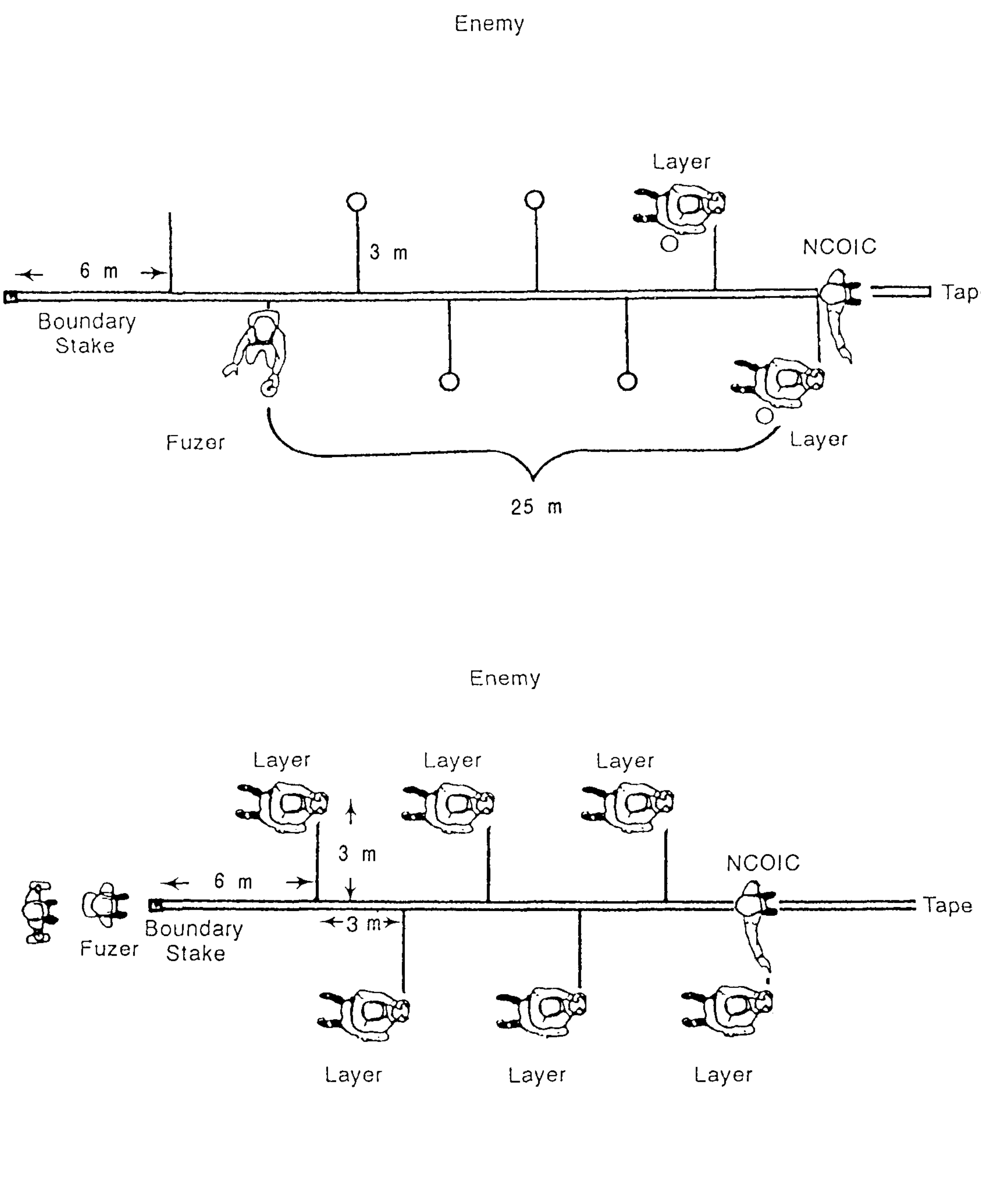
enemy, indicates the placement of the base mine. The first layer on the enemy side places a mine on the ground 3 meters from the centerline.

The NCO measures 3 more meters and indicates the placement of the second base mine on the opposite (friendly) side of the strip. The first layer on that side places a base mine on the ground. As the initial load of mines is laid, each layer returns to the nearest mine dump for another load. Fuzers follow behind the layers and insert the mine fuzes but do not arm the mines. This procedure is followed until the boundary stake on the far side of the minefield is reached.

The NCO tells layers the number and types of mines to be placed next to the base mine in each cluster. As AP mines are being placed, the NCO proceeds along the strip and ensures the proper number of AP mines are placed in each cluster. The NCO places a spool of trip wire next to mines that are to be activated by it.

When all mines are positioned in clusters, layers draw shovels and return to the starting boundary markers. One layer is assigned to dig holes for all mines in each cluster. The spoil from the holes is placed in sandbags and left beside the base mine at each cluster. Each layer checks the positioning of mines in the holes but leaves the mines beside the holes, not in them. The layers also anchor any trip wires with nails or stakes and wrap loose ends around fuzes. When digging has progressed at least 25 meters from the starting point, the arming operation begins. Fuzers arm all mines in a cluster, beginning with the mine farthest from the centerline and working back. They place all mines in holes, attach trip wires, and arm and camouflage mines. They place filled sandbags on the centerline of the strip opposite the base mine. Fuzers keep their back toward the centerline. Other personnel maintain a minimum distance of 25 meters from the fuzers. (See Figure 3- 13.)

Mines located in lanes are not initially buried but are placed to the side to prevent confusion in counting clusters. Mines may be buried later when the lane is closed. Upon completing the arming operation, fuzers give safety clips to the NCO, who verifies that all mines have been armed and camouflaged. Upon verification, the NCO checks the strip and ensures sandbags, tape, and debris are picked up. Safety clips



★ *Figure 3-13. Maintaining a minimum distance of 25 meters from the fuze* are then turned over to the platoon sergeant, who buries them 30 centimeters to the rear of the start of strip marker.

All mines and other explosive items are recorded against the party to which they are issued. They are summarized on a Mines Tally Sheet. (See Table 3-2.) If more than one mine dump is established, a Mines Tally Sheet is kept at each dump and the information is later transferred to a Master Tally Sheet.

The platoon sergeant is responsible for ensuring that the number of mines used per tally sheets is entered on the minefield record.

When a lane is no longer required through a minefield, it is sealed by a sealing party that consists of one NCO and two other soldiers. Before sealing starts, the party NCOIC checks the minefield record to ascertain the—

- Width of the lane to be sealed.
- Cluster composition of each strip and total number of mines required.
- Number of strips that intersect the lane.
- Azimuth of each strip and distance between strips along the lane centerline.
- Location of the mine dump.

The procedure for sealing is as follows:

- Party moves along the safe lane centerline until it arrives at the strip/safe lane marking picket. (See Figure 3- 14.)
- NCO lays out a strip centerline tape and a side tape on both sides of the safe lane to mark its boundaries. (See Figure 3- 15.)

Table 3-2. Example of a Mines Tally Sheet

		Types of Mines				
Strip	Movement of Mines	M15	M16	M14	Trip Wire	AHD Type
(a)	(b)	(c)	(d)	(e)	(f)	(g)
IOE Strip	No. forecast	23	46	46	--	--
	No. issued	23	46	46	--	--
	No. returned	--	--	--	--	--
	No. used	23	46	46	--	--
Strip A	No. forecast	81	154	154	35	--
	No. issued	81	154	154	35	--
	No. returned	7	6	6	9	--
	No. used	74	148	148	26	--
Strips B, C, D, and so forth	No. forecast					
	No. issued					
	No. returned					
	No. used					
Total	No. forecast					
	No. issued					
	No. returned					
	No. used					

Date _______ Rank _______ Name ______________________ Signature ______________________

- Clusters are laid.
- Side tapes and the safe lane centerline are recovered.
- Above steps are repeated at successive strips.
- NCO amends the minefield record.

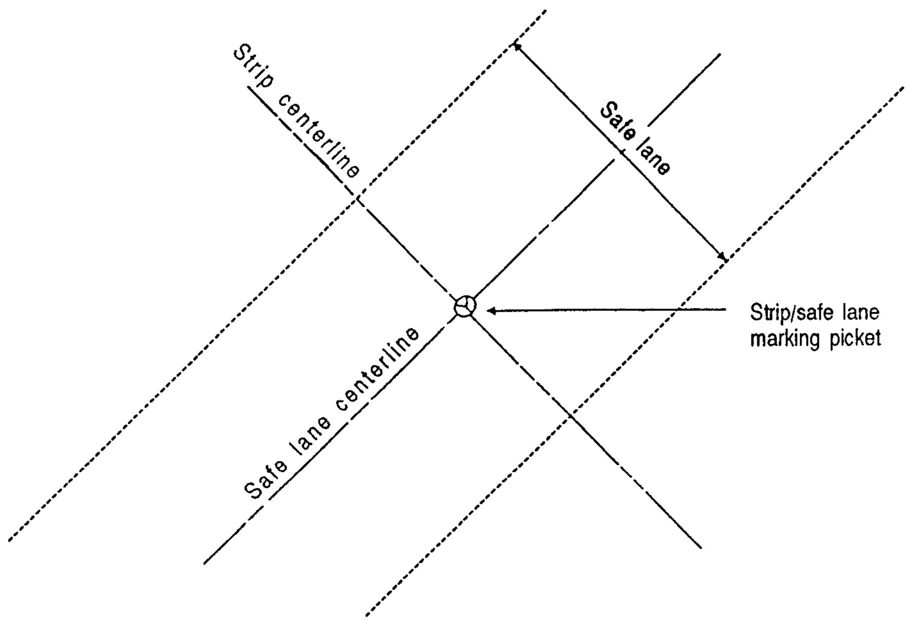


Figure 3-14. Sealing a lane - strip/safe lane marking picket

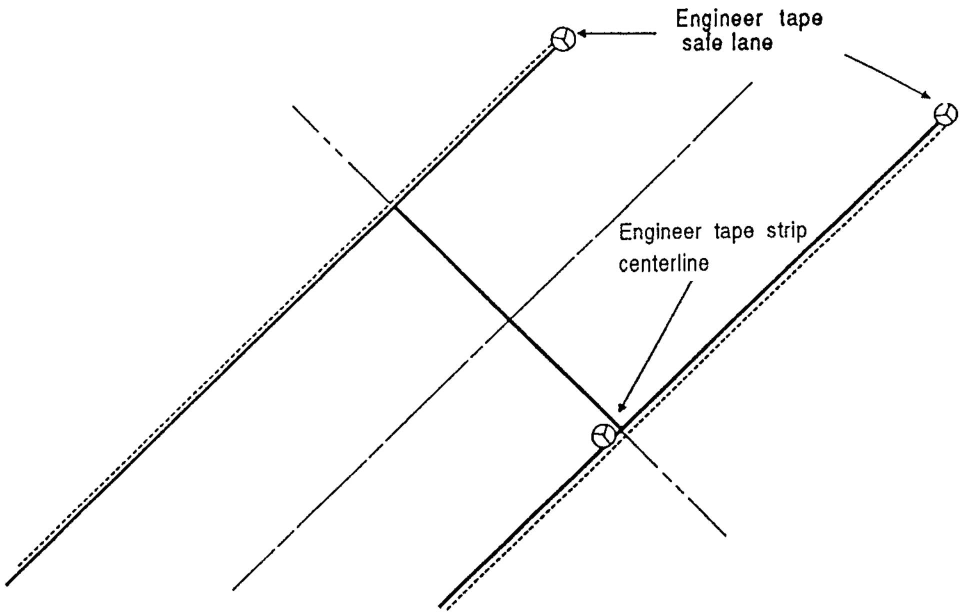


Figure 3-15. Sealing a lane - laying out the tapes

When gaps have to be sealed, fences are temporarily erected along the side boundaries. They are removed later to avoid indicating a passage through the field.

Party NCOICs do not act as working members; they ensure that—

- No one moves back into a mined area.
- Any irregularity (such as an omitted cluster) is recorded.
- All safety devices are recovered and checked against the minefield record.

Safety tapes are used to facilitate laying trip wires and to ensure a safe exit from the minefield. They create a network of safe routes to an area outside the minefield. When trip wires are used, safety tapes are laid between strips where the trip wire will be positioned (including Strip A and IOE baseline). If trip wires are not used, safety tapes are recommended but are not mandatory. Safety tapes may be removed progressively but are normally left in place until the minefield is complete.

NUISANCE MINEFIELDS

Factors Affecting Siting

Take the following factors into consideration:

- Effort needed by the enemy to bypass a mined area, either locally or by using alternative routes.
- Importance of an area or a route to the enemy.
- Goal achievement (maximum casualties/morale effect; minimum effort).
- The more ingenious the methods of concealment are, the longer it will take to lay mines.

Observation and covering fire are not essential and will seldom be feasible for nuisance minefields. Their value depends on effective siting and concealment to cause surprise.

Siting

The minefield OIC is responsible for detailed siting and design of a nuisance minefield. He must consider the minefield from the enemy's point of view and assess the courses open to the enemy when he encounters it. Such considerations may expose weakness in the initial plan and bring about a change to the proposed minefield layout or may lead to a decision to site the minefield elsewhere.

Location

In wooded or hilly country, the enemy's logistics transport will usually be confined to existing axial routes. Nuisance mines at selected sites along roads can impose considerable delay on the enemy and have a cumulative effect on his resources and morale. In open country, axial mining will not be very effective. The best sites for axial mining are—

- Natural defiles or constructed areas which are difficult to bypass (cuts, embankments, causeways, fords, forest tracks, and built-up areas.
- In the. vicinity of road craters, AT ditches, or any obstacles that have to be cleared.
- Around culverts.
- Demolished bridges, including likely adjacent crossing places and alternative building sites—particularly on the home bank.
- Likely assembly areas.
- Covered approaches or dead space.
- In the vicinity of fuel, supplies, or engineering material stocks that the enemy needs and that cannot be destroyed or removed.

- Railroads. The best places for mining are in or near culverts, bridges, sharp turns, tunnels, and steep grades. Lay mines where enemy trains cannot bypass the mined area on branches or spurs.

Laying

There is no absolute requirement for recording the precise location of individual nuisance mines. The practice of merely locating them in a defined boundary is used only when authorized. Recording mine positions that are laid to a pattern is easy and quick. Pattern laying should be used whenever it can be done without prejudicing concealment. When the number of mines to be laid on the site makes it impracticable or undesirable to lay mines in a pattern, they may be scatter-laid (provided their exact location is recorded) unless otherwise directed. Scatter laying by hand is useful in road blocks, bridge abutments, and craters when it would be difficult and wasteful to lay mines in a pattern. Again, scatter laying along routes to be denied to the enemy will add considerably to the delay imposed. All available types of AT and AP mines are used to make minefields complex and difficult to remove. Mine type combinations should be varied constantly so that each minefield presents a clearance problem. Deeply buried mines can be included; however, they take much longer to lay. These mines may be worthwhile around craters where the enemy is likely to need earthmoving equipment.

Laying Rules

If a nuisance minefield is laid to the standard pattern, standard procedures are followed. If mines are selectively positioned, procedures must be tailored to suit the situation. In all occasions, however, the following rules should be observed:

- The intended position for each mine is clearly marked on the ground before laying begins. If mines are used to indicate positions, they are clearly marked with a mine marker or tape.
- Laying parties work in pairs. Each pair is detailed to lay specific mines.
- The laying OIC briefs the pairs and clearly indicates the route they are to follow and the order in which mines are to be laid.
- If laying is done at night or if there is a chance pairs may stray from the indicated route, safety tapes are laid.
- Work is organized so the distance between each pair of men is a least 25 meters.
- If booby traps, AHDs, or trip wires are used, one member of the pair withdraws and the remaining member arms the mine. Mines are not armed until the order to do so is given by the OIC.

INSPECTION, MAINTENANCE, AND HAND OVER OF MINEFIELDS

Technical Inspection and Maintenance

Mines left in the ground for a long time may deteriorate and malfunction for one or more of the following reasons:

- Moisture may have entered the igniter or body of the mine and either neutralized the explosive or corroded the metal parts. Such action may be aggravated by local factors (soil acidity or wide temperature swings).
- Frost or heat may have subjected the mine to mechanical strain and caused distortion.
- Insects or vegetation may have caused obstructions.
- Animals may have turned mines over or detonated them.

Technical inspections should only be made by experienced engineers or EOD personnel. When a minefield deteriorates below the operating level, additional mine strips/rows are added to restore its effectiveness. They are sited to the front or rear of the existing minefield to increase its depth. The new mine strips are treated as a separate, additional minefield.

Technical inspections of minefields are nor-really done at three-month intervals. They are done more frequently during extreme weather conditions.

Minefield Hand Over

Minefield hand over is an extremely important task. Listed below are several items that need to be addressed between emplacing and over-matching units.

- Discuss minefield composition.
- Discuss minefield extent and walk/ride the minefield trace.
- Discuss friendly minefield marking.
- Discuss lane closure, if applicable.
- Train unit on how to close lane, if applicable.
- Discuss obstacle protection against enemy dismounted patrols.
- Sign over written report.
- Discuss indirect fires.
- Report completion of hand over to higher engineer headquarters.
- Forward written minefield report.

CHAPTER 4
ROW MINING

CONSIDERATIONS

Row mining is the process of laying mines in rows as opposed to laying them in a standard or random pattern. The typical row minefield is several rows of regularly spaced mines.

Use of Row Mining

Row mining is not a new idea. It has been used since the beginning of modern mine warfare and has proved to be very effective. It is especially effective in support of maneuver-oriented doctrine such as AirLand Battle. Row mining is faster than standard pattern mining. It improves the maneuver commander's flexibility by providing him an obstacle effort that requires smaller manpower effort than standard pattern mining.

Mines may be surface-laid or buried, and they are often laid directly from a slow-moving vehicle. This reduces time and personnel required to emplace a minefield. Soldiers can emplace row minefields from an armored vehicle. Row minefields can be used as tactical obstacles or as situational obstacles. They are usually emplaced at or near the FLOT, along flank AAs to support security operations. The speed and efficiency of row mining make it a desirable option, and row mining supports AirLand Battle doctrine.

Rules for Row Mining

Rules governing authority, reporting, recording, and marking are generally the same for row minefields as they are for other minefields. Row mining is simply a method for laying mines.

The most important factor in row mining is the requirement for strict command and control. Row mining is potentially the most hazardous form of mine laying. It entails movement of vehicles and personnel in and around mines without the safety of a centerline strip. Leaders must place extreme emphasis on safety because the laying procedure is very rapid.

Only a few rules govern row mining. Most of these rules are in STANAG 2036, but the following rules also apply:

- Minimum distance between rows of AT mines is 8 meters.
- Minimum distance between any row and a row with AP mines is 15 meters.
- Clusters are placed on the row centerline, directed toward the enemy side. A cluster in row mining is usually one AT mine, but a cluster may also consist of AP mines.
  - Cluster composition must remain the same throughout the row.
  - Different types of AP mines may be used in a cluster.
  - Total number of mines in one cluster will not exceed five; no more than one will be an AT mine.
  - AT mine type may vary from one cluster to another.
  - A cluster of AP mines can be laid in a 2-meter semicircle on the enemy side of the base mine.

★ – When a cluster contains a mine equipped with an AHD, the mine is armed before the AHD is armed. The cluster is not armed until all personnel are at least 25 meters away.

- Spacing between mines or clusters can vary from 4 to 10 meters, but it will remain constant within the row.
- Mines or clusters will not be closer than 15 meters from the perimeter fence.
- The distance between a start row marker and the first mine in a row is the mine spacing for that row.
- If the distance between a mine or cluster and any turning point is less than the mine spacing for that row, omit that mine or cluster. The mine immediately following a turning point is always located at the mine spacing for that row.
- Record all minefields on DA Form 1355 (see Chapter 5). Figure 4-1, pages 4-3 and 4-4, shows a completed DA Form 1355 for a row minefield.
- Minefield marking and reporting are the same as for other minefield.

Row Mining Logistical Calculations

The following method is used to determine the number of AT mines required for a row minefield when not using the standard row minefields discussed at the end of this chapter. Resulting numbers are rounded up to the nearest whole number.

Step 1. Determine the number of mines required. Multiply the desired density by the minefield frontage.

Density X Frontage = Number of Mines

Step 2. Determine the number of mines per row. Divide the minefield frontage by the desired spacing interval between mines.

Frontage/Mine Spacing = Number of Mines per Row

Step 3. Determine the number of rows. Divide the number of mines by the number of mines per row.

Number of Mines/Number of Mines per Row = Number of Rows

Step 4. Determine the actual number of mines. Multiply the number of mines per row by the number of rows.

Number of Mines per Row X Number of Rows = Actual Number of Mines

Step 5. Determine the number of mines to request. Multiply the actual number of mines by 1.1 (includes 10 percent resource factor).

Actual Number of Mines X 1.1 = Number of Mines to Request

Step 6. Determine the number of vehicle loads by using Table 2-3, page 2-37.

Step 7. Determine the fencing and marking material required. Use the same procedure used for a standard pattern minefield.

Sample Problem

Your platoon has been tasked to emplace a 400-meter row minefield with a density of 0.5-0-0. You have decided to space the mines 6 meters apart. Determine the number of M15 mines to order and the number of 5-ton dump trucks required to deliver the crated or uncrated mines.

Step 1. Density X Frontage = Number of Mines

0.5 mines / meter X 400 meters = 200 mines

Step 2. Frontage / Mine Spacing = Number of Mines per Row

400 meters / 6 meters = 66.6 = 67 mines per row

~~SECRET~~ SAMPLE (when completed)

MINEFIELD - RECORD

SAMPLE

3	Copy No 1 of 4	Sheet No 1 of 1	
1	AUTHORITY: CG, 2ND INF. DIV.	2 DATE AND TIME — START: ~~100700~~Z JAN 92	4 MINEFIELD NUMBER: 2XX (INF) 2-E
	LAYING UNIT: 3RD PLT, B. Co, 2ND ENGR. BN.	COMPLETION: 101200 Z JAN 92	5 MAP: SERIES, NO. AND SCALE: H754 1:50,000
	OFFICER IN CHARGE: JOHN J. SMITH, 2LT 123-45-1111	RECORDER: SFC DON JOHNSON 987-65-1124	SHEET NO. (OR NAME): NJ201J MUNSAN

6 LANDMARKS

NO	COORDINATES	DESCRIPTION
1	UT 35817602	U-SHAPED PICKET FLUSH W/GROUND
1		ON NORTH CORNER ROAD JUNCTION
2	UT 36507719	U-SHAPED PICKET FLUSH W/GROUND
1		NORTH END OF ROAD CULVERT

7 INTERMEDIATE MARKERS

NO	DESCRIPTION
1	
2	
3	
4	

8 DESCRIPTION OF BOUNDARY FENCE OR MARKING: STANDARD MARKING FENCE: ONE STRAND CATTLE FENCE ON 3 SIDES OF MINEFIELD

9 NO. OF ~~STRIPS~~/ROWS: 6

DESCRIPTION OF ~~STRIP~~/ROW MARKERS: SHORT U-SHAPED PICKETS, BURIED WITH 6" ABOVE THE GROUND.

10 LANES

NO	WIDTH	HOW MARKED	METHOD OF CLOSING
1			
2			
3			

11 TACTICAL MINEFIELD ~~NUISANCE MINEFIELD~~ ~~PHONEY MINEFIELD~~

MINES — BURIED AND SURFACE LAID; ~~IN STRIPS~~ IN ROWS ~~W/O PATTERN~~

	ANTITANK MINES (AT) TYPE M21	TYPE M19	TYPE	TYPE	TYPE	TYPE	TOTAL AT MINES	ANTI-LIFT DEV	ANTIPERSONNEL MINES (AP) TYPE M16	TYPE	TYPE	TOTAL AP MINES
	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
10E	42						42					
A	76						76					
B	98						98		49			49
C	84						84		49			49
D	84						84					
E		96					96					
F		84					84					
G												
H												
J												
TOTAL	384	180					564		98			98

12 NOTES

1. MINE CLUSTERS AT 6 METRES/~~PACE SPACING~~
ALL DISTANCES IN MINEFIELD ARE MEASURED IN METERS.

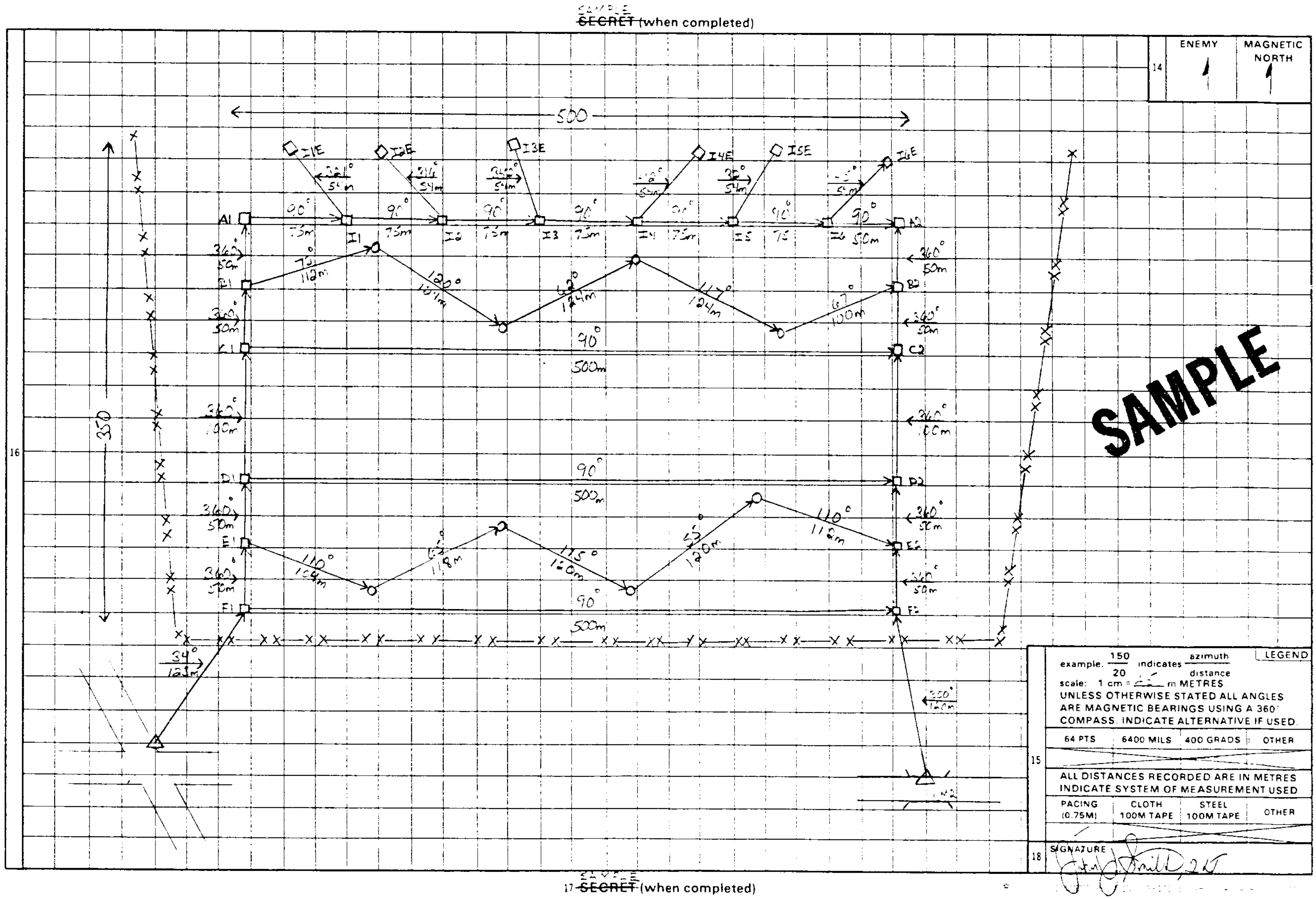
(2) NUMBER OF 10E LIVE CLUSTERS (ALL OTHERS NUMBERED BUT OMITTED). I1 (1-7), I2 (1-7), I3 (1-7), I4 (1-7), I5 (1-7), I6 (1-7). (3) NUMBERED OMITTED CLUSTERS IN REGULAR STRIPS; A: 12, 24, 36, 48, 60, 72 (10E SHORT STRIPS), B: NONE, C: NONE, D: NONE, E: NONE, F: NONE. (3B) OMITTED CLUSTERS FOR LANES OR GAPS: NONE (4) CLUSTERS WITH AHDs: A: NONE, B: 13, 22, 34 (M5), C: 11, 22, 65 (M5) D: 4, 17, 67 (M5), E: NONE, F: NONE. (5) CLUSTERS WITH TRIPWIRE ACTIVATED AP MINES: NONE (6) STRIP CLUSTER COMPOSITION: A, D, E, F (1-0-0); B, C (1-1-0) (M16 EVERY THIRD CLUSTER. (7) LOCATION OF SAFETY CLIPS/PINS BURIED 30 CM BEHIND START ROW MARKER. (8) LOCATION OF MINES FOR CLOSING LANES AND GAPS: NONE.

13 SIGNATURE (OFFICER IN CHARGE): John J. Smith, 2LT DATE: 10 Jan 92

DA FORM 1355, MAR 87
EDITION OF JUL 87 IS OBSOLETE

~~SECRET~~ SAMPLE (when completed)

★ *Figure 4-1. Sample DA Form 1355 for row minefield*



★ *Figure 4-1. Sample DA Form 1355 for row minefield (continued)*

Step 3. Number of Mines / Number of Mines per Row = Number of Rows

200 mines / 67 mines per row = 2.98 = 3 rows

Step 4. Number of Mines per Row X Number of Rows = Actual Number of Mines

67 mines per row X 3 rows = 201 mines

Step 5. Actual Number of Mines X 1.1 = Number of Mines to Request

201 mines X 1.1 = 221.1 = 222 mines

★ Step 6. Mines Requested / Crated Mines per 5-Ton Dump Truck (see Table 2-3, page 2-37) = Number of Trucks

222 mines / 204 mines per truck = 1.08 = 2 trucks

Task Organization

To maximize the efficiency of the row mining process, the platoon leader must task-organize his platoon. The organization of the task, as a whole, is intricate and places great demands on the leader. Because each situation is different, leave nothing to chance when planning and executing a row minefield. Make allowances for transporting, handling, and controlling the mines. The officer and squad leaders must be able to exercise control throughout the task under all conditions and during darkness. Always observe safety.

Organize the platoon into the following parties: *siting and recording, marking, mine dump,* and *laying.*

Siting and recording party. The platoon leader directs this party and is responsible for siting, recording, and reporting the minefield. This party consists of one or two soldiers and a vehicle to carry material. (If a vehicle is not available, increase the party to three soldiers.) Because siting is usually done in daylight, take appropriate physical security measures. Start well ahead of the actual laying and set out all control markers. Avoid using sharp turns. The distance between intermediate markers in a row depends on terrain, but it should not exceed 100 meters. Mark vehicle traffic routes to and from the rows. When siting is complete, task the soldiers to perform other tasks. The platoon leader supervises minefield laying.

Marking party. This party is composed of an NCOIC and personnel not working as members of other teams. After the minefield is sited, the marking party emplaces fence posts, wire, and marking signs.

★ **Mine dump party.** This party is controlled by an NCOIC and is composed of personnel not working as members of other teams. It is responsible for setting up vehicle mine sets at the mine dump and hauling more mines as required. If mines are delivered by the tailgate method, personnel will reload vehicles. They may uncrate mines if necessary. They will create vehicle sets by setting aside the number of mines and separated fuzes required by each vehicle, loosening then hand- tightening arming or shipping plugs, helping load mines onto laying vehicles, and disposing of residue. They may also assist the marking party or provide local security. For initial vehicle loads, the mine dump party may be assisted by laying squads to speed up the process.

Laying party. This party consists of an NCOIC (laying leader), four soldiers, and a vehicle to carry mines. The laying leader controls the movement of each laying vehicle. He directs each vehicle to start and stop laying and controls immediate action drills.

NOTE: Using tilt-rod fuzes requires more soldiers to stake mines, insert fuzes, and arm mines.

When laying three rows at once, each laying party consists of three armored personnel carriers (APCs) (labeled 1, 2, and 3) and the following teams:

Carrier team. This team is composed of the APC driver and the track commander (TC). They keep the APC on the proper course and speed.

Sapper team. This team is composed of the squad leader and remaining squad members. It provides personnel to lay and arm mines. Each soldier carries wrenches and fuzes. If laying AP mines, the arming party positions and arms them. The squad leader supervises laying. Task personnel not needed for laying to other parties.

Digging team. This party consists of an NCOIC and several soldiers equipped with suitable digging tools. If mines are surface-laid, there is no digging party. Increase the arming party by two to speed up the laying process or task personnel not needed to other parties.

Site Layout

General. Once the platoon leader has coordinated the location of the minefield(s) with the maneuver commander, siting can begin. Siting is the first step in the actual laying process. Siting is done for safety and control. Although the minefield may be emplaced at night or during limited visibility, the siting party should site the minefield under favorable conditions, preferably during daylight. Siting consists of identifying landmarks; establishing routes; and emplacing start, end, and intermediate row markers. Actual control measures (stake or picket) should not stand out to such an extent that they give away the minefield orientation but must be easily discernible to the laying party.

Considerations. Certain features, like thick woods and deep, wide streams, are natural obstacles. Mine rows should be laid to reinforce terrain and increase effectiveness of the minefield.

Mine rows. Mine rows are labeled with a letter. Row A is nearest to the enemy, followed by rows B, C, D, E, and so forth. Rows should be laid in this order. When laying tactical minefields, each row has a start and end row marker. Intermediate markers may be required depending on row length and terrain. Platoon leaders consider the number of laying vehicles to be employed. The preferred technique is to use three vehicles so three rows can be laid simultaneously. Using more than three vehicles is beyond the command and control capabilities of a platoon and is not considered. The distance between rows is determined by the following factors:

- Depth and density of the minefield.
- Terrain.
- Suitability of the ground for use of laying vehicles.
- Desired obstacle intent.

NOTE: Standard row minefields discussed later in this chapter use a distance of 50 meters between rows.

Mine spacing. The minefield OIC decides mine spacing. Desired density, availability of laying vehicles, number of rows, and possibility of sympathetic detonation (see Table 2-1, page 2-33) affect the distance between mines.

NOTE: Standard row minefields discussed later in this chapter use a mine spacing of 6 meters.

★ **Control measures.** Laying vehicles are guided by row mining control measures. All personnel must be familiar with control measures. Control measures should be constructed of different markers from the start and end row markers and from intermediate markers. (For example, use VS17 panels on poles for start and end row markers and use an M133 hand-emplaced minefield marking set (HEMMS) poles with flags for intermediate markers.) Use intermediate markers to make the following control measures:

NOTE: All control measures are not required for each row minefield.

- ★ Start row marker.
- Start laying (first intermediate marker after start row marker).

- ★ Intermediate markers should be used between last marker and next visible point more than 100 meters away.
- Change of direction or turning point (three markers— first is warning, second is turning point, and third is new direction marker).
- ★ Stop laying marker.
- ★ End row marker.

Materials used to construct control measures include—

- U-shaped pickets.
- HEMMS poles.
- Wooden posts.
- Steel rods.
- Engineer tape.
- VS17 panels.

Control measures for laying mines at night require lights or infrared equipment as follows:

- Chem-lights placed in U-shaped pickets or hand-held.
- Directional flashlights taped in U-shaped pickets or hand-held.
- HEMMS lights used with U-shaped pickets or poles.
- Lights from minefield marking set #2.
- Infrared reflectors.

Procedures for site layout. The minefield OIC arrives on site with the siting and recording party. He selects landmark 1 and then sites the left (or right) boundary fence and start row markers. The siting and recording party takes distances and azimuths to be used in preparing the recording form. If the tactical situation permits and the marking party is ready, the siting and recording party emplaces the fence.

★ If the minefield is to have a separate IOE strip, the siting and recording party proceeds across the IOE and establishes I1, I1E, I2, I2E, and so on until he reaches the end. Personnel proceed down the right (or left) boundary and emplace start row marker A1. Proceeding from Al toward A2, they place intermediate markers as required. When they reach A2, they emplace the end row marker and repeat the procedure from B1 to B2, Cl to C2, and so on until they emplace all required control measures (Figure 4-2, page 4-8). They establish landmark 2 and the left (or right) rear fence location. They site in mine dumps near the minefield. It is also permissible to lay the IOE off row A if both the IOE and row A are buried. The party laying row A sites and records the IOE during laying as described in Drill 2 below.

Mine-Laying Vehicles

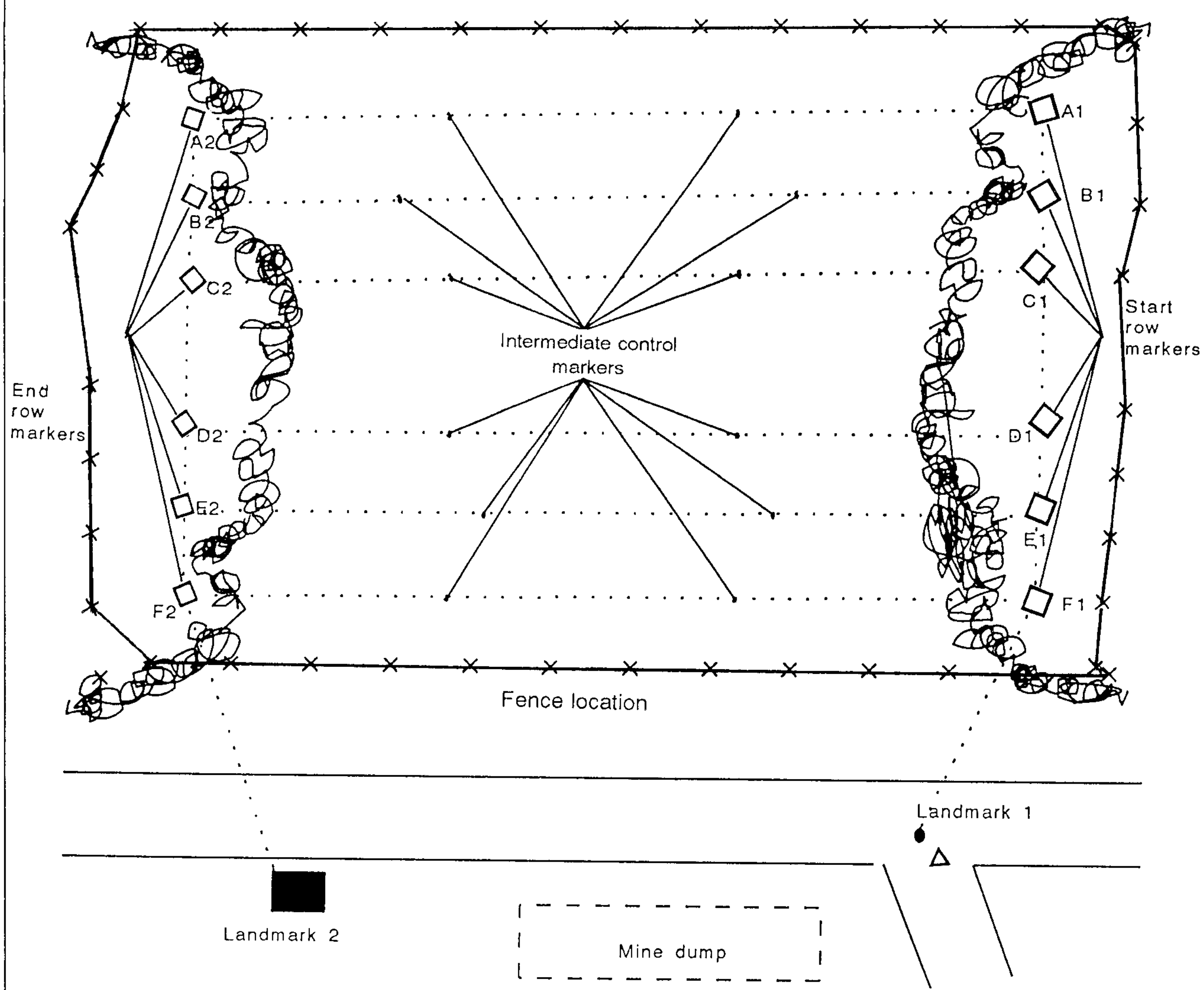
★ Soldiers normally lay row minefields from a vehicle to speed up emplacement. Use any tactical or wheeled vehicle for mine laying. Consider vulnerability, capacity, and trafficability when selecting a vehicle. Before preparing vehicles for mine laying, drive them in random patterns across the minefield before it is emplaced. The random pattern deceives the enemy by masking the actual laying vehicle pattern. Preparation includes loading mines. Load enough mines so each vehicle can complete an entire row or rows before reloading, but do not stack fuzed mines more than two high.

Laying a Row Minefield

★ A platoon usually emplaces a row minefield using three vehicles. The following two drills demonstrate how to lay the minefield as a platoon and as a squad in the laying platoon.

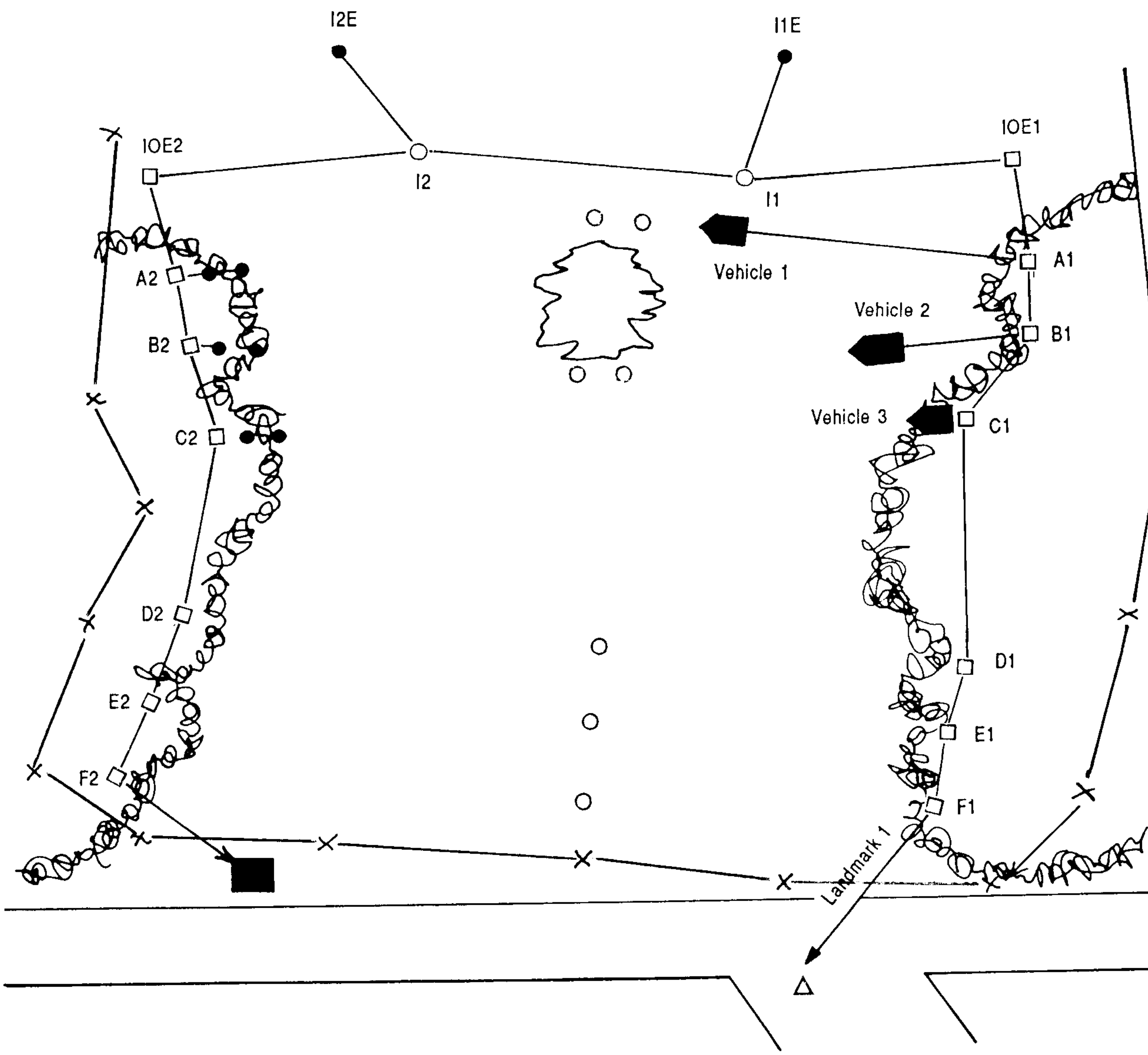
Drill 1.

Squad vehicles arrive on site and proceed down the right (or left) boundary of the minefield to their assigned row. (A separate party must be detailed to install the IOE.) At the start row marker, the squad vehicle moves into position and prepares to lay mines. The squad leader for row A tells vehicle 1 to move out. Mines are laid on the ground at the required spacing along the line of control markers positioned by the siting and recording party. As mines are laid, the arming party moves behind the vehicle and arms the mines. They remove temporary control measures installed by the siting and recording party. When vehicle 1 moves a

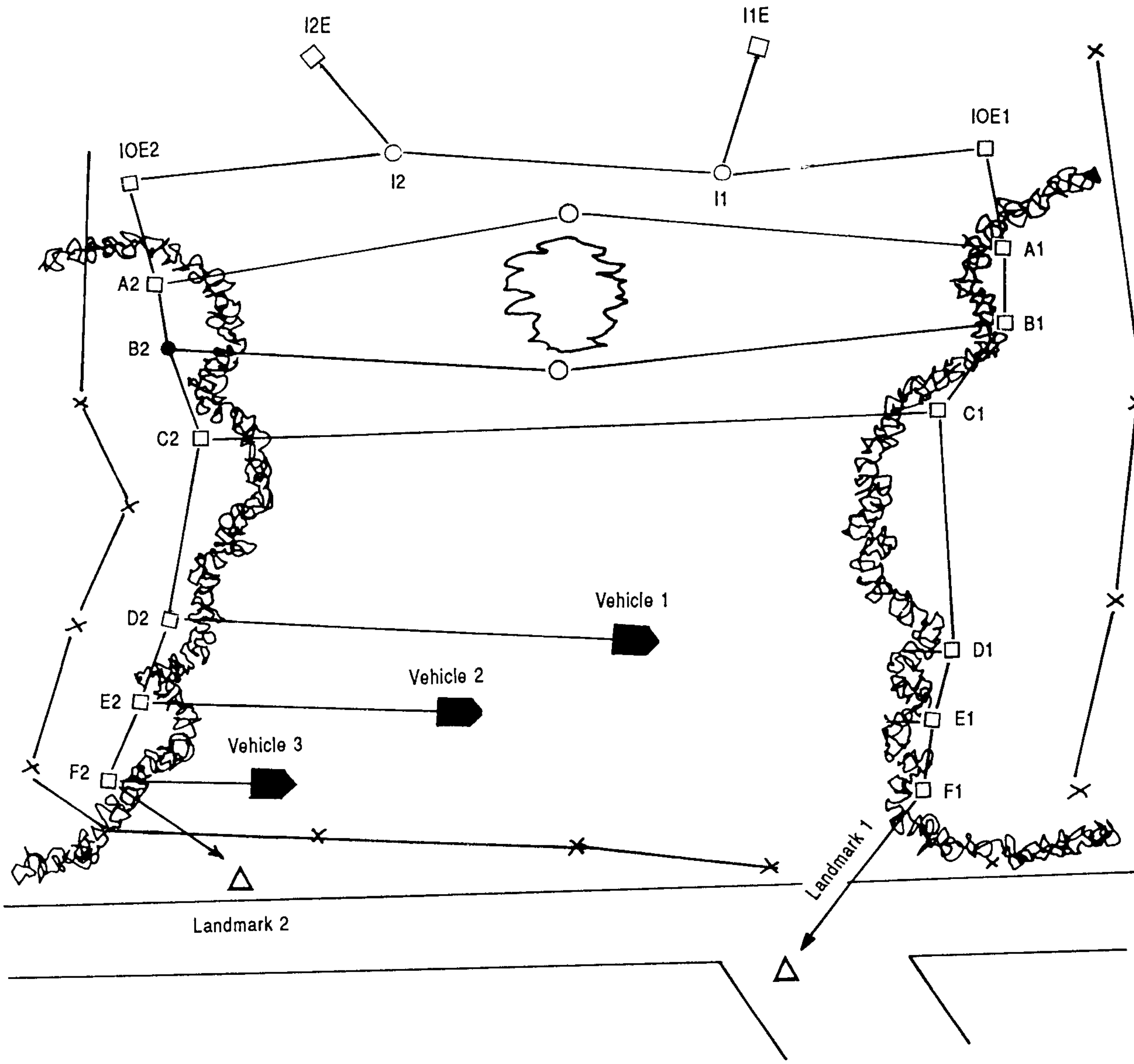


★ *Figure 4-2. Row mining—site layout*

★ safe distance (approximately 25 meters) down row A, vehicle 2 begins to lay mines on row B. When vehicle 2 moves a safe distance down row B, vehicle 3 begins to lay mines on row C. The marking party continues to emplace the left and right boundary fence (see Figure 4-3). The OIC completes the recording form. The IOE party exits the minefield outside the left or right boundary after it completes the IOE. As vehicles 1 and 2 finish their assigned rows, they move past the end row marker and execute a left (or right) turn and wait for vehicle 3 to complete its row. All vehicles move in column down the left (or right) boundary to their next assigned row. The process of laying and arming mines is repeated, this time in the opposite direction (see Figure 4-4, page 4- 10). After vehicles 1 and 2 have completed their second row, they execute a right (or left) turn and wait for vehicle 3 to finish its row. All vehicles then exit the minefield down the right (or left) boundary and out the rear. The marking party completes the rear fence, and the OIC completes DA Form 1355 (see Figure 4-4).



★ *Figure 4-3. Laying a minefield*



★ *Figure 4-4. Laying a minefield (continued)*

Drill 2.

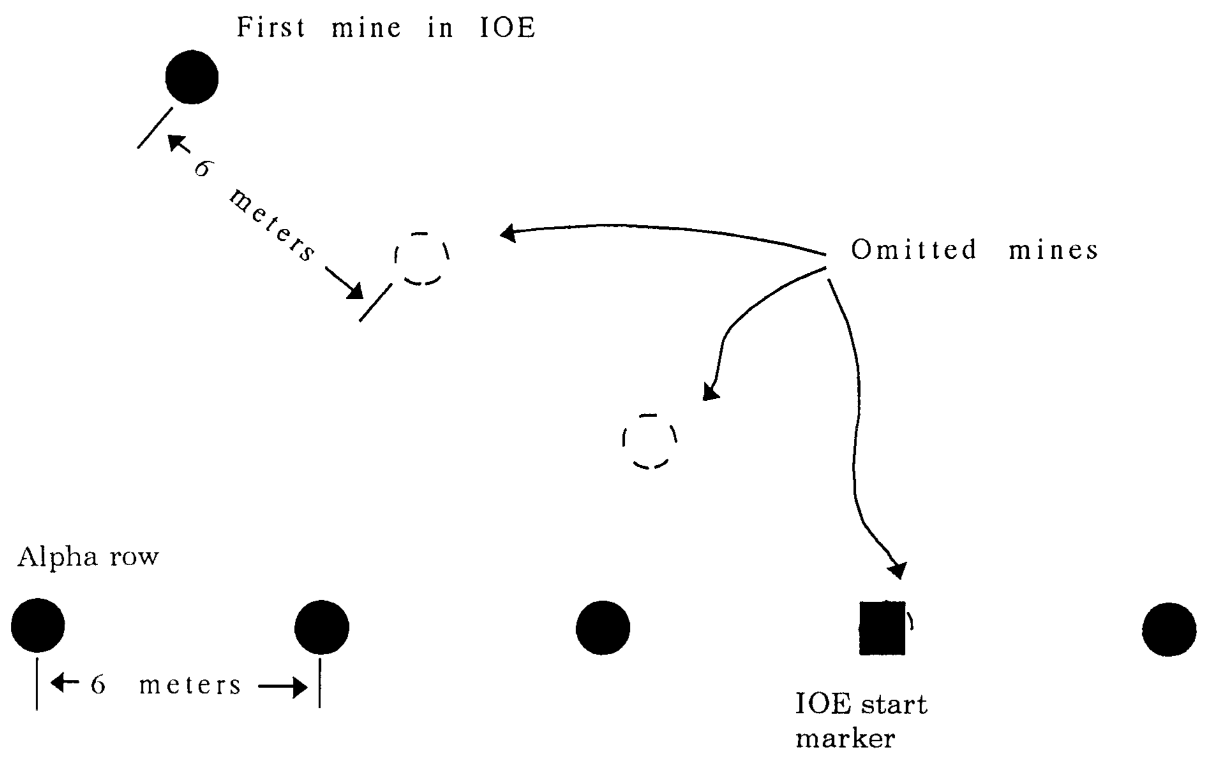
This drill may be used to speed up mine laying. However, to ensure security and safety, strict command and control is vital. This method is difficult to use when the terrain is rugged or when weather and visibility is subject to change.

This drill is conducted by three squad vehicles, each laying one row. Row B has turning points and rows A and C have none. If the minefield has six rows, row E has turning points and rows D and F have none. The squad leader (laying leader) in row B (and row E, if required) is in charge of the overall laying.

Squad vehicles arrive on site and proceed down the right (or left) boundary of the minefield to their assigned row. At the start row marker, squad vehicles move into position and prepare to lay mines.

The laying leader tells vehicle 1 to move out on row A. The sapper team lays mines on the ground at the required spacing. If an IOE is required, the row A team emplaces the IOE concurrently with row A and at the same mine spacing. Each IOE strip is laid after laying a predetermined number of mines in row A. For example, the platoon leader (or laying leader, if delegated) may require an IOE to be emplaced off every eighth mine. In that case, the squad laying row A would omit the eighth mine and place an IOE end marker instead. The laying party starts at the IOE end marker along an azimuth designated by the laying leader or squad leader, omits the first two mines in the IOE, and begins laying at the position of the third mine (Figure 4-5).

After mines are laid, the arming party moves behind the vehicle and arms the mines. They remove temporary control measures installed by the siting and recording party. The arming



★ *Figure 4-5. Laying IOE strip*

party must be distinguishable from everyone else. The last member of the arming party should wear a colored vest or carry a specific colored chem-light. No one will be allowed behind the last member of the arming party.

★ The NCOIC completes a strip feeder report on laid mines and gives the information to the recording party. The strip feeder report includes how many mines of what type were laid, what mines were omitted, azimuths of IOE strips and turning points, AHDs emplaced, and anything else the platoon leader requires.

Vehicle 1 moves down row A until the laying leader tells vehicle 1 to stop. The laying leader chooses vehicle stops to coincide with the location of turning points. Then the laying leader tells vehicle 3 to begin laying mines along row C. Vehicle 3 begins to lay mines on row C until the laying leader says stop (somewhere well past vehicle 1).Again, the laying leader chooses the vehicle stop at another turning point.

★ Vehicle 2 begins to lay mines on row B by heading toward vehicle 1. (At night or during low risibility, the squad leader in vehicle 1 has a soldier direct two red flashlights, held side by side, at vehicle 2. The driver of vehicle 2 drives toward the lights until he can distinguish the two lights or until the light holder turns them off.) When vehicle 2 is within 15 meters of vehicle 1 and is just about to place a mine, he stops and turns toward vehicle 3. Vehicle 2 then lays mines on row B by heading toward vehicle 3 in the same fashion as it headed toward vehicle 1. (At night or during low visibility, the light holder in vehicle 3 will have green lights.)

When vehicle 2 is about to lay its first mine, within 15 meters of vehicle 3, it stops and turns toward vehicle 1. The process continues as before until each vehicle reaches the end of its row (Figure 4-6).

NOTE: If the platoon leader feels that low visibility or other reasons preclude the use of vehicle positions as turning points, he may have the siting party emplace turning point markers (three intermediate markers) for vehicle 2 to guide on. In that event, the three vehicles will emplace mines simultaneously, and the laying leader will still control vehicle movement.

As vehicles 1 and 2 finish their assigned rows, they move past the end row marker and execute a left (or right) turn and wait for vehicle 3 to complete its row. All vehicles move in column down the left (or right) boundary to their next assigned row, if there is one. The process of laying and arming mines is repeated, this time in the opposite direction.

After vehicles 1 and 2 have completed their second row, they execute a right (or left) turn and wait for vehicle 3 to finish its row. All vehicles then exit the minefield down the right (or left) boundary and out the rear. The marking party completes the rear fence, and the OIC completes DA Form 1355. (See Figure 4-1, pages 4-3 and 4-4).

Immediate Action Drill

If the enemy attacks the platoon during minefield emplacement, the laying teams should execute the following drill. Sapper teams enter vehicles and recover the spacing sandbag. Vehicle 1 exits the minefield first by making a wide turn around the front of the other two vehicles. Vehicle 2 follows by making a wide turn around the front of vehicle 3. Then, vehicle 3 exits the minefield. The three squads conduct whatever immediate action drill the platoon leader has ordered.

Squad Drill

During row mining, the platoon usually uses three vehicles. Whether the platoon uses one or three vehicles, each squad in a laying vehicle conducts the following drill:

The carrier team—

- Moves the APC to the row start point.
- Lowers the APC ramp until it is horizontal or opens the rear door. (If using the APC ramp to distribute mines, chain the ramp open to support the weight.)

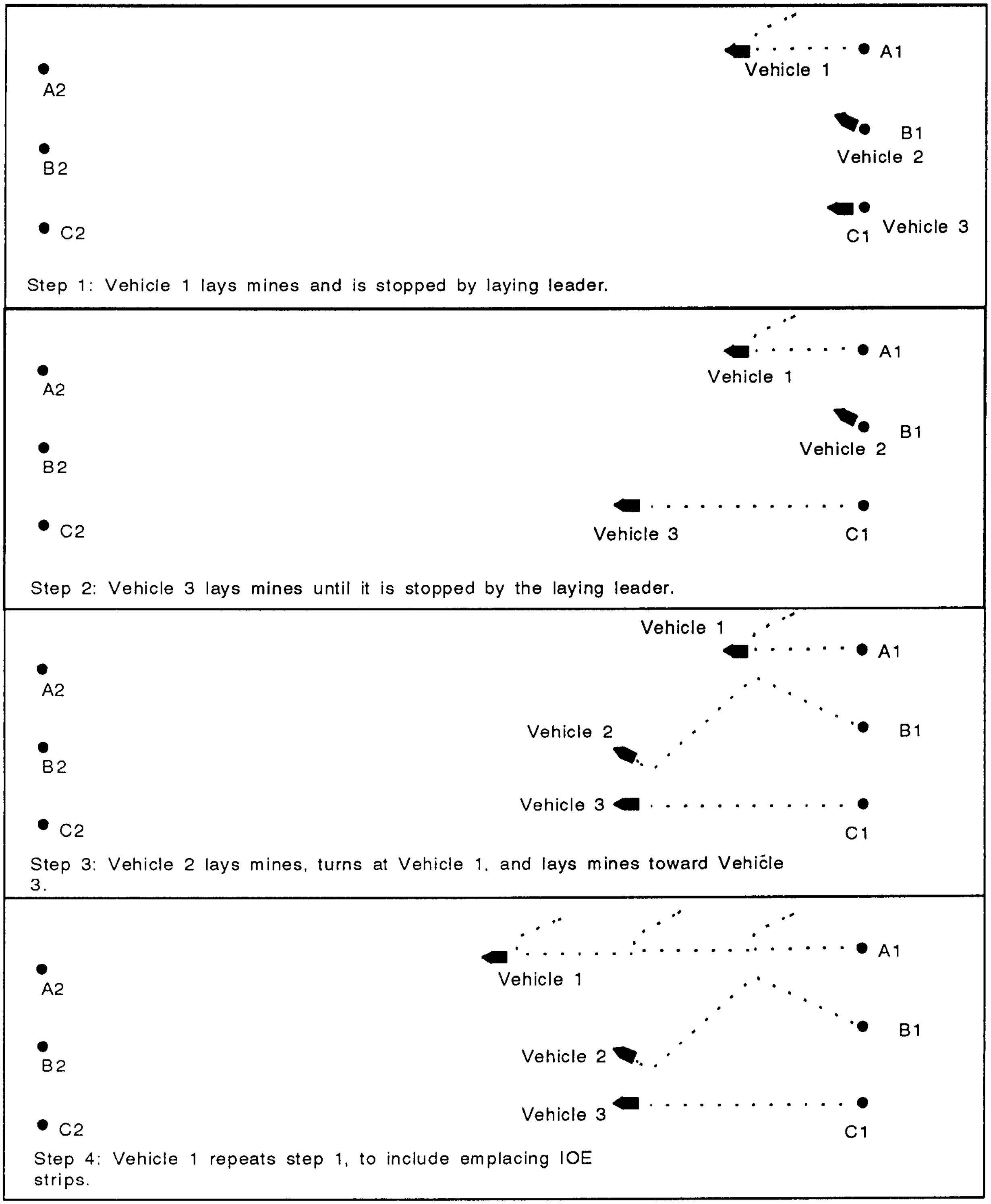


Figure 4-6. Vehicle position during row minefield laying

The sapper team—

- Soldier 1 ties the rope to the end of the lowered ramp or tow pintle.
- Soldier 2 ties the partially filled sandbag on the other end of the rope, (The rope length, from the end of the ramp or door to the sandbag, is the correct spacing between mines.) (See Figure 4-7.)
- The squad leader (soldier 3) positions team members. Soldier 1 is at the rear of the compartment. Soldier 2 sits on the edge of . the APC ramp or open door. Soldier 4 walks behind the APC.

The squad leader—

- Tells the squad to start laying mines.
- Supervises mine arming and placing.

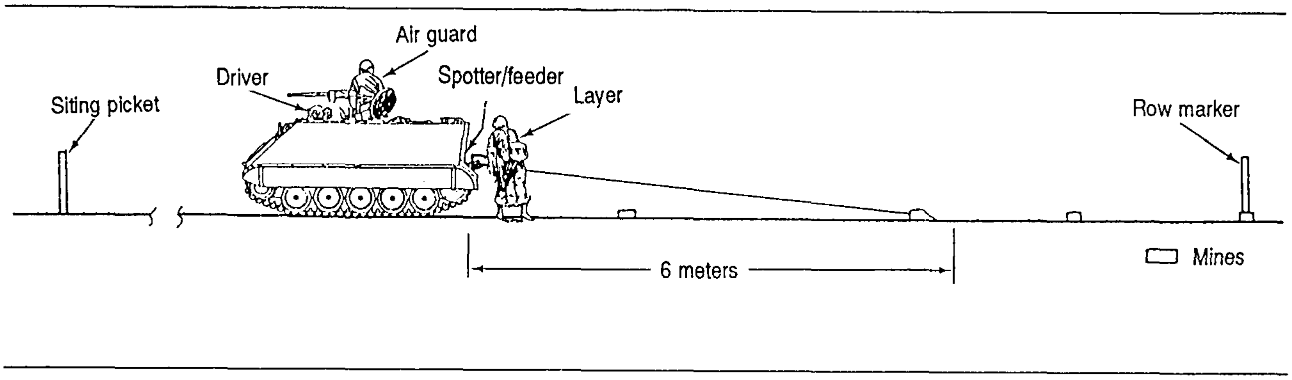
The carrier team moves the APC, at a low speed (2 to 3 miles per hour (mph)). in a straight line toward the row end point.

The sapper team—

- Soldier 1 fuzes and passes a mine to soldier 2. Soldier 2 records all mines issued. If AP mines are also laid, they are given out simultaneously. (Soldiers may carry Ml4 mines in a satchel to speed up laying.)
- Soldier 2 places the fuzed mine on the ground when the sandbag tied to the rope is even with the previously placed mine.
- Soldier 3 (squad leader) walks behind the vehicle and supervises mine laying.
- Soldier 4 walks behind the vehicle and arms mines.
- After the mine row is armed and camouflaged, Soldier 4 buries pins, clips, and shipping plugs 30 centimeters to the rear of each end row marker.

The above steps are repeated until the end of the row is reached.

If the platoon is burying mines, the digging party follows the laying party along the friendly side of the row and proceeds as follows:



★ *Figure 4-7. Using sandbag for distances between mines of a row*

- The NCOIC selects the mine to be buried by each soldier and supervises the operation.
- ★ Mines are dug in but left exposed until arming is complete. Use a posthole digger to dig a hole to fit M16 mines. Use a small sledgehammer to make a hole to fit M14 mines.
- Once a soldier completes digging in a mine, he moves along the friendly side of the row to the next unburied mine and repeats the process.
- ★ Arm AP mines in a cluster before arming AT mines.
- If possible, allocate a vehicle to help remove spoil from the site.

Marking, Recording, and Reporting Row Minefields

Marking procedures for row minefields are the same as those for other minefields. Row minefields are recorded on a DA Form 1355 (Figure 4-1, pages 4-3 and 4-4). Reporting procedures for row minefields are the same as those for other minefields—intent, initiation, status, and completion.

★ STANDARDIZED ROW MINEFIELDS

★ The specific composition of row minefields depends on METT-T and available resources. To aid in standardization and platoon techniques, four row minefield compositions have been developed to match obstacle intent/effect. Using standard minefields eases planning obstacle type, size, and logistical requirements (see page 2-8). It is imperative that the designs and effect of these minefields are well understood. They are an integral part of combined arms obstacle doctrine and form the cornerstone of engineer obstacle operations. The platoon leader is given the obstacle intent—disrupt, turn, block, or fix. He has the resources to emplace a standardized row minefield. Use the following standardized row minefields as building blocks to create the appropriate obstacle based on intent.

Disrupt and Fix Minefields

Disrupt and fix minefields are similarly constructed, except the fix minefield has an IOE and does not have AHDs. The standard minefield is 250 meters wide. The disrupt minefield is 100 meters deep and has a mine density of 0.5 mine per linear meter; the fix minefield is 120 meters deep and has a density of 0.6. Both minefields require 1.5 platoon hours and 84 track-width mines. The disrupt minefield requires 42 full-width mines, and the fix minefield requires 63 full-width mines. (See Figure 4-8, page 4-16.)

Emplacement: The emplacement of disrupt and fix minefields is the same, except fix minefields have an IOE.

★ **NOTE: Stake surface-laid, M21 tilt-fuzed mines to keep them from tipping over.**

Row A.

- Use 42 full-width AT mines (tilt rod), placed 6 meters apart.
- ★ May have no turning points.
- May be surface-laid or buried.

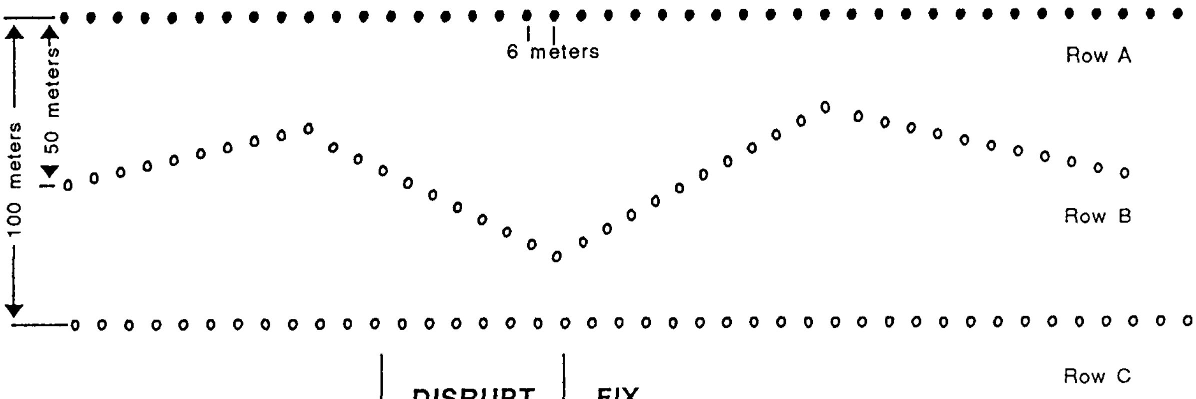
Row B.

- Emplace start and end row markers 50 meters behind row A.
- Use 42 track-width AT mines, placed 6 meters apart.
- ★ Preferably has no more than three turning points.
- May be surface-laid or buried.

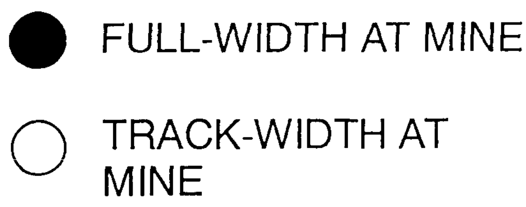
Row C.

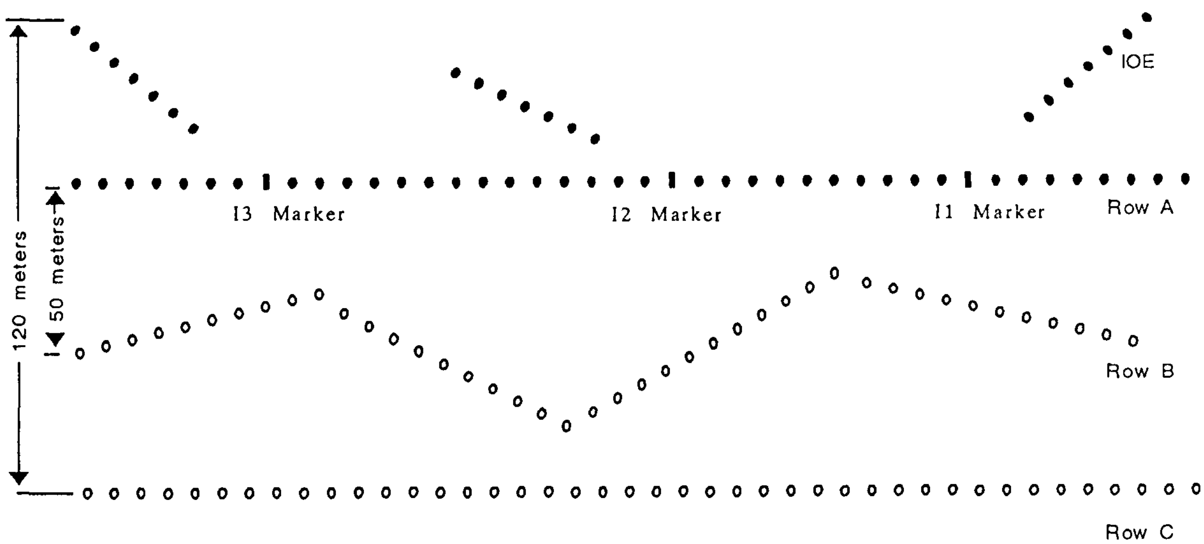
- Emplace 100 meters behind row A.
- Use 42 track-width AT mines, placed 6 meters apart.

STANDARD DISRUPT ROW MINEFIELD



	DISRUPT	FIX
FRONTAGE(m)	250	250
DEPTH(m)	100	120
AT FULL(# ROWS)	1	1
AT TRACK(# ROWS)	2	2
IOE(YES OR NO)	NO	YES
AHD(YES OR NO)	NO	NO
PLT HOURS REQ'D	1.5	1.5
FULL-WIDTH MINES	42	63
TRACK-WIDTH MINES	84	84
DENSITY	0.5	0.6





STANDARD FIX ROW MINEFIELD

★ *Figure 4-8. Standard disrupt and fix row minefield patterns and characteristics*

★ • May have no turning points.

• May be surface-laid or buried.

IOE (fix minefield only).

• Has three IOE strips.

★ • Row A may be used as a baseline or estab - lish a separate IOE baseline.

• Use seven track-width AT mines, placed 6 meters apart for each IOE strip (total of 21 mines).

• May be surface-laid or buried.

★ • Place the first IOE strip off the IOE end marker, in place of the omitted eighth mine in row A. After 12 more mines are laid, omit the thirteenth mine for the second and third IOE end markers and strips, leaving eight mines until the end row marker. If a separate IOE baseline is established, follow standard layout procedures discussed on page 3-6.

Turn Minefields

Turn minefields are constructed similar to disrupt and fix minefields. Turn minefields consist of four rows of full-width mines and two rows of track-width mines. The width of a turn minefield is 500 meters. It is 300 meters deep and has a density of 1 mine per linear meter. It requires 3.5 platoon hours, 336 full-width mines, and 168 track-width mines. (See Figure 4-9, page 4-18.)

Emplacement. The emplacement of rows D, E, and F is the same as in a disrupt minefield.

Row A.

• Use 84 full-width AT mines (tilt rod), placed 6 meters apart.

★ • May have no turning points.

• May be surface-laid or buried.

Row B.

• Emplace start and end row markers 50 meters behind row A.

• Use 84 full-width AT mines (tilt rod), placed 6 meters apart.

★ • Preferably has no more than five turning points.

• May be surface-laid or buried.

Row C.

• Emplace 100 meters behind row A.

• Use 84 full-width AT mines (tilt rod), placed 6 meters apart.

★ • May have no turning points.

• May be surface-laid or buried.

Row D.

• Emplace 100 meters behind row C.

• Use 84 full-width AT mines (tilt rod), placed 6 meters apart.

★ • May have no turning points.

• May be surface-laid or buried.

Row E.

• Emplace start and end row markers 50 meters behind row D.

• Use 84 track-width AT mines, placed 6 meters apart.

★ • Preferably has no more than five turning points.

• May be surface-laid or buried.

Row F.

• Emplace 100 meters behind row D.

• Use 84 track-width AT mines, placed 6 meters apart.

★ • May have no turning points.

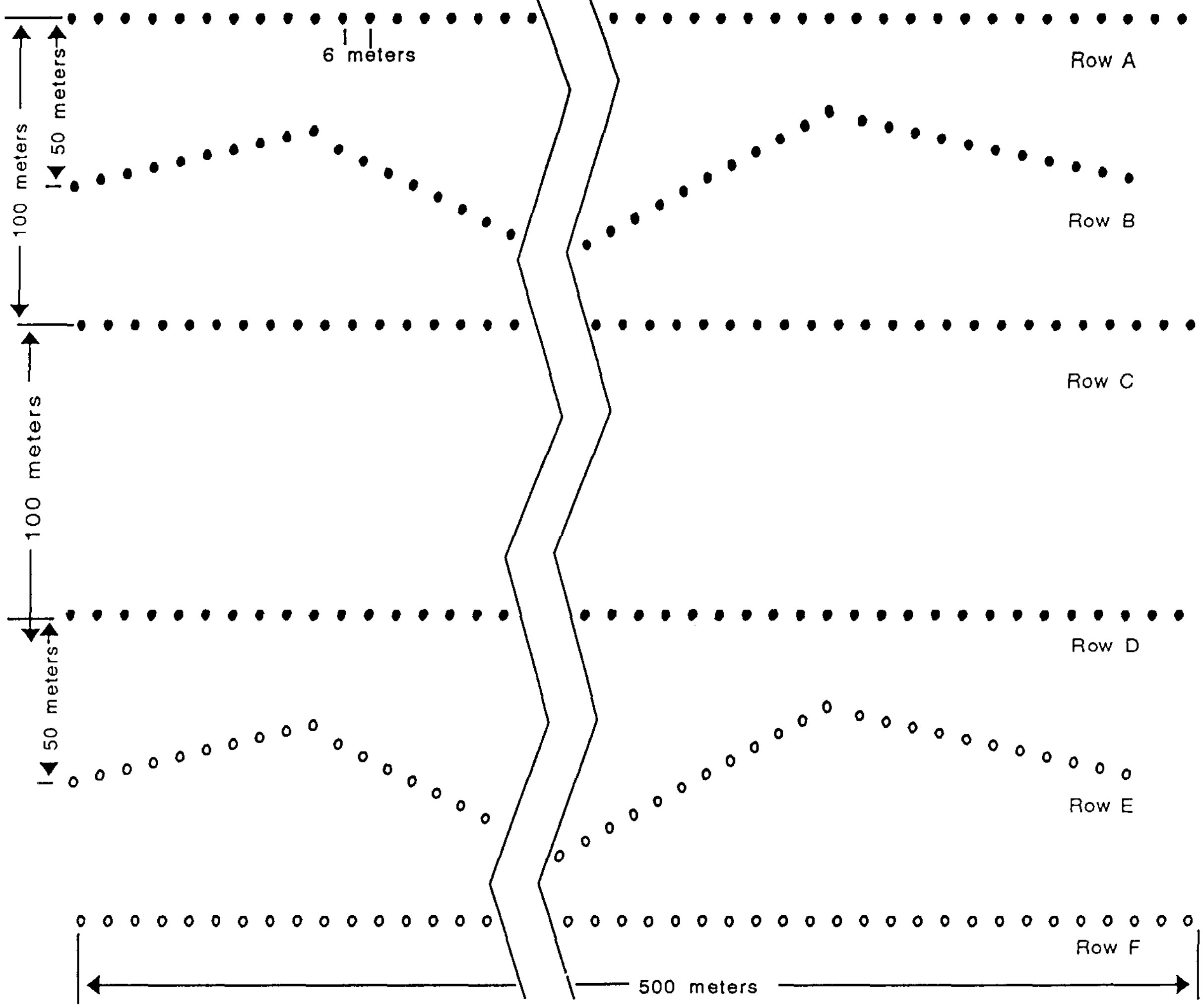
• May be surface-laid or buried.

Block Minefields

Block minefields are constructed similar to turn minefields, except block minefields have an IOE, AHDs, and AP mines in two of its rows

STANDARD TURN ROW MINEFIELD

NOTE: Center of minefield figure is omitted for clarity.



	TURN
FRONTAGE(m)	500
DEPTH(m)	300
AT FULL(# ROWS)	4
AT TRACK(# ROWS)	2
IOE(YES OR NO)	NO
AHD(YES OR NO)	NO
PLT HOURS REQ'D	3.5
FULL-WIDTH MINES	336
TRACK-WIDTH MINES	168
DENSITY	1.0

● FULL-WIDTH AT MINE

○ TRACK-WIDTH AT MINE

Figure 4-9. Standard turn row minefield pattern and characteristics of full-width mines. The width of a block minefield is 500 meters. It is 320 meters deep and has a density of 1.1 AT mines per linear meter. It has a minefield density of 0.17 M16 AP mine per linear meter or 1 M14 AP mine per linear meter. It requires 5 platoon hours, 378 full-width mines, and 168 track-width mines. It also requires 84 M16 mines or 500 M14 mines. (See Figure 4-10, page 4-20.)

Emplacement. The emplacement of the block minefield is the same as the emplacement of the turn obstacle, except the block minefield has an IOE and AP mines.

Row A.

- Use 84 full-width AT mines (tilt rod), placed 6 meters apart.
- ★ May have no turning points.
- May be surface-laid or buried.

Row B.

- Emplace start and end row markers 50 meters behind row A.
- Use 84 full-width AT mines (tilt rod), placed 6 meters apart.
- ★ Preferably has no more than five turning points.
- May be surface-laid or buried.

Row C.

- Emplace 100 meters behind row A.
- Use 84 full-width AT mines (tilt rod), placed 6 meters apart.
- ★ May have no turning points.
- May be surface-laid or buried.

Row D.

- Emplace 100 meters behind row C.
- Use 84 full-width AT mines (tilt rod), placed 6 meters apart.
- ★ May have no turning points.
- May be surface-laid or buried.

Row E.

- Emplace start and end row markers 50 meters behind row D.
- Use 84 track-width AT mines, placed 6 meters apart.
- ★ Preferably has no more than five turning points.
- May be surface-laid or buried.

Row F.

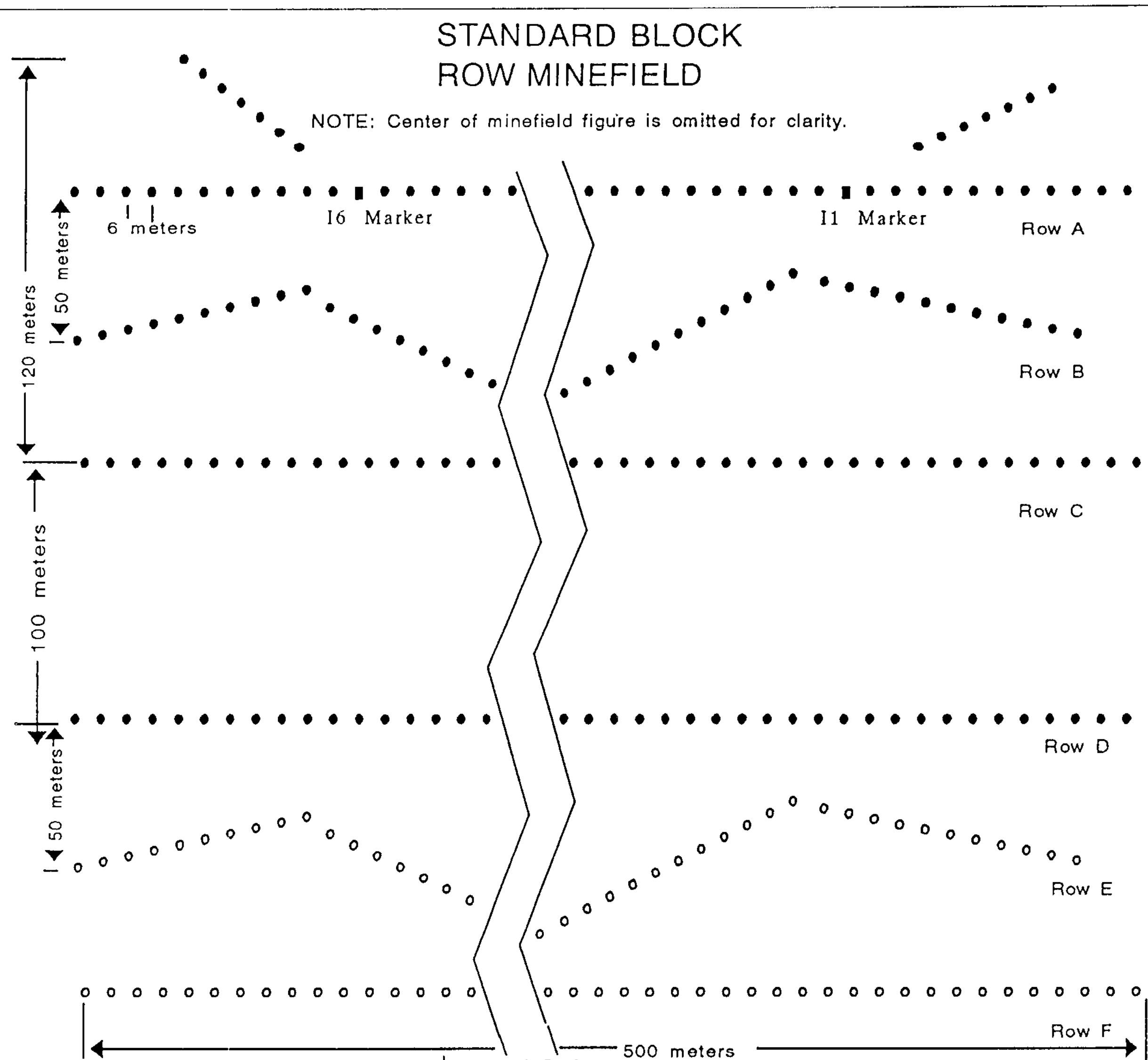
- Emplace 100 meters behind row D.
- Use 84 track-width AT mines, placed 6 meters apart.
- Has no turning points.
- May be surface-laid or buried.

IOE.

- Has six IOE strips.
- ★ Use row A as a baseline or establish a separate IOE baseline.
- Use seven track-width AT mines, placed 6 meters apart for each IOE strip (total of 42 mines).
- May be surface-laid or buried.
- ★ Place first IOE strip off the IOE end marker, in place of the omitted twelfth mine in row A. After 11 more mines are laid, omit the twelfth mine for the second through sixth IOE end markers and strips. If a separate IOE is established, follow standard layout procedures discussed on page 3-6.

AP mines.

- Use AP mines on any two rows of full-width AT mines.
- Place AP mines in a cluster around AT mines.
- Place one AP mine in front of every other AT mine in each of two rows when using M16 (bounding frag) mines.
- Place one AP mine on the enemy side (12 o'clock), one on the left (9 o'clock), and one on the right (3 o'clock) sides of each AT mine, in each of the two rows when using M14 (blast) mines.



	BLOCK
FRONTAGE(m)	500
DEPTH(m)	320
AT FULL(# ROWS)	4
AT TRACK(# ROWS)	2
IOE(YES OR NO)	YES
AHD(YES OR NO)	YES
PLT HOURS REQ'D	5.0
FULL-WIDTH AT MINES	378
TRACK-WIDTH AT MINES	168
DENSITY AT	1.1
M16 OR	84 OR
M14	500
DENSITY AP	.17/1.0

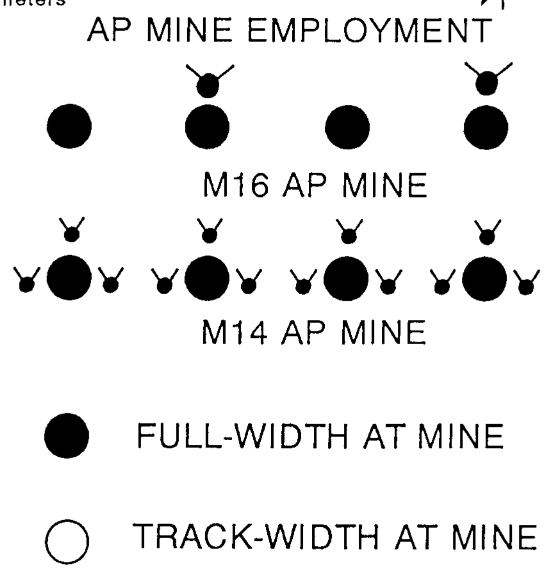


Figure 4-10. Standard block row minefield pattern and characteristics

CHAPTER 5
REPORTING AND RECORDING

MINEFIELD REPORTS

A minefield report is an oral, electronic, or written communication concerning friendly or enemy mining activities. The report format is specified by the local command. It is submitted by the emplacing unit commander through operational channels to the Assistant Chief of Staff, G3 (Operations and Plans) (G3)/Operations and Training Officer (US Army) (S3) of the authorized headquarters. The headquarters integrates the report with terrain intelligence and disseminates it with tactical intelligence. The report is sent by the fastest, most secure means available. Figure 5-1, page 5-2, summarizes the minefield report flow at the division level and below.

Report of Intention

When planning to emplace a minefield, the unit must submit a report of intention to notify their higher headquarters. The report doubles as a request when it is initiated at levels below emplacement authority. The report includes—

- Tactical purpose of the minefield.
- Estimated number and type of mines to be emplaced.
- Location.
- Proposed start and completion times.
- Type of minefield.
- Whether mines are surface-laid or buried.
- Whether AHDs are used.
- Location and width of lanes and gaps.

Conventional minefields that are part of an operation plan (OPLAN) or general defense plan (GDP) approved by the authorizing commander do not require a report of intention because inclusion in an OPLAN or GDP implies an intention to lay.

Report of Initiation

A report of initiation is mandatory. It informs higher headquarters that emplacement has begun and that the area is no longer safe for friendly movement and maneuver. The report specifies the time emplacement began and identifies the location and target number of minefields.

Report of Completion

A report of completion is usually an oral report to the authorizing commander. It indicates the minefield is complete and functional. A report of completion is immediately followed by a completed DA Form 1355 or DA Form 1355-1-R.

Additional Reports

Progress reports. During the emplacing process, the commander may require periodic reports on the amount of work completed.

Report of transfer. Minefield responsibility is transferred from one commander to another in a report of transfer. This report is signed by the relieved commander and the relieving commander. It includes a certificate stating the relieving commander was shown or otherwise informed of all mines within the relieved commander's zone of responsibility. The report states the relieving commander assumes full

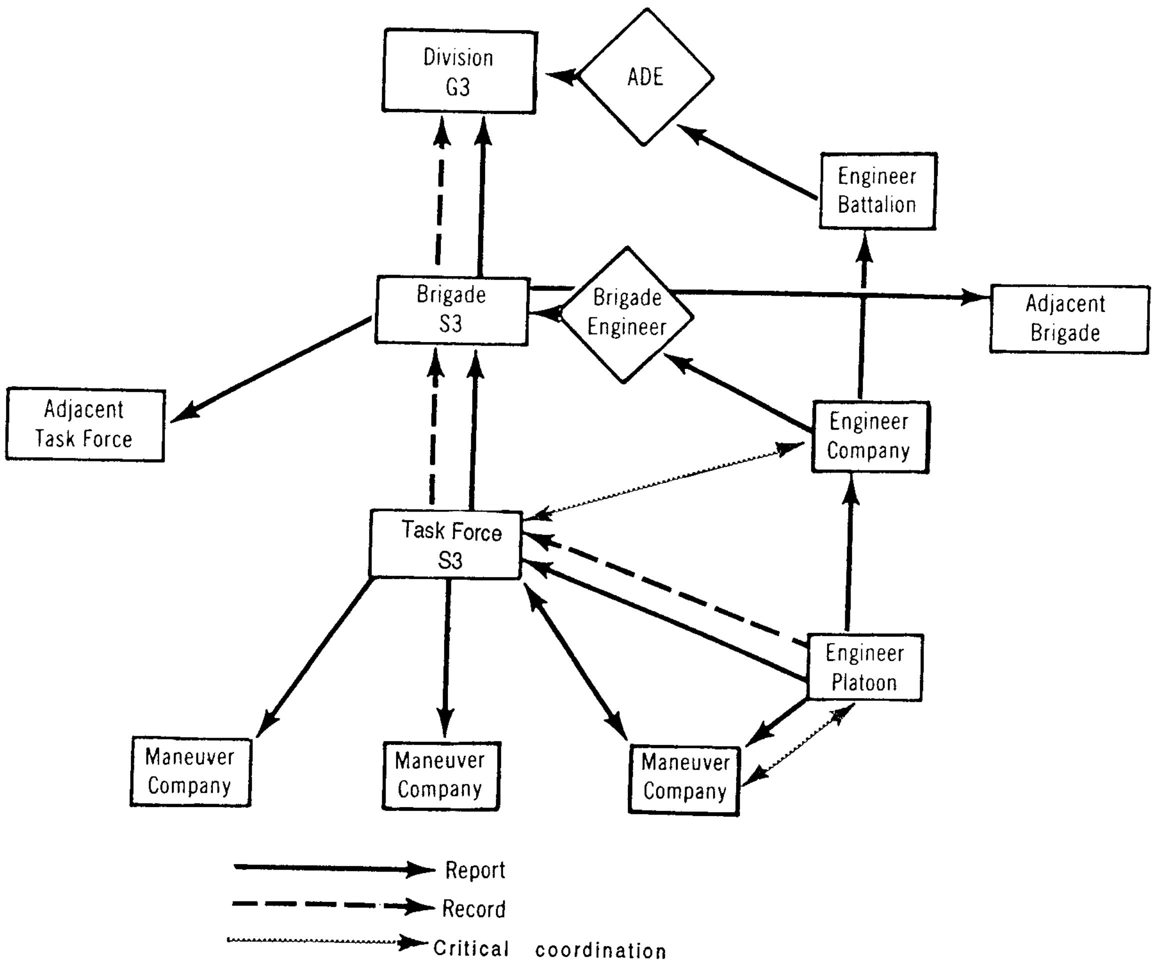


Figure 5-1. Conventional minefield reporting chain

responsibility for those mines. The report of transfer is sent to the next higher commander who has authority over both the relieved commander and the relieving commander.

Report of change. A report of change is made immediately upon any change or alteration to a previously reported minefield. It is sent to the next higher commander and then through channels to the headquarters that keeps the written minefield record. A report of change is made by the commander responsible for surveillance and maintenance of the minefield.

MINEFIELD RECORDS

★ Conventional minefields (except hasty protective) are recorded on DA Form 1355. Hasty protective minefields are recorded on DA Form 1355-1 -R. Examples of completed DA Forms 1355 and 1355-1-R are shown in Figures 5-2a through 5-2c, pages 5-4 through 5-6, and in Figure 5-3, page 5-7. A blank DA Form 1355-1-R is provided at the back of this publication. It can be locally reproduced on 8 1/2- by 11-inch paper. The laying unit prepares the standard minefield record form. The OIC signs and forwards the form to the next higher command as soon as possible. Once the information is entered on the form, the form is classified SECRET or NATO SECRET. The number of copies prepared depends on the type of minefield and local procedures. Unit standing operating procedures (SOPS) should provide advanced guidance on how minefield information is to be passed to higher, lower, and adjacent commands. Minefield records are circulated on a need-to-know basis. When a record is made, it should be reproduced at the lowest level having the equipment to make copies. When used for training, the record is marked *SAMPLE*. Large minefields are recorded on two or more DA Forms 1355.

When changes are made to an existing minefield, a new record must be prepared on DA Form 1355. This record is marked REVISED. It shows the minefield as it is after changes. The original minefield number remains unchanged. Some changes which require a new record are—

- Relocation of mines in safe lanes.
- Relocation of safe lanes.
- Changed lane or minefield markings.
- Inclusion of the minefield into a larger minefield system.
- Removal or detonation of mines.
- Addition of mines to the field.

Conventional minefield records are forwarded through operational channels to theater army headquarters (TAHQ) where they will be maintained on file by the theater engineer. If a TAHQ has not been established, minefield records are maintained on file with the assistant corps engineer in whose area of operation the minefield is located.

SECRET (when completed) SAMPLE

MINEFIELD - RECORD

SAMPLE

1	AUTHORITY	CG, 2ND INF. DIV.
1	LAYING UNIT	1ST PLT, B. Co., 2ND ENGR. BN.
1	OFFICER IN CHARGE	2LT GREG BIER 762-01-1352
2	DATE AND TIME — START	090630Z JAN 90
2	DATE AND TIME — COMPLETION	091800Z JAN 90
2	RECORDER	S/C FOX LING 550-82-1333
3	Copy No.	1 of 4
3	Sheet No.	1 of 1
4	MINEFIELD NUMBER	2XX (INF) 1-E
5	MAP SERIES, NO AND SCALE	H754 1:50,000
5	SHEET NO. (OR NAME)	1JZ015 MUNSAN

6 LANDMARKS

NO	COORDINATES	DESCRIPTION
1	UT 34917312	U-SHAPED PICKET FLUSH W/GROUND
1		LEFT SIDE OF ROAD
2	UT 34927323	U-SHAPED PICKET FLUSH W/GROUND
2		LEFT SIDE OF ROAD

7 INTERMEDIATE MARKERS

NO	DESCRIPTION
1	(3) U-SHAPED PICKETS 12" ABOVE GROUND.
2	
3	
4	

8 DESCRIPTION OF BOUNDARY FENCE OR MARKING: STANDARD MARKING FENCE; ONE STRAND CATTLE FENCE, 4 SIDES (MINEFIELD ENCLOSED)

9 NO. OF STRIPS/~~ROWS~~: 3

DESCRIPTION OF STRIP/~~ROW~~ MARKERS: U-SHAPED PICKETS FLUSH WITH THE GROUND.

10 LANES

NO	WIDTH	HOW MARKED	METHOD OF CLOSING
1	8 M	HEMMS SET	SEE NOTE 8, BLOCK 12
2			
3			

11 PROTECTIVE ~~TACTICAL~~ MINEFIELD / ~~NUISANCE MINEFIELD~~ / ~~PHONEY MINEFIELD~~

MINES		ANTITANK MINES (AT) TYPE M15 NO.	TYPE NO.	TYPE NO.	TYPE NO.	TYPE NO.	TYPE NO.	TOTAL AT MINES NO	ANTI-LIFT DEV NO.	ANTIPERSONNEL MINES (AP) TYPE M16 NO	TYPE M14 NO.	TYPE NO.	TOTAL AP MINES NO.
BURIED ~~AND SURFACE LAID~~	IOE	28						28		56	56		112
	A	72						72		144	144		288
	B	74						74		148	148		296
	C	76						76		152	152		304
	D												
IN STRIPS ~~IN ROWS~~ ~~W/O PATTERN~~	E												
	F												
	G												
	H												
	J												
TOTAL		250						250		500	500		1000

12 NOTES

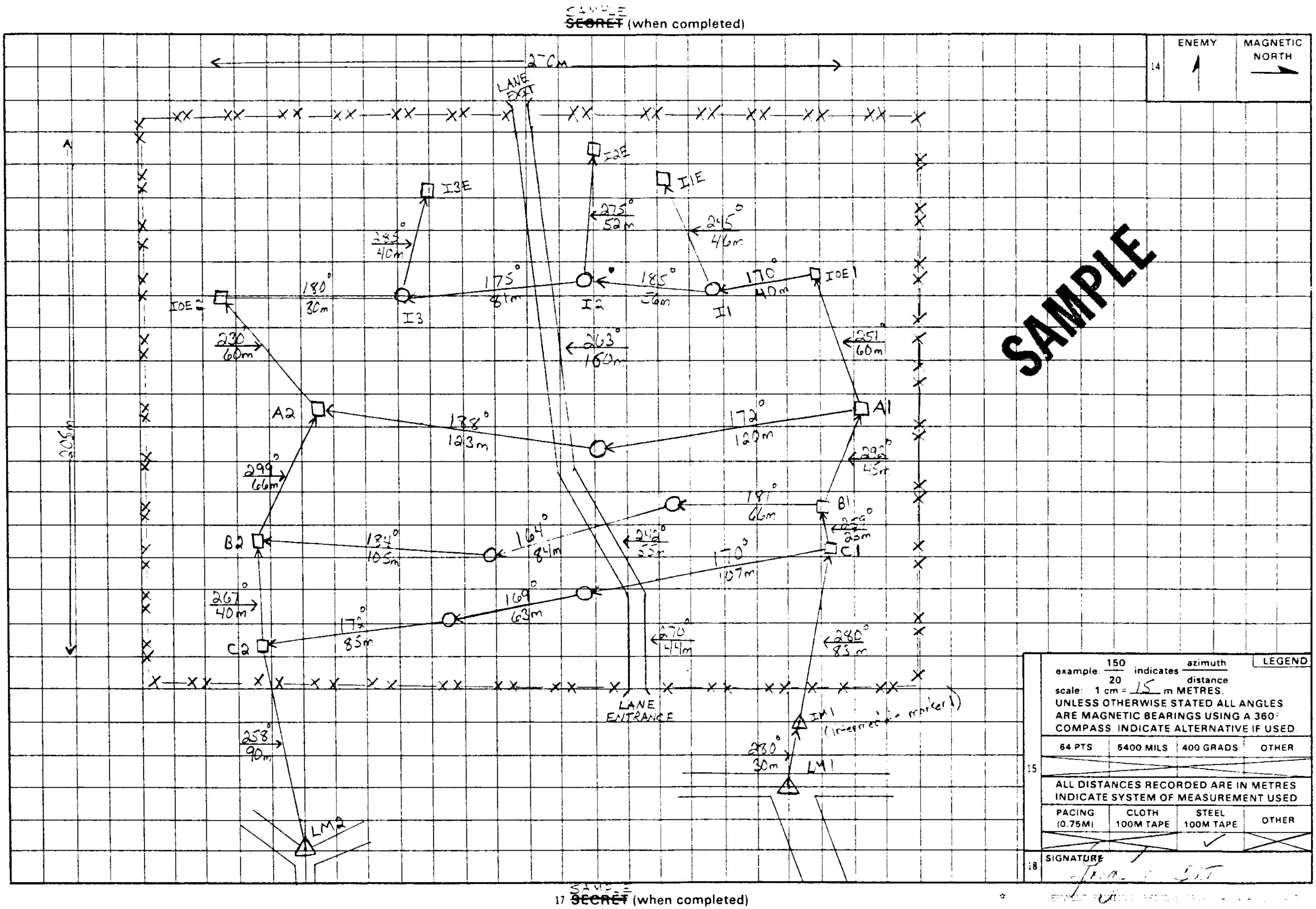
1. MINE CLUSTERS AT 3 METRES/~~PACE~~ SPACING
ALL DISTANCES IN MINEFIELD MEASURED IN METERS.
(2) NUMBER OF IOE LIVE CLUSTERS (ALL OTHERS NUMBERED BUT OMITTED) I1: 1, 2, 4, 5, 7, 8, 9, 10, 11, I2: 1, 3, 4, 6, 7, 9, 10, 11, I3: 2, 3, 4, 5, 7, 8, 9. (3A) NUMBERED OMITTED CLUSTERS IN REGULAR STRIPS: A: 10, 23, 26, 51, 62 (ROCKS) B: 4, 6, 8, 9, 71 (TREES) C: 4, 15, 18, 40 (ROCKS) (3B) OMITTED CLUSTERS FOR LANES AND GAPS: IOE: NONE, A: 39, 40, 41, 42, 43, B: 47, 48, 49, 50, 51, C: 30, 31, 32, 33, 34 (4) CLUSTERS WITH AHD's: NONE (5) CLUSTERS WITH TRIPWIRE ACTIVATED AP MINES: IOE: NONE, A: 13, 27, 61, 73, B: 19-33, C: NONE (6) STRIP CLUSTER COMPOSITION: IOE (1-2-2), A (1-2-2), B (1-2-2), C (1-2-2) (7) LOCATION OF SAFETY CLIPS/PINS BURIED 30 CM TO REAR OF START MARKER. (8) LOCATION OF MINES FOR CLOSING LANES AND GAP: UT34827331 - 15 EA. M15's, 30 EA M16's, AND 30 EA. M14's

13 SIGNATURE (OFFICER IN CHARGE): [signature], 2LT — DATE: 09 JAN 90

DA FORM 1355, MAR 87 — EDITION OF JUL 67 IS OBSOLETE

SAMPLE ~~SECRET~~ (when completed)

★ *Figure 5-2a. Standard pattern minefield - completed sample DA Form 1355 (front side)*



★ *Figure 5-2b. Standard pattern minefield - completed sample DA Form 1355 (inside) (continued)*

SAMPLE
~~SECRET~~ (when completed)

MINEFIELD REQUIREMENTS COMPUTATION FORMULA

		AT	APF	APB
Desired Density		a____	b____	c____
IOE Representative Cluster		a____	b____	c____
Front ____ meters				
Depth ____ meters				
AHD ____ %				
*1. No. of IOE Clusters = Front ÷ 9	____			
2. No. of IOE clusters x IOE Representative Cluster		a____	b____	c____
3. Mines in Minefield = Front x Desired Density		a____	b____	c____
4. Subtotal of Mines Required = Line 2 + Line 3		a____	b____	c____
*5. Mine Rejections, Strip Length Variances = Line 4 x .1		a____	b____	c____
6. Total AT Mines Required = Line 4 + Line 5		a____	b____	c____
7. Add a + b + c of "Desired Density" =	____			
*8. Line 7 x .6 =	____			
9. AT Mine "Desired Density" x 3 =	____			
10. No. of Regular Strips = Highest No. of Line 8 or 9	____			
*11. No. of AHD = % AHD x Total AT Mines (Line 6)	____			
12. Strip cluster Composition = Desired Density x 3		a____	b____	c____

* NOTE: Round up to the next whole number.

	STRIP	AT	APF	APB	ROW TOTAL (Cannot exceed 5)
"CLUSTER	A	a____	b____	c____	____
	B	a____	b____	c____	____
	C	a____	b____	c____	____
	D	a____	b____	c____	____
COMPOSITION	E	a____	b____	c____	____
	F	a____	b____	c____	____
	G	a____	b____	c____	____
	H	a____	b____	c____	____
TABLE"	I	a____	b____	c____	____
	J	a____	b____	c____	____
	COLUMN TOTAL (Totals cannot exceed Line 12).	a____	b____	c____	____

TABULAR DATA (Numbers correspond to numbered blocks on front of form).

1. Enter complete data on authority of laying and on the laying unit. OIC blanks will include name, rank, and SSN.
2. Enter date-time groups for starting and completion times. Recorder blanks will include name, rank, and SSN.
3. Enter copy and sheet numbers. Number of copies will depend upon unit SOP and the classification of the minefield. The number of sheets will depend upon the length and the depth of the minefield versus scale.

4. Enter minefield number as follows:

   Designation of unit authorizing installation
   Number of obstacle
   Status of obstacle
   (E=Executed, P=Proposed, U=Under Construction). 3/147-Inf-2-E

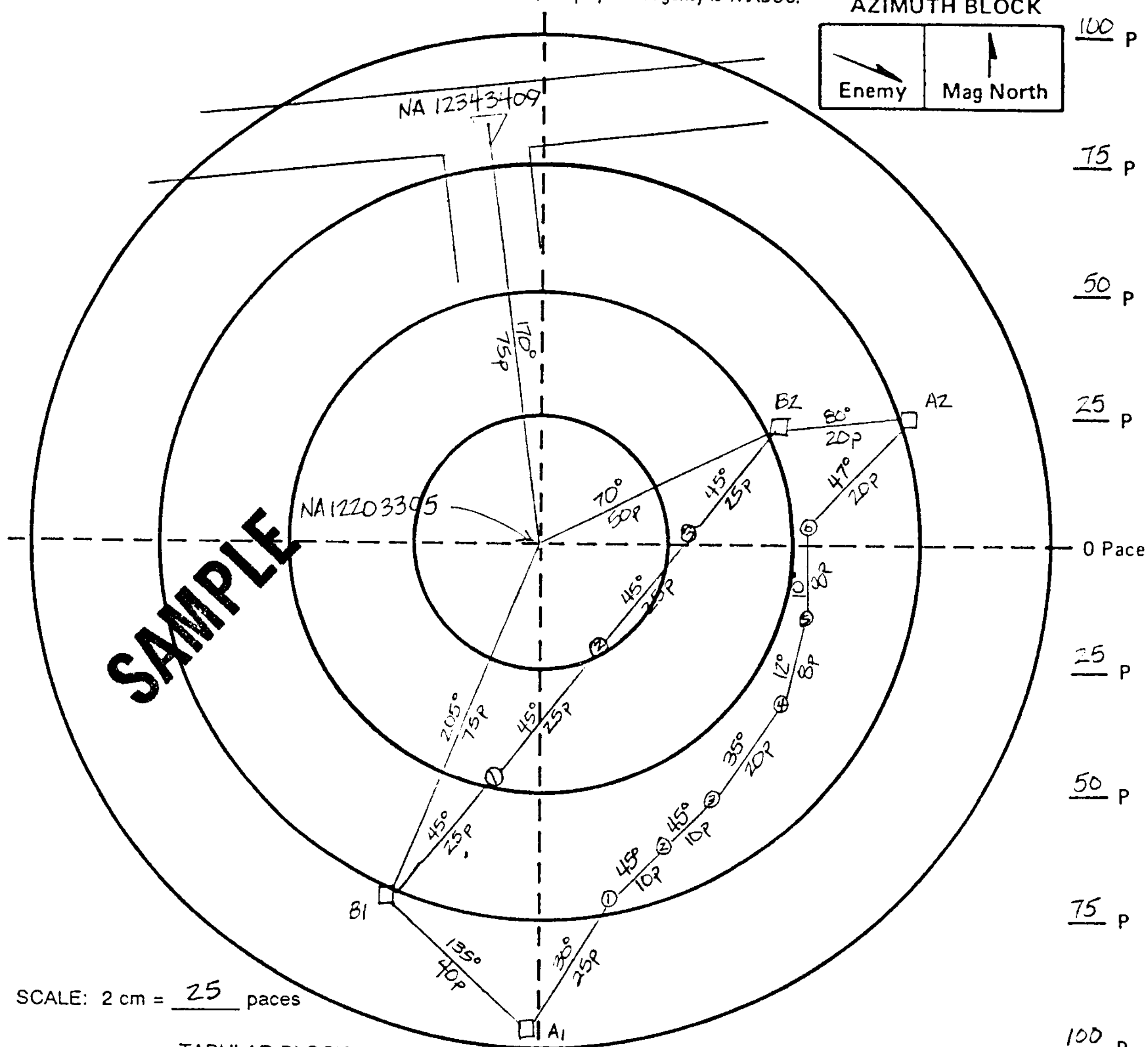
5. Enter map data as stated on map(s) used.
6. Enter complete data on at least two landmarks with 8 digit grid coordinates. Cross out unused blocks.
7. Enter description(s) of any intermediate markers used. When a landmark is more than 200 meters from the minefield or the strip/row reference stake cannot be seen from the landmark, an intermediate marker must be used. If possible, the intermediate marker should not be closer than 75 meters to the strip/row reference stake. Cross out unused blocks.
8. Enter the word "Standard" when the standard marking fence is used. Describe the boundary marking if other than the standard marking fence is used.
9. Enter the number of strips/rows laid other than IOE. Describe the strip/row markers (Line out words not applicable).
10. Enter the width, marking, and closing provisions for each lane; when appropriate give the type and number of mines for closing. The location of these mines is described in the "Notes" (Line 12). Patrol lanes are 1 meter wide, one-way vehicular lanes are 8 meters and two-way vehicular lanes are 16 meters. Cross out unused blocks.
11. Enter type of minefield by crossing out lines not needed. Indicate method of laying by marking out incorrect descriptions. Enter types of mines as AT, APF, APB. (Enter chemical mines under AT mines). For each type of mine, enter number of mines and antihandling devices installed in the IOE and in each Strip or Row. Strips or Rows will be lettered serially, starting with the first one laid. Enter totals. Cross out unused blocks.
12. Enter under Notes information which would be useful to personnel clearing the minefield. Appropriate items include location of chemical mines, location of AT mines with antihandling devices, location AP mines with tripwires, clusters in IOE which contain mines, where safety devices are buried, strip cluster composition and numbered omitted clusters in regular strips.
13. OIC enters signature, rank and date.
14. Enter arrows for the direction of the enemy and magnetic north. The enemy arrow should always point within the top 180 degrees of the paper; the north arrow should follow one of the lines of the graph.
15. Enter scale of sketch for standard pattern minefields the sketch should be drawn to a scale of about 1cm=10 **meters**.
16. Sketch in the following, as applicable.
   a. Show directional arrows as follows:
      (1) Landmarks (or intermediate markers) to strip markers at starting and finishing points of the last strip laid or to the nearest or farthest mine in a group.
      (2) From landmarks (or intermediate markers) to fence or boundary markers.
      (3) From landmarks to intermediate markers, if used.
      (4) For each straight line section of a lane centerline.
      (5) Between markers of starting points of adjacent strips, including IOE, and between finishing points of adjacent strips, including (IOE).
      (6) For each segment of a strip or of the IOE, label all directional arrows with magnetic azimuth in degrees and distance in meters. Express as a fraction (247 **degrees**/90 **meters**). Recorded from friendly to enemy side and from right to left/or left to right.
   b. Show approximate location of protective fence or boundary markers.
   c. Show length and depth of minefield in **meters**. These dimensions indicate the extremities of the minefield.
   d. Show a grid intersection and give grid coordinates.
   e. Show trace of shoreline and direction and approximate rate in **meters** per second of water current, for mines laid underwater.
17. Enter security classification of the form. (If the form is used for training, enter the word SAMPLE.)
18. OIC enters signature and rank.

SAMPLE
~~SECRET~~ (when completed)

Figure 5-2c. Standard pattern minefield - completed sample DA Form 1355 (back side) (continued)

HASTY PROTECTIVE MINEFIELD RECORD

For use of this form, see FM 20-32; the proponent agency is TRADOC.



TABULAR BLOCK

Row	Type	Actuation	Mine Number
A	M16A1	Tripwire	1, 2, 6
A	M21	Pressure	3, 4, 5
B	M16A1	Tripwire	1, 3
B	M18A1	Controlled	2

Remarks: Points A1, A2, B1, B2 are marked with orange tent pegs flush with ground.

DA Form 1355-1-R, Jul 75

IDENTIFICATION BLOCK

Unit	2nd Platoon, D Co, 16th Engr BN
Ref Pt	Tree stump side of road with white engr tape at NA 12203305.
Remarks	Landmark is road junction at NA 12343409.
Map & Sheet No	TALBOT 5568
Name of OIC	2LT ALLAN, SSN: 123-45-6789
Signature	A.G. Allan — Time & Date 1700 / 29 Sept 93
Mines Removed	
Mines Transferred	

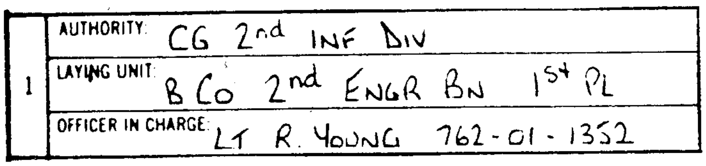
★ *Figure 5-3. Sample DA Form 1355-1-R (completed)*

DA Form 1355, Minefield Record

DA Form 1355 from STANAG 2036 consists of a single sheet, printed on both sides. The front side contains blocks for tabular data. The back side is a graph consisting of l-centimeter squares for a scaled sketch of the field. The scale for plotting minefields depends on the size of the field. To avoid using two sheets for the sketch, adjust the scale so that one form will support the sketch. For very large minefields, two sheets may be required. The system of measurement and scale sizes must be indicated in the legend block. A second form may be used to support any additional in for - mation in the mandatory notes block. Any blocks or lines not used on the form must be crossed out to avoid unauthorized entries on the form. The following step-by-step instructions are provided for completing DA Form 1355.

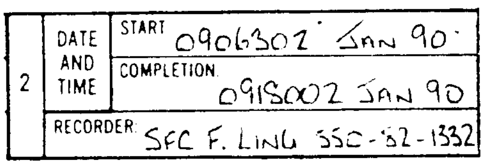
Block 1

Enter complete data on authority for laying and on the laying unit. The OIC block includes rank, name, and social security account number (SSAN).


1
AUTHORITY: CG 2nd INF DIV
LAYING UNIT: B Co 2nd ENGR BN 1st PL
OFFICER IN CHARGE: LT R. YOUNG 762-01-1352

Block 2

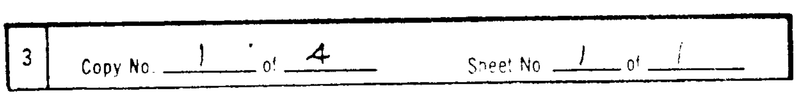
Enter date-time group (DTG) for starting and completion times. The recorder block includes rank, name, and SSAN.


2
DATE AND TIME
START: 0906302 JAN 90
COMPLETION: 0918002 JAN 90
RECORDER: SFC F. LING 552-52-1332

Block 3

Enter copy and sheet number. The number of copies prepared depends on the unit SOP and minefield classification.

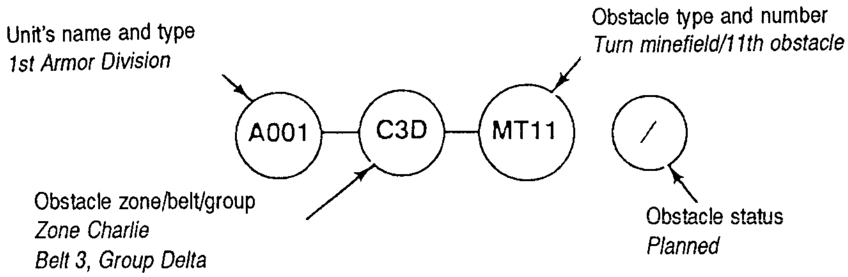
The minefield record is forwarded by the laying unit. One copy is retained by the overmatching unit, one copy by the next higher command, one copy by corps, where appropriate, and one copy by the proper national territorial authority.

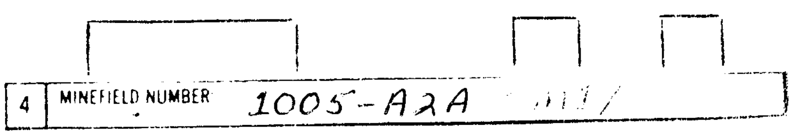

3 Copy No. 1 of 4 Sheet No 1 of 1

Block 4

The minefield obstacle numbering system shown below will consist of 11 characters and an obstacle status symbol. It will show the type of obstacle, the belt and zone in which it is located, and the headquarters that established the zone.

Character	**Description**
1 through 4	Alphanumeric descriptions of the headquarters type and numerical designation that established the obstacle zone. Character 1 designates the unit type with a letter (A, armor division / brigade: I, infantry division / brigade; C, cavalry division; R, cavalry regiment; and Z, corps.
5	Letter indicating obstacle zone.
6	Number indicating belt number in obstacle zone.
7	Letter indicating group in obstacle belt.
8 and 9	Letters indicating obstacle type.
10 and 11	Two numbers indicating obstacle number in the group.
12	One of four characters indicating obstacle status: / (slash) = planned obstacle. – (dash) = obstacle being prepared. + (plus) = prepared obstacle. (The + is for reserve demolition targets and may indicate a readiness state of safe or armed.) X (X) = completed obstacle





Obstacle Type Abbreviations

B - Bridge demolitions (demos)
BA - bridge demo, abutment
BS - bridge demo, span
BC - bridge demo, combination of abutment and span

M - Minefields
MD - minefield, disrupt
MT - minefield, turn
MF - minefield, fix
MB - minefield, block
MN - minefield, nonstandard
MP - minefield, protective
MQ - minefield, nuisance
MS - minefield, standard pattern

R - Road craters
RH - road crater, hasty
RD - road crater, deliberate
RM - road crater, mined

W - Wire obstacles
WA - wire, double apron
WB - wire, obstacle with booby traps
WF - wire, tangle foot
WG - wire, general purpose barbed tape (GPBT)
WN - wire, nonstandard
WR - wire, road block
WT - wire, triple standard

S - Scatterable minefields
SA - FASCAM, ADAM
SP - FASCAM, PDM
SG - FASCAM, GEMSS
SB - FASCAM, Gator
SR - FASCAM, RAAM
SF - FASCAM, ADAM and RAAM
SM - FASCAM, MOPMS
SV - FASCAM, Volcano
SW - FASCAM, wide area mine (WAM)

Miscellaneous
AD - antitank ditch
AR - rubble by combat engineer vehicle (CEV) gun
AB - rubble by blade
AT - abatis
AE - rubble by explosives
AM - movable military operations on urbanized terrain (MOUT) obstacle (car, bus)
AN - expedient nonstandard
AL - log crib, log obstacles
AP - post obstacles (hedgehog, tetrahedron)
AH - log hurdles

Example: Obstacle number 1005-A2A-SM21 / indicates the 5th Infantry Division planned the obstacle in zone A. It is the 21st obstacle in group A, belt 2, and has not been executed. The obstacle is a MOPMS.

Block 5

Enter map data as stated on the map(s) used.

5	MAP SERIES, NO AND SCALE H754 1:50 000
	SHEET NO (OR NAME) NJ 2015 MUNSAN

Block 6

Enter grid coordinates and a description of at least two landmarks. If landmarks are roads, trails, or routes, enter their name or number. This makes identification easier when removing the minefield.

6	LANDMARKS		
	NO	COORDINATES	DESCRIPTION
	1	UT 34917312	U-SHAPED PICKET FLUSH WITH GROUND
	2	(crossed out)	NEXT TO ROAD
	2	UT 34927323	U-SHAPED PICKET FLUSH WITH GROUND
	4	(crossed out)	NEXT TO ROAD

Block 7

Enter the description(s) of any intermediate markers. When a landmark is more than 200 meters from the minefield or the strip/row reference stake cannot be seen from the landmark, an intermediate marker must be used. If possible, the intermediate marker is no closer than 75 meters to the strip/row reference stakes. Cross out any unused blocks.

7	INTERMEDIATE MARKERS	
	NO	DESCRIPTION
	1	3 U-SHAPED PICKETS 12" ABOVE GROUND
	2	(crossed out)
	3	(crossed out)
	4	(crossed out)

Block 8

Enter the word STANDARD when a standard marking fence is used. Describe the boundary marking if a standard marking fence is not used. (Use two sides and the rear for tactical; four sides for protective.)

8	DESCRIPTION OF BOUNDARY FENCE OR MARKING STANDARD 4 SIDES MINEFIELD FULLY ENCLOSED

Block 9

Enter the number of strips/rows laid. (Do not include the IOE.) Describe strip/row markers. Cross out words that do not apply.

9	NO. OF STRIPS/~~ROWS~~: 3 DESCRIPTION OF STRIP/~~ROW~~ MARKERS U-SHAPED PICKETS FLUSH WITH GROUND

Block 10

Enter width, marking, and closing provisions for each lane. When appropriate, give the type and number of mines for closing. The location of these mines is described in Block 12.

10

LANES			
NO	WIDTH	HOW MARKED	METHOD OF CLOSING
1	8m	HEMMS SET	15×M15, 30×M16, 30×M14
2			
3			

Block 11

Enter the type of minefield by crossing out lines not needed. Indicate the method of laying by crossing out incorrect descriptions. Enter the types of mines as APB, APF, or AT. For each type of mine, enter the number of mines. Also enter the number of AHDs installed in the IOE and in each row. Strips or rows are lettered sequentially, starting with the first one laid. Enter totals.

11

Protective ~~TACTICAL~~ MINEFIELD ~~NUISANCE MINEFIELD~~ ~~PHONEY MINEFIELD~~	ANTITANK MINES (AT)								ANTIPERSONNEL MINES (AP)			
	TYPE M15	TYPE	TYPE	TYPE	TYPE	TYPE	TOTAL AT MINES	ANTI LIFT DEV	TYPE M16	TYPE M14	TYPE	TOTAL AP MINES
	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
MINES — BURIED ~~AND SURFACE LAID~~ — IOE	28						28		56	56		112
A	72						72		144	144		288
B	74						74		148	148		296
C	76						76		152	152		304
D												
MINES — IN STRIPS ~~IN ROWS~~ ~~W/O PATTERN~~ — E												
F												
G												
H												
J												
TOTAL	250						250		500	500		1000

★ Block 12

At a minumum, enter the following items in the note block. Also, enter any additional information that would be useful in the removal of the minefield.

1. Mine clusters at ____ meters / paces spacing.

2. Number of IOE live clusters (all others numbered but omitted).

3a. Numbered omitted clusters in IOE and regular strips and why.

3b. Omitted clusters for lanes or gaps.

4. Clusters with AHDs (what type and where they are located on the mine). When using the M 142 multipurpose firing device, state the activation mode for each mine.

5. Clusters with trip-wire actuated AP mines.

6. Strip cluster composition,

7. Location of safety clips / pins (are buried 30 cm to the rear of each start strip / row marker).

8. Location of mines for closing lanes and gaps.

12

NOTES

1. MINE CLUSTERS AT ..3.... METRES/~~PACE~~ SPACING

ALL DISTANCES IN MINEFIELD MEASURED IN METERS.

(2) NUMBER OF IOE LIVE CLUSTERS (ALL OTHERS NUMBERED BUT OMITTED) I1: 1, 2, 4, 5, 7, 8, 9, 10, 11 I2: 1, 3, 4, 6, 7, 9, 10, 11 I3: 2, 3, 4, 5, 7, 8, 9. (3A) NUMBERED OMITTED CLUSTERS IN REGULAR STRIPS: A: 10, 23, 26, 51, 62 (ROCKS) B: 4, 6, 8, 9, 71 (TREES) C: 4, 15, 18, 40 (ROCKS) (3B) OMITTED CLUSTERS FOR LANES AND GAPS: IOE: NONE, A: 39, 40, 41, 42, 43, B: 47, 48, 49, 50, 51, C: 30, 31, 32, 33, 34 (4) CLUSTERS WITH AHD'S: NONE (5) CLUSTERS WITH TRIPWIRE ACTIVATED AP MINES: IOE: NONE, A: 13, 27, 61, 73, B: 19-33, C: NONE (6) STRIP CLUSTER COMPOSITION: IOE (1-2-2), A (1-2-2), B (1-2-2), C (1-2-2) (7) LOCATION OF SAFETY CLIPS/PINS BURIED 30CM TO REAR OF START MARKER. (8) LOCATION OF MINES FOR CLOSING LANES AND GAP: UT34827331 - 15EA. M15's, 30 EA. M16's, AND 30 EA. M14's

13 SIGNATURE (OFFICER IN CHARGE) [illegible], 2LT DATE 09 JAN 90

Block 13

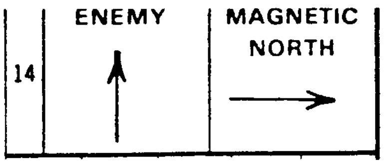
The emplacing unit OIC signs and dates the form.

13	SIGNATURE (OFFICER IN CHARGE) Roger P. Young LT	DATE 10 Jan 90

The front side of DA Form 1355 is now complete. The rest of the form and step-by-step instructions follow.

Block 14

When filling out the sketch, enter arrows for the direction of the enemy and magnetic North. The enemy arrow will always point within the top 180° of the form; the North arrow will follow one of the graph lines.



Block 15.

If a compass was not available, enter what was used in the information block. Indicate the system of measurement and the scale used.

15 LEGEND

example: 150/20 indicates azimuth/distance

scale: 1 cm = 15 m METRES.

UNLESS OTHERWISE STATED ALL ANGLES ARE MAGNETIC BEARINGS USING A 360° COMPASS. INDICATE ALTERNATIVE IF USED.

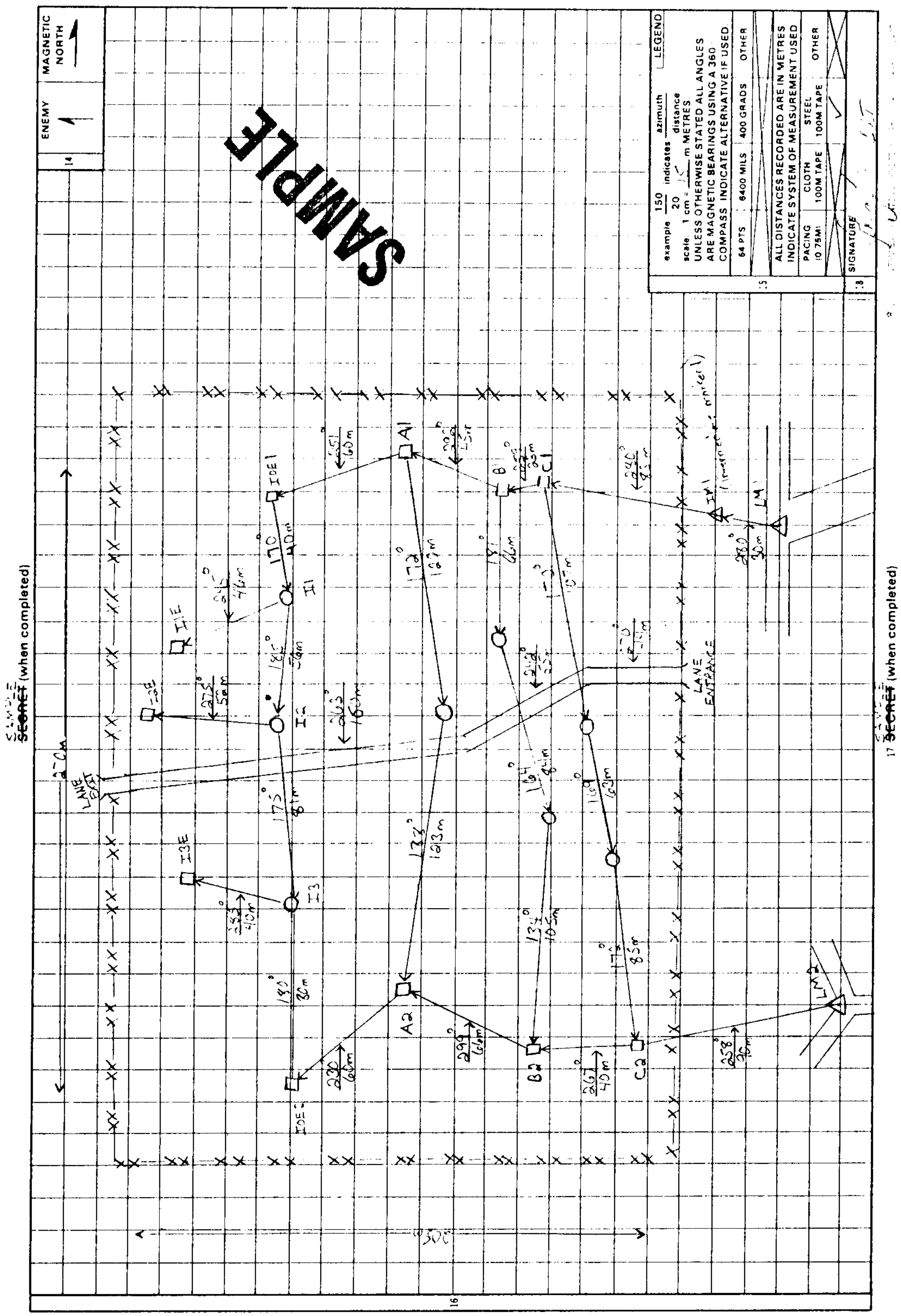
64 PTS	6400 MILS	400 GRADS	OTHER
X	X	X	X

ALL DISTANCES RECORDED ARE IN METRES INDICATE SYSTEM OF MEASUREMENT USED

PACING (0.75M)	CLOTH 100M TAPE	STEEL 100M TAPE	OTHER
X	X	✓	X

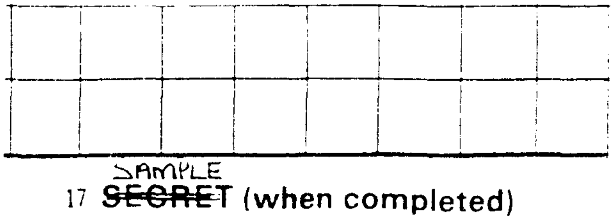
★ Block 16

Enter the following information on the sketch:



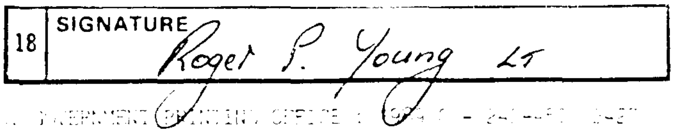
Block 17.

Enter the security classification of the form. If the form was used for training, enter the word *SAMPLE.*


17 ~~SECRET~~ SAMPLE (when completed)

Block 18.

The emplacing unit OIC signs in the signature block.


18 SIGNATURE Roger P. Young LT

DA Form 1355-l-R, Hasty Protective Minefield Record

The purpose and composition of a hasty protective minefield are discussed in Chapter 1. Hasty protective minefields are recorded on DA Form 1355-1-R (see Figure 5-3, page 5-7). Conducting a thorough leader's reconnaissance of the proposed minefield area is the first step when emplacing a hasty protective minefield. Mine locations that cover likely AAs, enhance key weapon systems, and cover dead space are identified. After the reconnaissance, mines are emplaced but not armed. As mines are being emplaced, an easily identifiable reference point (RP) is established between the minefield and the unit's position. From the RP, mines are visualized as running in rows parallel to the unit position. This procedure simplifies recording and makes retrieval quicker and safer. By international agreements, the row closest to the enemy is designated row A; succeeding rows are designated B, C, D, and so on. Procedures for recording a hasty protective minefield are explained below. In the minefield depicted in Figure 5-4, only two rows are appropriate (row A and row B). The ends of a row are indicated by markers labeled with the row's letter and the numbers 1 (for one end of the row) and 2 (for the other end of the row). The marker should be an easily identifiable object, such as a wooden stake or steel picket.

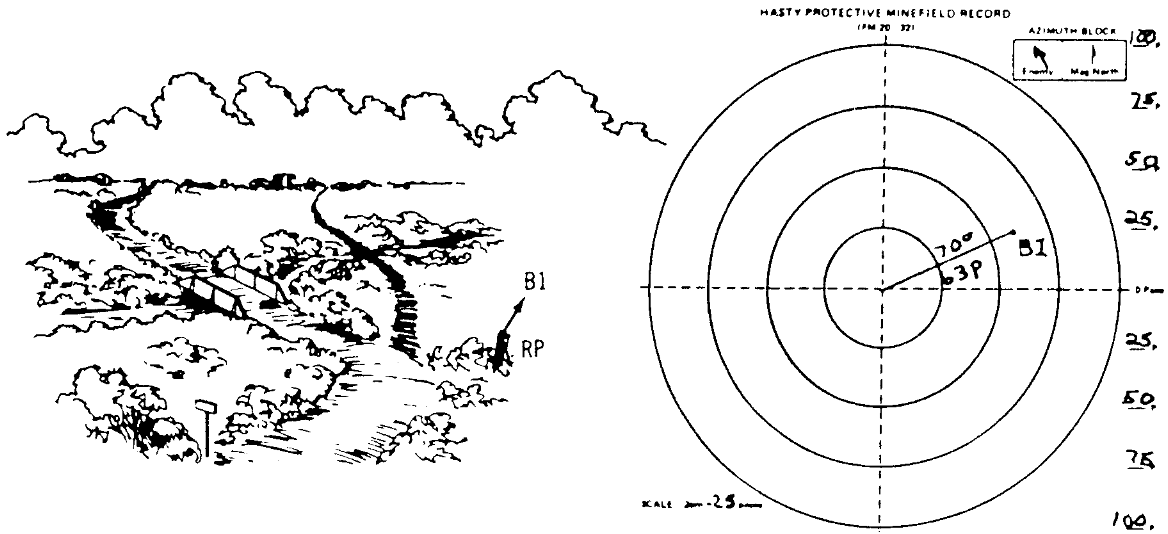
To determine the scale for use on DA Form 1355-1-R, use the following formula:

Distance from RP to the farthest point in the field + 10 paces /4 = scale.

EXAMPLE: 90 paces + 10 paces = 100 /4 = 25 paces.

The number 4 is a constant and represents the four concentric rings on DA Form 1355-1-R. Ten is added to the pace count as a safety margin to ensure the minefield sketch is entirely contained within the largest ring. The distance between rings is 2 centimeters; therefore, the scale used in this example is 2 centimeters = 25 paces.

From the RP, the magnetic azimuth is measured in degrees. The distance to a point arbitrarily selected is between 15 and 25 paces to the right of the first mine laid. This point, called B1 (if there are two rows), marks the beginning of the second row. A marker is placed at B1, and the azimuth and distance are recorded on DA Form 1355-1-R.



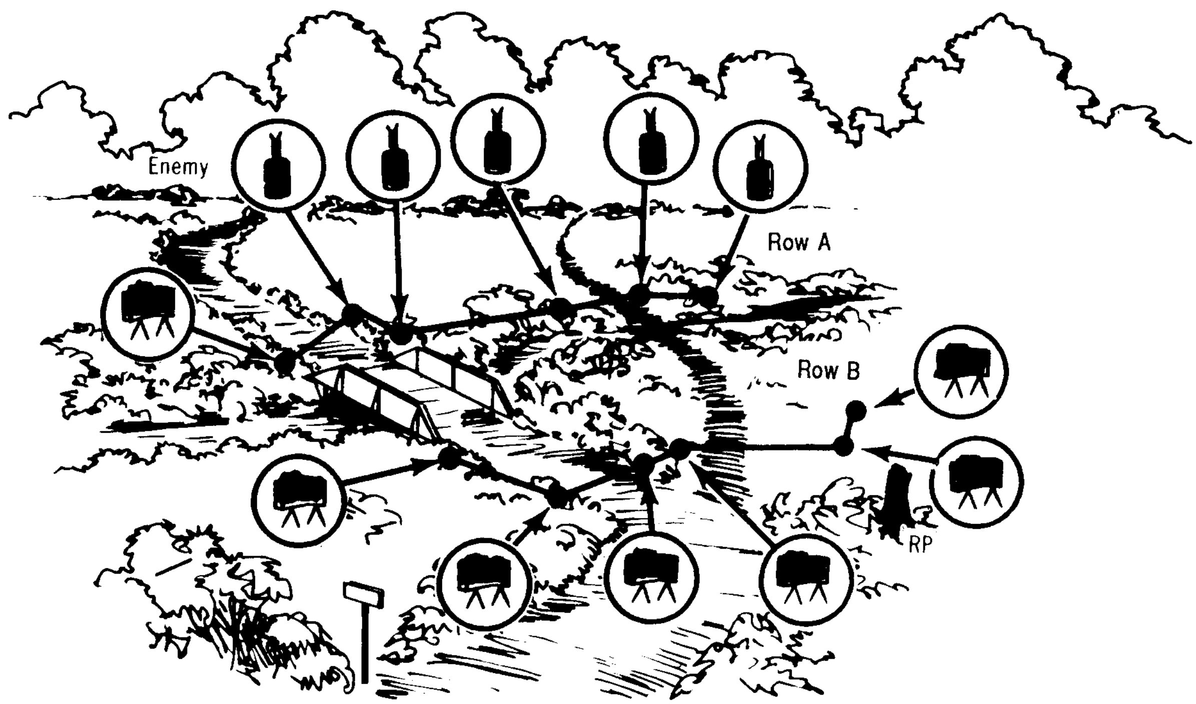
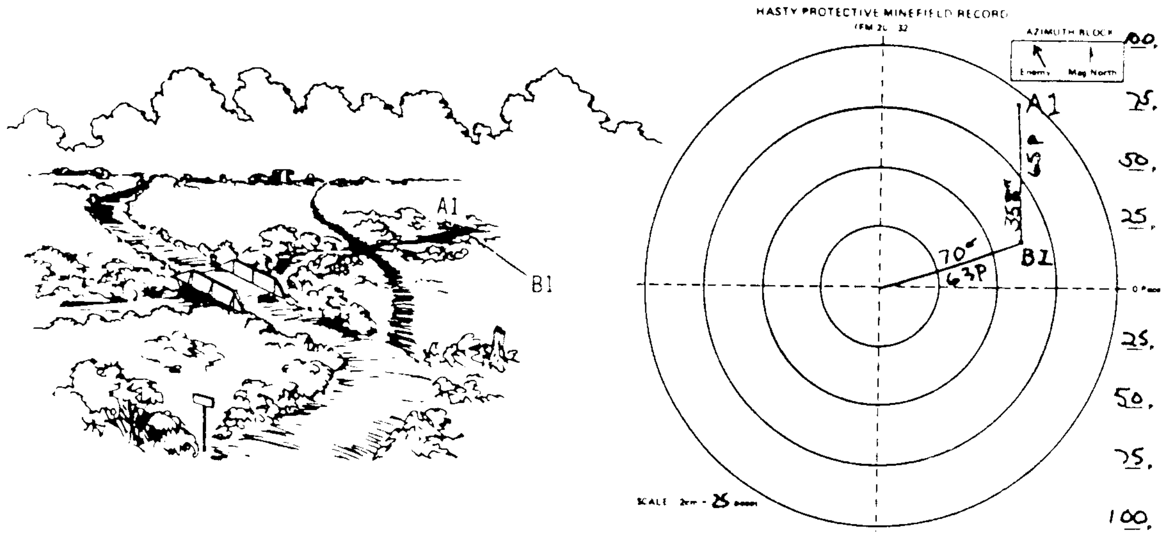
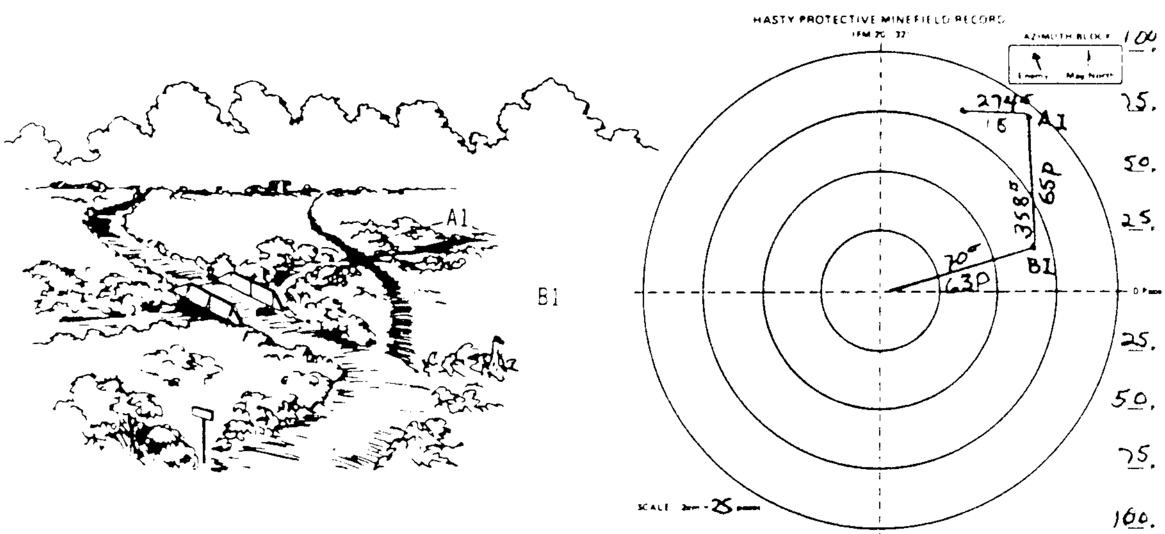


Figure 5-4. Hasty protective minefield

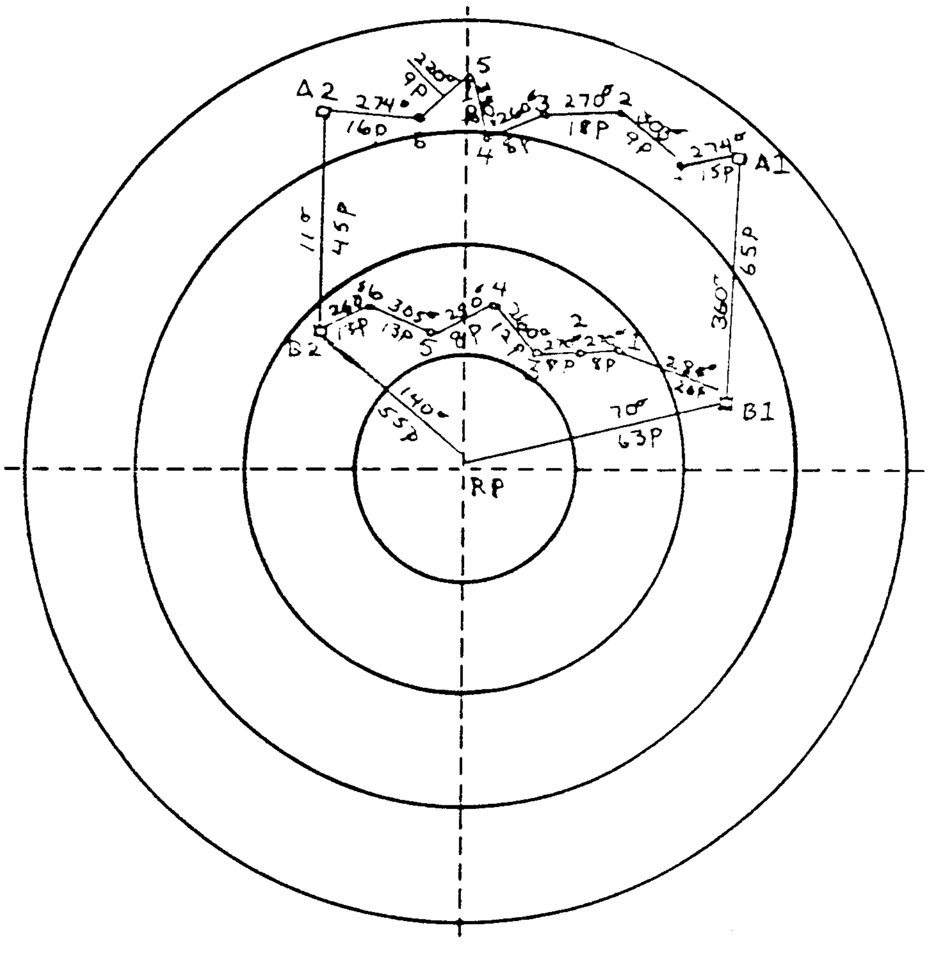
The azimuth and distance are measured to a point 15 to 25 paces from the first mine in row A. A marker is placed at this point and recorded as A1.



The distance and azimuth are measured from A1 to the first mine and recorded.



The distance and azimuth are measured from the first mine to the second, and so on, until all mine locations have been recorded as shown. This procedure is repeated for the second row. As each mine is recorded, it is assigned a number to identify it in the minefield record. When the last mine location is recorded, the distance and azimuth are measured from that point to another arbitrary point, A2 or B2. Here, a marker is placed in the same manner as Al and B1. Next, the distance and azimuth from the reference point to B2, and from B2 to A2, are measured and recorded.



The distance and azimuth between the RP and a landmark are recorded on DA Form 1355-1-R. The landmark is used to assist others in locating the minefield if it is abandoned. Finally, the tabular and identification blocks are completed.

Mines can be armed after recording is complete. Mines nearest the enemy are armed first, allowing soldiers to safely work their way back to the platoon position. Pins and clips can be buried 30 centimeters behind the row marker, the RP, or any easily identifiable, accessible location. Note the location in the remarks section (tabular block) of DA Form 1355- l-R.

DA Form 1355, Nuisance Minefield

The precise location of individual nuisance mines does not need to be recorded. The practice of locating mines within a defined boundary is used only when authorized. For this reason and because recording positions of mines which are laid to a pattern (either standard pattern or one adopted for the situation) is easy and quick, patterned laying should be used when it does not prejudice concealment. The number of mines to be laid on the site may make it impracticable or undesirable to lay mines to a pattern. In this case, they may be laid individually (unless otherwise authorized) if their positions are accurately recorded. Figures 5-5a through 5-5c, pages 5-21 through 5-23, provide an example of a completed nuisance minefield record.

Minefield Overlay Symbols

The symbols contained in Figure 5-6, pages 5-24 through 5-26, are extracts from FM 101-5-1 and are provided to assist in posting mine data on maps and overlays.

MINEFIELD - RECORD

3 Copy No. 1 of 3 Sheet No 1 of 1

1 AUTHORITY: CG 2nd INF DIV
LAYING UNIT: RCo 2nd ENGR BN, 2nd PL
OFFICER IN CHARGE: LT I. M. SMART 689-02-2725

2 DATE AND TIME — START: 090630Z JAN 90
COMPLETION: 091100Z JAN 90
RECORDER: SFC I. R. TOO 661-91-2691

4 MINEFIELD NUMBER: 2XX(INF)2-E

5 MAP: SERIES, NO. AND SCALE: H754 1:50 000
SHEET NO. (OR NAME): NJ 2015 MUNSAN

SAMPLE

6 LANDMARKS

NO	COORDINATES	DESCRIPTION
1	UT 34107309	CULVERT HEADWALL NORTH SIDE OF ROAD
2	UT 34561299	10 MILE MARKER ON NORTH SIDE OF ROAD
3	UT 34497200	CULVERT HEADWALL ON NORTH SIDE OF ROAD
4		

7 INTERMEDIATE MARKERS

NO	DESCRIPTION
1	
2	
3	
4	

8 DESCRIPTION OF BOUNDARY FENCE OR MARKING
NONE

9 NO. OF STRIPS/ROWS: NONE
DESCRIPTION OF STRIP/ROW MARKERS
NONE

10 LANES

NO	WIDTH	HOW MARKED	METHOD OF CLOSING
1			
2			
3			

11

~~TACTICAL MINEFIELD~~ NUISANCE MINEFIELD ~~PHONEY MINEFIELD~~	ANTITANK MINES (AT) TYPE M15 NO	TYPE NO	TYPE NO	TYPE NO	TYPE NO	TYPE NO	TOTAL AT MINES NO	ANTI-LIFT DEV NO	ANTIPERSONNEL MINES (AP) TYPE M16 NO	TYPE M14 NO	TYPE NO	TOTAL AP MINES NO
MINES IOE												
BURIED A									5			5
BURIED B	20						20			40		40
BURIED C	10						10	3	30	30		60
BURIED D									226	226		452
W/O PATTERN E										9		9
W/O PATTERN F												
W/O PATTERN G												
W/O PATTERN H												
W/O PATTERN J												
TOTAL	30						30	3	261	305		566

12 NOTES

1. MINE CLUSTERS AT ——— METRES/PACE SPACING
2. LOCATION OF AHD'S NOT RECORDED
3. NUISANCE MINING A: 5 M16 MINES LOCATED IN RUBBLE OF CRATER LOCATED AT INTERSECTION UT 33907300 IN VERGE OF NORTH SIDE OF ROAD 10m FROM CENTERLINE OF EW ROAD.
4. NUISANCE MINING B: MINING EXTENDS 100m SE OF LANDMARK 1 AND HAS FOLLOWING PATTERN: MOVE FROM LM1 SOUTH ALONG ROAD CENTERLINE, MINES PLACED 3m TO LEFT, CONTINUE 5m ALONG CENTERLINE MINES PLACED 3m TO RIGHT CONTINUED AT 5m INTERVALS LEFT/RIGHT FOR 100m (20 CLUSTERS) EACH CLUSTER CONSISTS OF 1 AT AND 2 AP (M14) MINES.
5. NUISANCE MINING C: MINES RANDOM LAID WITHIN 75m RADIUS OF NE POST OF BRIDGE
6. NUISANCE MINING D: MINES LAID TO PATTERN BETWEEN LM2 AND 3. NO OMITTED CLUSTERS. ALL CLUSTERS 0:2:2
7. NUISANCE MINING E: THREE MINES PLACED AT EACH INTERSECTION OF TRACK LEADING FROM HOUSES. TOTAL OF 9 (M14) MINES.

SIGNATURE (OFFICER IN CHARGE): Ian M. Smart LT
DATE: 9 Jan 90

SECRET (when completed) — Sample

DA FORM 1355, MAR 87
EDITION OF JUL 67 IS OBSOLETE

Figure 5-5a. Nuisance minefield - completed sample DA Form 1355 (front side)

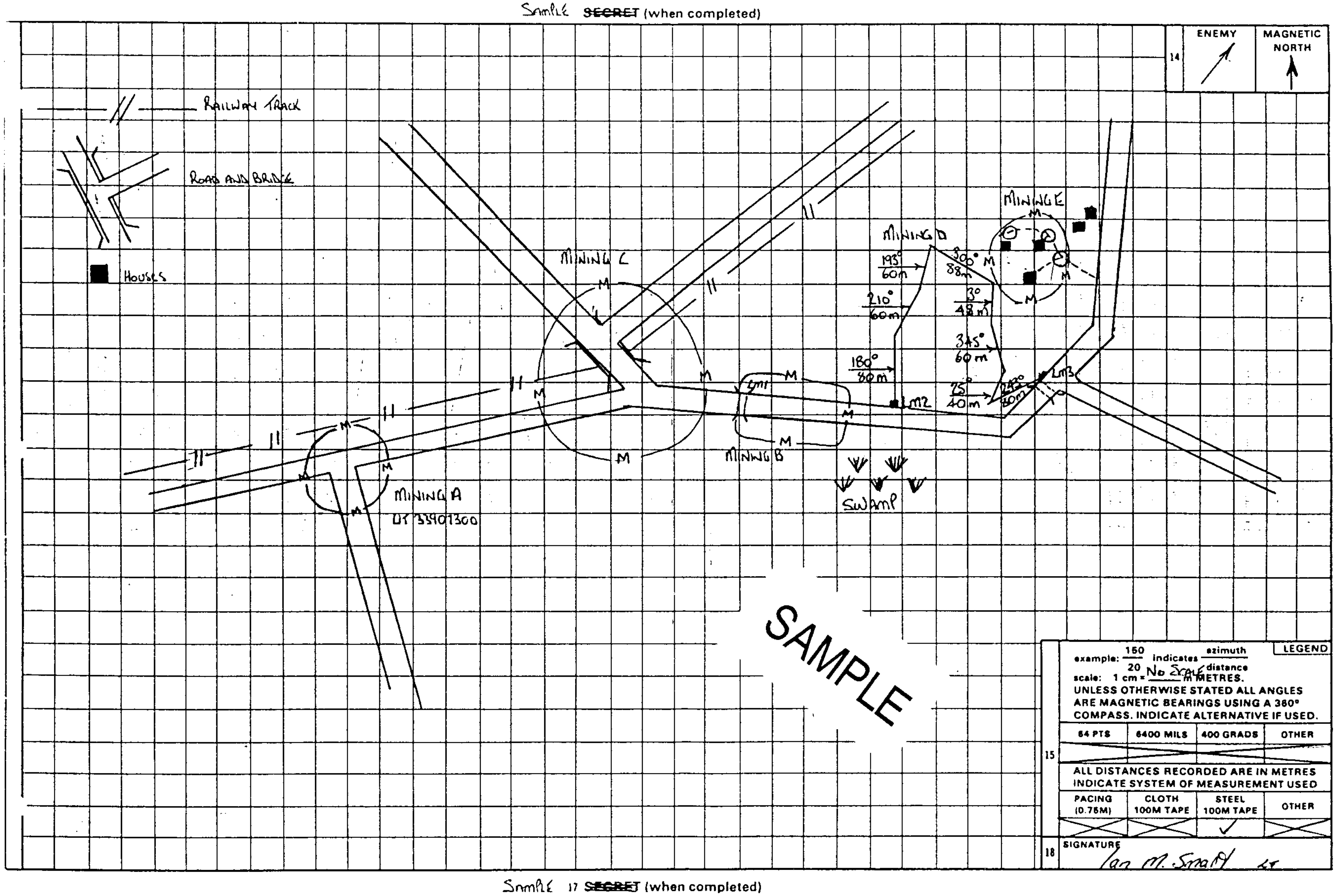


Figure 5-5b. Nuisance minefield - completed sample DA Form 1355 (inside) (continued)

SAMPLE
~~SECRET~~ (when completed)

MINEFIELD REQUIREMENTS COMPUTATION FORMULA

	AT	APF	APB
Desired Density	a____	b____	c____
IOE Representative Cluster	a____	b____	c____
Front ____ meters			
Depth ____ meters			
AHD ____ %			
*1. No. of IOE Clusters = Front ÷ 9 ______			
2. No. of IOE clusters x IOE Representative Cluster	a____	b____	c____
3. Mines in Minefield = Front x Desired Density	a____	b____	c____
4. Subtotal of Mines Required = Line 2 + Line 3	a____	b____	c____
*5. Mine Rejections, Strip Length Variances = Line 4 x .1	a____	b____	c____
6. Total AT Mines Required = Line 4 + Line 5	a____	b____	c____
7. Add a + b + c of "Desired Density" = ____			
*8. Line 7 x .6 = ____			
9. AT Mine "Desired Density" x 3 = ____			
10. No. of Regular Strips = Highest No. of Line 8 or 9 ____			
*11. No. of AHD = % AHD x Total AT Mines (Line 6) ____			
12. Strip cluster Composition = Desired Density x 3	a____	b____	c____

* NOTE: Round up to the next whole number.

"CLUSTER COMPOSITION TABLE"	STRIP	AT	APF	APB	ROW TOTAL (Cannot exceed 5)
	A	a____	b____	c____	____
	B	a____	b____	c____	____
	C	a____	b____	c____	____
	D	a____	b____	c____	____
	E	a____	b____	c____	____
	F	a____	b____	c____	____
	G	a____	b____	c____	____
	H	a____	b____	c____	____
	I	a____	b____	c____	____
	J	a____	b____	c____	____
COLUMN TOTAL (Totals cannot exceed Line 12).		a____	b____	c____	____

TABULAR DATA (Numbers correspond to numbered blocks on front of form).

1. Enter complete data on authority of laying and on the laying unit. OIC blanks will include name, rank, and SSN.
2. Enter date-time groups for starting and completion times. Recorder blanks will include name, rank, and SSN.
3. Enter copy and sheet numbers. Number of copies will depend upon unit SOP and the classification of the minefield. The number of sheets will depend upon the length and the depth of the minefield versus scale.

4. Enter minefield number as follows:

Designation of unit authorizing installation
Number of obstacle
Status of obstacle
(E=Executed, P=Proposed, U=Under Construction). 3/147-Inf-2-E

5. Enter map data as stated on map(s) used.
6. Enter complete data on at least two landmarks with 8 digit grid coordinates. Cross out unused blocks.
7. Enter description(s) of any intermediate markers used. When a landmark is more than 200 meters from the minefield or the strip/row reference stake cannot be seen from the landmark, an intermediate marker must be used. If possible, the intermediate marker should not be closer than 75 meters to the strip/row reference stake. Cross out unused blocks.
8. Enter the word "Standard" when the standard marking fen~e is used; describe the boundary marking if other than the standard marking fence is used.
9. Enter the number of strips/rows laid other than IOE. De ... 'rip/row markers (Line out words not applicable).
10. Enter the width, marking, and closing provisions for ... ppropriate, give the type and number of mines for closing. The location of these mines is describ ... 12). Patrol lanes are 1 meter wide, one-way vehicular lanes are 8 meters and two-way vehicul ... out unused blocks.
11. Enter type of minefield by crossing out lines not r ... 'y marking out incorrect descriptions. Enter types of mines as AT, APF, APB. (E... s). For each type of mine, enter number of mines and antihandling devices installed in ... Row. Strips or Rows will be lettered serially, starting with the first one laid. Enter totals. Cros...
12. Enter under Notes information which would be useful to personne... efield. Appropriate items include location of chemical mines, location of AT mines with antihandling device... AP mines with tripwires, clusters in IOE which contain mines, where safety devices are buried, strip cluster com... on and numbered omitted clusters in regular strips.

SAMPLE

13. OIC enters signature, rank and date.
14. Enter arrows for the direction of the enemy and magnetic north. The enemy arrow should always point within the top 180 degrees of the paper; the north arrow should follow one of the lines of the graph.
15. Enter scale of sketch for standard pattern minefields the sketch should be drawn to a scale of about 1cm=10 **meters**.
16. Sketch in the following, as applicable.
   a. Show directional arrows as follows:
      (1) Landmarks (or intermediate markers) to strip markers at starting and finishing points of the last strip laid or to the nearest or farthest mine in a group.
      (2) From landmarks (or intermediate markers) to fence or boundary markers.
      (3) From landmarks to intermediate markers, if used.
      (4) For each straight line section of a lane centerline.
      (5) Between markers of starting points of adjacent strips, including IOE, and between finishing points of adjacent strips, including (IOE).
      (6) For each segment of a strip or of the IOE, label all directional arrows with magnetic azimuth in degrees and distance in meters. Express as a fraction (247 **degrees**/90 **meters**). Recorded from friendly to enemy side and from right to left/or left to right.
   b. Show approximate location of protective fence or boundary markers.
   c. Show length and depth of minefield in **meters**. These dimensions indicate the extremities of the minefield.
   d. Show a grid intersection and give grid coordinates.
   e. Show trace of shoreline and direction and approximate rate in **meters** per second of water current, for mines laid underwater.
17. Enter security classification of the form. (If the form is used for training, enter the word SAMPLE.)
18. OIC enters signature and rank.

SAMPLE
~~SECRET~~ (when completed)

Figure 5-5c. Nuisance minefield - completed sample DA Form 1355 (back side) (continued)

Extract from FM 101-5.

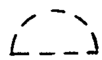
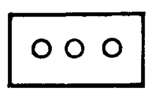
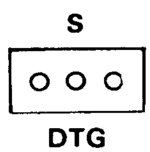
Description	Symbol
Minefields	
Indicators Antipersonnel mine	
Antitank mine	
Antitank mine with antihandling device	
Directional mine (arrow points in direction of main effect)	
Mine cluster	
Mine, type unspecified	
Conventional A planned minefield consisting of unspecified mines	
A completed minefield consisting of unspecified mines	
Scatterable minefield (DTGs used for self-destruct mines)	

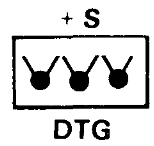
Figure 5-6. Minefield overlay symbols

Extract from FM 101-5.

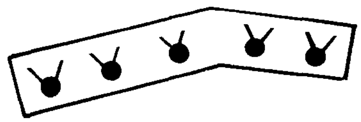
Description — **Symbol**

Conventional (cont)

Conventional minefield thickened with scatterable mines

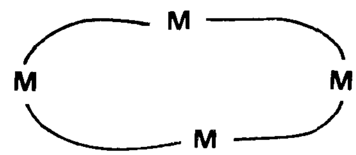


Conventional row mining (outline drawn to scale)

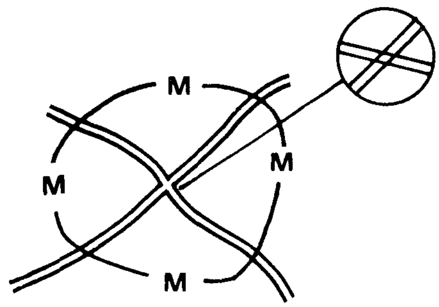


Nuisance

Nuisance minefield

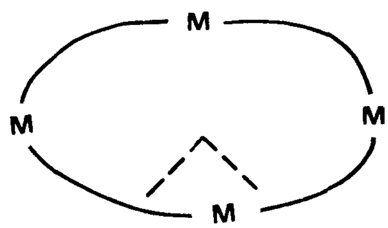


Demolished crossroads with nuisance mines



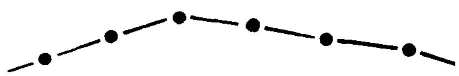
Phony

Phony minefield



Protective

Protective minefield



Antitank ditch reinforced with antitank mines

Figure 5-6. Minefield overlay symbols (continued)

Extract from FM 101-5.

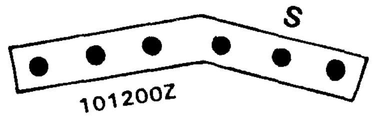
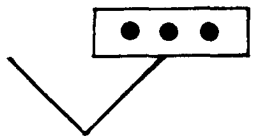
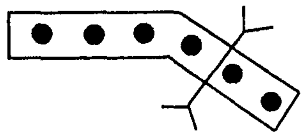
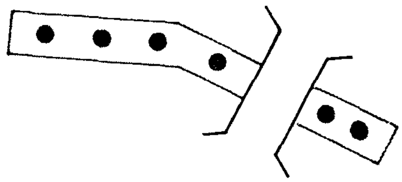
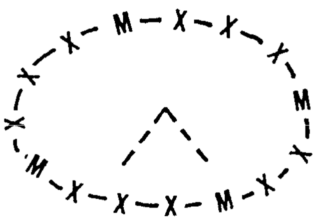
Description	Symbol
Tactical Tactical minefield of scatterable antitank mines, effective till 101200Z	
Completed antitank minefield (drawn away from the location and connected by a vector)	
Lane in conventionally laid antitank minefield	
Gap in conventionally laid antitank minefield	
Phony (dummy) minefield, fenced	

Figure 5-6. Minefield overlay symbols (continued)

Part Two. US Scatterable Mines

CHAPTER 6
SCATTERABLE MINES AND MINE SYSTEMS

Scatterable mines are laid without regard to classical pattern. They are designed to be delivered or dispensed remotely by aircraft, artillery, missile, or ground dispenser. All scatterable mines have a limited active life and self-destruct after their active life has expired. The duration of the active life varies with the type of mine and delivery system.

Scatterable mine systems enable the tactical commander to emplace minefields in enemy-held or contaminated territory, or in other areas where it is impossible to emplace conventional minefields. Some systems allow for rapid emplacement of minefields in friendly areas. As with all minefields and obstacles, scatterable minefields are an engineer responsibility.

Based on the tactical plan, the maneuver commander's staff engineer determines the location, size, time, and density of the minefield. With this information and a thorough understanding of available systems, he recommends the type minefield to be emplaced [conventional or scatterable]. If a scatterable minefield is selected, he recommends the delivery system and coordinates with the appropriate staff officers.

GENERAL CHARACTERISTICS

Most scatterable mines have similar (generic) characteristics. With the exception of the ADAM, standard scatterable AP and AT mines have a cylindrical shape and size (approximately 4.75 inches in diameter by 2.6 inches in height). (See Figures 6-1 and 6-2, page 6-2.) Scatterable mines are much smaller in size and weight than conventional mines. A standard scatterable AT mine weighs approximately 4 pounds and has 1.3 pounds of explosive; an M 15 conventional mine weighs 30 pounds and has 22 pounds of explosive. Arming mechanisms, arming times, and self-destruct times of scatterable mines differ based on the dispensing system and the chosen self-destruct time.

Antipersonnel Mines

There are two general categories of scatterable AP mines: wedge and cylindrical (Figure 6-1). Table 6-1, page 6-3, summarizes the characteristics of each type scatterable AP mine. The types of scatterable AP mines are—

- M67 and M72 AP mines (artillery-delivered).
- M74 AP mine (GEMSS- and Flipper-delivered).
- BLU 92/B AP mine (US Air Force-delivered).
- M77 AP mine (MOPMS-delivered).
- Volcano AP (ground or air Volcano-delivered).

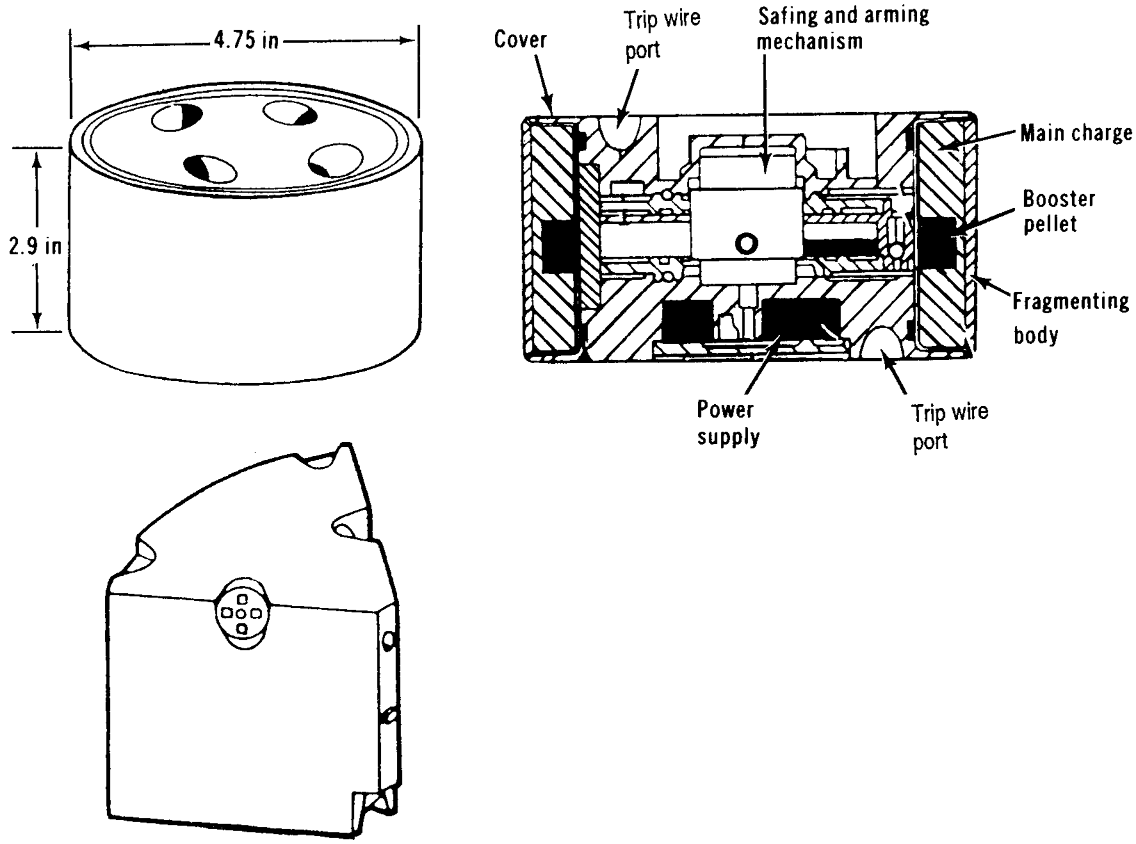


Figure 6-1. Antipersonnel mines

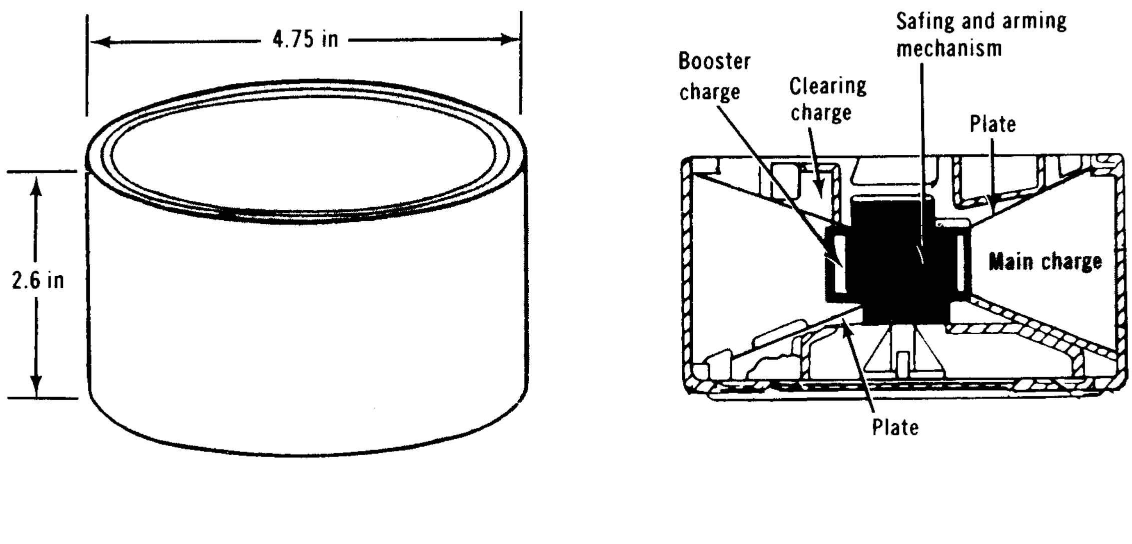


Figure 6-2. Antitank mine

★ *Table 6-1. Scatterable AP mine characteristics*

Mine	Delivery system	Arming mechanism	Safe arm time	Fuzing	Warhead	AHD	Self-destruct time	Explosive weight	Mine weight (lb)	Mines per 5-ton dump
M72	155 mm artillery (ADAM)	1-G force 2-spin	45 sec 2 min	Trip wire	Bounding fragment	20%	48 hr	21 grams Comp A5	1.2	36 per M692
M67	155 mm artillery (ADAM)	1-G force 2-spin	45 sec 2 min	Trip wire	Bounding fragment	20%	4 hr	21 grams Comp A5	1.2	36 per M731 projectile
M74	GEMSS Flipper	1-spin 2-electric	45 min	Trip wire	Blast fragment	20%	5 days 15 days	1.2 lb Comp B4	3.2	1,600
BLU 92/B	USAF (Gator)	1-bore pin 2-electric	2 min	Trip wire	Blast fragment	100%	4 hr 48 hr 15 days	1.2 lb Comp B4	3.2	NA
M77	MOPMS	1-bore pin 2-electric	2 min	Trip wire	Blast fragment	0%	4 hr (recycle up to 3 times)	1.2 lb Comp B4	3.2	30 modules (120 mines)
Volcano	Ground/Air	Crystal oscillator	4 min	Trip wire	Blast fragment	0%	4 hr 48 hr 15 days	1.2 lb Comp B4	3.2	160 canisters (160 mines)

★ The M67 and M72 are wedge-shaped AP mines that are dispensed from an ADAM projectile, which is a special 155-millimeter artillery munition. Each mine weighs 1.2 pounds and is 2.75 inches high.

The M74, BLU 92/B, M77, and Volcano AP mines are all cylindrical-shaped. They are 2.6 inches high and 4.75 inches in diameter, Cylindrical AP mines kill enemy soldiers through the combined effects of blast and fragmentation. Each mine contains 0.9 pound of Composition B4 as its main charge. The charge detonates upon actuation and shatters the mine's metal casing to produce shrapnel. Shrapnel is propelled upward and outward from the mine and produces fatal casualties to a distance of 15 meters. Each mine has eight trip wires (four on the top and four on the bottom) that deploy after ground impact up to 40 feet from the mine. Trip wires are similar in appearance to very fine fishline, and they are weighted at one end. Tension of 0.9 pound applied to one trip wire is enough to create a break in an electrical circuit and cause the mine to detonate.

Antitank Mines

All scatterable AT mines (except the M56 helicopter -delivered mine) have similar functional characteristics. They are cylindrical in shape, weigh approximately 4 pounds, contain 1.3 pounds of cyclonite (RDX) explosive as the main charge, and have a magnetic-induced fuze (Figure 6-2, page 6-2). The characteristics of each specific type of scatterable AT mine are summarized in Table 6-2, page 6-4. The types of mines include—

- M70 and M73 AT mines (artillery-delivered).
- M75 AT mine (GEMSS- and Flipper-delivered).
- BLU 91/B (US Air Force-delivered).
- M76 (MOPMS-delivered).
- Volcano AT (ground or air Volcano-delivered).

★ Scatterable AT mines are designed to produce a K-Kill (kill the crew of the vehicle) instead of an M-Kill. The mine produces a kill by using an SFF warhead (also called an M-S SFF plate). The warhead penetrates the vehicle's belly armor,

★ *Table 6-2. Scatterable AT mine characteristics*

Mine	Delivery system	Arming mechanism	Safe arm time	Fuzing	Warhead	AHD	Self-destruct time	Explosive weight (lb)	Mine weight (lb)	Mines per 5-ton dump
M723	155 mm artillery (RAAM)	1-G force 2-spin	45 sec 2 min	Magnetic	M-S plate	20%	48 hr	1.3 RDX	3.8	9 per M718 projectile
M70	155 mm artillery (RAAM)	1-G force 2-spin	45 sec 2 min	Magnetic	M-S plate	20%	4 hr	1.3 RDX	3.8	9 per M741 projectile
M75	GEMSS Flipper	1-spin 2-electric	45 min	Magnetic	M-S plate	20%	5 days 15 days	1.3 RDX	3.8	1,600
BLU 91/B	USAF (Gator)	1-bore pin 2-electric	2 min	Magnetic	M-S plate	No	4 hr 48 hr 15 days	1.3 RDX	3.8	NA
M76	MOPMS	1-bore pin 2-electric	2 min	Magnetic	M-S plate	No	4 hr (recycle up to 3 times)	1.3 RDX	3.8	30 modules (510 mines)
Volcano	Ground/Air	Crystal oscillator	2 min 30 sec	Magnetic	M-S plate	No	4 hr 48 hr 15 days	1.3 RDX	3.8	160 canisters (800 mines)

and spalling metal from the vehicle (created by the-mine blast or secondary explosives) kills occupants instantly. On enemy tanks with autoloaders, detonation of rounds in the belly-mounted ammunition carousel is very likely. The mine may not achieve a kill when the track of an armored vehicle runs directly over it. Also, due to the concentrated area of the blast, it is possible that an armored vehicle may continue to move. Even though the crew is killed, the drive train may be undamaged.

★ The magnetic fuze is designed to detonate as the magnetic field peaks over the mine. The warhead is bidirectional, meaning that it. can fire from the top or the bottom. The M70/M73 (RAAM) and M75 (GEMSS/Flipper) also have anti disturbance devices built into 20 percent of the AT mines. While the Volcano AT, MOPMS AT, and BLU 91/B (Gator) do not have antidisturbance devices, they will self-destruct when moved due to a change in their orientation to the earth's magnetic field. While this feature was not expressly designed as an antidisturbance device, it accomplishes the same function

Due to their small size, reduced explosive, and possibility of landing with an improper orientation (on their side or at an angle), scatterable AT mines have less chance of killing a vehicle than a conventional full-width AT mine. An armored vehicle will not always be destroyed after an encounter with a scatterable AT mine. Further, the effectiveness of scatterable mines in water obstacles is reduced even more, because 2 inches of water prevents the formation of the M-S slug. Although the blast wave is accentuated by underwater placement (attacking hatches and covers), mining of banks and approaches is recommended instead.

The M56 helicopter-delivered mine (Figure 6-3) is an AT blast mine that produces an M-Kill on wheeled or tracked vehicles, Each mine resembles a cylinder that is split in half lengthwise. The mine weighs 5.9 pounds, is approximately 10.4 inches long, and is 2.3 inches high. It utilizes an electrical/mechanical pressure fuze and an HE blast warhead. Pressure between 49 and 200 pounds is required for actuation. The M56 functions underwater as long as the water pressure does not exceed the actuation pressure. Some mines

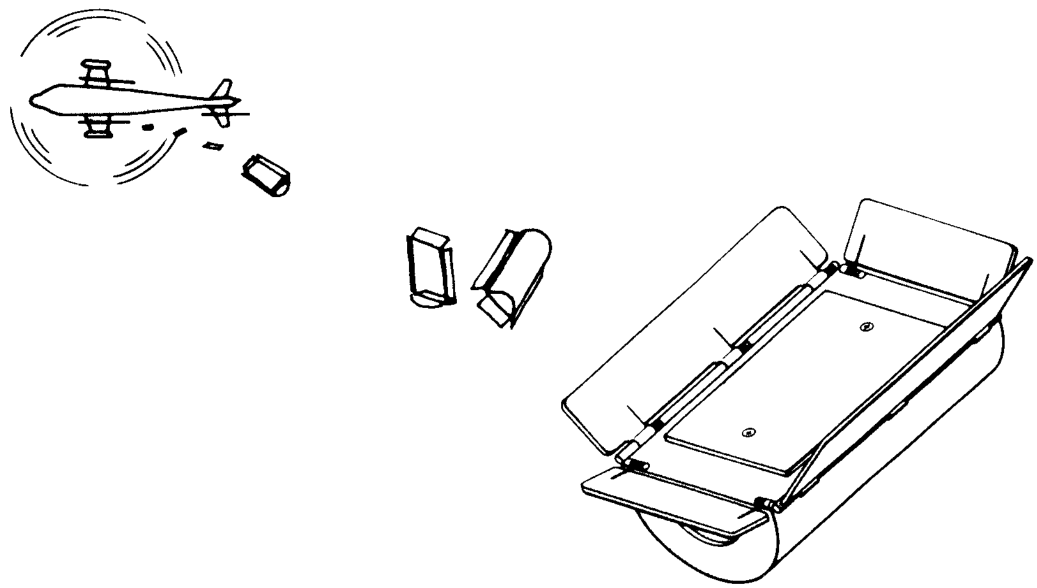


Figure 6-3. M56 mine system

have antidisturbance features. This system is currently being replaced by the air Volcano and is being phased out of the inventory.

CAPABILITIES

Faster response. Scatterable mines can be emplaced faster than conventional mines, so they provide the commander with greater flexibility, and they can be used to react to changes in situations. The commander can use scatterable mines to maintain or regain the initiative by acting faster than the enemy. This also helps preserve scarce mine resources.

Remote emplacement. Scatterable mines are remotely emplaced. This enhances battlefield agility and allows the maneuver commander to rapidly emplace mines to best exploit enemy weaknesses. Scatterable mines can therefore be used as a situational obstacle; as a reserve obstacle emplacement capability; and to directly attack enemy formations through disrupt, fix, turn, and block. Modern fuzing, sensing, and antidisturbance devices allow scatterable mines to better defeat enemy attempts to reduce the minefield.

Increased tactical flexibility. Upon expiration of the self-destruct time, the minefield is cleared, and the commander can move through an area that was previously denied to enemy or friendly forces. In many cases, the self-destruct period may be set at only a few hours. This feature allows for effective counterattacks to the enemy's flanks and rear areas.

Efficiency. Scatterable mines can be emplaced by a variety of delivery methods. They can be deployed by fixed-wing aircraft, helicopters, artillery, or ground vehicles. They satisfy the high-mobility requirements of modern warfare, Manpower, equipment, and tonnage are reduced for their emplacement.

Increased lethality. Scatterable AT mines utilize an SFF created from a two-sided M-S plate charge to produce a full-width kill. In simple terms, a metal plate is formed into a superdense molten rock that punches a hole in the belly of the tank. This produces an M-Kill against the vehicle engine, track, or drive train; a firepower kill against the vehicle weapon system; or a K-Kill in which the on-board ammunition is set off and the crew is killed or incapacitated. The scatterable AT mine is designed to kill any tank in the world. In order to form the SFF, the mine requires a standoff between the vehicle and the target. Mines must also be nearly perpendicular to the target (lying on either side). Because the M-S plate is two-sided, the mine will successfully attack the target while lying on either side. Scatterable AP mines are actuated by trip wires and utilize a blast/fragmentation-type kill mechanism. Scatterable mines are much smaller and lighter than conventional mines.

LIMITATIONS

Extensive coordination. Because scatterable mines are very dynamic weapon systems, great care must be taken to ensure proper coordination is made with higher, adjacent, and subordinate units. To prevent friendly casualties, all affected units must be notified of the location and duration of scatterable minefields. Recording and reporting procedures for scatterable mines are specifically designed to help minimize this problem.

Proliferation of targets. Scatterable mines may be regarded by some commanders as an easy solution to tactical problems. Target requests must be carefully evaluated, and a priority system must be established. Indiscriminate use of weapon systems results in rapid depletion of a unit's basic load. Controlled supply rates (CSRs) will probably be a constraint in all theaters.

Visibility. Scatterable mines are very effective, even though they lie exposed on the surface of the ground. They are relatively small and have natural colorings. Scatterable mines are highly effective, especially when fires and obscurants strain the enemy's command and control.

Accuracy. Scatterable mines cannot be laid with the same accuracy as conventional mines; however, their self-destruct capability eliminates the need for recovering them. Remotely delivered scatterable mine systems are as accurate as conventional artillery or tactical aircraft-delivered munitions.

Orientation. Between 5 and 15 percent of scatterable mines will come to rest on their edge. Mines with spring fingers will be in the lower percentile. If there is mud or snow more than 10 centimeters deep, mines will be in the higher percentile. Classified lethality data provides for 10 percent of scatterable mines to rest on their edge. When employing the ADAM and the RAAM in over 10 centimeters of snow, high-angle fire is used and the number of mines is increased. AP mines may be less effective in snow, because the deployment of trip wires is hindered. Melting snow may also cause mines to change position and activate antidisturbance features.

SCATTERABLE LIFE CYCLE

All scatterable mines have a similar life cycle, although specific times vary based on the self-destruct time and the dispensing system. The life cycle is as follows:

- At launch, all mines must receive two arming signals for safety reasons. Usually, one signal is physical (spin, acceleration, or unstacking) and the other is electronic. This same electronic signal sets the mine self-destruct time.

★ • Upon receiving arming signals, mines start their arming (or safe separation) countdown. Mines are still in flight. This allows them to come to rest and allows the dispenser to exit safely. Arming time for most mines is two minutes. Arming time for the GEMSS is 45 minutes, and newer model ADAM and RAAM rounds (with an Al suffix) have a 45-second safe separation arming delay. Volcano mines from the M87A1 canisters have a delay time of 2 minutes 30 seconds to 4 minutes.

• Mines are armed after the arming count-down. The first step in arming is a self-test to ensure proper circuitry. Approximately 0.5 percent of the mines fail the self-test and self-destruct immediately.

★ • After the self-test, mines remain active until their self-destruct time expires or until they are encountered. Mines actually self-destruct at 80 to 100 percent of their self-destruct time. The time period from when the mines begin to self-destruct and when they finish is called the *self-destruct window.* When the full self-destruct time is reached, no mines should remain. The probability of a live mine existing past its self-destruct time is 1 in 10,000, Mines that remain are duds. They are inoperative due to battery run-down, but should be treated as unexploded ordnance. Mines with a 4-hour self-destruct time will actually start self-destructing in 3 hours 12 minutes. When the 4-hour self-destruct time is reached, no unexploded mines should exist. The self-destruct times of US scatterable mines are shown in Tables 6-1 and 6-2, pages 6-3 and 6-4.

LETHALITY AND DENSITY

Lethality and tactical obstacle effect. Scatterable minefields are employed to reduce the enemy's ability to maneuver, mass, and reinforce against friendly forces. They increase the enemy's vulnerability to fires by producing specific obstacle effects on the enemy's maneuver (disrupt, fix, turn, and block). To achieve this aim, individual minefields must be emplaced with varying degrees of lethality. During emplacement, minefield lethality is varied primarily by changing its density. Therefore, there is a direct correlation between obstacle effect and minefield density. The following guidance is provided for use in choosing an appropriate density for individual minefields to achieve the tactical obstacle effect:

- *Disrupt:* Low density; 40-50 percent probability of encounter; linear density between 0.4 and 0.5 mine/meter front.
- *Fix:* Medium density; 50-60 percent probability of encounter; linear density between 0.5 and 0.6 mine/meter front.
- *Turn:* High density; 75-85 percent probability of encounter; linear density between 0.9 and 1.1 mine/meter front.
- *Block:* High density; 85 percent and higher probability of encounter; linear density higher than 1.1 mines/meter front.

Density. Density is normally expressed as *linear* or *area* density. For conventional mines, linear density is normally used and is expressed in the average number of mines per meter of minefield front. For scatterable mine systems, area density in normally used and is expressed in the average number of mines per square meter. Since scatterable mine systems normally employ a preset combination of AT and AP mines, the area density includes both. For example, a scatterable minefield with an area density of .006 mine/square meter may have an AT density of .004 AT mine/square meter and an AP density of .002 AP mine/square meter.

Linear density equals the number of mines divided by the frontage of the minefield.

$$\frac{\text{Number of mines}}{\text{front length (m)}} = \text{mines per meter of front}$$

Area density equals the number of mines divided by the minefield area (front times depth) in square meters.

$$\frac{\text{Number of mines}}{\text{front x depth}} = \text{mines per square meter}$$

Area density can be converted to linear density by multiplying the area density by the minefield depth.

Area density x depth (meters) = linear density

EXAMPLE: A 65- x 200-meter Gator minefield contains 564 mines (432 ATs and 132 APs).

- Overall area density: 564/(200 x 650)=.004 mine per square meter.

- AT area density: 432/(200 x 650) = .003 AT mine per square meter.

- AP area density: 132/(200 x 650) = .001 AP mine per square meter.

Overall linear density: 564/650 = .87 mine per meter front.

AT linear density: 432/650 = .67 AT mine per meter front.

AP linear density: 132/650 = .2 AP mine per meter front.

NOTES:

1. AT area density plus AP area density equals the overall area density; AT area density plus AP linear density equals the overall linear density.

★ **2. Converting area density to linear density is not always accurate due to the space between minefield strips (mines/meter of front).**

SCATTERABLE MINE EMPLOYMENT AND EMPLACEMENT

Employment considerations and emplacement techniques and procedures differ for each type of mine and delivery system. This section discusses the characteristics of each delivery system and provides tactical considerations for the employment of each system on the battlefield. Techniques and procedures for emplacing minefields intended to disrupt, fix, turn, and block are also discussed, and they build on the tactical obstacle design principles developed in Chapter 2.

ADAM/RAAM

ADAM and RAAM mines (Figure 6-4) are delivered by a 155-millimeter howitzer. No special modifications or adaptations are required for the firing system. Mines are contained within a 155-millimeter projectile and dispensed while in flight. The effective range of an M 109 howitzer is 17,500 meters, and the effective range of an M 198 howitzer is 17,740 meters.

The M692 (long duration) and M731 (short duration) ADAM projectiles deliver AP mines with different self-destruct times. Each ADAM artillery round contains 36 mines. The M731/M731A1 round contains M72 AP mines with a 4-hour self-destruct time; the M692/M692A1 round contains M67 AP mines with a 48-hour self-destruct time. Self-destruct times are preset during the manufacturing process and cannot be changed.

In either case, the wedge-shaped ADAM mine is a bounding fragmentation mine that deploys up to seven tension-activated trip wires 6 meters away from the mine. After ground impact, trip wires are released and the mine is fully armed. The ADAM contains a metal-jacketed sphere that is filled with 21 grams of Composition A5 as its main charge. A liquid explosive propelling charge positions itself at the bottom of the sphere after ground impact. Once the ADAM is jarred, tilted, or a tension of 0.9 pound or more is applied to one or more of the trip wires, the sphere propels upward 2 to 8 feet and detonates. The lethal casualty radius is between 6 and 10 meters.

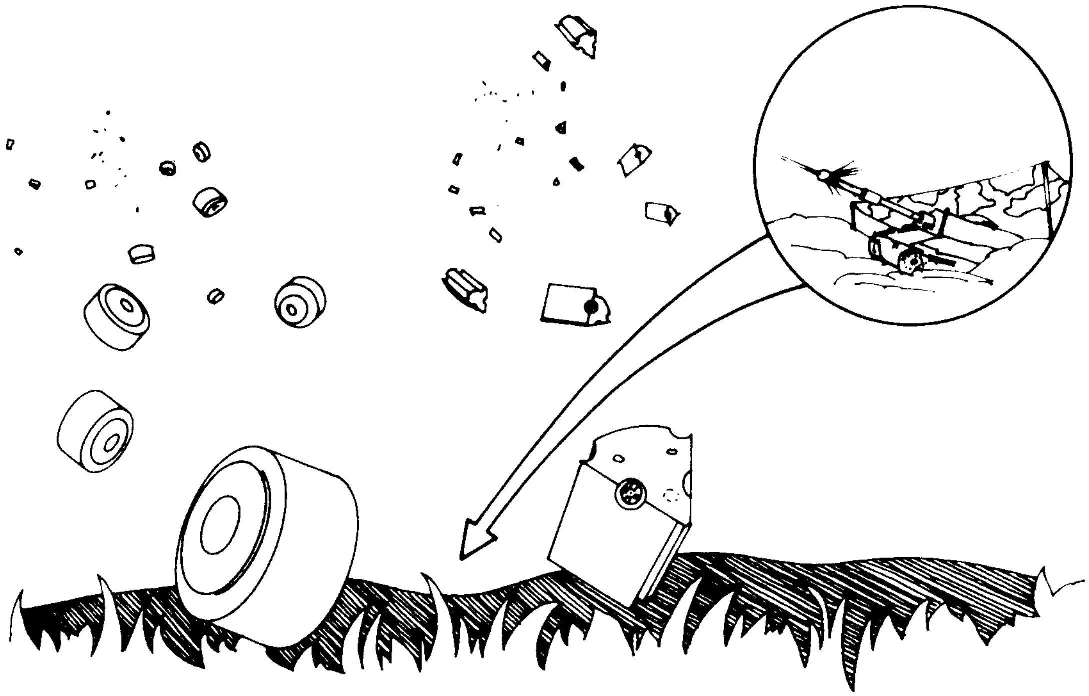


Figure 6-4. ADAM and RAAM mines

The M741 (short duration) and M718 (long duration) RAAMs are artillery-delivered AT mines. Each RAAM artillery round contains nine mines. The M741/M74111 round contains M70 AT mines with a 4-hour self-destruct time; the M718/M718Al round contains M73 AT mines with a 48-hour self-destruct time. Self-destruct times are preset during the manufacturing process and cannot be changed.

The RAAM mine utilizes an SFF warhead, has a magnetic-influence fuze, weighs 3.8 pounds, and has a small (4.75 inches in diameter by 2.6 inches in height) cylindrical shape. Newer model ADAM and RAAM mines (designated by Al) have a 45-second arming time. Older models have a 2-minute arming time. The newer model RAAM has a built-in feature that defeats magnetic signature-duplicating breaching devices.

Employment.

ADAM and RAAM systems were designed to provide flexible, rapid-response mining capabilities. These systems provide the maneuver commander with the capability to emplace mines directly on top of, in front of, or behind enemy forces. This is their greatest advantage. Their responsiveness allows the mission to be executed quickly and allows the commander to effectively influence a rapidly changing battlefield. Their major advantage is that they allow the commander to emplace minefields while maintaining maximum stand-off from the target. In short, they do not require committing any force (ground or air) forward to emplace. ADAM and RAAM systems may be used for the following purposes:

In defense, ADAMs and RAAMs may be used to—

- Develop targets for long-range AT weapons.
- Close gaps and lanes in other obstacles.
- Delay or disrupt attacking forces.
- Deny enemy unrestricted use of selected areas.
- Disrupt movement and commitment of second-echelon forces.
- Disrupt and harass enemy command and control, logistics, or staging areas.
- Reinforce existing obstacles.
- Disrupt or delay river crossings.

In offense, ADAMs and RAAMs may be used to—

- Supplement flank reconnaissance and security forces in protecting flanks along AAs.
- Suppress and disrupt enemy security elements once contact has been made.
- Hinder withdrawal of enemy forces.
- Hinder the enemy's ability to reinforce the objective area.

The time and number of rounds required to install effective ADAMs and RAAMs limit their use. Their range is also limited to 17,500 or 17,740 meters depending on whether the M109 or M 198 is used. Many deep-interdiction missions supporting AirLand Battle require a greater distance. Due to the large *footprint* created when the minefield is fired, many mines will be scattered outside the minefield *box* requested. It is therefore necessary to plot the safety zone in order to prevent fratricide. The fire support element (FSE) is responsible for plotting the safety zone. The staff engineer should be familiar with the process and the expected results. He ensures the safety zone is plotted on the tactical command post (TAC CP)/tactical operations center (TOC) operations overlay.

Emplacement.

ADAM and RAAM mining missions are requested through normal artillery support channels. Although actual numbers vary based on the unit and mission, a representative basic load for an artillery battalion consists of approximately 32 ADAMs and 24 RAAMs (short self-destruct times) rounds per gun tube. The long self-destruct rounds are normally used for preplanned targets and are issued from an ammunition supply point (ASP) on a mission basis.

Once the proper authorization has been received to employ mines, requests for ADAM and RAAM mines are processed in the same way as normal requests for fire support, including targets of opportunity. Exercise prudent judgment with moving targets of opportunity. Allocate enough time for processing the request and completing firing procedures. This ensures the enemy has not moved out of the target area before execution. The use of ADAMs and RAAMs for preplanned fires requires close coordination among the G3/S3, engineer, and FSE sections. Relationships and responsibilities for conducting artillery-delivered scatterable mine missions are outlined in Chapter 7.

There are two critical aspects to emplacing ADAM/RAAM minefields—designing the minefield to achieve the required effect, and ensuring the technical correctness of resourcing and delivering the minefield. The engineer is responsible for deciding the location, size, and type minefield to ensure support of the tactical plan. The FSE is responsible for integrating the delivery of the minefield into the fire support plan based on the tactical situation and the commander's intent and priorities. The FSE is responsible for determining all technical aspects of delivery such as the number of rounds required to achieve the density, range to target, time needed to emplace, and number and location of aim points.

The following discussion provides general guidance on designing the minefield to achieve the effect and determine the safety zone to assess the impact on maneuver. Appendix H of FM 6-20-40 serves as the primary source for technically resourcing and delivering artillery-delivered minefields.

ADAM and RAAM minefields can be emplaced to achieve disrupt, fix, turn, and block effects based on the principles outlined in Chapter 2. The engineer is responsible for deciding the required location, density, size, composition, and duration of the minefield based on the tactical obstacle plan and obstacle restrictions of the higher unit. The engineer provides this information to the FSE on DA Form 5032-R. Table 6-3 provides guidance on minefield density and size necessary to achieve the right obstacle effect.

The FSE determines all technical aspects of delivering the minefield. The FSE determines the number of rounds required per aim point, the number of aim points, the size of the safety zone, and the time required to emplace mines. There is a wide variety of factors involved in determining the number of rounds, size of the safety zone, and emplacement time. Examples are: the range-to-target, battery-to-minefield angle, high- or low-angle trajectory, and method of firing (observer adjust or meteorological data/velocity error (Met+VE transfer). It is the responsibility of the FSE to tell the engineer whether the minefield mission is feasible based on the number of rounds available, scheme of indirect fires, and availability of artillery tubes.

The engineer is primarily concerned with two technical aspects of delivery provided by the FSE—the safety zone and the emplacement time. The engineer uses the safety zone and minefield duration to assess the impact of the minefield on the mobility requirements of the scheme of maneuver. The engineer depicts the safety zone on the obstacle overlay. Also, the engineer uses the safety zone to identify requirements for minefield marking if the unit leaves or turns over the area before the self-destruct time. The engineer and FSE use the emplacement time to synchronize the delivery of the minefield with the tactical plan.

Gator

The Gator (Figure 6-5, page 6-12) has a longer range than any other available scatterable mine system. It provides a means to rapidly emplace minefields anywhere that can be reached by tactical aircraft. The Gator is produced in two versions. The Air Force CBU-89/B system contains 94 mines (72 ATs and 22 APs) per dispenser; the Navy CBU-78/B system contains 60 mines (45 ATs and 15 APs) per dispenser. The mix for each dispenser is approximately three AT mines to one AP mine.

Mines used with the Gator are the BLU-91/B AT mine and the BLU-92/B AP mine. They are similar to those used with the Volcano. The mines are capable of three field-selectable, self-destruct times (4 hours, 48 hours, and 15 days). Both types of mines are encased in a plastic, square-shaped protective casing designed to aid dispersion and lessen ground impact upon delivery.

Mines are contained inside tactical munitions dispensers (TMDs) attached under the wings of high-performance, fixed-wing aircraft. The

Table 6-3. RAAM/ADAM minefield density and size

Obstacle effect	Minefield densitiies				Width (meters)	Depth (meters)
	RAAM		ADAM			
	Area	Linear	Area	Linear		
Disrupt	0.001	0.2	0.0005	0.1	200	200
Turn	0.002	0.8	0.001	0.4	400	400
Fix	0.002	0.4	0.0005	0.1	200	200
Block	0.004	1.6	0.002	0.8	400	400

Area density - mines per square meters
Linear density - mines per meter front

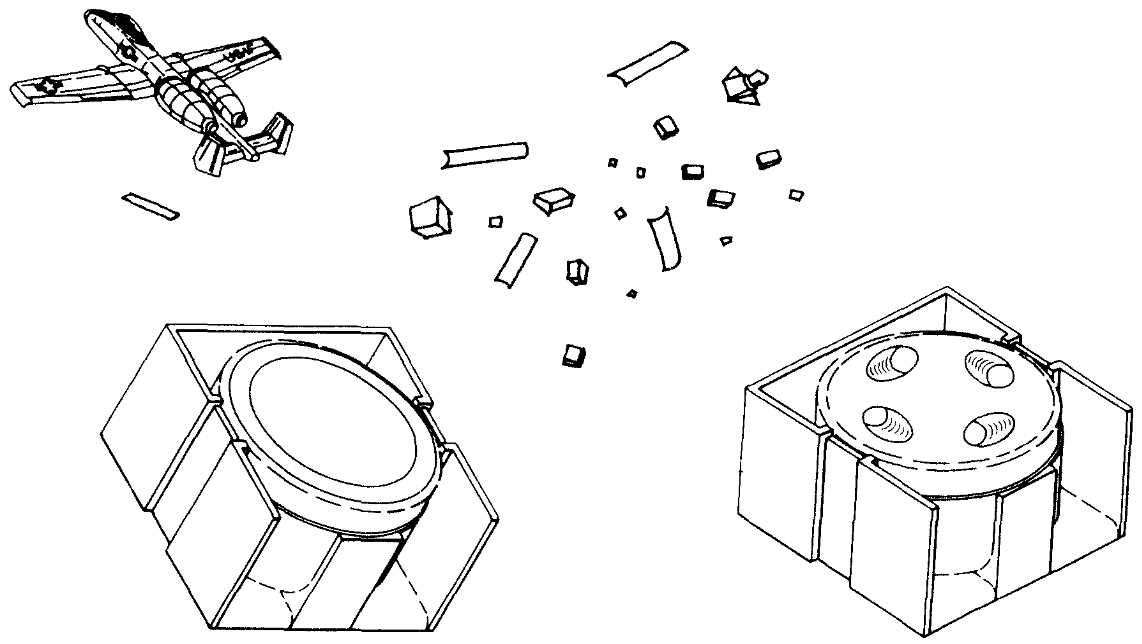


Figure 6-5. Gator mine system

TMD is a new Air Force dispenser designed for common use with future cluster munitions. Gator is compatible with the Air Force A-10, F-4, F- 16, F-111, and B-52 aircraft and the Navy A-6, A-7, F-4, FA-18, and AV-8B aircraft. While airborne, the dispenser is released and allowed to fall free. Four linear charges along the edge of the dispenser cut the outer casing, and the mines are aerodynamically dispersed. The maximum delivery speed is 800 knots at altitudes of 250 to 5,000 feet. The area of minefield coverage depends on the number of munitions carried, the aircraft speed and altitude, and the altitude that the fuze functions and opens the dispenser. The average area covered is approximately 200 by 650 meters.

Employment.

Gator missions are primarily used at long-range with the intent to disrupt, fix, or block enemy troop movements beyond the FLOT. The placement cannot be precise, because a one-second error in releasing the bomblet causes a significant change in minefield placement. All Gator missions should be preplanned. Gator munitions are well-suited for placing minefields on specific concentrations of forces (artillery, logistic, or command and control) that are out of range of conventional artillery.

While the Gator is capable of providing close combat support, deep interdiction mining is expected to be its primary mission. Normally, Gator minefields are employed in conjunction with other deep indirect fire attacks such as area of interest (AI), battlefield air interdiction (BAI), or joint air attack team (JAAT). However, a Gator minefield may be employed in conjunction with close air support and be covered by close indirect and direct fire systems. Typical Gator mining missions include the following:

- Isolate objectives.
- Counter ADA/artillery fires.
- Deny terrain.
- Disrupt and disorganize support activities.
- Inflict personnel and equipment losses.

The extended range of the Gator system, together with its speed and responsiveness, make it one of the most influential weapon systems on the deep battlefield. The primary limitations of the Gator are the competition for high-performance aircraft to emplace mines and its relative ineffectiveness on units in column. During any conflict, aircraft will be in high demand and will not always be immediately available for a Gator mission when required. Communications may also pose a problem because mission execution is a joint Army-Air Force operation.

The Gator is well-suited to support contingency operations and amphibious landing operations in an immature theater when there is no danger to friendly forces or host nation assets. Gator minefields are one of the light force commander's few durable, long-range antiarmor weapons.

Emplacement.

As an aircraft-delivered munition, the Gator is a corps asset. The Gator is a BAI mission and as such is controlled by the tactical air control center. Missions are requested 24 hours in advance through fire support channels to the corps FSE. As a mine system, Gator missions must be approved by corps. Corps FSE passes the mission to the theater/army group air headquarters for execution. In support of BAI or close air support (CAS), Gator sorties may be allocated down to battalion level with final control exercised by the battalion air liaison officer (ALO). Immediate Gator missions can also be requested directly from the maneuver unit tactical air control party. The same records and reports applicable to other scatterable mine systems are used with the Gator.

Close cooperation and coordination among the G3/S3, staff engineer, and ALO are required for planning and executing Gator missions. Responsibilities and guidelines involving Gator missions are discussed in Chapter 7.

As with artillery-delivered minefields, the engineer is primarily responsible for identifying the minefield location, size, duration, and density. Minefield density is varied by changing the orientation of the minefield with respect to the target AA. Figure 6-6, page 6-14, illustrates how minefield orientation is changed to achieve a fix or block effect. Normally, Gator is employed as a fixing obstacle with a frontage of 650 meters. Emplacing a fix obstacle group along a battalion AA (1,500 meters) requires two Gator sorties delivering two minefields. Each Gator minefield would have a frontage of 650 meters and a depth of 200 meters. The minefields would be delivered at different locations so that the group covers the entire AA and affects the entire enemy battalion.

M128 GEMSS

The GEMSS is a trailer-mounted system (Figure 6-7, page 6-14) that is towed by a variety of wheeled and tracked vehicles. It is usually towed by an Ml13, a 5-ton dump truck, or an M9 armored combat earthmover (ACE). The dispenser consists of two magazines; each magazine holds 400 mines. Mines are fed from magazines into the ejector that propels them 30 meters from the centerline of travel. The dispenser is controlled by the operator via a detachable, remote-control panel that allows selection of mine pattern, density, and self-destruct time. One of six pattern positions may be selected from the panel, allowing the operator to lay 26-, 34-, or 60-meter-wide mine strips (Figure 6-8, page 6-15). The sixth position (position J) allows the operator to lay mines in special patterns.

There are five density selections on the control panel— 0.001, 0.005, 0.007, 0.010, and 0.025 mine per square meter. The system has an effective emplacement speed of 5 to 8 mph that allows the entire 800 mines to be dispensed in about 15 minutes. The operator can also select a normal self-destruct time of 5 days or an extended self-destruct time of 15 days.

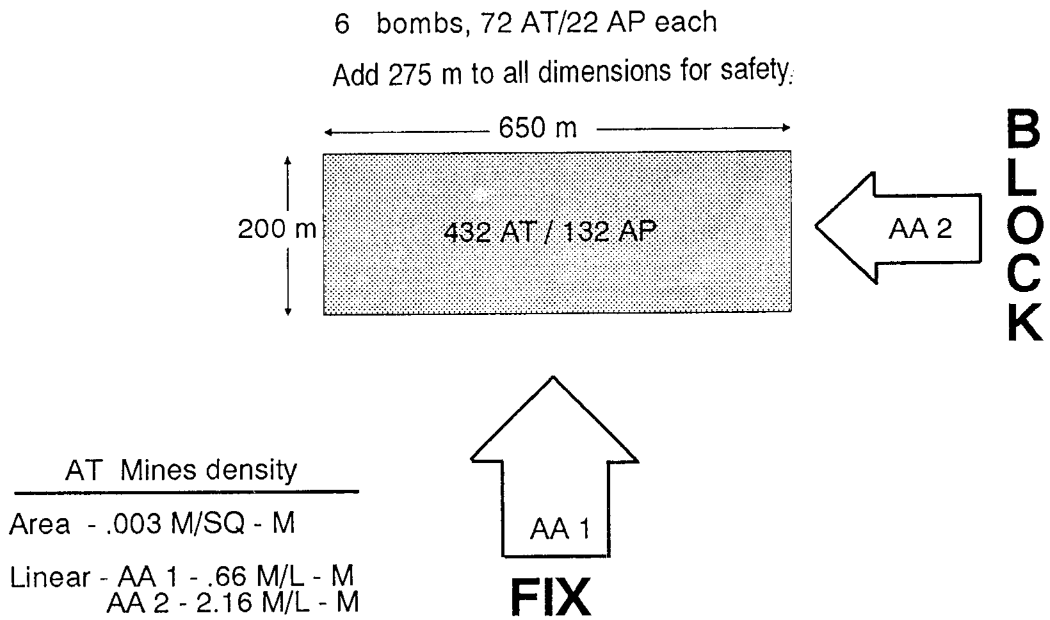


Figure 6-6. Scatterable mine employment of a Gator minefield

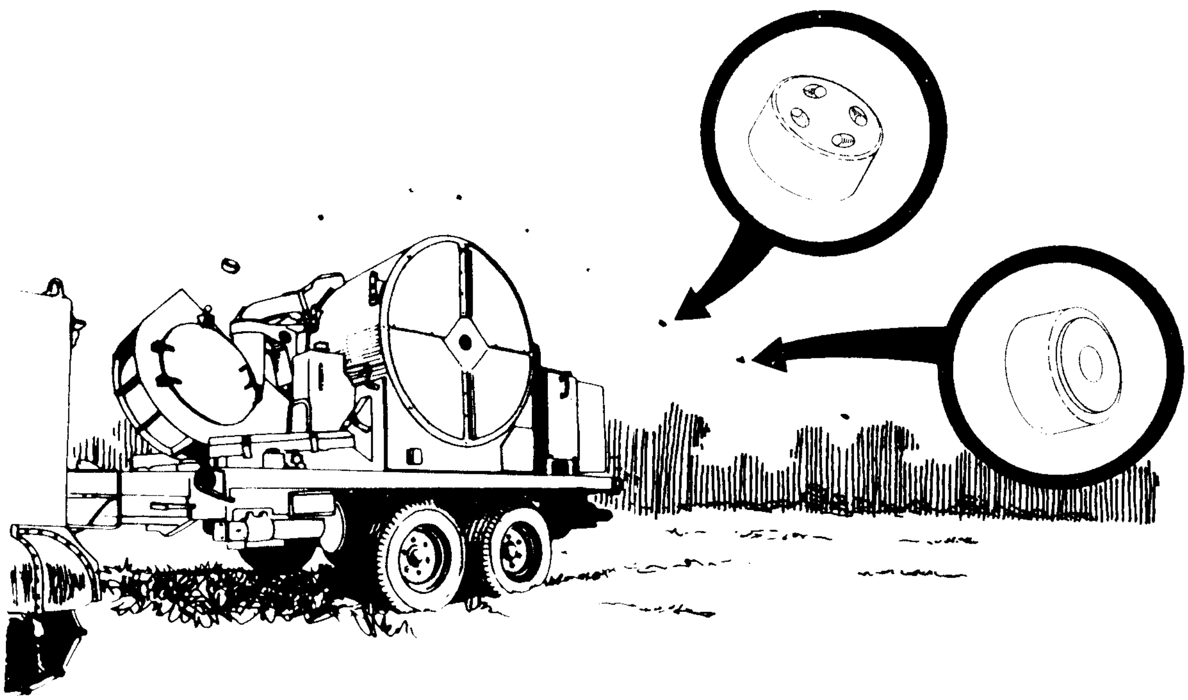


Figure 6-7. M128 Ground-Emplaced Mine Scattering System (GEMSS)

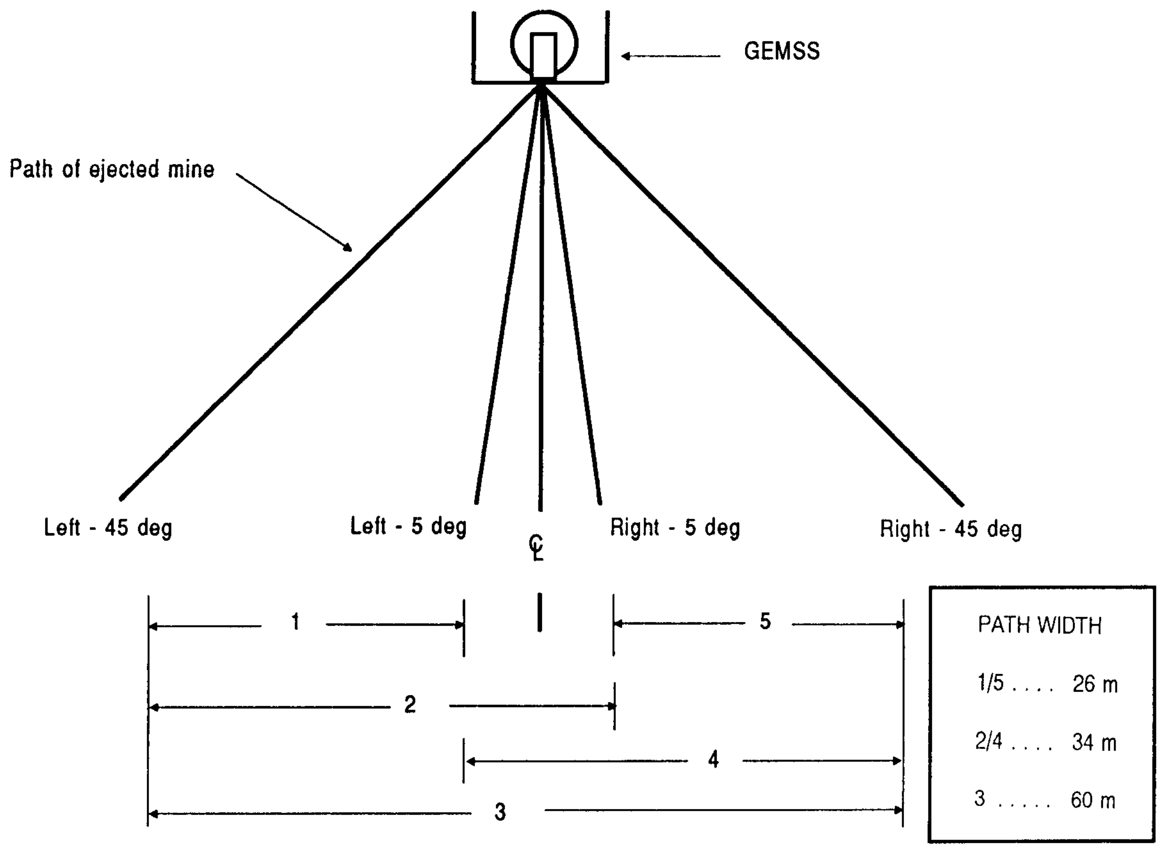


Figure 6-8. GEMSS minefield width settings

GEMSS M75 AT and M74 AP have a unique arming feature that requires spinning at a high velocity before the mines are armed. As the dispenser ejects the mines, they are spun at more than 2,500 revolutions per minute (rpm). This spinning action and a magnetic arming signal initiate arming sequences, and the mines are armed after a 45-minute delay period. Mines come in sleeves of five mines each; there are eight sleeves per shipping container.

Employment.

The GEMSS system was designed primarily to provide rapid emplacement of large minefields in areas controlled by friendly forces. It can be used to emplace tactical or protective minefields; however, it is normally employed only for tactical minefields. Key advantages of the GEMSS are the 800-mine capacity of the dispenser and the speed of emplacement. The GEMSS is capable of rapidly emplacing large-scale tactical minefields while making minimal stops for loading.

Major limitations of the system include the vulnerability of operating personnel to small caliber fire, support assets required to conduct the mission, and the arming initiation sequence. The GEMSS is too vulnerable to be employed along the FLOT. It is used as an obstacle reserve and employed when the enemy reaches a decision point that indicates future movement. Obstacles can then be emplaced on avenues the enemy is using, leaving other avenues open for friendly movement. This type employment requires at least six hours notice before minefield completion to allow for movement, emplacing the minefield, and arming time. This time can be reduced if minefields are preplanned and the GEMSS is prelocated at the most likely minefield location. Possible employment of GEMSS includes—

- Tactical minefields.
- Situational minefields to protect the flanks of an attacking or advancing force.
- Reseeding breached minefields or closing gaps left in friendly minefields.
- Reinforcing existing minefields or obstacles.
- Mining potential drop zones (DZs) or landing zones (LZs).

Emplacement.

GEMSS missions are tasked to engineer units in the same manner as conventional minefield missions. The type minefield to be emplaced and the self-destruct period determine the authorization required for employment. Once a unit has authorization to emplace a GEMSS, the G3/S3 and the staff engineer plan the minefield. As a minimum, the following items should be addressed in the plan:

- Location and proposed frontage of the minefield.
- Self-destruct time setting.
- AT to AP mine ratio.
- Number and width of strips.
- Mine density.

Although specific mission requirements vary depending on the tactical situation, several planning guides have been developed. Minefield density and width setting are based on METT-T considerations. The width of each strip is influenced by considerations such as mining a road or just the road shoulders. The system is extremely flexible. Table 6-4 provides guidance on combining density setting, strip width, and number of strips to achieve disrupt, fix, turn, and block minefields. For example, a turn minefield could be emplaced using one 60-meter strip with an area density setting of .025 or by using three 34-meter strips with a .01 area density setting. Other combinations are possible using the chart and are based on METT-T.

Figure 6-9 provides another technique for employing the GEMSS to emplace standard disrupt, fix, turn and block minefields. This technique uses standard GEMSS minefield packages, reduces the decisions the crew must make on minefield design, and standardizes emplacement drills. These standard packages are based on using only one of two density settings; emplacing one or two strips; and using only AT mines in disrupt, fix, and turn minefields. AP mines are mixed during loading using a 5 AT:1 AP mine mix for block minefields only. Minefield depth and frontage are varied for each type minefield per the principles outlined in Chapter 2. Figure 6-9 illustrates the strip layout for each type minefield. One load of GEMSS is capable of seven disrupt, five fix, one turn, or one block minefield.

GEMSS mines are dispensed approximately 30 meters, at a velocity of approximately 50 feet per second (15 meters per second). This presents a hazard to personnel in the rear of or in line with the dispenser. Personnel marking the location of mines must stay a minimum of 300 feet (92 meters) behind the vehicle. All personnel in the area must be cautioned concerning this hazardous area. If a mining mission requires dispensing mines over hilly terrain, mining should be accomplished while traversing across the top of the hill or while going uphill. Mining missions should not be conducted when descending a steep hill because mines may roll to the base of the hill. When mining on hilly terrain, the danger area should be expanded, to include the area from the top to the base of the hill.

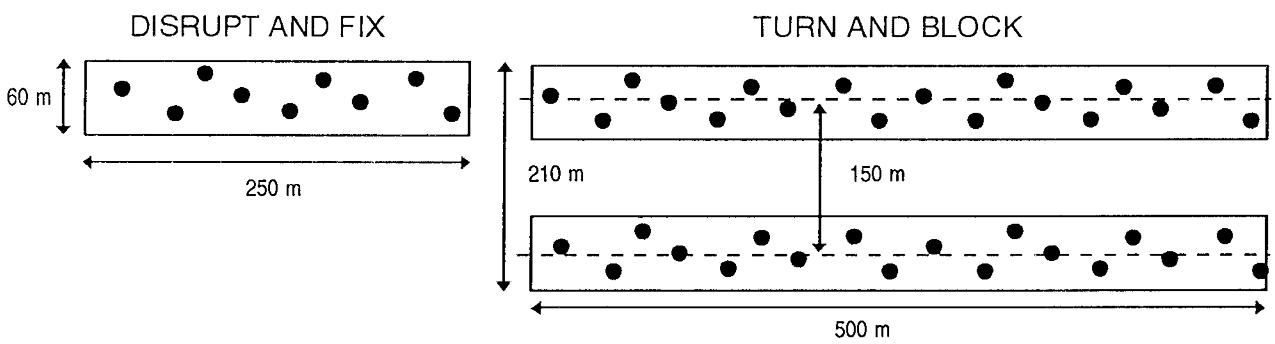
During dispensing operations, adhere to warnings found in the operator’s manual and those indicated on the dispenser. These precautions address requirements for hearing protection for all personnel within 25 feet of the dispenser and the host vehicle. Host vehicles determine the need for hearing protection.

Table 6-4. GEMSS emplacement data

Lethality and obstacle function

Density	Linear density for: 1 strip/2 strips/3 strips		
.001 m/sq m	.06/.12/.18 D/D/D	.034/.068/.102 D/D/D	.026/.052/.078 D/D/D/
.005 m/sq m	.3/.6/.9 D/F/F	.17/.34/.51 D/D/F	.13/.26/.39 D/D/D
.007 m/sq m	.42/.84/1.26 D/F/T	.24/.48/.71 D/D/F	.18/.36/.55 D/D/D
.01 m/sq m	.6/1.2/1.8 F/T/B	.34/.68/1.02 D/F/T	.26/.52/.78 D/F/F
.025 m/sq m	1. 5/3.0/4.5 T/B/B	.85/1.7/2.55 F/T/B	.65/1.3/1.95 T/T/B
	60 M	34 M	26 M

D - disrupt F - fix T - turn B - block



Type minefield	Path setting	Area density setting	Effective linear density	Number of strips	Depth	Frontage	Number AT mines M75	Number AP mines M74	Number minefield in one load
Disrupt	60 m	0.007	0.42	1	60	250	105	0	7
Fix	60 m	0.01	0.6	1	60	250	150	0	5
Turn	60 m	0.01	1.2	2	210	500	600	0	1
Block	60 m	0.01	1.2	2	210	500	500	100*	1

*NOTE: Requires loading mix of 5-M75 AT mines : 1-M74

Figure 6-9. Standard GEMSS minefield patterns, settings, and resources

M138 Flipper

The Flipper is a manual, auxiliary dispenser designed to emplace M74 AP and M75 AT mines designed for the GEMSS (Figure 6-10). The Flipper is a simple dispensing system and uses little automation to load and dispense mines. In short, mines are loaded by hand into the feeder chute. The operator determines the pattern by manually pivoting the dispenser across a 180-degree arc. Mines are dispensed in a 35-meter arc from the host vehicle. The Flipper provides the commander with great flexibility since it can be mounted on M113 personnel carriers, M548 cargo carriers, 2-ton cargo and dump trucks, or 5-ton cargo and

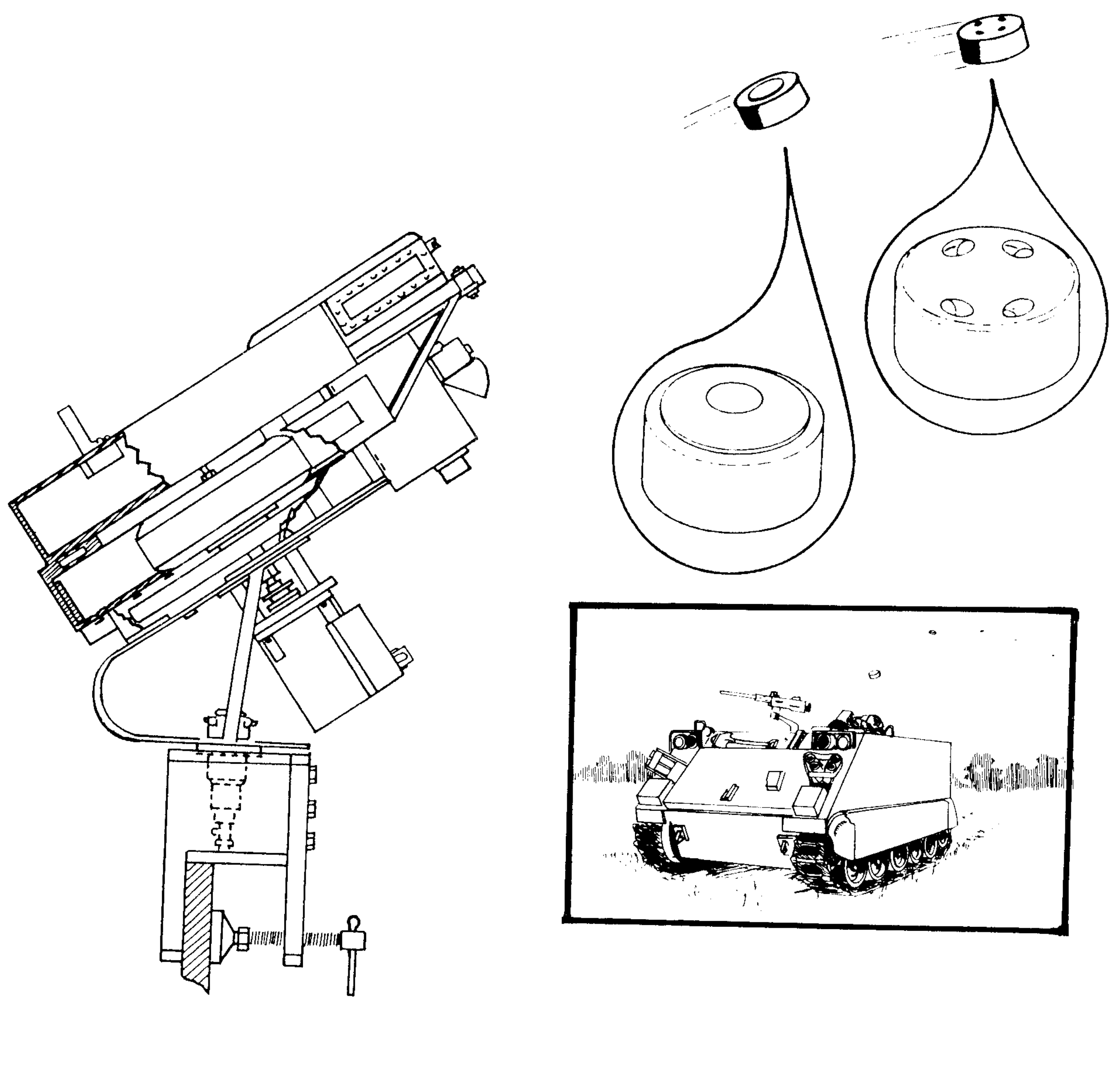


Figure 6-10. Flipper (GEMSS) auxiliary dispenser

dump trucks with no modification. The Flipper weighs approximately 130 pounds.

The Flipper uses the electrical power system of the host vehicle and launches the standard GEMSS mine 35 meters from the vehicle. It performs functions similar to the GEMSS dispenser (starts the arming cycle, sets the self-destruct time, and deploys the mine), and is the only alternative means of employing GEMSS mines. It can dispense six mines per minute. Mine deployment requires only two people—the mine loader and the operator. The Flipper can be used to augment the GEMSS since it emplaces the same mines, or the Flipper can be employed by itself.

Employment.

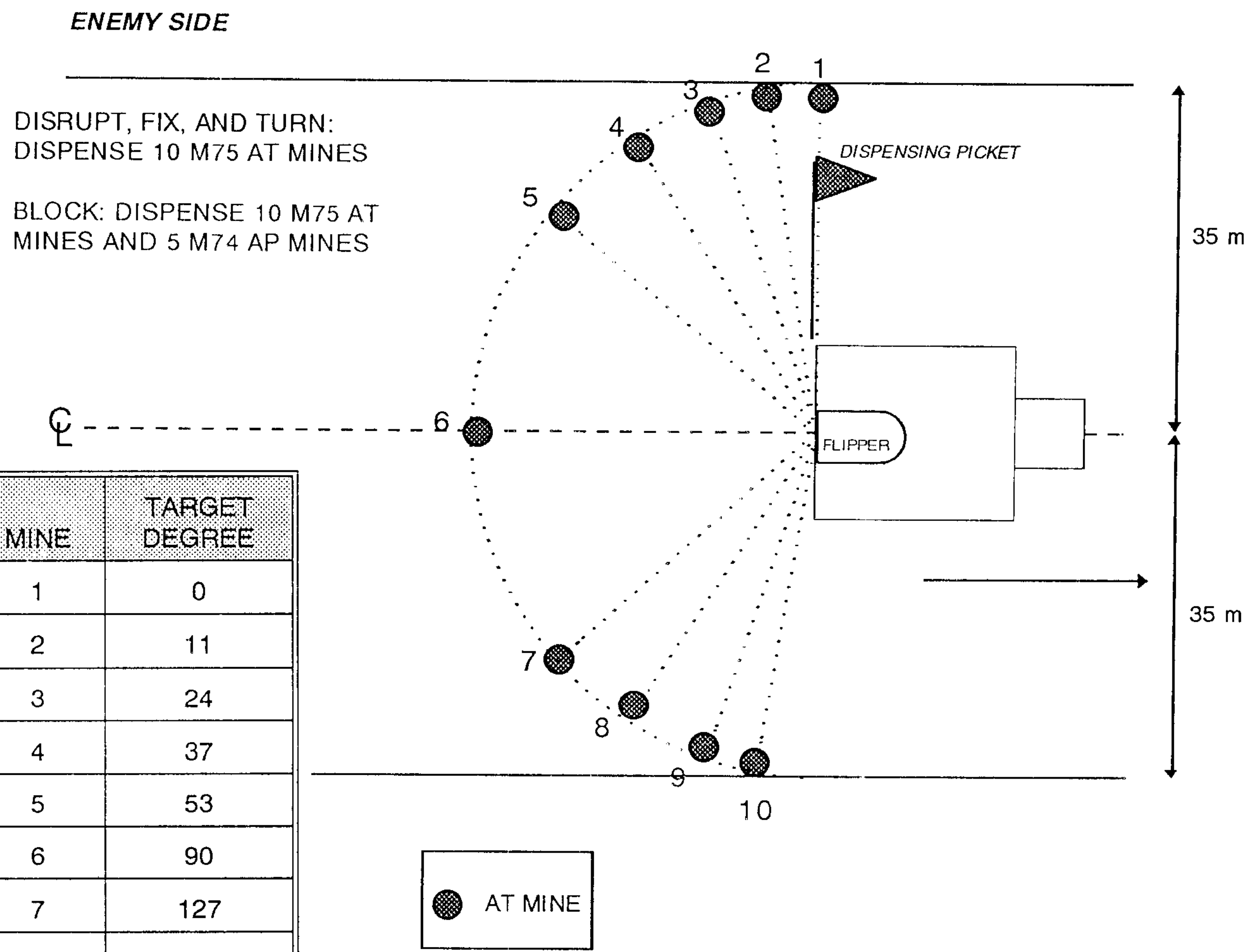
Employment considerations for the Flipper are essentially the same as those for the GEMSS. The major limitations of the Flipper are that it requires the crew to be exposed during operation and it cannot dispense mines on the move. However, when mounted on a tracked vehicle, the Flipper gives the commander the ground mine-dispensing capability that can keep up with maneuver forces during movement, and it can emplace a minefield quickly in response to a threat. An additional advantage is the system's versatility when emplacing mines. It can be used to emplace standard tactical minefields, small point minefields, or protective minefields relatively close to friendly positions. Manually aiming the dispenser allows engineers to emplace scatterable mines with great accuracy on a point target or in restrictive terrain.

Emplacement.

To minimize hazard risks to the Flipper operator, *stop-and-dispense* laying procedures should be conducted. However, if it is necessary to dispense while the host vehicle is in motion (roll and dispense), speed restrictions on the host vehicle must be applied. Personnel should not operate the Flipper dispenser when the prime vehicle speed exceeds 8 kilometers per hour (kph) (5 mph) on highways or 2.8 kph (1.76 mph) off the road. Since it is very difficult to maintain a speed under 2 mph, the stop-and-dispense laying procedure is recommended. Flipper minefield density and composition can be varied by the operator. The density is varied by the number of mines dispensed at each stopping point. The mix of mines in the minefield is determined by the number of AT and AP mines dispensed by the operator at a given stopping point.

When emplacing a standard minefield intended to disrupt, fix, turn, or block with the Flipper, the crew uses a set stop-and-dispense procedure. During site layout, dispensing markers are placed every 35 meters along a centerline. These markers are offset from the centerline half the width of the vehicle to the left (relative to the direction of emplacement). This allows the vehicle driver to guide on the markers during movement and allows the vehicle to remain on the centerline.

When the driver reaches a dispense marker, he stops the vehicle. The operator then traverses the dispenser to the zero-degree position (at right angle to direction of emplacement toward the enemy) as shown in Figure 6-11, page 6-20. This is the number 1 mine position. The operator dispenses mines in the order shown, traversing the dispenser in a 180-degree arc from the enemy side to the friendly side. The target angles shown are only a guide to achieve optimal spacing between mines and uniform linear density. All angles are relative to the number 1 mine at zero degrees. Crews may want to fabricate and mount an *aiming circle* to make dispensing more accurate. As a general guide, the operator should traverse between 15 and 20 degrees between mines. For all standard minefields, the operator dispenses 10 M75 AT mines (two sleeves) at each dispensing point. For blocking minefields, the operator dispenses five M74 AP mines (one sleeve) in addition to the AT mines.



MINE	TARGET DEGREE
1	0
2	11
3	24
4	37
5	53
6	90
7	127
8	143
9	156
10	168

Figure 6-11. Flipper stop and dispense point

Figure 6-12 illustrates the total pattern for a minefield intended to disrupt or fix. These minefields have a frontage of 245 meters and a total depth of 70 meters. Emplacing fix and disrupt minefields with the Flipper requires four dispensing points; the first one is 35 meters from the centerline start point. Disrupt and fix minefields require 70 M75 AT mines (14 sleeves).

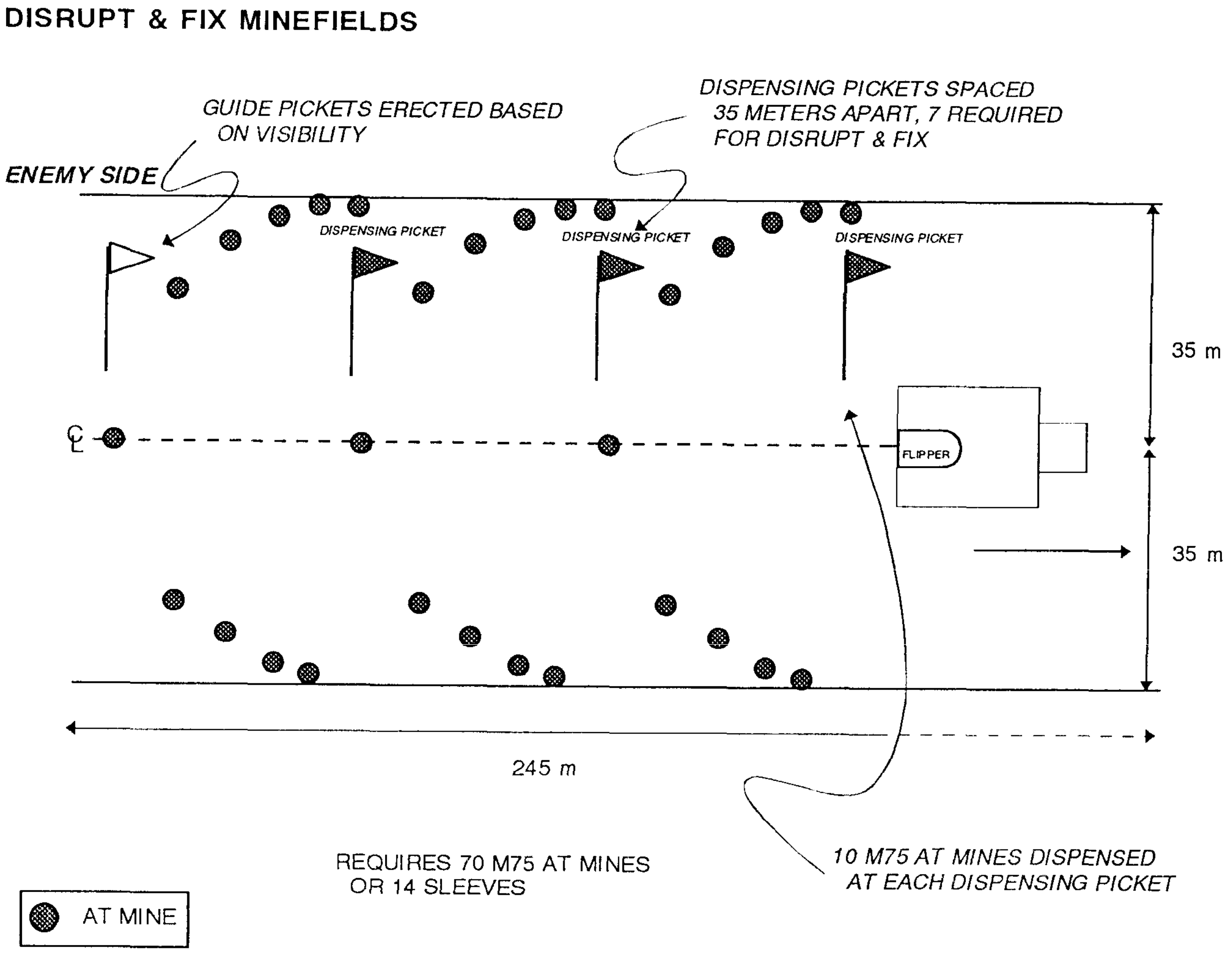


Figure 6-12. Standard Flipper disrupt and fix minefields

★ Figure 6-13, page 6-22, illustrates the standard Flipper minefield intended to turn and block. Turn and block minefields require two centerlines 170 meters apart. The minefield frontage is 490 meters and requires 14 dispensing points on each centerline. The total minefield depth is 240 meters. Both turn and block minefields require 280 M75 AT mines (56 sleeves). Block minefields require 140 M74 AP mines (28 sleeves) in addition to AT mines. Optimally, two Flipper dispensers are used to emplace turn and block minefields so that both strips are emplaced simultaneously. However, one Flipper can emplace both strips, one at a time. Table 6-5 summarizes the site layout and mine requirements for each type Flipper minefield.

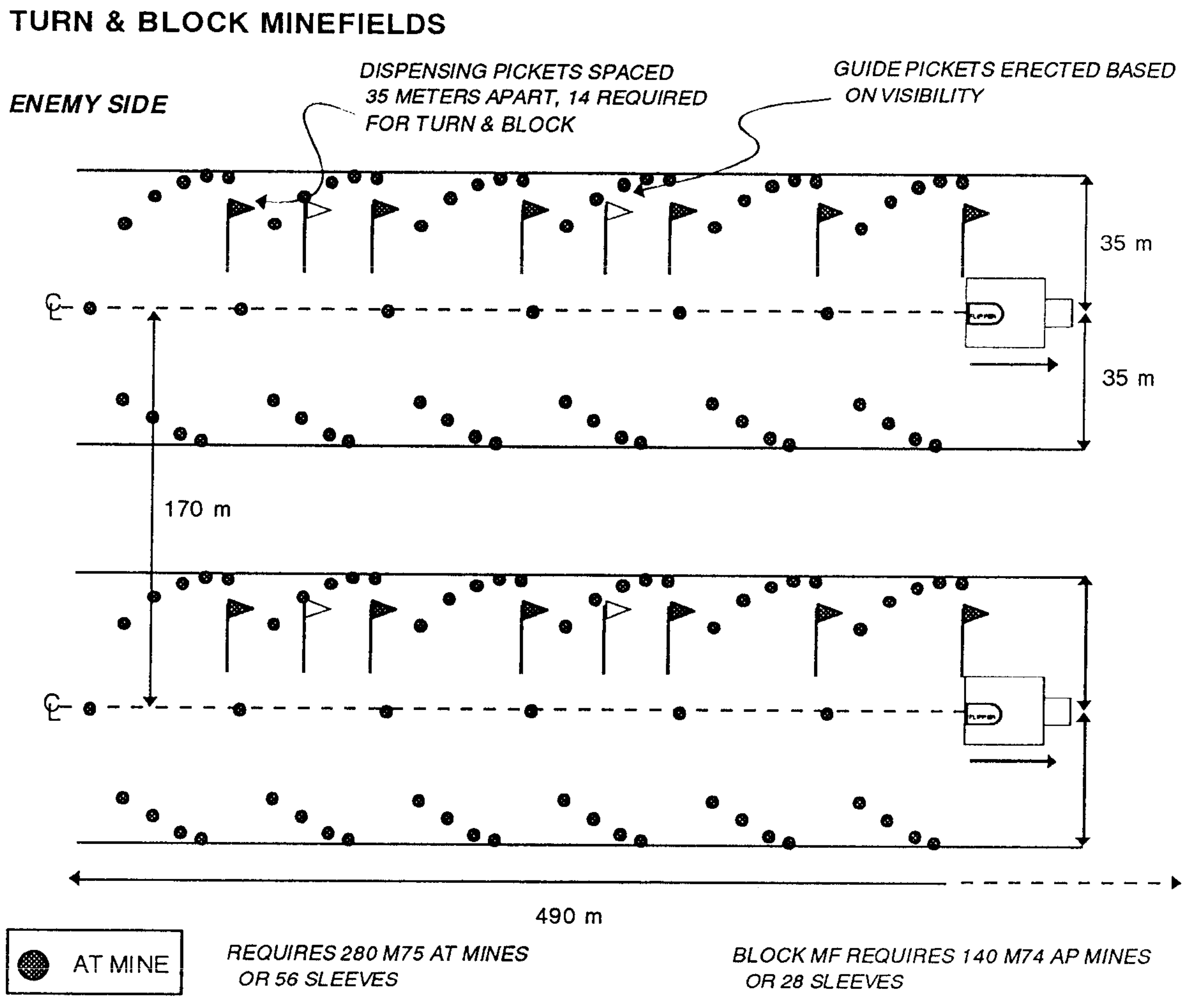


Figure 6-13. Standard Flipper turn and block minefields

Table 6-5. Flipper minefield data

Type minefield	Depth (meters)	Front (meters)	Number of strips	Dispensing points per strip	Number M75s per dispensing point	Number M74s per dispensing point	Total number M75 AT mines	Total number M74 AP mines
Disrupt	70	245	1	7	10 (2 sleeves)	0	70 (14 sleeves)	0
Fix	70	245	1	7	10 (2 sleeves)	0	70 (14 sleeves)	0
Turn	240	490	2	14	10 (2 sleeves)	0	280 (56 sleeves)	0
Block	240	490	2	14	10 (2 sleeves)	5 (1 sleeve)	280 (56 sleeves)	140 (28 sleeves)

Volcano

★The multiple delivery mine system (Volcano) (Figure 6- 14) is intended to replace the M56 helicopter-delivered mine system, the GEMSS, and the Flipper. It provides a single mine-delivery system capable of being dispensed from the air or the ground. The Volcano can be mounted on a 5-ton vehicle, an M548 tracked cargo carrier, or a UH-60A Blackhawk helicopter. This system uses modified Gator mines and consists of three components (Figure 6-15)—M87 mine canister, the M139 dispenser, and the vehicle-specific mounting hardware (aircraft also require a jettison kit). The Volcano uses the M87 mine canister. The mine canister is prepackaged with five AT mines, one AP mine, and a propulsion device inside a tube housing, The mixture of mines is fixed and cannot be altered in the field. Mines are electrically connected with a web that also functions as a lateral dispersion device as the mines exit the canister. Spring fingers mounted on each mine prevent mines from coming to rest on their edge. All canisters are capable of dispensing mines with 4-hour, 48-hour, or 15-day self-destruct times. These times are field selectable prior to dispensing and do not require a change or modification in the base M87 canister. The Armament Research Development Center (ARDEC) is redesigning the current Volcano mine to add dual magnetic influence fuzes and to remove the bore-rider timer safe separation device. The bore--rider timer is being replaced with an in--ternal crystal oscillator. The delay arm times have been extended from 2 minures (both AP and AT) to 2 minutes 30 seconds for the AT mine and 4 minutes for the AP mine. These mines will be in the M87A1 canister.

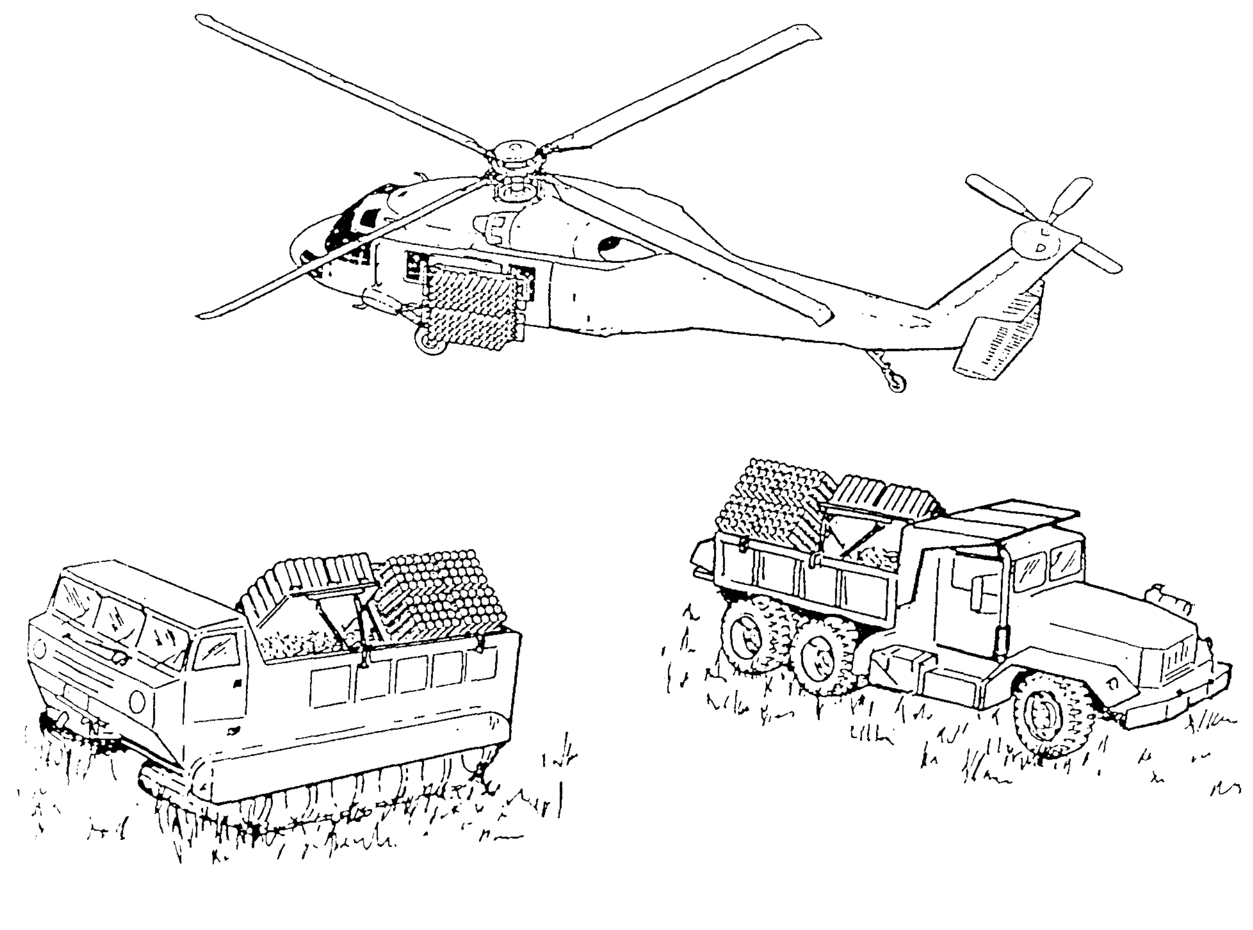


Figure 6-14. Multiple-delivery mine system (Volcano)

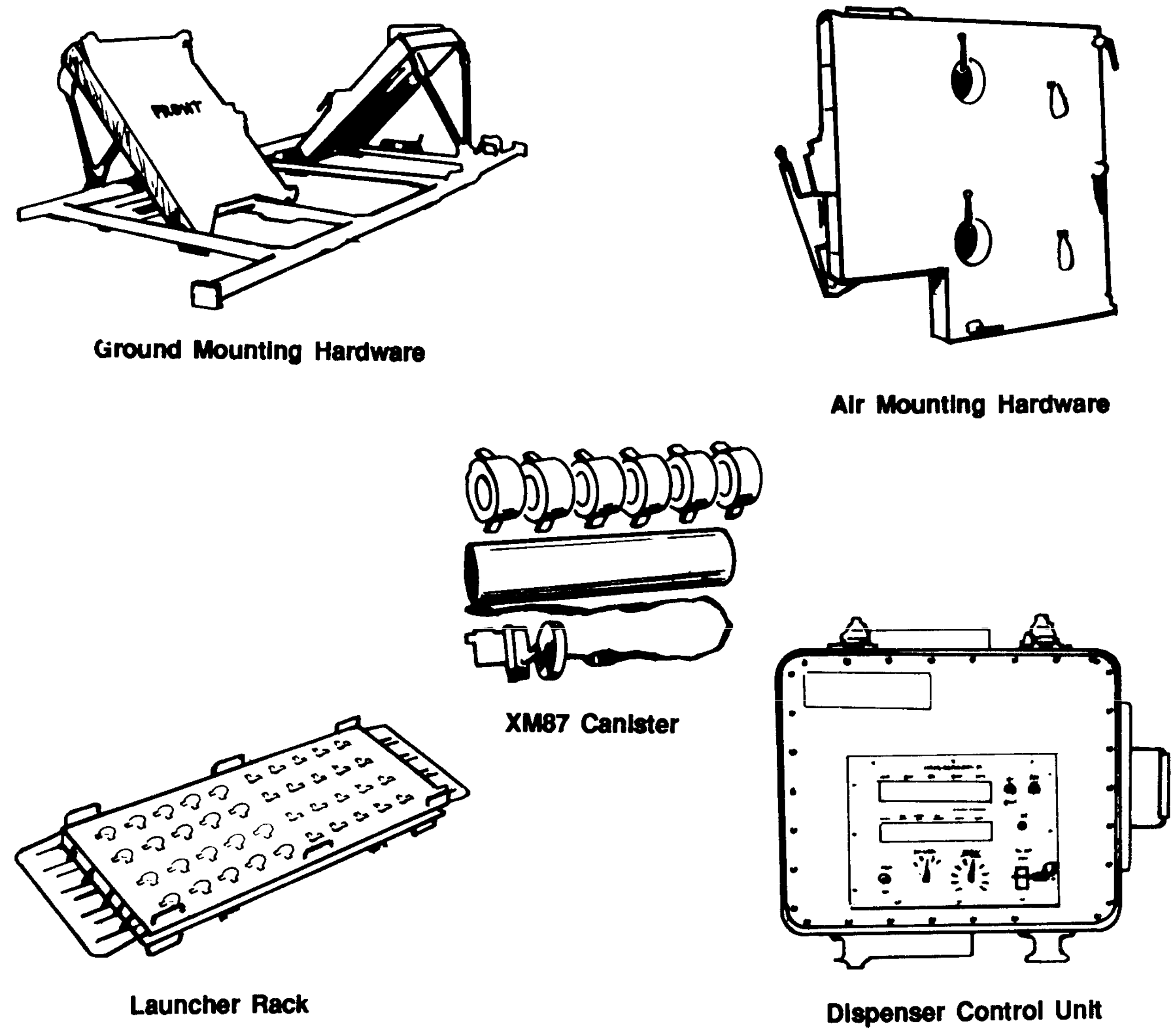


Figure 6-15 Volcano system components

The dispenser consists of an electronic dispenser control unit (DCU) and four launcher racks. Up to four racks can be mounted on a vehicle. Each rack holds 40 M87 mine canisters. The rack provides structural strength and mechanical support required for launch and provides electrical interface between mine canisters and the DCU. Mounting hardware secures racks to the vehicle or aircraft. Mounting hardware for the UH-60A Blackhawk includes a jettison subassembly to propel the Volcano racks and canisters away from the aircraft in the event of an emergency.

The operator uses the DCU to electrically control the dispensing operation from within the carrier vehicle. The DCU provides controls for the arming sequence and the delivery speed selection. It also sets mine self-destruct times. The DCU allows the operator to start and stop mine dispensing at any time. A counter on the DCU indicates the number of canisters remaining on each side of the carrier.

Mines are dispensed from their canisters by an explosive propelling charge. For ground vehicles, mines are dispensed 25 to 60 meters from the vehicle at ground speeds of 5 to 55 mph. For aircraft, mines are dispensed 35 to 70 meters from the line of flight. The aircraft flies at a minimum altitude of 5 feet, at speeds of 20 to 120 knots. It can deliver up to 960 mines (160 canisters) per sortie. The Volcano uses the host vehicle as a power source. (Attaching the system to the vehicle does not significantly degrade its mobility.) The system has three field-selectable, self-destruct times (4 hours, 48 hours, and 15 days). Except for the mounting hardware, there is total system commonality between air and ground Volcano systems.

Employment.

The primary mission of the Volcano is to provide US forces with the capability to rapidly emplace large minefields under varied conditions. The Volcano can be rapidly attached to aerial or ground vehicles. It is used to emplace tactical minefields; reinforce existing obstacles; close lanes, gaps, and defiles; protect flanks; and deny enemy air defense sites. Volcano minefields are ideal for flank protection of advancing forces and for operating in concert with air/ground cavalry units on flank guard or screen missions.

The air-dispensed Volcano is the fastest method of emplacing large tactical minefields. When employed by combat aviation elements in support of maneuver units, close coordination between aviation and ground units assures Volcano-dispensed mines are emplaced accurately and quickly. Although placement is not as precise as it is with ground-emplaced systems, air Volcano minefields can be placed accurately enough to avoid the danger inherent in artillery or jet aircraft-delivered minefields. Air Volcano minefields can be emplaced in both friendly and enemy territories. They should not be planned in areas of enemy observation and fire because the helicopter is extremely vulnerable while flying at the steady altitude, speed, and path required to emplace the minefield. The air Volcano system is the best form of an obstacle reserve because a minefield can be emplaced within minutes.

Like the GEMSS, the ground Volcano is designed to emplace large minefields in depth. The ground Volcano is normally employed by combat engineer units. The primary use of mounted dispensers is to emplace tactical minefields oriented on enemy forces in support of maneuver operations and friendly AT fires. The system is vulnerable to direct and indirect fires, so it must be protected when close to the FLOT. It is an ideal obstacle reserve, employed when the enemy reaches a decision point that indicates future movement. Obstacles can then be emplaced on avenues the enemy is using, leaving other avenues open for friendly movement. The Volcano is more mobile than the GEMSS. It is mounted directly on the prime mover and weighs 4 1/2 tons less (loaded) than the GEMSS.

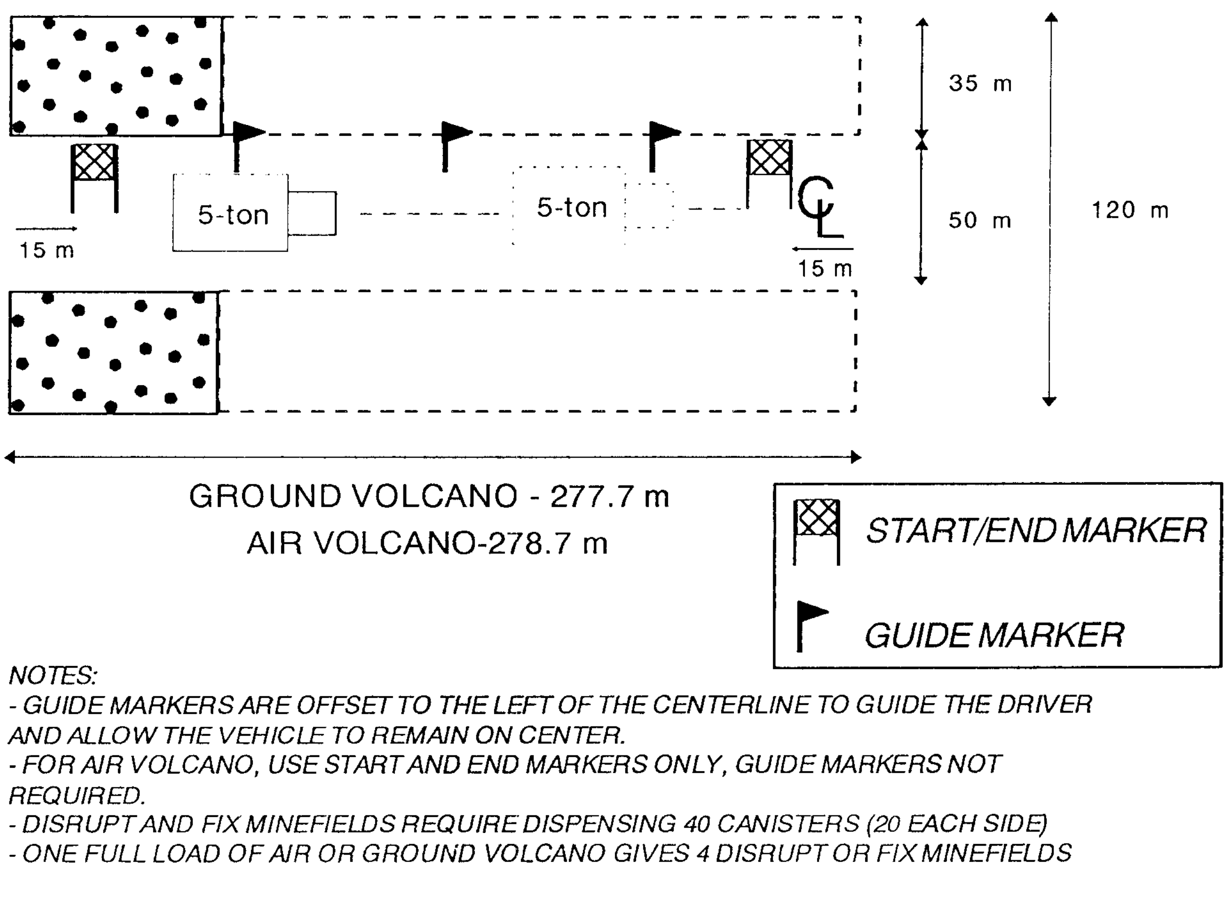
Emplacement.

The principles of Volcano emplacement are the same as those for air or ground delivery systems. This section outlines the use of the Volcano system to emplace minefields intended to disrupt, fix, turn, and block. Both the ground and air Volcano systems are capable of emplacing nonstandard minefields. However, using the emplacement norms below streamlines identifying resource requirements and emplacement drills.

★ The Volcano system emplaces a minefield with an average AT linear density of 0.72 mine/meter and AP density of 0.14 mine/meter. These densities may vary slightly since some mines will fail the arming sequence and self-destruct 2 to 4 minutes after dispensing. Additionally, some mines may not orient correctly, will not deliver their full mine effect, and will not produce a K-Kill, further reducing the effective density. The probability of failing the arming sequence and disorienting is relatively small and does not appreciably degrade the minefield's lethality. For tracked vehicles, the AT density yields more than 80 percent probability of encounter. Volcano AT mines do not have antidisturbance devices but are highly sensitive to any movement once they are armed. Any attempt to remove the mines will likely result in detonation.

The basic site layout is the same for all types of Volcano minefields whether delivered by ground or air. Site layout is extremely important. Wherever the situation allows (planned targets within the main battle area (MBA) of a defensive operation), the limits of air and ground Volcano minefields are marked before emplacement. When the situation does not allow (offensive operations or situational obstacles), the minefield is not premarked but is marked before the unit leaves the area or turns over the area to an adjacent unit if the mines have not self-destructed. Minefield marking must include the safety zone, which is 100 meters from the start and end points and 100 meters to the left or right of the centerline. The start and end points of the strip centerline are marked based on minefield frontage and number of strips. For ground-emplaced Volcano, guide markers are emplaced along the path of the centerline but offset left to allow the host vehicle to remain on the centerline. The number of guide markers depends on terrain and visibility. Guide markers are not required for air-delivered Volcano since the pilot will use the start and end point markers of the centerline as reference points. Additionally, minefield marking must leave a gap for vehicle entrance and exit of each centerline when using a ground delivery system.

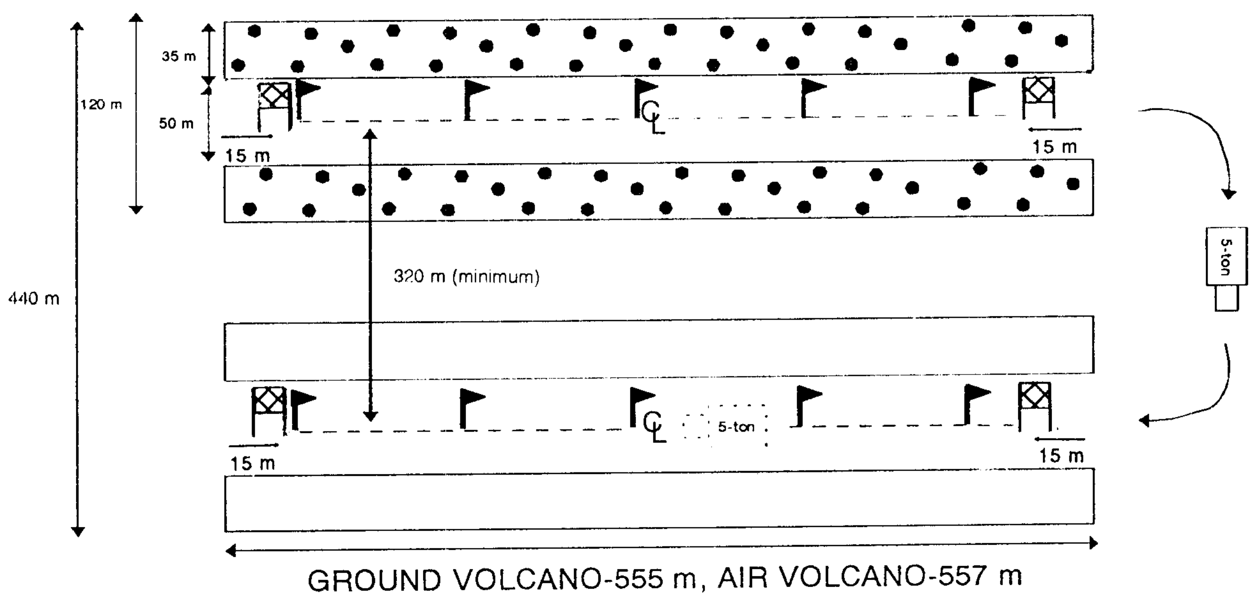
Figure 6-16 illustrates the emplacement pattern for standard disrupt and fix minefields using the ground or air Volcano. Disrupt and fix minefields use only one centerline to give



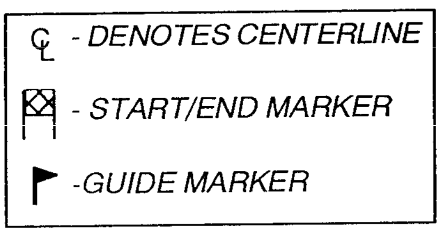
★ *Figure 6-16. Ground/air Volcano disrupt and fix minefields*

★ a minefield depth of 120 meters (140 meters for air), not including the safety zone. The strip centerline is 277 meters long (278 meters for air). The host vehicle moves toward the start. point, achieving and maintaining the ground or air speed selected on the dispensing control unit (DCU). The operator depresses the launch switch on the DCU as the vehicle passes the start point marker and stops as the vehicle passes the end marker. The operator dispenses 40 canisters (20 on each side). For ground emplacement, the vehicle moves out of the minefield, marks the exit, and waits a minimum of four minutes before approaching the minefield. This delay allows faulty mines to self-destruct.

★ Turn and block minefields are emplaced using the same basic procedures as disrupt and fix minefields. However, turn and block minefield use two strip centerlines along a frontage of 555 meters (557 for air) (Figure 6-17). During site layout, centerlines are separated by 320 meters (minimum) for both ground and air delivery. This gives a total minefield depth of 440 meters (460 meters for air). The operator dispenses 80 canisters—40 canisters on each side of each centerline. Both turn and block minefields, therefore, require a total Volcano load of 160 canisters. Wherever possible, two ground Volcanos are employed simul-



NOTES:
- AFTER FIRST PASS, VEHICLE MUST MOVE TO SAFE DISTANCE FOR 2 MINUTES TO ALLOW MINES FAILING THE ARMING SEQUENCE TO SELF DESTRUCT
- GUIDE MARKERS ARE OFFSET FROM CENTERLINE
- FOR AIR VOLCANO, USE START AND END MARKERS ONLY
- TURN AND BLOCK MINEFIELDS REQUIRE DISPENSING 80 CANISTERS (40 EACH SIDE) ON EACH PASS; TOTAL OF 160 CANISTERS
- ONE FULL LOAD OF GROUND OR AIR VOLCANO EMPLACES ONE TURN OR BLOCK MINEFIELD



★ *Figure 6-17. Ground/air Volcano turn and block minefiels*

✶ taneously on turn and block minefields. When only one ground system is used, the crew must wait four minutes after dispensing the first strip before beginning the second strip. This allows mines failing the arming sequence to self-destruct. For air delivery, two sorties is also optimal; but demands for sorties elsewhere in the division may preclude the simultaneous employment of two Blackhawks.

Table 6-6 summarizes the standard Volcano minefield size, site layout, and resource requirements to emplace disrupt, fix, turn, and block minefields.

Special consideration for air delivery.

While air delivery is fastest, it is difficult to accurately dispense mines within the confines of the minefield marking. The following discusses techniques unique to air delivery for getting the minefield on target and dispensing the right number of mines.

The desired obstacle effect norms for the air Volcano require extensive premission coordination and positive control during air emplacement. The critical aspect of the air Volcano is getting the right amount of mines in the specified locations and in the desired density. The premission coordination focuses on positive control. Positive control of air Volcano mission requires a redundancy of control techniques to minimize errors in minefield size and location. Positive control techniques must compensate for poor visibility of target, wind speed and direction, and navigational errors.

✶ The following positive control techniques are used by the engineer and the air mission commander to ensure Volcano minefields match specific obstacle effect norms. They rely on these techniques to accomplish the mission, and the techniques are part of the Volcano air mission brief prior to the operation.

- Visual identification.
- Time lapse.
- Doppler guidance system.

✶ **Visual identification.** This positive control technique focuses on the visual identification of minefield emplacement. As part of the preparation of a Volcano minefield, an engineer platoon erects airfield panel markers to mark the start and end points. This provides a visual signal for the engineer and air mission commander to start and stop the firing of Volcano canisters. The pilot depresses the launch switch over the first marker and depresses it again over the second marker to terminate the firing. This control technique is good for open terrain with adequate visibility and little canopy coverage.

Time lapse. This control technique focuses on when to terminate the firing of Volcano canisters. Once the air Volcano is initiated, terminating the firing depends on the Blackhawk's air speed and the type of minefield (278.7 meter-disrupt/fix or 557.5 meter-turn/block). The air Volcano system has six air speed settings— 20, 30, 40, 55, 80, and 120 knots. Table 6-7 shows the time required to lay the two minefield widths and the full load time. Again, for turn and block minefields, two passes are required. If two Blackhawks with air Volcano systems are avail-

Table 6-6. Volcano minefield data

Type minefield	Depth (meters)	Front ground/air (meters)	Number strips	Canisters per strip	Total canisters	Minefields per load
Disrupt	120	277/278	1	40 (20 each side)	40	4
Fix	120	277/278	1	40 (20 each side)	40	4
Turn	320	555/557	2	80 (40 each side)	160	1
Block	320	555/557	2	80 (40 each side)	160	1

able, they can work in pairs and lay one minefield with one pass, dispensing 80 canisters each.

The following example is provided to show how Table 6-7 is used:

The air Volcano mission is to install a disrupt minefield. The Blackhawk is traveling at 40 knots (this is entered on the DCU) and is initiated (launch switch is depressed) at the identification of Volcano start marker (or Doppler data discussed below) on the ground. The engineer or the air mission commander depresses the launch switch the second time after 13 seconds.

Number of canisters fired. This positive control technique focuses on when to terminate the firing of Volcano canisters. Once the air Volcano is initiated, terminating the firing depends on the number of Volcano canisters dispensed. The disrupt or fix Volcano minefield requires 40 canisters, and the turn or block minefield requires 80 canisters on one pass (see Table 6-6, page 6-27). On the DCU, there is a canisters remaining digital readout for the left and right side. The engineer and the air mission commander terminate the firing after reaching the designated number of canisters required.

Using the disrupt minefield example above, the Blackhawk started the mission with a full load— 80 canisters on each side. The engineer or air mission commander initiates (launch switch depressed) at the identification of Volcano start marker (or Doppler data) on the

Table 6-7. Air Volcano dispensing times based on air speed

AIR VOLCANO STANDARD MINEFIELDS

KNOTS	DISRUPT & FIX MINEFIELD	TURN & BLOCK MINEFIELD	160 CANISTERS LOAD
20	27 SECONDS	54 SECONDS	108 SECONDS
30	18 SECONDS	36 SECONDS	72 SECONDS
40	13 SECONDS	27 SECONDS	54 SECONDS
55	9 SECONDS	18 SECONDS	39 SECONDS
80	6 SECONDS	13 SECONDS	27 SECONDS
120	4 SECONDS	9 SECONDS	18 SECONDS
WIDTH OF MINFIELD	278.7 METERS	557.5 METERS	1115 METERS
# PASSES PER MF	1	2 (SEE NOTE)	1
# CANISTERS PER PASS	40 CANISTERS	80 CANISTERS	160 CANISTERS

RECOMMENDED AIR SPEED (40 knots)

AIR SPEED NOT RECOMMENDED (shaded cells)

NOTE: BLACKHAWKS IN PAIRS CAN LAY TURN & BLOCK MF IN ONE PASS FIRING 80 CANISTERS EACH ground. The engineer or the air mission commander depresses the launch switch the second time after 20 canisters have been expended on each side (total of 40). The digital readout that would trigger the depression of the launch switch is *left 60 right 60.*

Ideally, the timing of delivery and the number of canisters fired are done simultaneously. As the engineer or the air mission commander counts down the time over target, they monitor the DCU readout on the canisters remaining.

Doppler guidance system. This positive control technique focuses on when to initiate and terminate the firing of Volcano canisters using the Blackhawk's Doppler navigation set. The Doppler navigation set provides present position or destination navigation information in latitude and longitude (degrees and minutes) or universal transverse mercator (grid) (UTM) coordinates. As part of the preparation for the air Volcano minefield, exact coordinates are determined for the approach and the limits of the minefield. During the air mission brief, these grids are given to the air mission commander. The air mission commander enters those grids into his Doppler navigation set.

During execution, the air mission commander monitors the Doppler and can estimate time to target, and when to initiate, and can terminate the firing of the Volcano canisters.

Premission coordination. If air Volcano has been allocated to a unit, an ALO will conduct initial coordination with the S3 air, engineer, and air defense officer. During this meeting, air Volcano requirements are outlined. Listed below are the critical items that must be discussed.

Logistical requirements. The engineer must provide the ALO the location of the Class IV/V supply point where the Blackhawk will be loaded, reporting time, and approach direction. The ALO must provide the amount of air time available and be prepared to discuss emplacement times based on Volcano locations.

Concept of the operation. The scheme of maneuver, fires, and engineer operations are outlined. The scheme of engineer operations outlines exact grid coordinates, obstacle intents, and minefield composition and size. The air Volcano can be emplaced during the preparation time or under enemy contact. Additional control measures must be emplaced if the air Volcano is emplaced under contact (possibly informal airspace coordination area). If the air Volcano is triggered by enemy action, the decision support template (DST) must be briefed outlining named area of interest (NAIs), tactical area of interest (TAIs), decision points, and execution criteria.

Volcano control points/markers. The initial point (IP), approach marker, and minefield markers are designated. The IP is usually an easily identifiable terrain feature for the coordination of the entry point of the Blackhawk in sector. The approach marker allows the Blackhawk to set altitude, air speed, and final orientation to the minefield. The approach marker could be an easily identifiable terrain feature. Minefield markers establish the limits of the desired minefield. Approach and minefield markers must be visible from the air and distinctly different. Sketches of the minefield are provided to the ALO. The sketches include minefield location, probable enemy location, identifiable terrain features, IP, direction and distance from IP to minefield, and location of Class IV/V supply point (if resupply is required).

Command and control. Radio frequencies, points of contact (air mission commander and designated engineer platoon leader), code words, identification, friendly or foe (radar) (IFF) mode and challenge, and password are exchanged.

Air mission brief. Updates and changes to the situation are exchanged between the engineer platoon leader and the air mission commander as Volcano canisters are being loaded. The engineer and the air mission commander use the four positive control techniques to ensure mission success. The primary technique and responsibilities for each control technique are outlined in the air mission brief. The Blackhawk crew chief can also assist in monitoring one of the positive control techniques. For example, during the air mission brief, the air mission commander states that strong variable headwinds will be encountered, and the approach to Volcano markers will be obscured due to the amount of foliage. The engineer and the air mission commander designate that the Doppler system will be the primary positive control technique, with the time lapse and canister countdown as backup. The air mission commander will initiate the firing, while the engineer will terminate the firing. The grid coordinates for the initial point, approach marker, and start and stop markers are entered into the Doppler system. As a backup, the air mission commander will terminate the firing based on Doppler data. In this scenario, the engineer platoon leader and the air mission commander create redundancy in positive control techniques.

MOPMS

The MOPMS is a man-portable, 162-pound, suitcase-shaped mine dispenser (Figure 6- 18) that can be emplaced anytime before dispensing mines. The dispenser contains 21 mines (17 ATs and 4 APs). Mines have finger-like leaf springs along their outer circumference. The springs are designed to push the mine into proper orientation if it lands on its side.

Each dispenser contains seven tubes; three mines are located in each tube. When dispensed, an explosive propelling charge at the bottom of each tube expels mines through the container roof. Mines are propelled 35 meters from the container in a 180-degree semicircle (Figure 6-19). The resulting density is 0.01 mine per square meter. The safety zone around one container is 55 meters to the front and sides of the container and 20 meters to the rear.

Mines are dispensed on command using an M71 remote control unit (RCU) or an electronic initiating device, such as the M34 hand-blasting machine connected to the container by field wire. Once mines are dispensed, they cannot be recovered or reused. If mines are not dispensed, the container may be disarmed and recovered for later use.

The RCU can recycle the 4-hour self-destruct time of the mines three times, for a total duration of 16 hours (4 hours after initial launch and three 4-hour recycles). This feature makes it possible to keep the minefield emplaced for longer periods, if necessary. The RCU can also self-destruct mines on command. It allows a unit to counterattack or withdraw through the minefield, as necessary, rather than wait until the self-destruct time has expired. The RCU can control up to 15 containers or groups of containers via separate pulse-coded frequencies, out to 300 to 1,000 meters. Coded frequencies defeat threat electronic countermeasures directed against the system.

If the M71 RCU is not available, a direct wire link is used in conjunction with the M32, M34, or M57 blasting machine. Using the M32 10-cap blasting machine, one MOPMS dispenser can be detonated at a maximum range of 1,000 meters. The M34 50-cap blasting machine can detonate one MOPMS at a maximum range of 3,000 meters. (Due to internal resistance, the maximum range is decreased by 400 meters for each additional MOPMS connected in series.) The M57 Claymore-type firing device can fire only one MOPMS at a maximum range of 100 meters. When controlled by direct wire, MOPMS dispensers cannot be command-detonated, and the self-destruct time cannot be recycled.

The MOPMS dispenser has seven launch tubes. If **all** seven tubes are not visible after deployment or upon later inspection, mines are jammed in the tube(s). In this event, clear the area and notify EOD. The dispenser is considered as unexploded ordnance. Do not attempt to recover the dispenser.

Employment.

The MOPMS provides a self-contained, on-call minefield emplacement capability for all forces. It can be command-detonated, reused (if mines are not dispensed), and directly emplaced to provide complete and certain coverage of small or critical targets. The ability to command detonate mines or extend their self-destruct time provides an added flexibility not currently available with other scatterable mine systems. With its unique characteristics, the MOPMS is ideally suited for the following minefield missions:

- Close gaps or lanes in existing minefields.
- Hasty protective minefields.

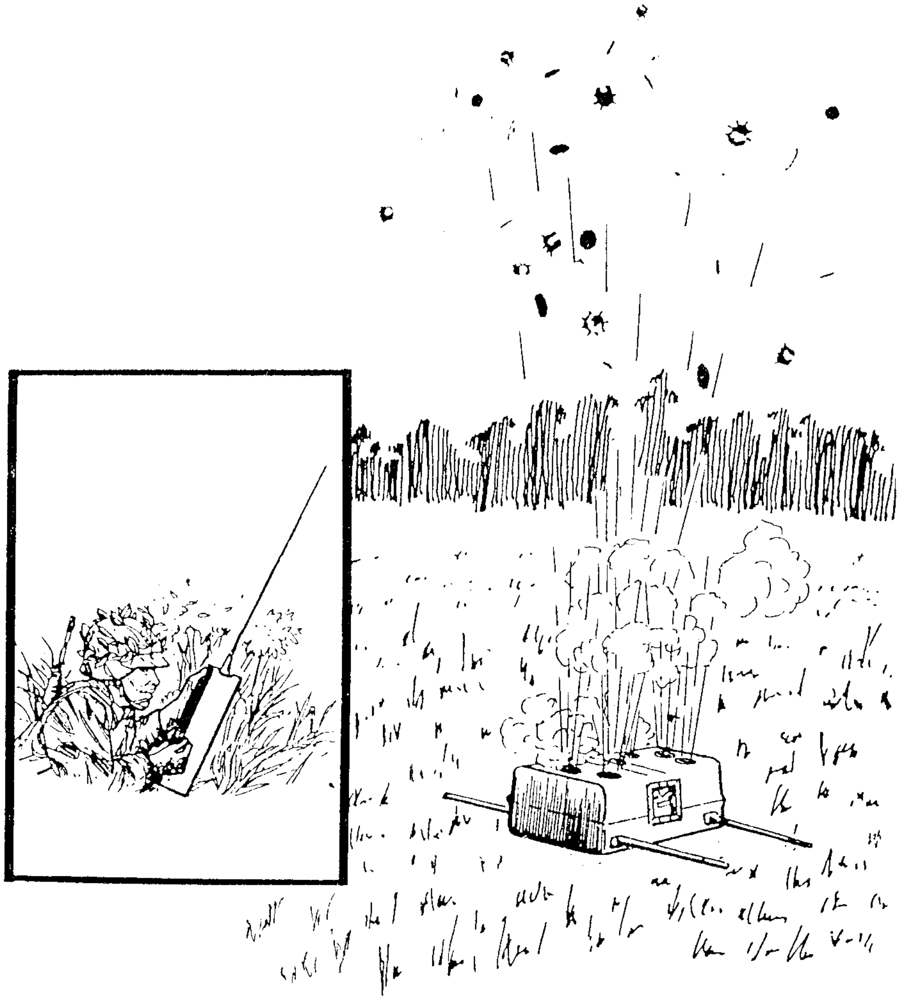


Figure 6-18. Modular Pack Mine System (MOPMS)

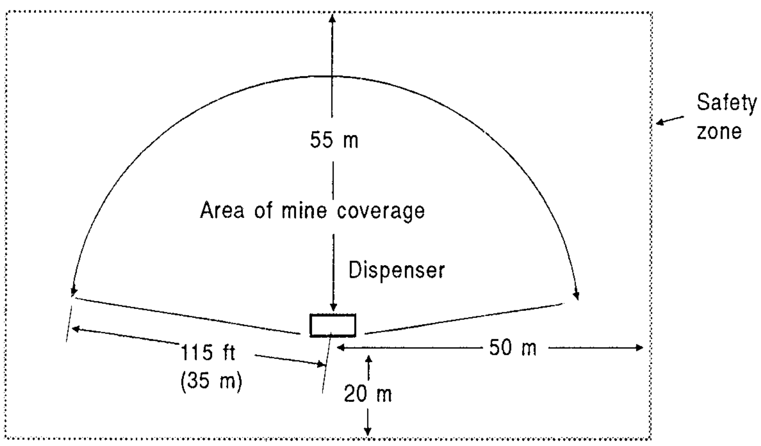


Figure 6-19. MOPMS dispenser emplacement and safety zone

- Deliberate protective minefields (cases emplaced but mines not dispensed).
- Nuisance minefields (trails, crossing sites, LZs/DZs, and road junctions).
- Ambushes and booby traps.
- Tactical minefields intended to disrupt or fix.
- In support of MOUT operations.

When the MOPMS is used to close lanes, the container is positioned and dispensed by personnel in an overmatching position from a safe standoff. The MOPMS is ideally suited for creating a small disrupting obstacle in support of engineers blowing a reserved demolition. Engineers prepare the reserved target for demolition and emplace several MOPMS units on the enemy side, just out of target range. When the last forward elements pass through the target, the firing party detonates charges. If something goes wrong or the firing party needs more time, MOPMS mines can be dispensed to disrupt the enemy before they reach the target.

The MOPMS provides light forces and special forces with a versatile, compact system for emplacing nuisance minefields. It can be used in low-, mid-, and high-intensity conflicts and in a variety of environments. Its major limitation is the requirement to transport the system using a vehicle, helicopter, or fixed-wing aircraft.

Emplacement.

MOPMS dispensers are issued as standard Class V munitions and are drawn from an ASP on a mission basis. RCUs are organizational issues of equipment and are assigned to engineer and combat arms units. Due to the weight of the system, it will normally be transported by vehicle, as close as possible to the emplacement site where it can easily be hand-emplaced by four soldiers using the four foldout carrying handles.

To ensure the minefield will be dispensed in the proper location, the container should be carefully sited by the NCOIC. Several containers can be used together to provide a greater area of coverage or higher mine density, if desired. If mines are not dispensed immediately, containers should be camouflaged and, if possible, buried. When placed in sand or snow, brace the container to prevent it from moving during mine dispensing. Designate a firing point that gives the operator clear observation of the area to be mined. Firing systems must be inspected according to MOPMS operating instructions. If mines are dispensed immediately, empty containers are removed to avoid revealing the minefield location.

The MOPMS can be employed to emplace tactical minefields with a disrupt or fix effect. Emplacement procedures are the same as above. However, MOPMS containers arc arranged in a specific pattern to achieve the necessary depth, frontage, and density. Once the minefield is marked (to include the safety zone), MOPMS containers are arranged as shown in Figure 6-20. The safety zone is 55 meters to the front and sides of the MOPMS container and 20 meters behind the container. The disrupt minefield uses four MOPMS containers spaced 70 meters apart to give a minefield frontage of 280 meters (not including the safety zone). Every other container is offset from the baseline 35 meters to give the minefield a depth of 70 meters (not including the safety zone). All containers are fired using the same RCU or other firing device.

Figure 6-21 illustrates the arrangement of MOPMS containers to achieve a fix minefield. The basic layout is the same as the disrupt minefield. However, the fix minefield uses one additional MOPMS placed 70 meters forward of the baseline to act as an IOE. This gives the same 280-meter frontage but increases the depth of the minefield to 115 meters (not including the safety zone).

MOPMS can be used to construct turn and block tactical minefields using the principles outlined in Chapter 2. However, turn and block minefields require more containers than are normally available to a unit.

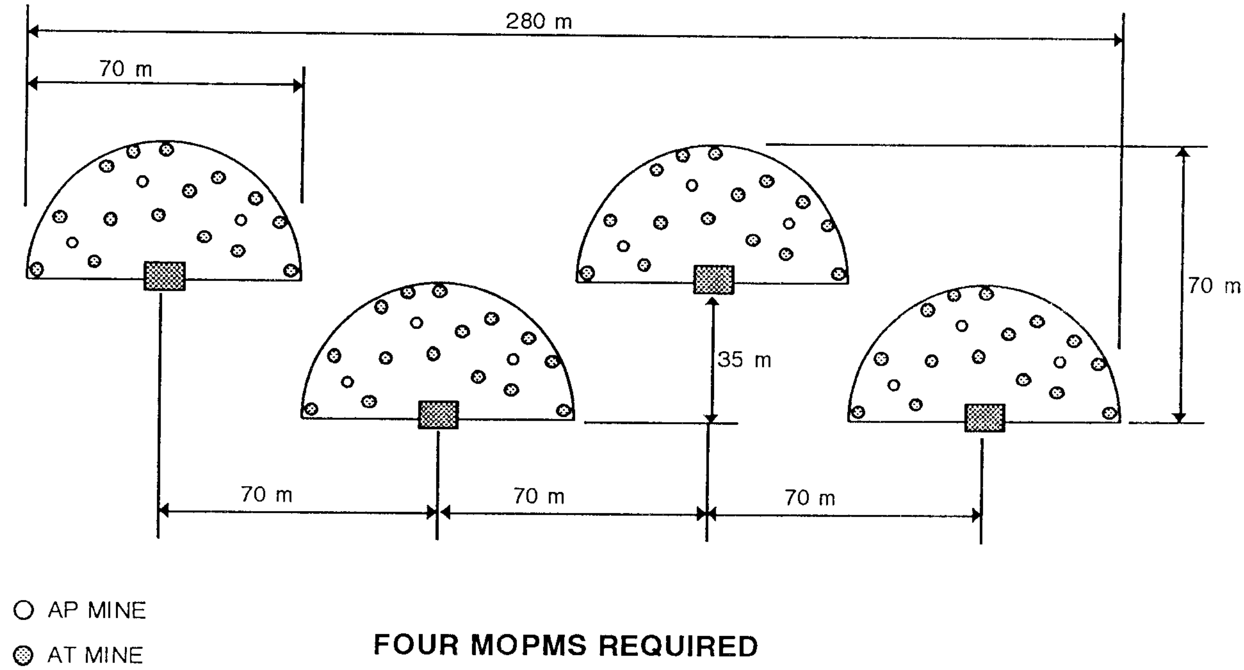


Figure 6-20. MOPMS disrupt minefield

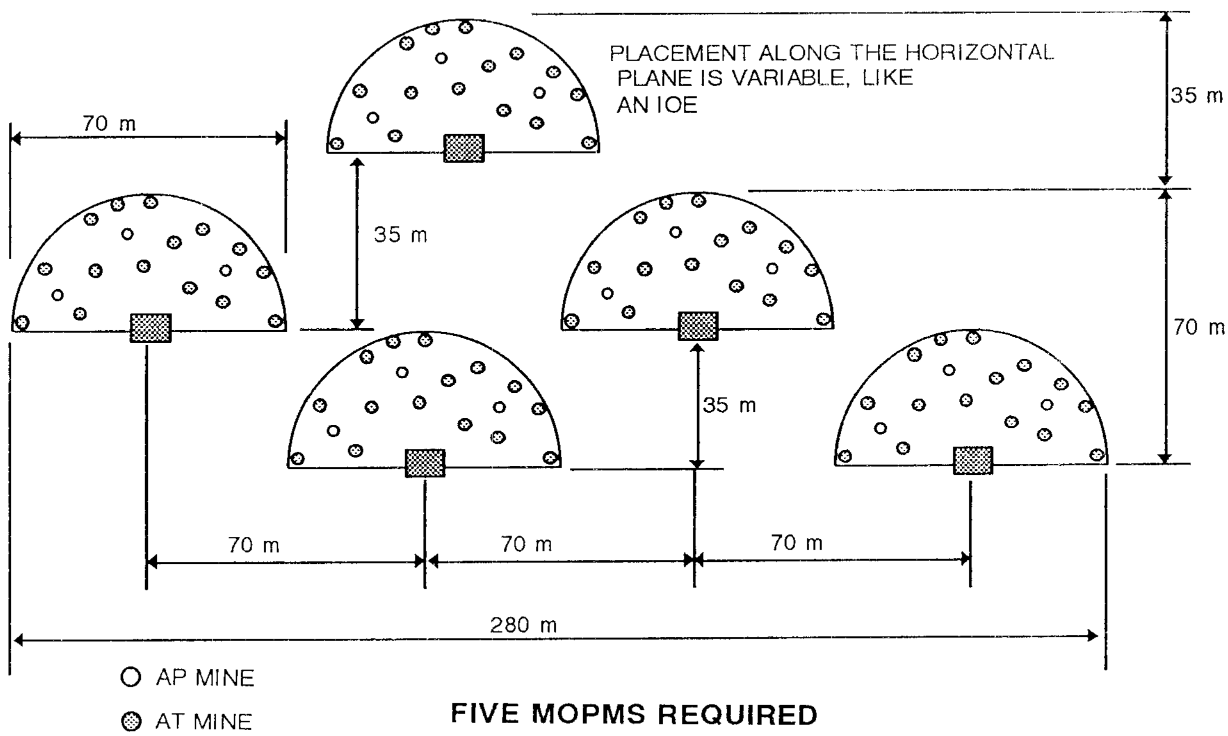


Figure 6-21. MOPMS fix minefield

CHAPTER 7
RESPONSIBILITIES, MARKING, RECORDING, AND REPORTING

RESPONSIBILITIES

Command and Control

Due to the delivery means, command and control of scatterable mine operations is more complex than it is for conventional mines. Scatterable mines are very dynamic weapon systems, because they can be rapidly emplaced and then cleared through their self-destruct capability. Also, the physical boundary of a scatterable minefield is not clearly defined. These characteristics require impeccable communication and coordination to ensure friendly units know where mines are located, when they will be effective, and when they will self-destruct.

Employment

The corps commander holds authority for emplacing scatterable minefields within the corps area of operations. He may delegate this authority to lower echelons based on the self-destruct time of the mine system according to the following guidelines:

Self-Destruct Time	Emplacement Authority
Long duration (greater than 24 hours)	Corps commander may delegate employment authority to division level, who may further delegate it to brigade level.
Short duration (24 hours or less)	Same as for long duration but may be further delegated to battalion or task force level.

Based on the commander's desired shape of the battlefield, the authority to employ scatterable mine systems must be delegated or withheld. The commander's guidance is found in the operation order (OPORD / OPLAN) (paragraph 3, concept subparagraph, engineer part). Additional information is included in the engineer annex and fire support annex, if used.

Authority for Gator missions is normally held at the division, corps, or theater command level. Further allocation is on a mission basis.

Authority for air Volcano missions is delegated no lower than the element with command authority over the aircraft; for example, division level. Sorties are allocated by one of two methods—

- Subordinate elements submit requests for support. Each request is approved or disapproved on an individual basis.
- The parent unit allocates a specified number of sorties to subordinate maneuver commands.

Due to the complete control a commander has over the MOPMS mine and dispenser, employment authority guidelines do not apply to the MOPMS. It is impractical for the corps or brigade commander to authorize each MOPMS protective minefield. Therefore, the authority to emplace MOPMS minefields is specifically delegated. In general, units can emplace MOPMS protective minefields as required for their own self-defense and report them as they do any protective obstacle. Any MOPMS minefield used as part of an obstacle plan must be reported as a normal scatterable minefield.

Coordination

Basic responsibilities of key command, staff, and units are outlined in Table 7-1. The fire support coordinator (FSCOORD) is involved in planning for artillery-delivered scatterable mine systems (ADAM/RAAM), and the air liaison officer is involved in planning for air-delivered scatterable mine systems (Gator/Vol-cane). The engineer has primary shift responsibility for planning and employing scatterable mine systems.

Table 7-1. Coordination responsibilities

Element	Responsibilities
G3/S3 with engineer FSCOORD/ALO	Plan and coordinate minefield location, size, composition, density, self-destruct time, safety zone, and emplacement time.
	Designate and brief the emplacing unit.
	Incorporate the minefield and safety zone into the obstacle plan.
	Receive and forward the scatterable minefield report and record.
	Disseminate scatterable mine warning (SCATMIN-WARN) information to adjacent and subordinate units before laying.
	Post operation maps with minefield location, safety zone, and DTG of self-destruct time. Disseminate the SCATMINWARN one hour before to initiation of the self-destruct sequence.
Emplacing unit	Calculate logistical requirements.
	Calculate the safety zone.
	Emplace the minefield.
	Report ammunition expended.
	Prepare and forward the scatterable minefield report and record to the authorizing commander via appropriate channels.
Maneuver units	Be aware of calculated safety zone boundary locations.

MARKING

Scatterable minefields are marked to protect friendly troops. GEMSS, Flipper, and ground-delivered Volcano minefields are marked according to the guidelines listed below. The maneuver unit responsible for the area of ground in which the minefield is emplaced is always responsible for marking the minefield. This generally requires direct coordination between elements of the maneuver command (usually the engineer) and the delivering/emplacing unit. However, it is unrealistic to expect units to mark artillery, Gator, and air-delivered Volcano minefields. For this reason, units operating in the vicinity of these minefields must know calculated safety zones and use extreme caution.

Minefield Location	Marking
Enemy forward area	Not marked
Friendly forward area	Sides and rear marked
Friendly rear area	All sides marked

★ **NOTE: The safety zone around the GEMSS and Volcano minefields is depicted in Figures 7-1 through 7-3, The safety zone is the area where a stray or outlier mine has a chance of landing and laying to rest. This area may be marked with a fence depending on its specific location on the battlefield. This is the area where the commander must preclude any friendly forces from maneuvering during the minefield's life cycle. If an AT mine, oriented on its side, self-destructs, the explosively formed penetrator can theoretically travel 2,000 feet or 640 meters. This is the maximum fragment hazard zone. However, the chances of being struck are negligible at this distance. Tests indicate that acceptable risk for maneuver is the distance over 235 meters from the outer edges of the minefield's safety zone. This fragment hazard zone is also associated with the Gator and MOPMS AT mines. When the MOPMS is used for protective minefield missions, commanders must be made aware of the fragment hazard. Use Table 7-2 to help determine the necessary zones.**

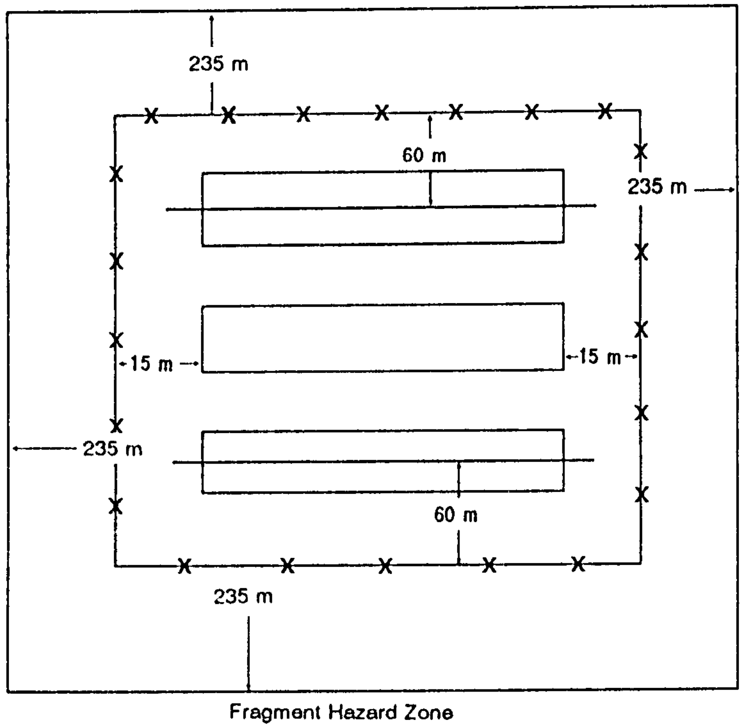
Table 7-2. Safety and fragment hazard zones

System	Safety Zone	Fragment Hazard Zone
ADAM/ RAAM	500 to 1,500 meters fron aim point(s). Depends on the delivery factors.	Add 235 meters to the outside dimensions of the safety zone.
Gator	925 x 475 meters from aim point(s).	1,395 x 945 meters from aim point(s).
Volcano: Ground Air	1,150 x 160 meters (from centerline). 1,315 x 200 meters (from centerline).	235 meters from start/stop point(s) and centerlines.
GEMSS/ Flipper	Add 15 meters from start and stop points. Add 45 meters from centerlines.	Add 235 meters to the safety zone's dimensions.
MOPMS	See page 6-32 for specific placement.	Add 235 meters to the safety zone's dimensions.

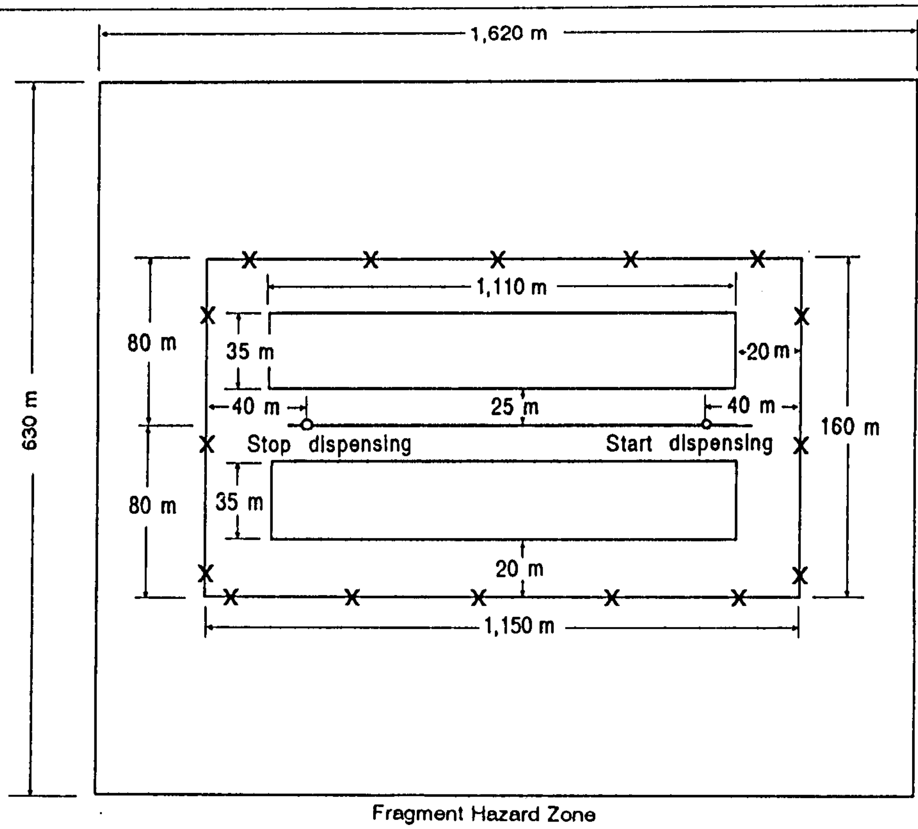
Fencing for GEMSS/Flipper minefields is emplaced 60 meters beyond the centerline of the two end strips and 15 meters beyond the start and end markers. (See Figure 7- 1.)

Fencing for ground Volcano minefields is emplaced 80 meters beyond the centerline of the minefield and 40 meters from the start and stop points of mine dispensing. Fencing should be no closer than 20 meters from the nearest mine. (See Figure 7-2.)

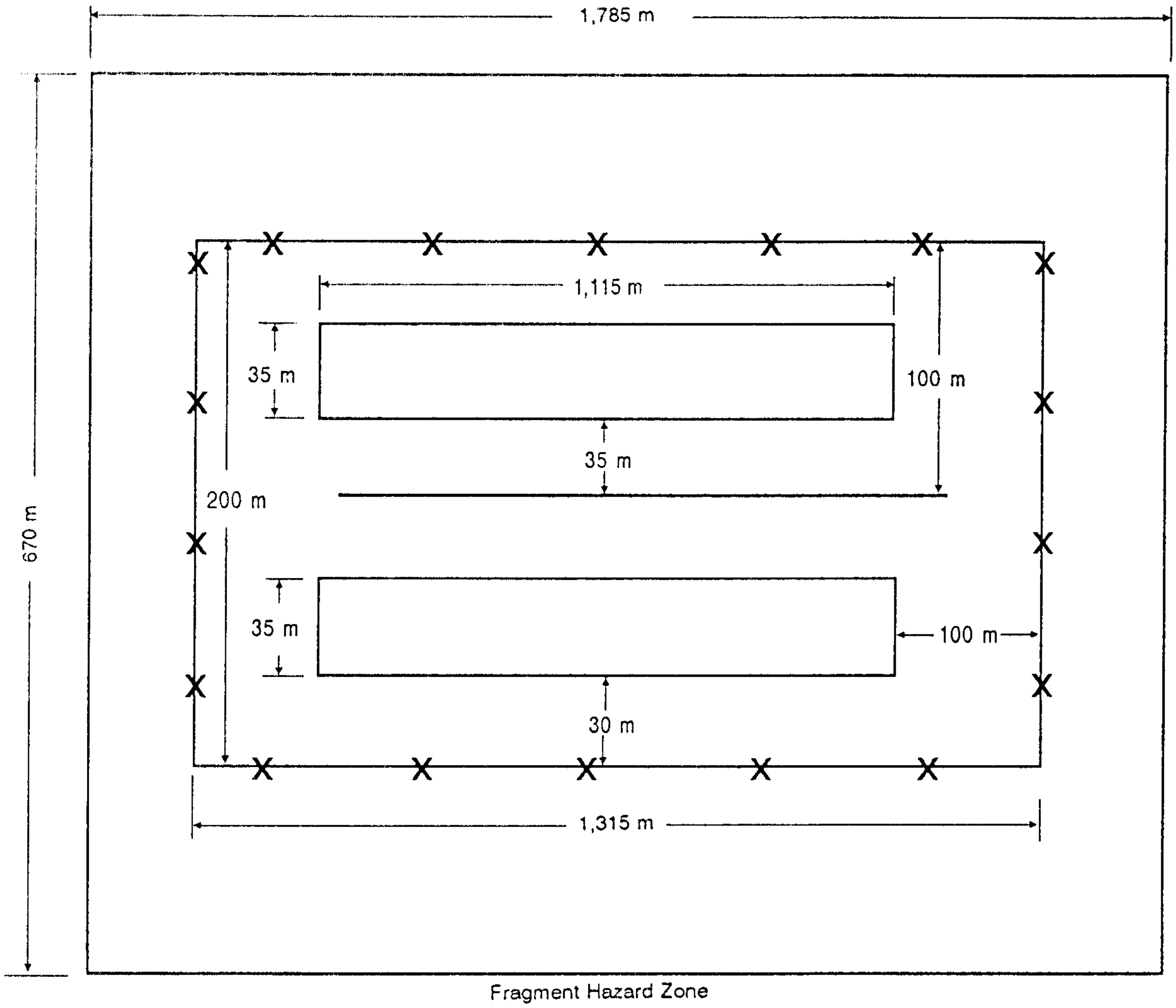
Air Volcano minefields are not normally marked by fencing. However, if air Volcano minefields are emplaced in friendly areas, they should be marked with fencing to protect friendly personnel. End points must be visibly marked for the pilot before emplacing deliberate air Volcano minefields. Fencing is installed before delivery of air Volcano minefields, and it is located 100 meters from the centerline of the minefield and 100 meters from the mining start and end points. (See Figure 7-3.)



★ *Figure 7-1. GEMSS/Flipper minefield*



★ *Figure 7-2. Ground volcano minefield*



★ *Figure 7-3. Air volcano minefield*

GEMSS Minefield

Figure 7-4a shows the platoon arriving on the minefield site. Figures 7-4b through 7-4h, pages 7-7 through 7-13, depict the actual execution of a typical GEMSS minefield. In this example, a lane is left in the minefield. More mines are required for another minefield mission, so the M548 must return to the mine dump after loading is complete.

Laying out the minefield (Figure 7-4b). The platoon leader briefs party leaders on siting and laying out the minefield. The siting party positions squad members with line-of-sight markers at points 1, 2, 3, and 4 and marks points 5 and 6. The marking party prepares the HEMMS for use, and the loading party begins loading the dispenser with mines. The maneuver unit or security element moves to overwatch positions.

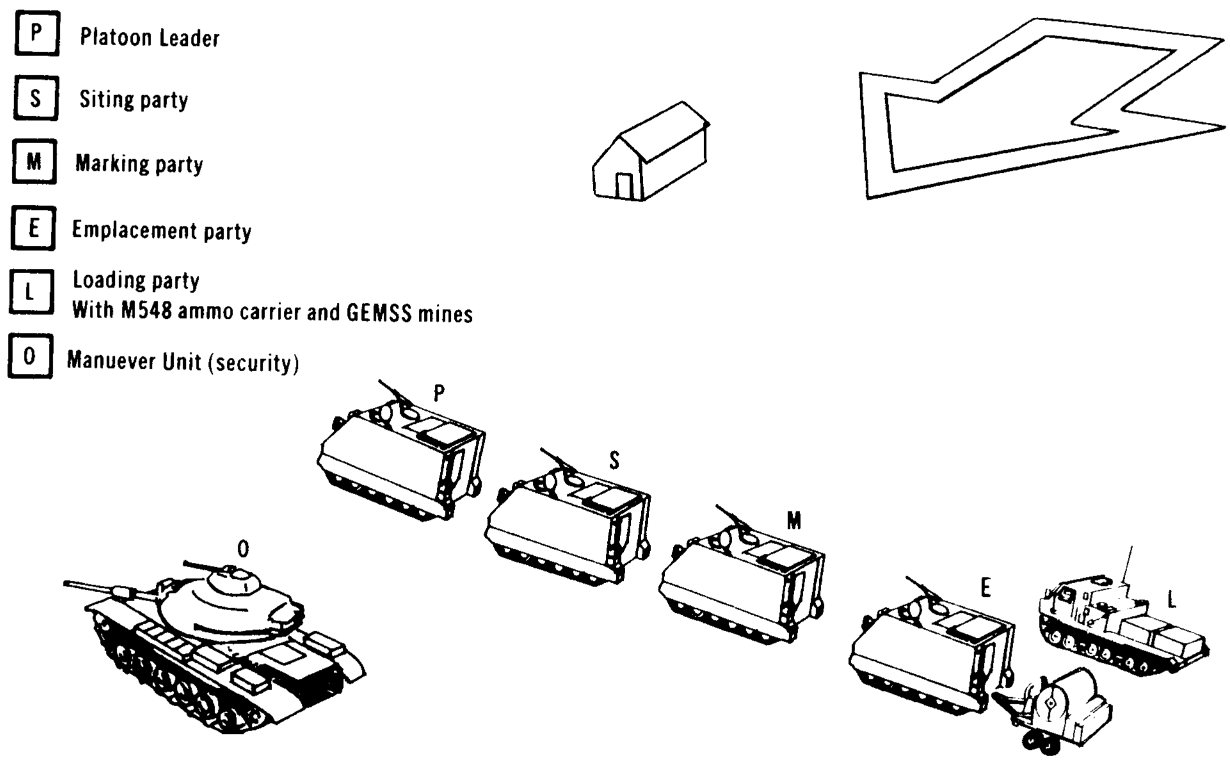


Figure 7-4a. Execution of typical GEMSS minefield (arriving on site)

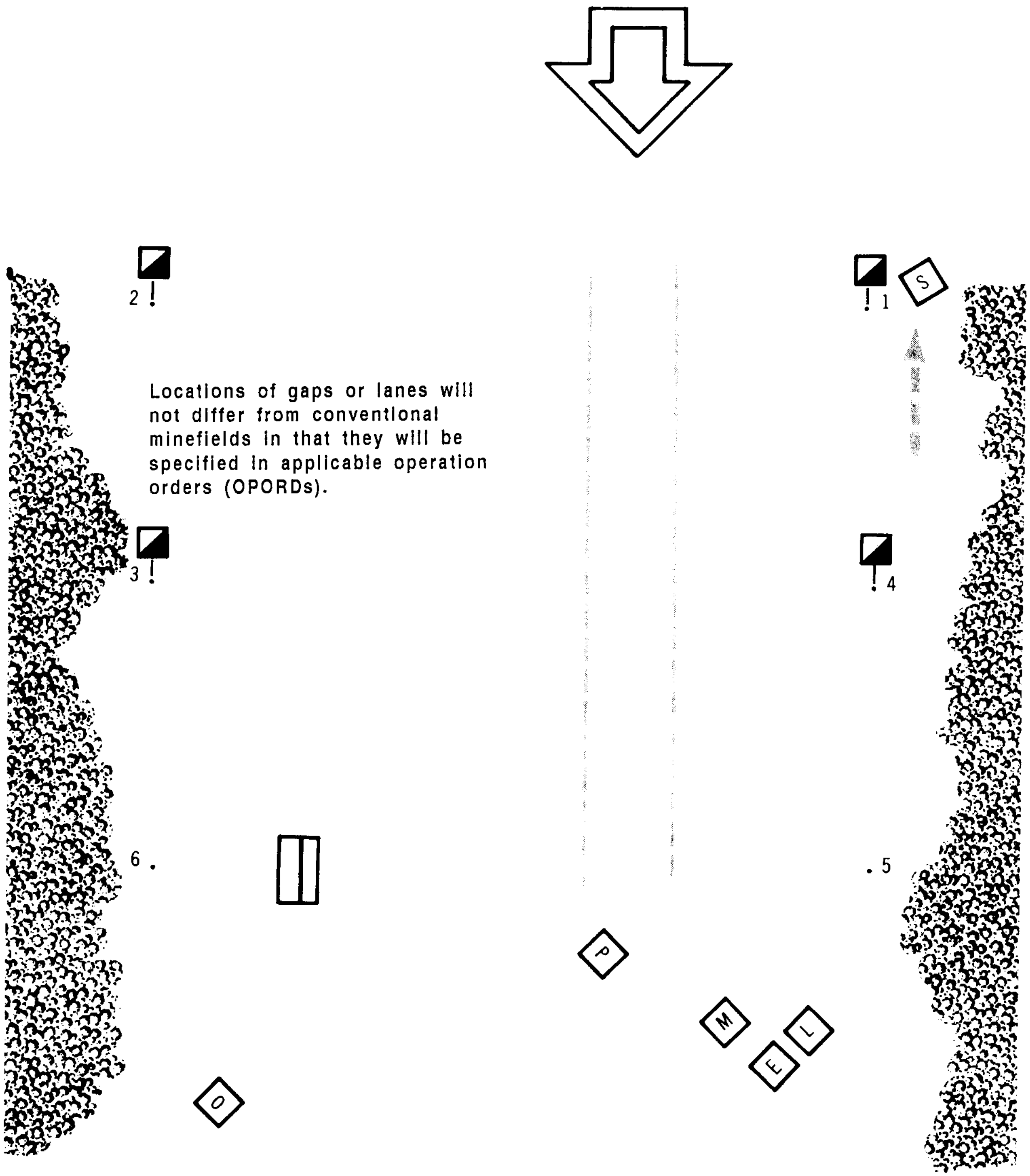


Figure 7-4b. Execution of typical GEMSS minefield (laying out the minefield)

Marking safe lanes (Figure 7-4c). The siting party leader completes laying out centerline strips and takes position at point 2 for overwatch. The marking party leader establishes the safe lane through the minefield and marks it with the HEMMS. Gaps are left open in the safe lane to allow the dispenser to pass. The loading party brings the empty containers back to the ASP to draw more mines. The emplacement party makes final operational checks on the dispenser.

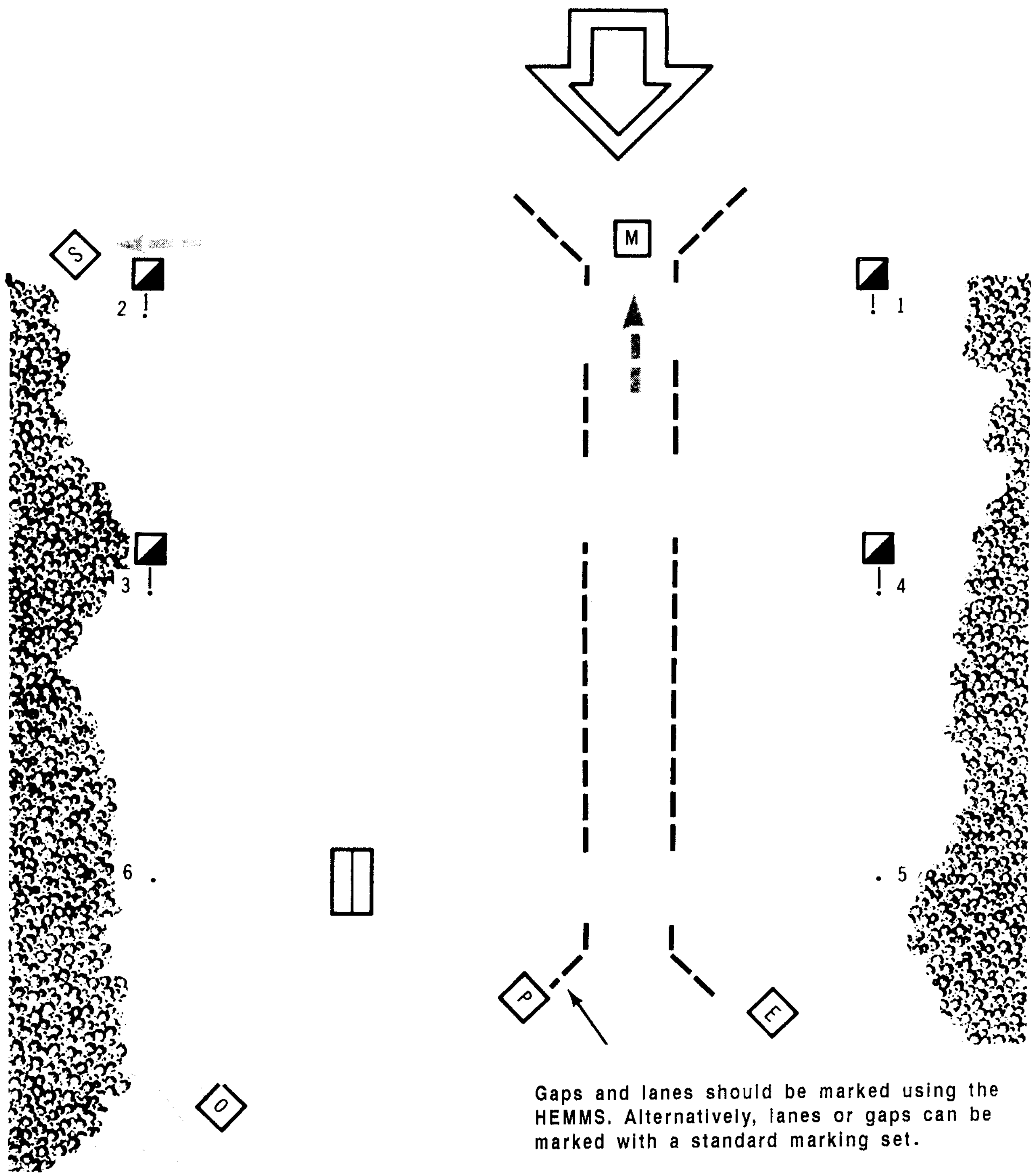


Figure 7-4c. Execution of typical GEMSS minefield (marking safe lanes)

Marking the minefield (Figure 7-4d). The marking party marks the minefield boundaries. The marking party is assisted by members of the siting and emplacement parties as needed. Fences are emplaced 60 meters beyond the centerline of the two end strips and 15 meters beyond the strip line-of-site markers. The platoon leader reorganizes and prepares to move to a new mission site when marking is complete.

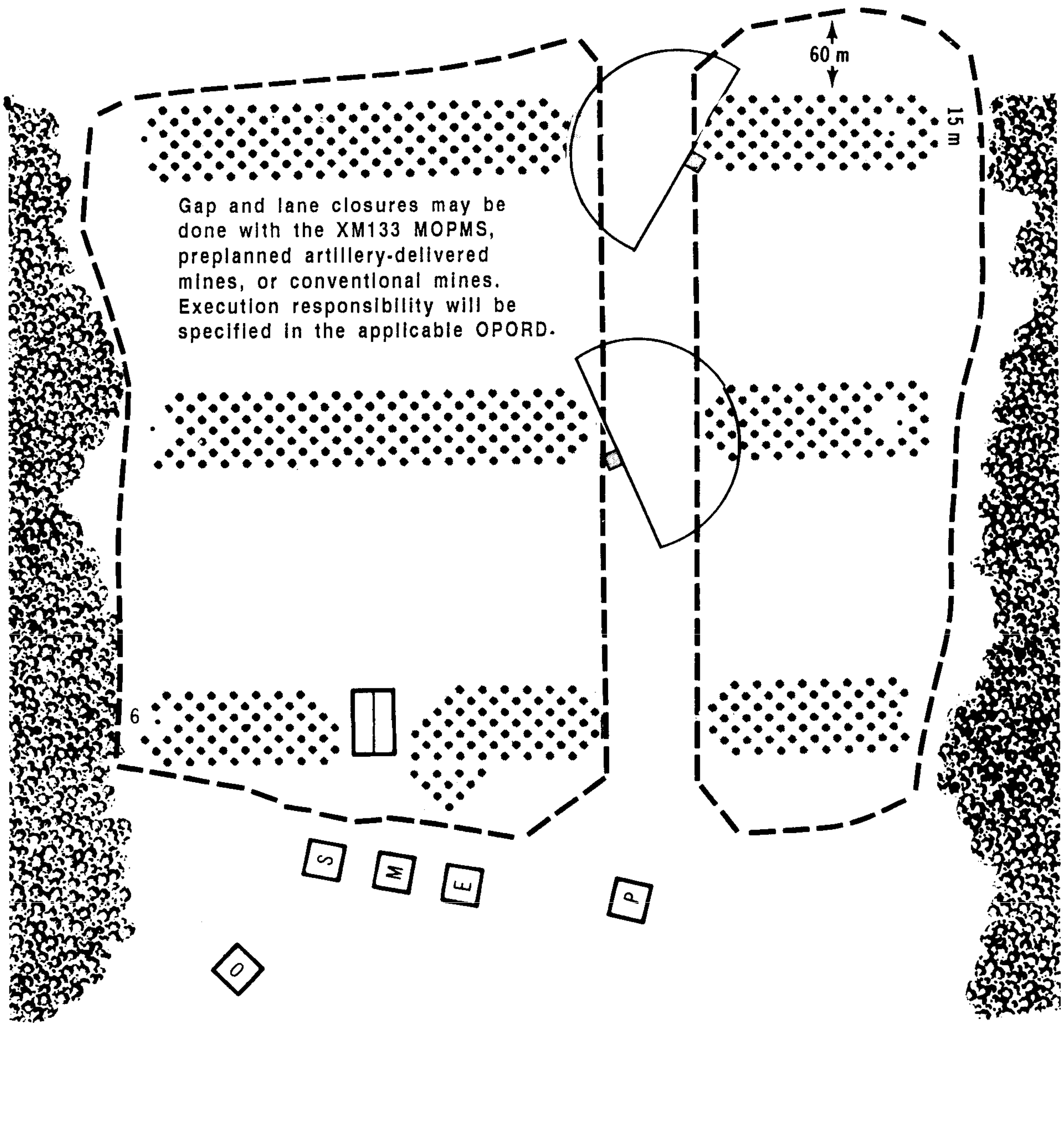


Figure 7-4d. Execution of typical GEMSS minefield (marking the minefield)

Making final preparations (Figure 7-4e). Siting and marking party leaders confirm completion of their initial missions to the platoon leader. The platoon leader instructs the emplacement party to begin dispensing mines.

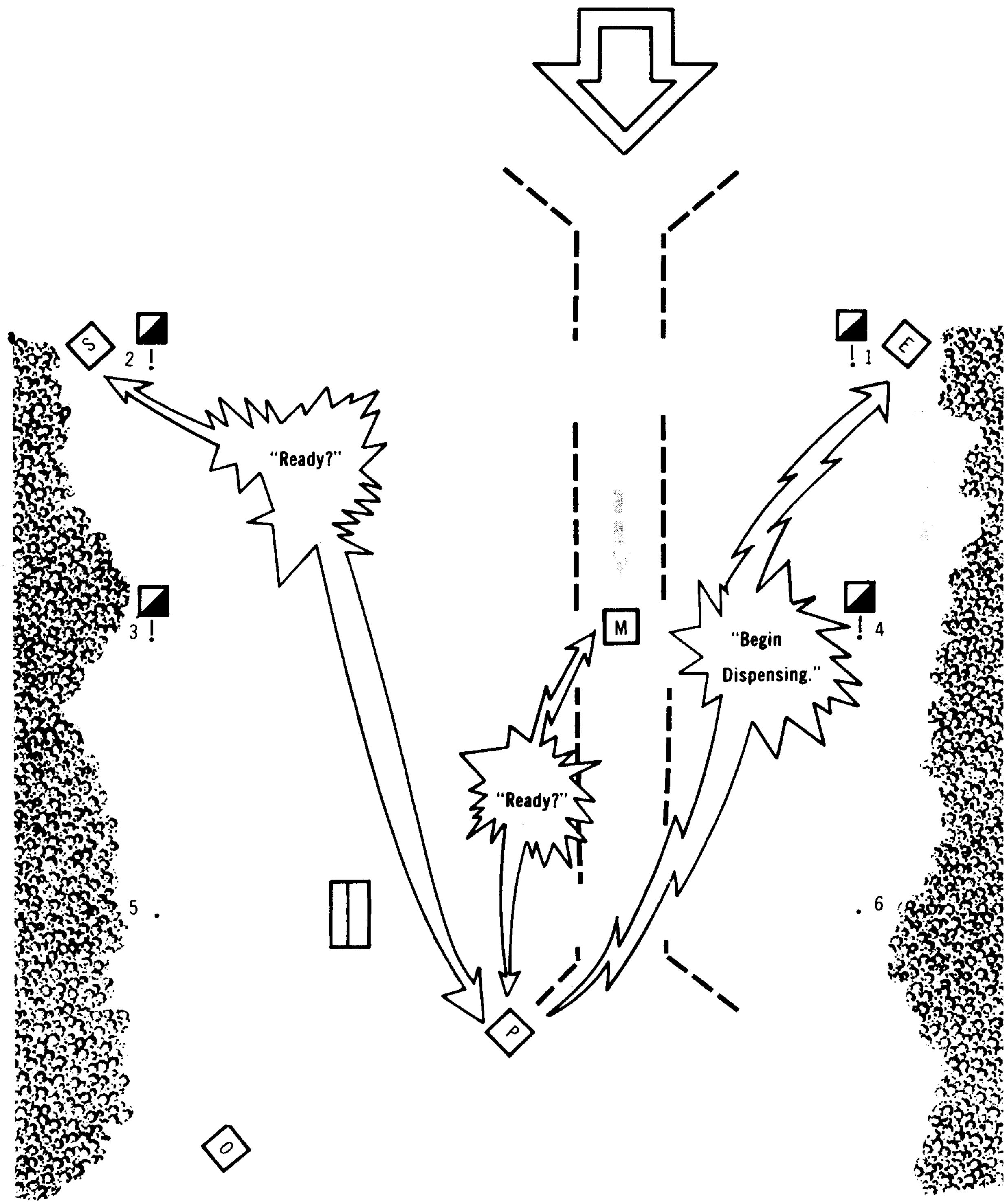


Figure 7-4e. Execution of typical GEMSS minefield (making final preparations)

Mining the first strip (Figure 7-4f). The emplacement party moves to point 2 while dispensing mines. It stops dispensing once the rear of-the M128 dispenser is 5 meters inside the safe lane, and begins again when it is 40 to 50 meters beyond the safe lane. After the GEMSS passes through the safe lane, a marking party member closes that portion of the lane with the HEMMS and ensures no mines have fallen into the lane. The siting party member at point 1 moves to point 5.

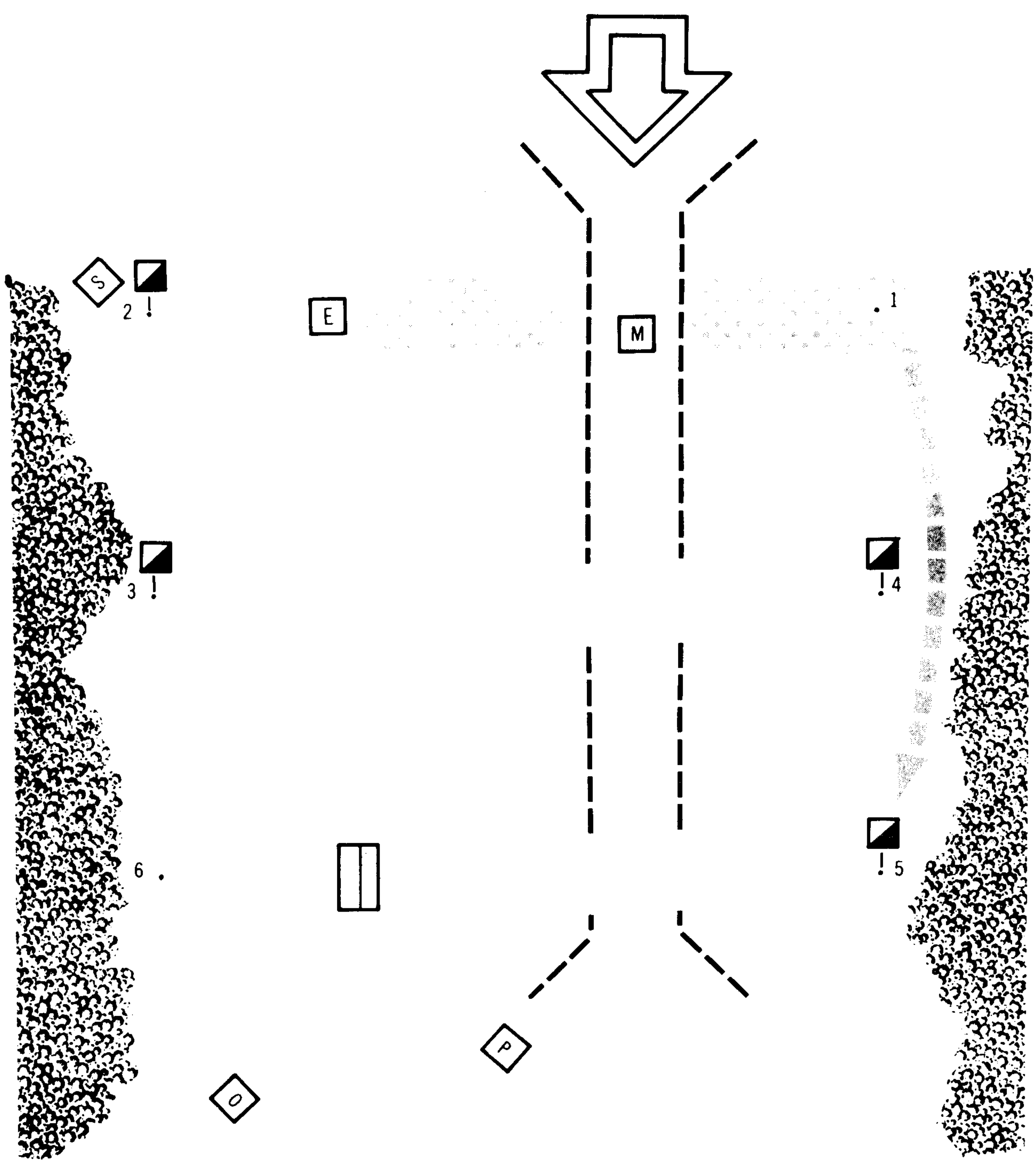


Figure 7-4f. Execution of typical GEMSS minefield (mining the first strip)

Mining the second strip (Figure 7-4g). The GEMSS stops dispensing 5 meters beyond point 2, turns around, and repeats the process for the second strip. The siting party member at point 2 moves to point 6.

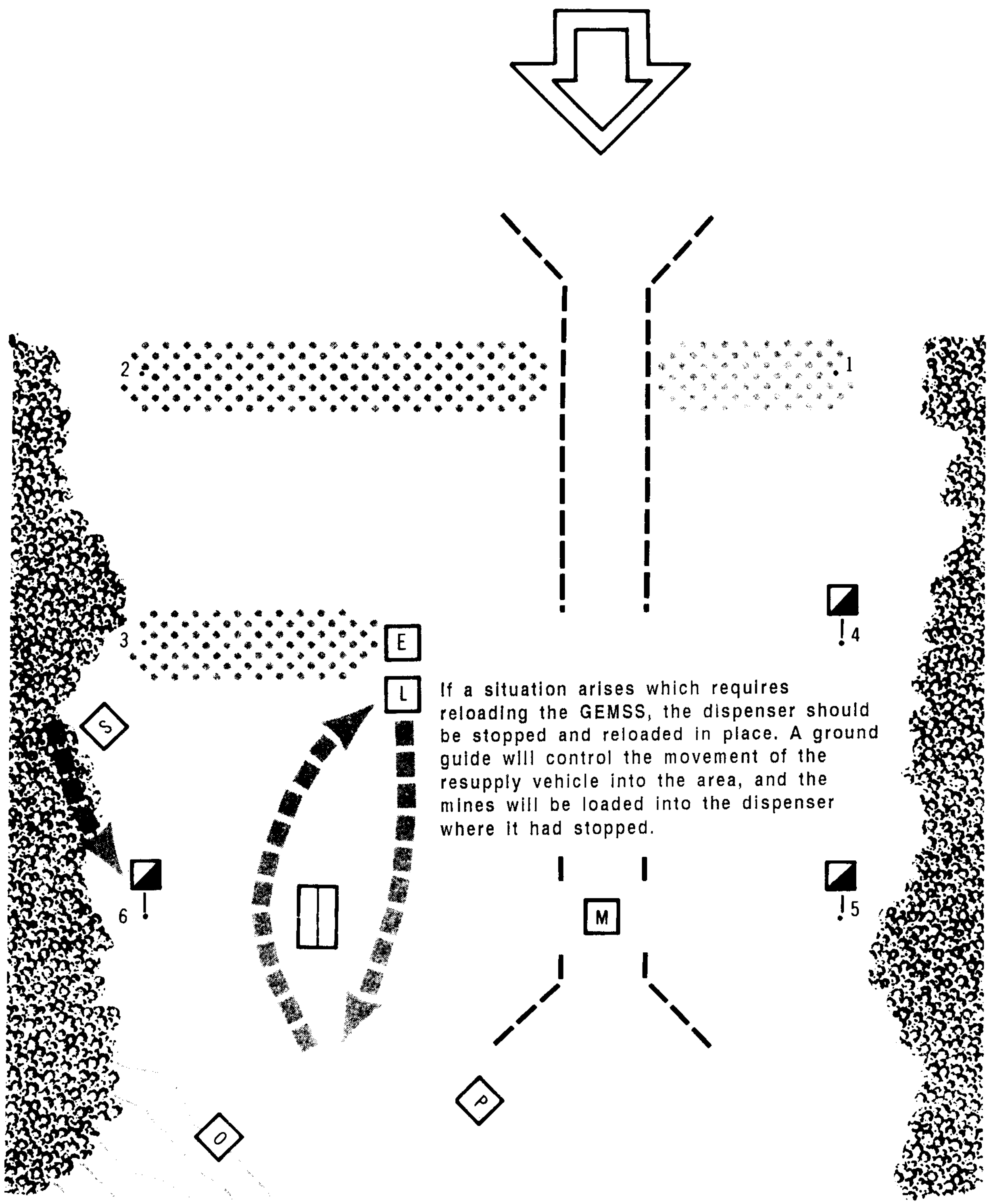


Figure 7-4g. Execution of typical GEMSS minefield (mining the second strip)

Mining the third strip (Figure 7-4h). Repeat the process used for the first and second strips. The siting party leader picks up personnel at the end of each strip. The marking party completes marking the safe lane after the final

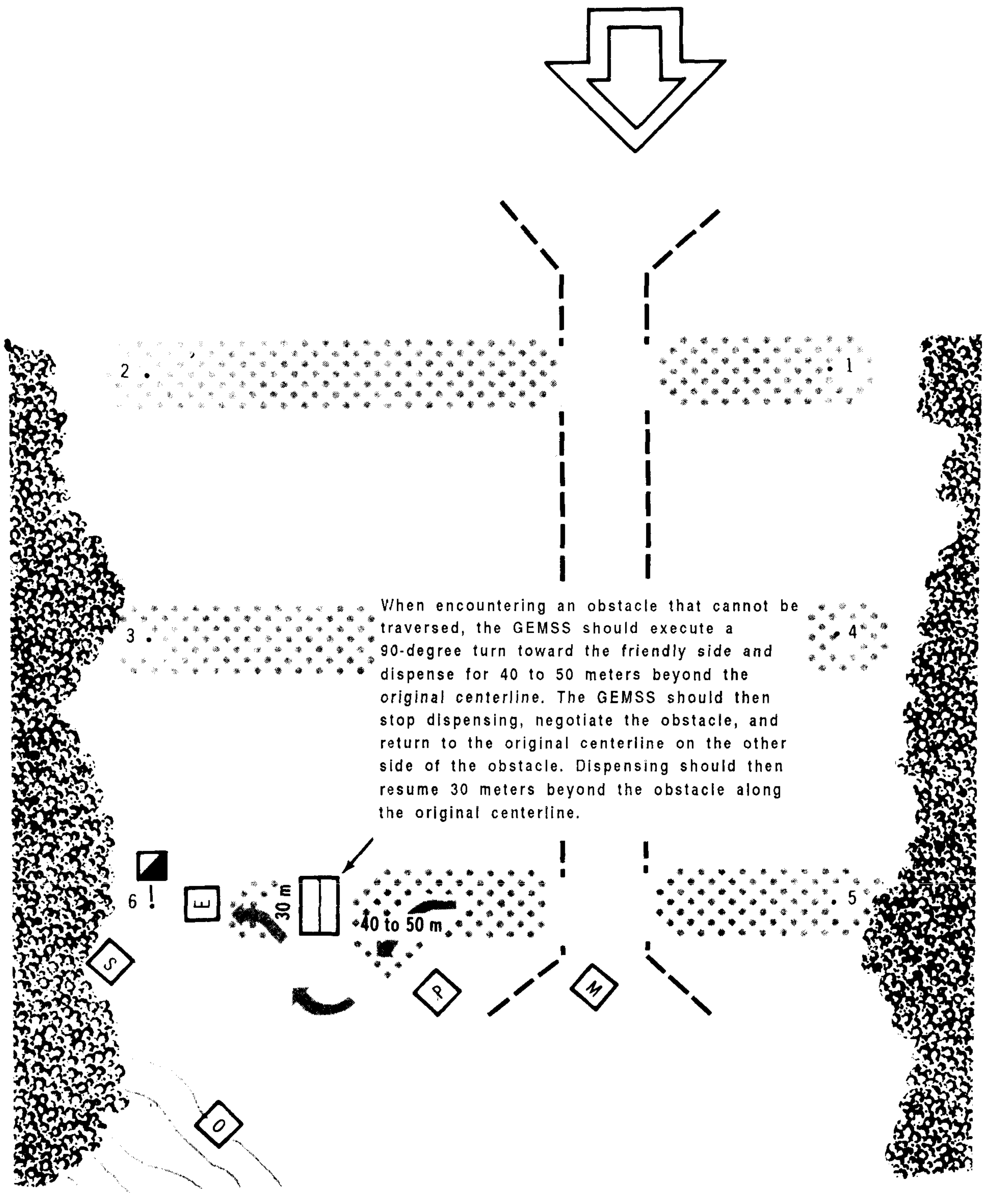


Figure 7-4h. Execution of typical GEMSS minefield (mining the third belt)

pass of the dispenser and ensures no mines have fallen into the lane.

Completing the GEMSS mission. After completing the GEMSS mission, the platoon leader transfers the minefield to the maneuver commander. The platoon leader prepares the scatterable minefield report and record and forwards it through channels to the appropriate command. The maneuver commander and the platoon leader sign a report of transfer. It is sent to the next higher commander having authority over both units. The maneuver commander assumes responsibility for the mine field. GEMSS minefields should be marked on all sides when emplaced in friendly controlled rear areas. Safe lanes are marked, and ground guides are used as much as possible.

RECORDING AND REPORTING

The speed and responsiveness of scatterable mine employment require accurate, uniform, and timely reports. All information on scatterable mine employment is simply and rapidly reported to all affected units. Although scatterable mines have a self-destruct capability, they are still recorded; and the information is disseminated to prevent casualties to friendly forces.

Since individual scatterable mine locations are unknown, they can not be recorded in as much detail as conventional mines. For most systems, a safety zone is calculated from one or more aim point. For example, a RAAM minefield is recorded based on the target location (the grid coordinates given to the firing battery). The size of the minefield depends on the number of rounds fired, the number of aim points, and the angle of fire. Artillery-delivered minefields are recorded by plotting them on a map, based on the aim point(s) and a safety zone area specified in the scatterable minefield report and record prepared by the emplacing unit. A GEMSS or ground Volcano minefield is recorded more accurately by plotting each minefield corner point rather than an aim point.

To facilitate reporting and recording of scatterable minefields, a simple uniform procedure is used. This procedure combines the report and the record into one document (scatterable minefield report and record) applicable for all delivery systems. In addition to the scatterable minefield report and record, the SCATMINWARN notifies effected units that scatterable mines will be emplaced. These two reports are the only reports used with scatterable mines. The scatterable minefield report and record form is shown in Figures 7-5a and 7-5b, pages 7-15 and 7-16.

A completed scatterable minefield report and record for an ADAM/RMM artillery mission is shown in Figure 7-6, page 7-17. Note that on line 6, only one grid coordinate is given. It is the aim point used when the minefield was fired. The 500-meter distance from the aim point (line 15) designates a safety zone that is 1,000 by 1,000 meters.

A completed scatterable minefield report and record for a GEMSS mission is shown in Figure 7-7, page 7-18. Five corner points are designated on the GEMSS example. Corner points can be directly determined for the GEMSS minefield. Corner points provide a more accurate means of recording the minefield than estimating a safety zone from an aim point. Five corner points, instead of four, are given in the GEMSS example because they provide a more accurate record when the minefield is irregularly shaped.

The SCATMINWARN report provides affected units with the necessary warning to plan and execute their operations. The information is kept to a minimum to ensure rapid dissemination. The report may be oral, digital, or hard copy. It is sent before or immediately after mines have been emplaced. A sample SCATMINWARN report is shown in Figure 7-8, page 7-19. A completed SCATMINWARN report for an artillery mission is shown in Figure 7-9, page 7-19.

LINE #	INFORMATION REQUIRED	DATA - INST ON BACK
1	APPROVING AUTHORITY	
2	TGT/OBSTACLE #	
3	TYPE EMPLACING SYSTEM	
4	TYPE MINES	
	LIFE CYCLE	
6	AIM PT/CORNER PTS OF MINEFIELD	
7		
8		
9		
10		
11		
12		
13		
14		
15	SIZE SAFETY ZONE FROM AIM PT	
16	UNIT EMPLACING MINES/RPT #	
17	PERSON COMPLETING RPT	
18	DTG OF REPORT	
19	REMARKS	

SAMPLE

Figure 7-5a. Scatterable minefield report and record (front side)

LINE #	INSTRUCTIONS
1	**Approving Authority.** Enter approving authority. CDR 3AD
2	**Target/Obstacle Number.** If the minefield is part of an obstacle plan, enter the obstacle number 2XXX0157. This number represents II corps, target number 147. If the minefield is not a part of an obstacle plan or does not have a number, then leave blank or enter NA.
3	**Type Emplacing System.** Enter the type system that emplaced the minefield, such as GEMSS, ARTY, Volcano.
4	**Type Mines.** Enter AP for antipersonnel mines, AT for antitank mines. If both, enter AP/AT.
5	**Life Cycle.** Enter the DTG the minefield was emplaced until the last mine self destructs.
6-14	**Aim Point/Corner Points of the Minefield.** If the system used to emplace the minefield uses a single aim point to deliver the mines, enter that aim point MB 10102935. If the system has distinct corner points such as GEMSS, enter those corner points MB 17954790, MB 18604860, MB 18504890, MB 18054895, MB 17804850.
15	**Size Safety Zone from Aim Point.** If an aim point is given in Line 6, enter the size safety zone from that aim point. Example: Artillery emplaces a minefield from aim point MB 10102935 and the safety zone is 1,000 m X 1,000 m, enter 500 m so that personnel plotting or receiving the information can plot the coordinate and go 500 m in each direction from the aim point and plot the safety zone.
16	**Unit Emplacing Mines and Report Number.** BCO 23 ENGR BN 4. Reports should be numbered consecutively. This would be the fourth minefield that B Company has emplaced.
17	**Person Completing the Report.** 160735ZOCT90
18	**Date-Time Group of Report.** 160735ZOCT90
19	**Remarks.** Any other items the reporting unit may feel are important.

Figure 7-5b. Scatterable minefield report and record (back side)

LINE #	INFORMATION REQUIRED	DATA - INST ON BACK
1	APPROVING AUTHORITY	CDR 3AD
2	TGT/OBSTACLE #	2XXX0157
3	TYPE EMPLACING SYSTEM	ARTY
4	TYPE MINES	AT/AP
5	LIFE CYCLE	081610Z - 082020OCT90
6	AIM PT/CORNER PTS OF MINEFIELD	MB 10102935
7		
8		
9		
10		
11		
12		
13		
14		
15	SIZE SAFETY ZONE FROM AIM PT	500 m
16	UNIT EMPLACING MINES/RPT #	2/48FA/2
17	PERSON COMPLETING RPT	SFC HOLLINS
18	DTG OF REPORT	061645ZOCT90
19	REMARKS	NA

Figure 7-6. Scatterable minefield report and record for ADAM/RAAM artillery mission

LINE #	INFORMATION REQUIRED	DATA - INST ON BACK
1	APPROVING AUTHORITY	2BDE3AD
2	TGT/OBSTACLE #	NA
3	TYPE EMPLACING SYSTEM	GEMSS
4	TYPE MINES	AT/AP
5	LIFE CYCLE	101630Z-152113ZOCT90
6	AIM PT/CORNER PTS OF MINEFIELD	MB 17955490
7		MB 18604860
8		MB 18504890
9		MB 18054895
10		MB 17804850
11		
12		
13		
14		
15	SIZE SAFETY ZONE FROM AIM PT	NA
16	UNIT EMPLACING MINES/RPT #	BCO23ENGR/4
17	PERSON COMPLETING RPT	1LT JENNINGS
18	DTG OF REPORT	051400ZOCT90
19	REMARKS	MINEFIELD AROUND TANK DITCH

Figure 7-7. Scatterable minefield report and record for GEMSS mission

LINE	MESSAGE
ALPHA	Emplacing System
BRAVO	AT YES/NO
CHARLIE	AP YES/NO
DELTA	# aim points/corners points
ECHO	Grid coordinates of aim points/corner points and size safety zone.
FOXTROT	DTG of life cycle

Figure 7-8. Sample SCATMINWARN report

LINE	MESSAGE
ALPHA	ARTY
BRAVO	Yes
CHARLIE	Yes
DELTA	One
ECHO	MB 10102935 500 m
FOXTROT	081610Z - 081920ZOCT90

Figure 7-9. Sample SCATMINWARN report for artillery mission

Part Three. Counteroperations

CHAPTER 8
COUNTERMINE OPERATIONS

Countermine operations are taken to breach or clear a minefield. All tasks fall under breaching or clearing operations. These tasks include detecting, reporting, reducing, proofing, and marking. Techniques and procedures are contained in Chapter 9.

DEFINITIONS

Obstacle. The term *obstacle* is used often in this chapter because the same breaching and clearing operations are used for minefields and other obstacles. For the purpose of this manual, breaching and clearing techniques and procedures focus solely on minefields.

Reduction. Reduction is the act or actions taken against an obstacle that diminishes its original effect. Regarding minefields, a lane breach would yield a reduction of the minefield obstacle.

Mine neutralization. Mine neutralization is when the mine has been rendered incapable of firing on passage of a target. The mine may still be dangerous to handle.

Breaching. Breaching is the employment of a combination of tactics, techniques, and procedures to project combat power to the far side of an obstacle. It is a synchronized combined arms operation under the control of the maneuver commander. Breaching actions are plays the unit executes on contact with an obstacle. Breaching is usually executed under enemy fire, but it can be executed when the obstacle is not covered by enemy fire.

Minefield clearance. Clearing is the total elimination or neutralization of an obstacle. Clearing operations are not conducted under fire. They are usually performed after the breaching operation by follow-on engineer forces, or anytime in a friendly area of operations where an obstacle is a hazard or hinders movement.

Route clearance. Route clearance is the removal of mines along preexisting roads and trails.

BREACHING OPERATIONS

Breaching is a synchronized combined arms operation under the control of the maneuver commander. FM 90-13-1 provides combined arms commanders and staffs with doctrine, tactics, and techniques needed to successfully overcome obstacles. Maneuver units employ the following types of breaching operations: bypass, in-stride, deliberate, assault, and covert. The first step in understanding breaching operations is to know the obstacle breach theory.

Knowing the theory behind breaching operations equips the engineer and maneuver commander with fundamentals needed to integrate a breach into the tactical planning, preparation, and execution of an operation.

Successful breaching operations are characterized by the application of intelligence, fundamentals, organization, mass, and synchronization breaching tenets.

Intelligence

In any operation where enemy obstacles can interfere with friendly maneuver, obstacles intelligence (OBSTINTEL) becomes a priority intelligence requirement (PIR). Finding enemy obstacles or seeing enemy obstacle activity validates and refines the intelligence officer's (S2's) picture of the battlefield. OBSTINTEL helps determine enemy intentions, plans, and strength. It is particularly important for discovering the types of mines and mine fuzes the enemy has used. The engineer depends on this information because he must determine which reduction techniques offer the best chance for success and minimize the risk to the breaching force. This requires a dismounted reconnaissance patrol to examine the minefield. When collecting OBSTINTEL, reconnaissance is a combined arms activity that includes engineers. An engineer squad moves with scouts or the patrol and conducts dismounted reconnaissance of templated or discovered obstacles. A combination of light and heavy engineers is the ideal obstacle reconnaissance force. Mechanized engineers use their mobility to reconnoiter numerous tactical obstacles, while light engineers use stealth to reconnoiter protective obstacles. (See Appendix C.)

Fundamentals

Breaching fundamentals are enduring principles that apply regardless of METT-T or specific breach assets. Tactics, techniques, and procedures may vary within the following breach fundamentals:

Suppress. Suppression is the focus of all available fires on enemy personnel, weapons, and equipment to prevent effective fires on friendly forces. Suppressive fires include the full range of weapons from direct and indirect fires, electronic countermeasures (ECM), and directed energy.

Obscure. Obscuration hampers enemy observation and target acquisition, and it conceals friendly activities and movement. Obscuration smoke deployed on or near the enemy position minimizes the enemy's vision. Screening smoke employed in the breaching area and on the enemy conceals movement and obstacle reduction activities. Obscuration also means using terrain to mask movement and breaching activities. Man-made obscuration includes artillery and mortar smoke, smoke generators, vehicle on- board smoke, and smoke pyrotechnits.

Secure. The force secures the breaching operation site to prevent the enemy from interfering with obstacle reduction and ensures safe passage of the force through lanes erected during obstacle reduction.

Reduce. Obstacle reduction is the creation of lanes through the minefield to allow passage of the attacking force. The number and width of lanes varies with the situation and type of breaching operation. Lanes must be sufficient to allow the force to cross the minefield and accomplish its mission. (Table 8-1 provides information on lane widths.) For an in-stride or deliberate breach, a minimum of two lanes are required for a task force and one for a company. For an assault breach, one lane is required per assaulting platoon. The unit reducing the minefield will mark and report the minefield, lane locations, and conditions to higher headquarters. Follow-on units will further reduce or clear the minefield, if required.

Organization

The commander organizes his force to accomplish the breaching operation quickly and effectively. He must organize support, breach, and assault forces with assets necessary to accomplish their role.

Support. The primary responsibility of the support force is to eliminate the enemy's ability

Table 8-1. Lane widths

Assault Footpath - 1 meter

The footpath is breached to pass dismounted troops so they may continue an attack or secure the far side of the minefield while vehicle lanes are being breached.

Initial Lane - 4 meters

The initial lane is the minimum width to pass the breaching and assault forces. It is widened and marked as soon as the tactical situation allows.

Single Lane - 8 meters

The single lane allows one-way vehicle traffic to pass with relatively little impact on vehicle speed or safety.

Double Lane - 16 meters

The double lane allows two-way traffic through the breach.

to interfere with the breaching operation. It must isolate the battlefield with fires and suppress enemy fires covering the breach location. This involves massive direct and indirect fires against the enemy to fix him in position and to attack and destroy enemy vehicles and personnel able to bring fire on the breach force.

Breach. The primary responsibility of the breach force is to create lanes through the minefield that allow passage of the assault force. The breach force is also responsible for marking lane lengths as well as entry and exit points to speed the passage of the assault and follow-on forces. The breach force includes engineers and breaching assets to reduce the minefield and infantry and armor assets to provide local security and suppression. The breach force applies the fundamentals of suppress, obscure, and secure while reducing the minefield. Once lanes are breached, the breach force secures the far side of the minefield and provides suppressive fires as the assault force passes through lanes. The maneuver commander allocates engineer platoons and equipment based on the number of lanes required. Normally, 100 percent more breaching assets than required are positioned with the breach force for redundancy. In close combat, one engineer platoon with breaching assets is required for each lane.

Assault. The primary responsibility of the assault force is to destroy or dislodge the enemy on the far side of the minefield. It secures the far side by physical occupation (as in most deliberate breaching operations). The assault force may be tasked to assist the support force with suppression while the breach force reduces the minefield.

Mass

Breaching is conducted by rapidly applying concentrated force at a point to crack the minefield and rupture the defense. Massed combat power is directed against an enemy weakness. The commander masses engineers and breaching equipment to reduce the obstacle. The breach force is organized and equipped to use several different reduction techniques in case the primary technique fails. Achieving necessary mass for the assault requires the breach force to open enough lanes through the minefield to permit rapid passage and the build-up of forces on the far side.

Synchronization

Breaching operations require precise synchronization of suppression, obscuration, security, and reduction (SOSR) breaching fundamentals by support, breach, and assault forces. Failure to synchronize effective suppression and obscuration with obstacle reduction during an assault can result in rapid, devastating loss of friendly troops in the minefield or in the enemy's fire sack.

Types of Breaching Operations

Breaching operations make maneuver possible in the face of enemy obstacle efforts. Since obstacles may be encountered anywhere, maneuver forces integrate breaching operations into all movement plans. When possible, enemy minefields are bypassed to maintain the momentum and conserve critical countermine assets. However, when making the decision to bypass rather than breach, consider the likelihood of friendly units being channelized into kill zones. Bypassing is done by maneuvering around the minefield or, if aviation assets are available, moving over the minefield. When maneuvering around the obstacle, attempt to locate a portion of the force in overwatch positions to cover the bypass of the main element. Even when the decision is made to conduct a breach, scouts should continue to reconnoiter for bypass routes.

In-stride. In-stride breaching is a very rapid technique using standard actions on contact and on normal movement techniques. It consists of preplanned, well-trained, and well-rehearsed breaching actions and reduction procedures by predesignated combined arms elements. The in-stride breach takes advantage of surprise and initiative to get through the obstacle with minimal loss of momentum. The force uses the in-stride breach against weak defenders or very simple obstacles and executes it from the march. The in-stride breach is normally conducted by a TF or brigade during a movement to contact or during a hasty attack. It maintains the momentum of the attack by denying the enemy time to mass forces to cover the obstacles. Brigade and TF commanders plan and prepare for an in-stride breach by task-organizing subordinate TFs or company teams with forces necessary to conduct independent breaching operations. The subordinate commander designates specific support, breach, and assault forces. Proper integration of engineers and breaching assets into TF and company team formations is critical to the success of an in-stride breach.

Deliberate. Deliberate breaching is a scheme of maneuver specifically designed to cross an obstacle in order to continue the mission. The deliberate breach is characterized by thorough reconnaissance, detailed planning, extensive preparation, and explicit rehearsal. Units conduct a deliberate breach when it is impossible to take the obstacle in stride or when an in-stride breach has failed. A unit conducts a deliberate breach when the forces required for support, breach, and assault are beyond the capability of a task-organized subordinate unit. Maneuver company teams, TFs, and brigades conduct deliberate breaching operations. Normally, a company team executes a deliberate breach because the commander must halt the unit's momentum to maneuver his platoons as support, breach, and assault forces.

Assault. Assault breaching allows a force to penetrate an enemy's protective obstacles and destroy the defender in detail. The assault breach is conducted by company teams and platoons assigned to assault an objective as part of a larger force attack. Engineers contribute to the assault in four major areas:

- Conduct decentralized obstacle reduction to maintain the mobility of the assault force and momentum of the attack.
- Reduce fortifications with demolitions.
- Widen initial assault breaches to permit follow-on forces to move on or through the objective.
- Hand over assault lanes to follow-on forces for widening and improved marking.

Engineers are integrated into assault forces to provide decentralized, responsive support at the lowest possible level. This is a sharp contrast to the in-stride and deliberate breach, where engineer platoons operate as a unit under the control of the platoon leader.

Covert. Covert breaching is a special operation used by dismounted forces during limited visibility. It is silently executed to achieve surprise and to minimize casualties. The covert breach relies on stealth, quiet manual lane reduction techniques, and dismounted maneuver. The TF commander plans to conduct a covert breach when the mission specifies infiltration through enemy forward, lightly defended obstacles to attack an objective deeper in the enemy's sector. A commander may also use the covert breach during an assault when the need for surprise outweighs the need for overwhelming suppression.

The main difference in a covert breach and other breaching operations is the execution of the SOSR breaching fundamentals. The TF commander task-organizes his force to support, breach, and assault the obstacle. In the covert breach, suppression from the support force is a *be-prepared* task upon detection of the breach force or an *on-order* task once the breach is complete and the assault is initiated.

CLEARING OPERATIONS

Clearing is the total elimination or neutralization of mines from an area. Breaching operations are usually conducted under enemy fires while clearing operations are not conducted under fire. Clearing operations can be conducted by engineers during war or after hostilities as part of nation assistance.

A limited clearing operation can be conducted by follow-on engineers after the force conducting a breaching operation has reduced the minefield and secured the area. In this situation, the clearing operation initially improves existing breach lanes by widening and marking them, and it clears and marks new lanes through the minefield. The clearing operation supports continued passage of forces. Eventually, all mines are eliminated or neutralized.

A clearing operation is also conducted to eliminate all mines in a minefield previously identified, reported, and marked in a friendly area of operations that hinders mobility or is a hazard to friendly forces or civilians.

The most extensive clearing operations occur as part of post-war nation assistance. Procedures and techniques for clearing operations presented in this section provide the fundamentals for large-scale clearing operations.

Upgrading Breach Lanes

Upgrading breach lanes is limited mine clearing conducted by follow-on engineers to improve existing lanes through minefields and to reduce new lanes. This clearing operation is intended to further reduce the minefield so follow-on units can pass through it as quickly as possible.

The breach force that initially reduced the obstacle and marked the lanes turns over the lanes to follow-on engineers. Follow-on engineers can expect lane widths of 4 to 5 meters. The total number of lanes depends on the size of the lead breach and assault forces. Two to four assault lanes are normal if the lead unit was brigade-size.

If forces continue to pass through existing lanes while further reducing and clearing is conducted, follow-on engineers first begin reducing new lanes. At a minimum, a brigade requires four lanes, and a division requires eight lanes to pass forces through the minefield. Lanes reduced during clearing should be a minimum of 100 meters apart. The clearing force reduces additional lanes using equipment and techniques outlined in Chapter 9. Lane clearance is more deliberate than lane breaching and normally takes longer. Fewer mechanical breaching assets are available for the clearance operation. Follow-on engineers will probably not have tank-mounted mine-clearing blades or rollers. Combat engineer vehicles with mine rakes are scarce. The main mechanical clearing asset is an armored dozer with a mine rake. Mine-clearing line charges (MICLICs) are used, if available. Engineers with mine detectors, mine probes, and demolitions assist in clearing additional lanes. Lanes are widened to 16 meters to allow for two-way traffic. They are marked using the original marking system for breach lanes or by using the division SOP. Entrances, exits, and left and right lane markers are emplaced to provide day and night capability. Lane-marking procedures are contained in Chapter 9.

After additional lanes are reduced and marked, and forces begin using them, engineers improve initial breach lanes by widening them to 16 meters. The marking system is improved to the new lane width. Traffic control is critical during additional lane reduction and when shifting lanes to improve existing lanes. Engineers conducting reduction and clearance may also provide guides at the lanes. Control procedures are outlined in FM 90-13-1.

To eliminate the danger of forces entering the minefield adjacent to lanes, the minefield is marked with fencing (barbwire or concertina) and mine markers. Marking is emplaced across the front, on both sides, between lanes, and to the left and right of the crossing site as far out as practical.

Engineers may also help remove damaged vehicles from minefield lanes. Recovery vehicles should be available near lanes for this purpose.

Mine Clearance

Clearing operations occur when engineers receive a mission to clear an area of mines or clear a specific minefield in a friendly area of operation. In this case, the minefield was reported and may already be marked on all sides. The worst case would be if the minefield was reported but not marked and its limits were unknown. The engineer unit receiving the mission bases plans on available information and prepares equipment based on the estimate.

Actions at the minefield begin with a thorough reconnaissance to identify minefield limits and types of mines. This is a time-consuming process that is hazardous to shortcut. Identified limits are marked with an expedient system of single-strand barbwire or concertina. In this situation, since all mines must be destroyed, the unit takes a systematic approach to clearing mines. The procedure depends on the type of mines and whether the mines are buried or surface-laid.

If mines are magnetic- or seismic-fuzed, mechanical assets are used. Pressure mines can be destroyed using hand-emplaced explosives. When a manual procedure is used, eliminate AP mine trip wires with grapnel hooks before moving forward to detect mines.

Using the manual procedure, engineers visually detect mines or detect them with mine detectors and probes. They also mark mines for destruction by explosives. Chapter 10 contains information on mine-sweeping procedures.

After mines are destroyed, proof used lanes and routes to ensure all mines were eliminated. This is done by using a mine roller or mine clearing blade/rake. Proofing is discussed further in Chapter 9.

CHAPTER 9
MINEFIELD REDUCTION

Reduction is the physical creation of a lane through a minefield. It is a fundamental of breaching operations as discussed in Chapter 8 and FM 90-13-1. A number of tasks directly support or are included in minefield reduction. Engineers are involved the most in this part of breaching. Minefield reduction tasks include: detecting, reporting, reducing, proofing, and marking.

These tasks also apply to clearing operations. The minefield is detected during reconnaissance for the breaching operation, and detection is also inherent in the clearing operation. While reduction in the breaching operation entails creating a lane through the minefield using specialized equipment, it is taken one step further in the clearing operation where all mines are eliminated-from an area.

DETECTING

Detection is the actual confirmation and location of mines. It may be accomplished through reconnaissance, or it may be unintentional (such as a vehicle running into a mine). Mine detection is used in conjunction with intelligence-gathering operations, minefield bypass reconnaissance, and breaching and clearing operations. The four detection methods are: visual, physical (probing), electronic, and mechanical.

Visual

Visual detection is part of all combat operations. The following techniques are recoinmended for visual detection of mines and booby traps. Personnel visually inspect the terrain for–

- Trip wires.
- Signs of road repair (such as new fill or paving, road patches, ditching, or culvert work).
- Signs placed on trees, posts, or stakes. Threat forces mark their minefields to protect their own forces.
- Wires leading away from the side of the road. They may be command firing wires that are partially buried.
- Odd features in the ground or patterns not present in nature. Plant growth wilts or changes color; rain may wash away some of the cover, or the cover may sink or crack around the edge; the material covering the mines may look like mounds of dirt.
- Civilians. They may know where mines or booby traps are located in the residential area. Civilians staying away from certain places or out of certain buildings are good indications of mines or booby traps. Question civilians to find exact locations.
- Pieces of wood or other debris on a road. They may indicate where the enemy has emplaced pressure or pressure-release firing devices.

These devices may be on the surface or partially buried.

- Patterns of objects which might be used as a sighting line. The enemy can use mines fired by command. Road shoulders and areas close to them should be searched.

Physical (Probing)

Probing is very time-consuming and is used primarily for clearing operations or for covert breaching operations. Detection of mines by visual or electronic methods should be confirmed by probing. Use the following procedures and techniques when probing for mines:

- Roll up sleeves and remove jewelry to increase sensitivity. Wear a Kevlar helmet with the chin strap buckled.
- Stay close to the ground; move on hands and knees or from a prone position.
- Use sight and touch to detect trip wires, fuzes, and pressure prongs.
- Use a slender, nonmetallic object as a probe.
- Probe every 2 inches (5 centimeters) across a 1-meter front.
- Gently push the probe into the ground at an angle less than 45 degrees.

DANGER

If the probe is pushed straight down, its tip may detonate a pressure fuze.

- Apply just enough pressure on the probe to sink it slowly into the ground.
- If the probe encounters resistance and does not go into the gorund freely, pick the soil. away with the tip of the probe and remove the loose dirt by hand.
- When a solid object is touched, stop probing and carefully remove the surrounding soil to determine what the object is.
- If the object is a mine, remove enough soil to show the mine type and mark its location. Do not attempt to remove or disarm the mine. Use explosives to destroy detected mines in place, or use a grappling hook and rope to cause mines to self-detonate. Do not use metal grappling hooks on magnetic-fuzed mines.

Electronic

Electronic mine detectors are effective for locating mines; however, they are time-consuming and expose personnel to enemy fire. In addition, the mine location must be confirmed by probing.

The AN/PSS-11 detector (Figure 9-la) and the successor model, AN/PSS-12 (Figure 9- lb), can only detect metal. However, most mines have metal components in their design. The detectors can locate and identify plastic or wooden mines by this slight metallic signature. Technical data is available on the AN/PSS-11 in TM 5-6665-202-13 and on the AN/PSS-12 in TM 5-6665-298-10. The detector is handheld and identifies suspected mines by an audio signal in the headphones.

Mechanical

The track-width mine roller is a minefield detection system. It is most effectively deployed to lead columns on route movement, but it can be used to precede tactical formations. In column movement, unit vehicles travel a narrow path, and one or two mine rollers can effectively detect mines in the path. Mine rollers are also used to detect minefield in front of deployed tactical formations, although more than one roller tank is required for good probability of detection.

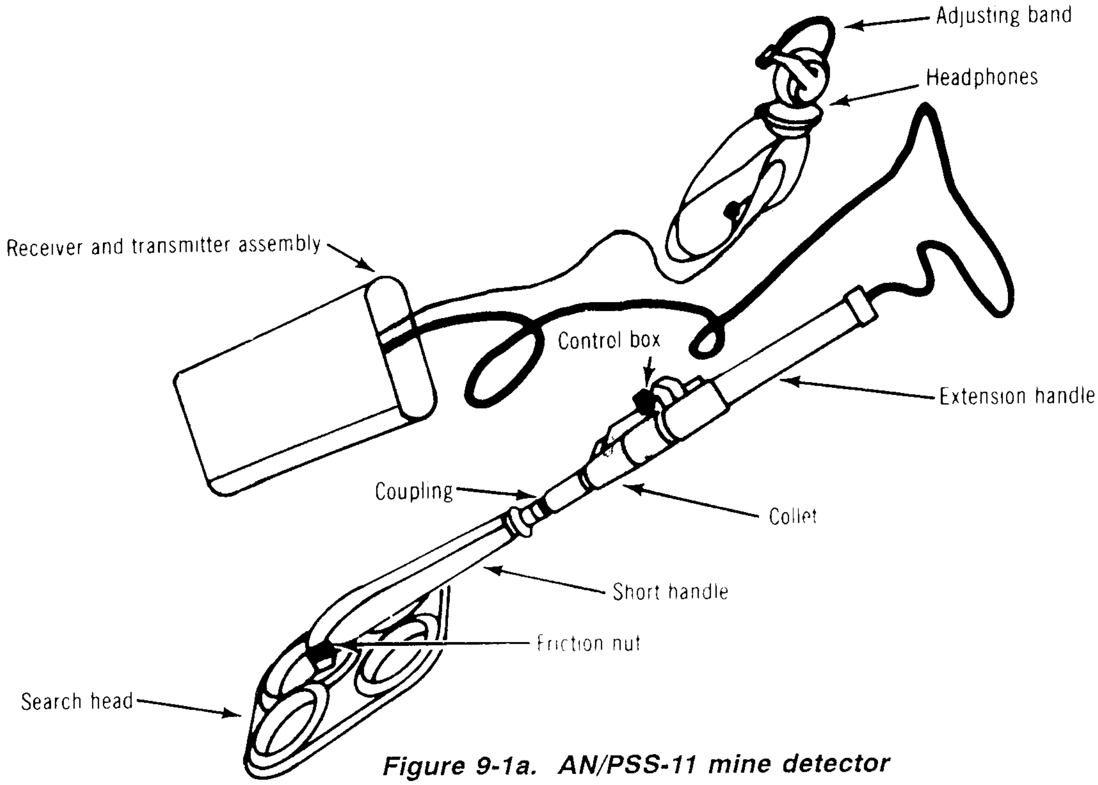


Figure 9-1a. AN/PSS-11 mine detector

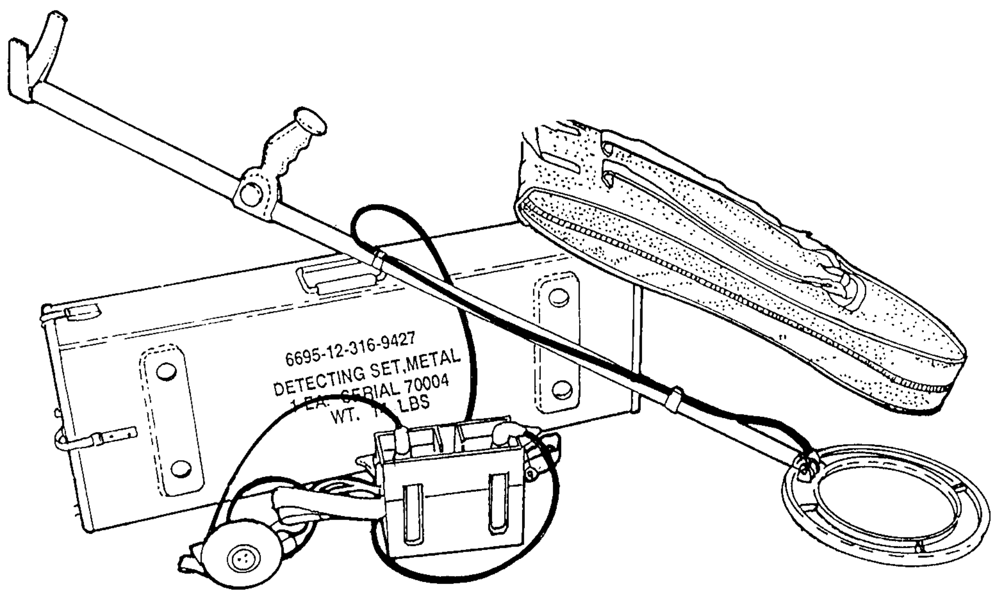


Figure 9-1b. AN/PSS-12 mine detector

REPORTING

Intelligence concerning enemy minefields is reported by the fastest means available. Spot reports are the tactical commander's most common source of minefield intelligence. They originate either from patrols that have been sent on specific minefield reconnaissance missions or from units that have discovered mine information in the course of their normal operations. The information is transmitted to higher headquarters using the enemy minefield report.

REDUCING (BREACHING AND CLEARING)

Minefield reduction and clearing equipment is broken down into explosive, mechanical, and manual means. Combat engineers and operators of breach assets practice and become proficient in reduction means. They integrate them into breach drills of units they support. The team applies different tactics and techniques to breach drills and prepares and rehearses them as part of the TF plan.

Explosive

M58A4 Mine-Clearing Line Charge.

The MICLIC (Figure 9-2) is a rocket-propelled explosive line charge used to reduce minefields containing single-impulse, pressure-activated AT mines and mechanically activated AP mines. It clears a 14- by 100-meter path. The MICLIC has a 62-meter standoff distance from launcher to detonation point. It has limited effectiveness against magnetically activated mines, including scatterable mines and those containing multiple-impulse or delay-time fuzes. It also has little effect on other obstacles, such as log and concrete barriers or antivehicular ditches and walls. The shock effect and psychological impact of the detonation make the MICLIC a useful weapon in a close fight or in MOUT.

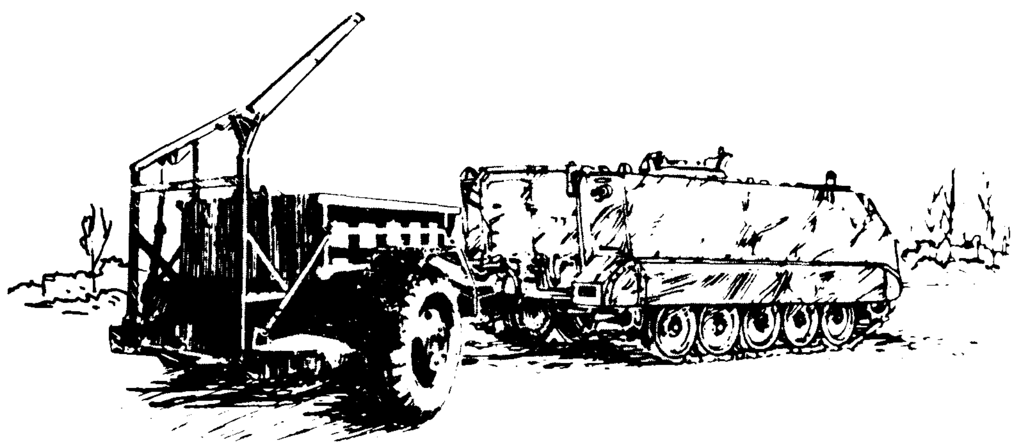


Figure 9-2. M58A4 Mine-clearing line charge (MICLIC)

The MICLIC is mounted on a rubber-tired trailer, or two MICLICs can be mounted on an armored vehicle launched bridge (AVLB) with the bridge downloaded. This is called an armored vehicle launched MICLIC (AVLM) (Figure 9-3). Using the AVLM is the preferred method because a trailer is not involved to hinder the mobility of the towing vehicle. Towing vehicles for the trailer -mounted MICLIC include the M60 tank, CEV, Ml 13, M2, M3, ACE, 5-ton wheeled vehicle, and 2 ½-ton wheeled vehicle. An M1 series tank has high exhaust temperatures so it cannot tow the charge. A trailer limits the MICLIC's mobility in rough terrain and degrades the maneuverability of the towing vehicle, thereby increasing vulnerability. Since the MICLIC is criticaI to the breach, it is kept under the protection of the force and is moved to the breach site along easily trafficable, covered, and concealed routes. This effectively prevents the towing vehicle from performing any other task (firing and maneuvering) or from serving as an engineer squad vehicle unless MICLIC employment is the squad's only mission. This is an important consideration when selecting the towing vehicle because the vehicle must be solely dedicated to the mission.

The MICLIC can be fired from within an armored towing vehicle without exposing soldiers to fires, although prefiring preparations must be done in advance at a covered and concealed location near the breach site. The lanyard and initiating cable are brought into the vehicle through a hatch which must be left ajar or through the portal of a periscope that has been removed. Therefore, the crew is not afforded nuclear, biological, chemical (NBC) protection. When the MICLIC is fired from a wheeled vehicle, however, the crew must move to a covered position to the rear and side of the launcher. The special-purpose cable of the firing controI switch is long enough to allow adequate standoff.

The towing vehicle operator must be proficient in all aspects of preparing and deploying the MICLIC, including the critical aspect of selecting the optimum breach site. Although the operator will generally be directed to the breach site by the engineer platoon leader or breach force commander, ensuring that he can independently accomplish the task simplifies the operation and greatly enhances its likelihood of success. The towing vehicle and operator must be selected well in advance and be

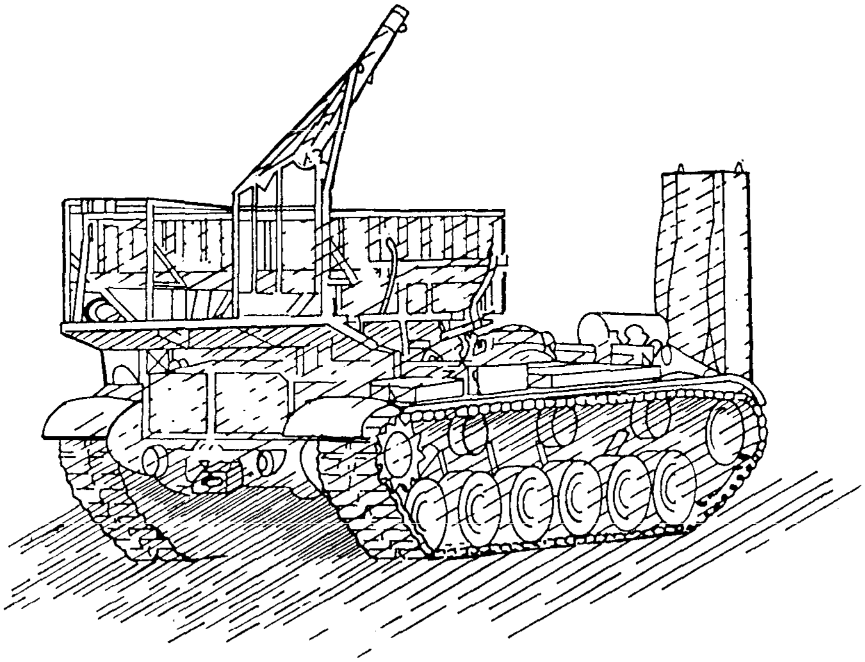


Figure 9-3. Armored vehicle launched MICLIC (AVLM)

dedicated solely to the task. The operator must be included in all rehearsals and planning sessions and, if possible, during leader reconnoiters.

Each MICLIC trailer transports and fires one charge and then reloads. The AVLM can fire both MICLICs before reloading. The loaded charge container weighs 2,850 pounds, so a lifting device such as a 5-ton wrecker or a heavy expanded mobility tactical truck (HEMTT) is needed. Reloading, which can be done by an experienced crew in about 30 minutes, entails loading a rocket on the rail and lifting a new charge container onto the launcher. The reloading operation must be clone in a covered and concealed location.

The number of MICLICs needed to clear a single lane through a minefield depends on the minefield depth. Minefields greater than 100 meters deep require two or more MICLICs; minefields less than 100 meters deep require only one MICLIC. However, the exact limits and depth of an enemy minefield are seldom known before the breach. This is particularly true when the situation is unclear and the minefield is encountered simultaneously with enemy contact. The first and only indication that the unit is in a minefield may be when a vehicle encounters a mine. The leading edge of the minefield may still be uncertain since the vehicle could have hit a mine in an interior row. Therefore, there are two basic drills for MICLIC employment:

- Clearing a lane through a minefield less than 100 meters deep requires one MICLIC (Figure 9-4). If time permits, the leading edge of the minefield is identified and confirmed by reconnaissance. The MICLIC is deployed from a minimum standoff distance of 62 meters from the leading edge of the minefield.

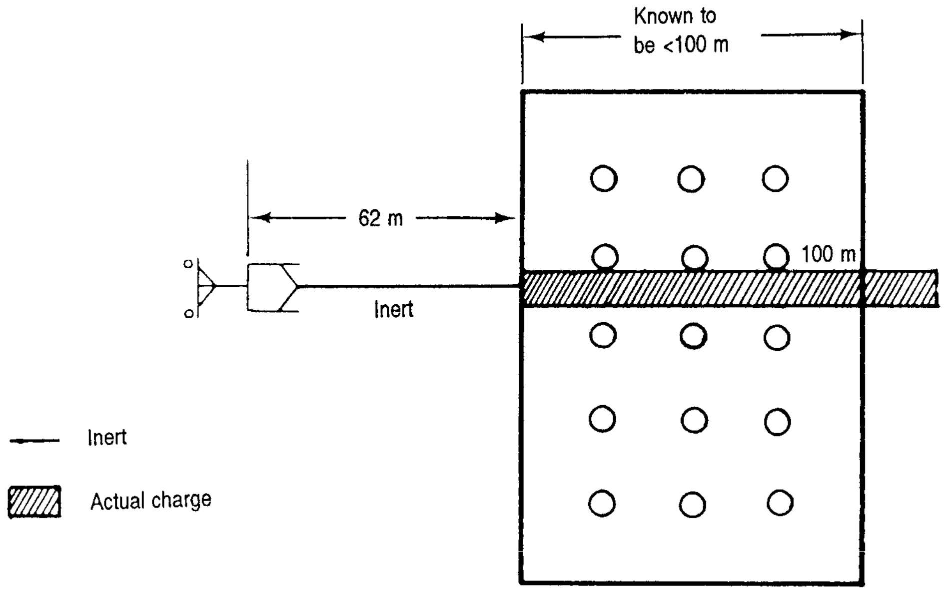


Figure 9-4. MICLIC employment in a minefield less than 100 meters deep

★• Clearing a lane through a minefield more than 100 meters deep or of uncertain depth requires two or more MICLICs. If the leading edge cannot be identified, the MICLIC is deployed 100 meters from the possible edge or stricken vehicle (Figure 9-5). When the first MICLIC is detonated, a second MICLIC moves 25 meters into the first MICLIC's path and fires its charge. This extends the lane an additional 87 meters. Additional MICLICs are used for minefields of extreme depth, and each one moves down the lane 25 meters into the path created by the previous charge.

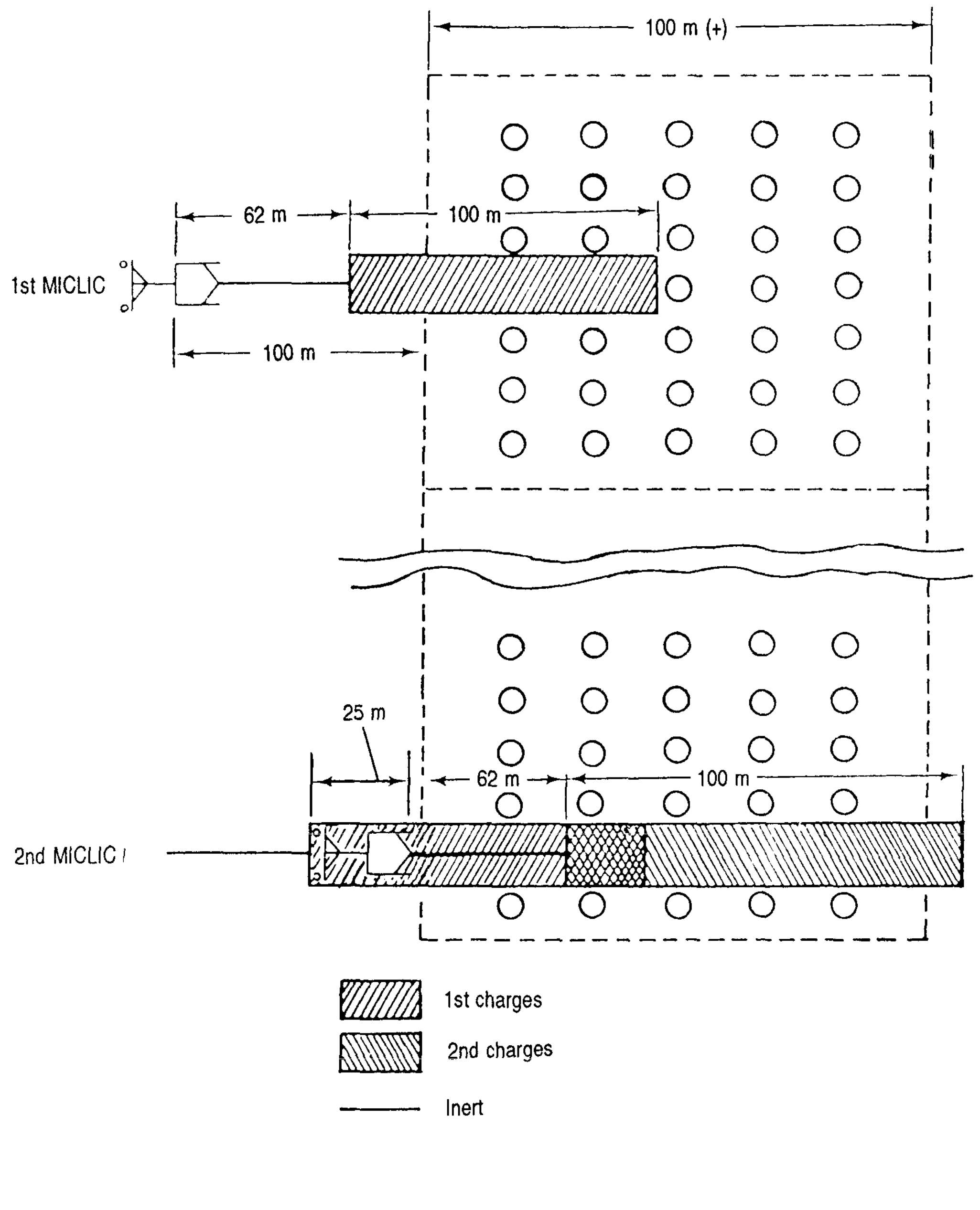


Figure 9-5. MICLIC employment in a minefield of uncertain depth or greater than 100 meters

Antipersonnel Obstacle Breaching System.

The Antipersonnel Obstacle Breaching System (APOBS) (Figure 9-6) is a man-portable device that is capable of quickly creating a footpath through AP mines and wire entanglements. The APOBS is normally employed by combat engineers. infantry, or dismounted armored cavalry personnel. It provides a lightweight, self-contained, two-man, portable line charge that is rocket-propelled over AP obstacles from a standoff position away from the edge of the obstacle. For dismounted operations, the APOBS is carried in backpacks by no more than two soldiers and for a maximum of 2 kilometers. One backpack assembly consists of the rocket motor launch mechanism containing a 25-meter line charge segment and 60 attaching grenades. The other backpack assembly contains a 20-meter line charge segment and 48 attached grenades. The APOBS weighs approximately 110 pounds. It is capable of breaching a footpath approximately 0.6 by 45 meters and is fired from a 25-meter standoff.

MlA1/M1A2 Bangalore Torpedo.

The bangalore torpedo (Figure 9-7) is a manually emplaced explosive-filled pipe that was designed as a wire breaching device, but it is also effective against simple pressure-activated AP mines. It is issued as a demolition kit and consists of 10 1.5-meter tubes. Each tube contains 9 pounds of high explosives and weighs 13 pounds. The kit clears a 1- X 15-meter lane.

The ban galore torpedo is used by dismounted infantry or engineer troops. An individual soldier or a pair of soldiers connects the number of sections needed and pushes the torpedo through the minefield before priming it. A detailed reconnaissance is conducted before employing the bangalore torpedo to ensure no trip wires have been used.

Bangalore torpedoes usually do not generate enough overpressure to detonate AT mines unless they are placed immediately next to them. Several threat and friendly mines require two

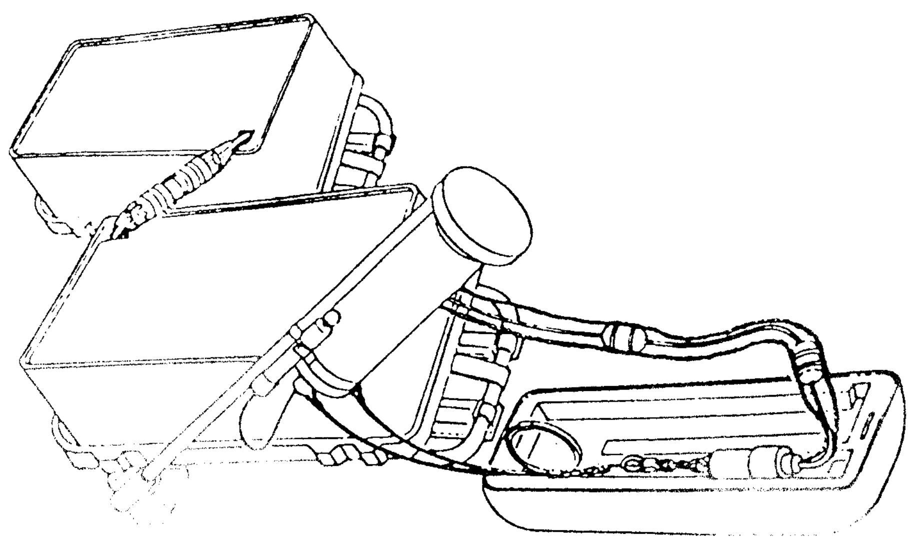


Figure 9-6. Antipersonnel Obstacle Breaching System (APOBS)

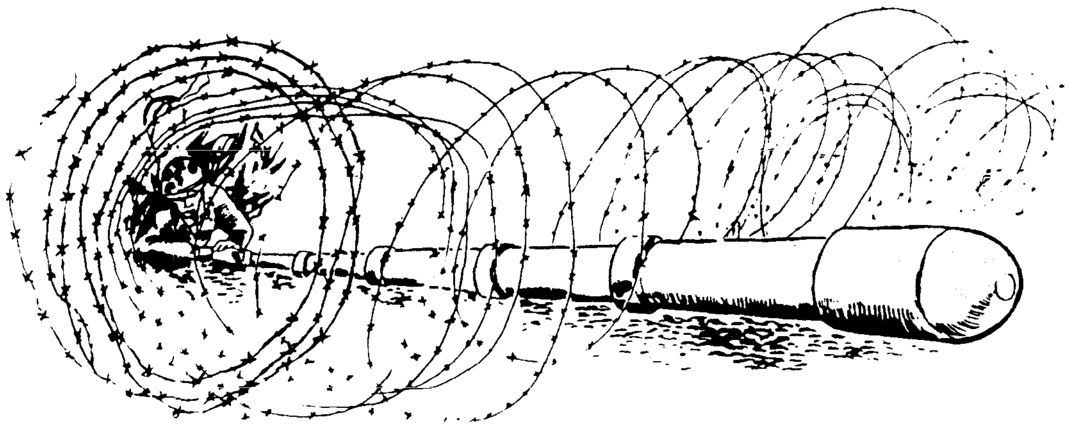


Figure 9-7. M1A1/M1A2 bangalore torpedo

impulses or a single, long impulse for detonation. The bangalore generates one short impulse. As a last resort against AT mines, use the bangalore as follows:

- Place the bangalore immediately adjacent to surface-laid mines. If mines are mechanically buried in furrows, lay three sections along the furrow, perpendicular to the direction of the lane (Figure 9-8). If mines are staggered or widely spaced, lay sections parallel to the direction of the lane.
- Clear two track-width paths. A 100-meter minefield requires several kits.

Mechanical

MCBs, mine clearing rollers (MCRs), and Cleared Lane Marking Systems (CLAMSs) are fielded as armor battalion sets containing twelve MCBs, four MCRs, and four CLAMSs. Blades clear lanes through minefields, while rollers are used to detect minefields and proof lanes created by other means. Rollers are not

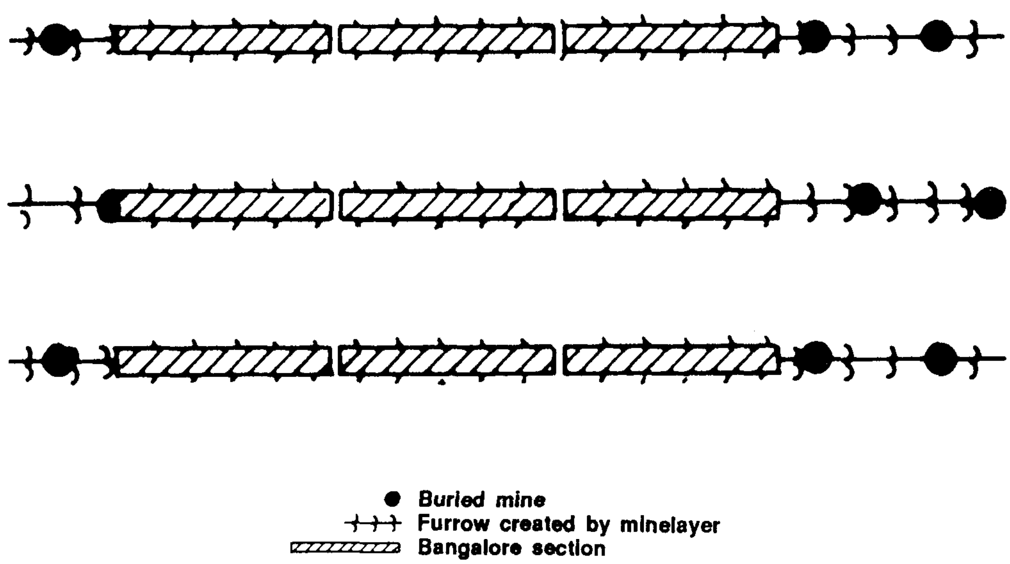


Figure 9-8. Placing bangalore sections to breach mechanically placed mines

a good primary system for lane reduction because multiple mine detonations destroy the roller system and the vehicle pushing it.

Mine Clearing Blade.

The MCB (Figure 9-9) is used to extract and remove land mines from the minefield. It consists of a blade arrangement with scarifying teeth to extract mines, a moldboard to cast mines aside, and leveling skids to control the depth of the blade.

The MCB lifts and pushes mines, which are surface-laid or buried up to 12 inches, to the side of a track. It has three depth settings—8, 10, and 12 inches. The blade creates a 58-inch cleared path in front of each track (Figure 9-10). The skidshoe for each blade exerts enough pressure to activate most single-pulse mines and effectively clears a section of the centerline by explosive detonation. This action may disable the blade. A *dog bone* and chain assembly between the blades defeats tilt-rod fuzed mines. The improved dog bone assembly (IDA) being fielded defeats tilt-rod and magnetically fuzed mines. The IDA projects a magnetic signature when plowing. Multiple impulse pressure fuzes encountered by skidshoes are not defeated. Mines armed with antihandling and antidisturbance devices or magnetic and seismic fuzes may be activated when lifted by the blade. They may also disable the blade. Mines lifted by the blade are left in the spoil on each side of the furrowed path and remain a hazard until they are removed.

The blade can be mounted to an M1 tank without special preparation or modification. Mounting requires lift capability and takes up to an hour, so it must be done well in advance of the mission. It is not easy to mount or transfer the MCB to another tank under battlefield conditions. Once mounted, an electric motor raises and lowers the blade. The MCB is also equipped with an emergency, quick disconnect feature.

The MCB weighs approximately 3 1/2 tons. When it is in the raised position, it minimally effects the M1's maneuverability and speed. This does not greatly impact the employment of the weapon system, except when the blade is in operation.

When plowing, the M1 is restricted to less than 10 kph depending on soil conditions. It cannot maneuver but must continue in a straight path

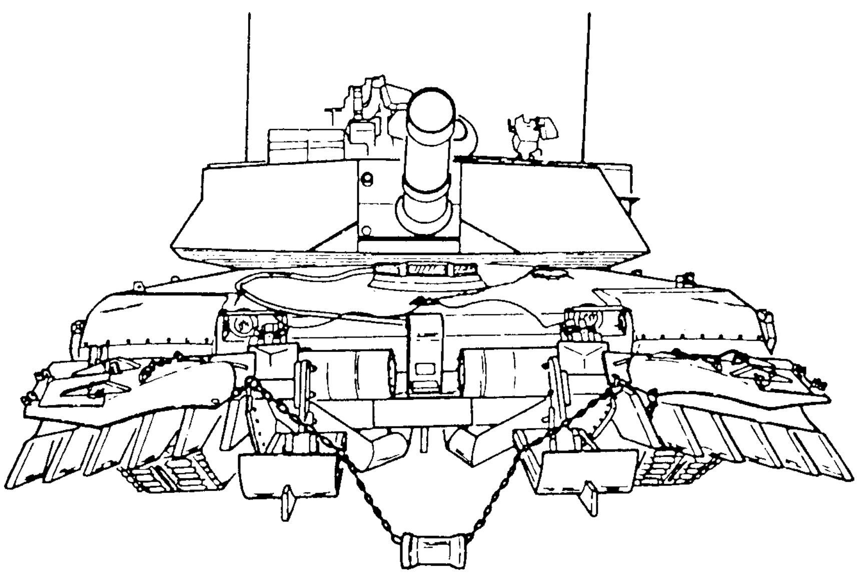


Figure 9-9. Mine clearing blade (MCB)

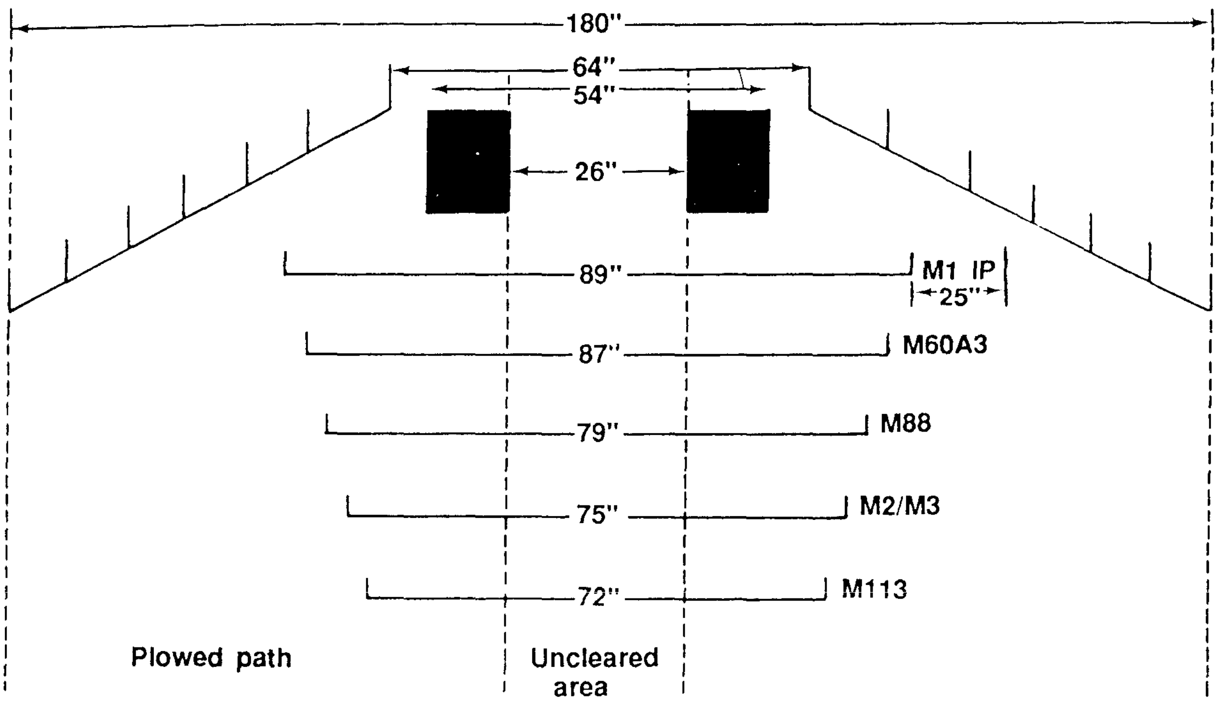


Figure 9-10. Mine blade width compared to track vehicle widths

through the minefield to avoid damaging the blade. The main gun must be traversed to the side during plowing, since a mine detonation under the blade may cause it to be thrown violently into the air and damage the tube. The area selected for the lane must be relatively flat and free of rocks or other obstructions.

The operator begins plowing approximately 100 meters from the estimated minefield leading edge. He creates a lane extending another 100 meters beyond the estimated minefield far edge to ensure the lane extends through the entire minefield.

Mine Clearing Roller.

The MCR (Figure 9-11, page 9-12) consists of a roller assembly, mounting kit, and hand winch kit. The roller assembly weighs approximately 10 tons and consists of two push beams mounted to the front of the tank. Rollers are designed to defeat most single-pulse, pressure-activated AT and AP mines. The roller creates a 44-inch cleared path in front of each track (Figure 9-12, page 9-12). A dog bone and chain assembly between the rollers defeats tilt-rod fuzed mines. The IDA can be fitted to the roller. The roller is designed to withstand multiple mine explosions before damage; however, this depends on the size of the mine explosive material. Large blasts may destroy the roller and vehicle or injure the crew.

The MCR can be mounted on an M1/M60 tank with a permanently attached mine roller mounting kit. Mounting of the roller to the tank is a cumbersome and time-consuming operation. It is very difficult under battlefield conditions and requires lift capability. When employed, the roller tank is limited to 5 to 15 kph. When employed in a suspected minefield, the MCR must travel in a relatively straight

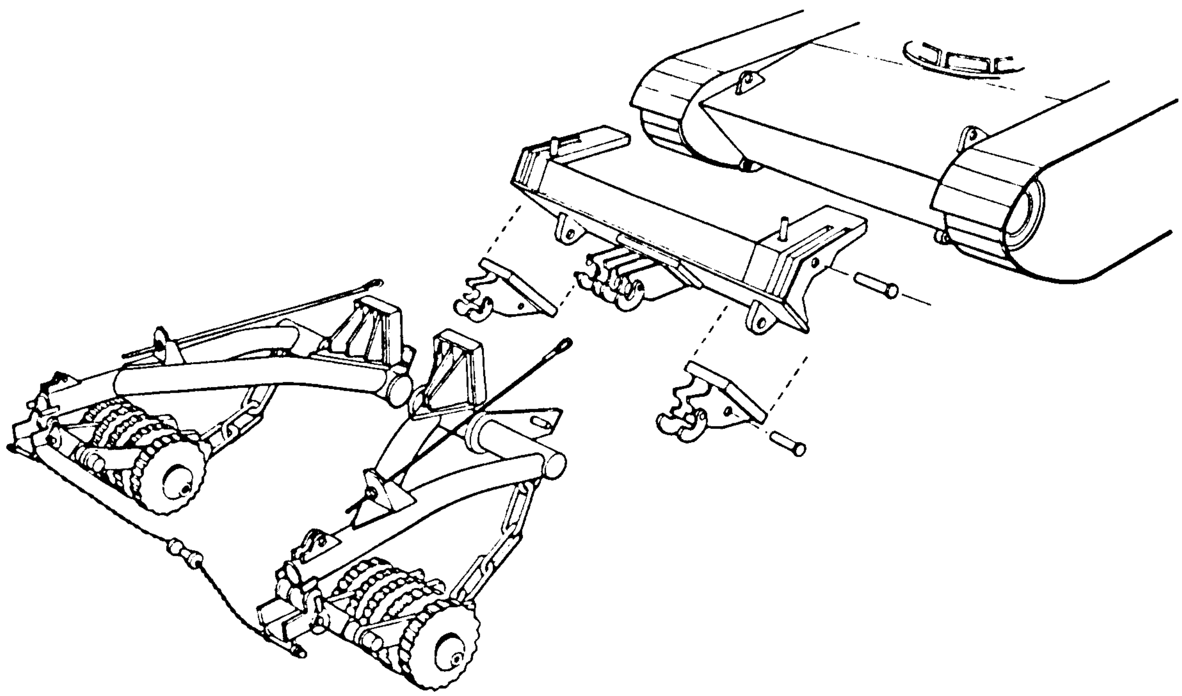


Figure 9-11. Mine clearing roller (MCR)

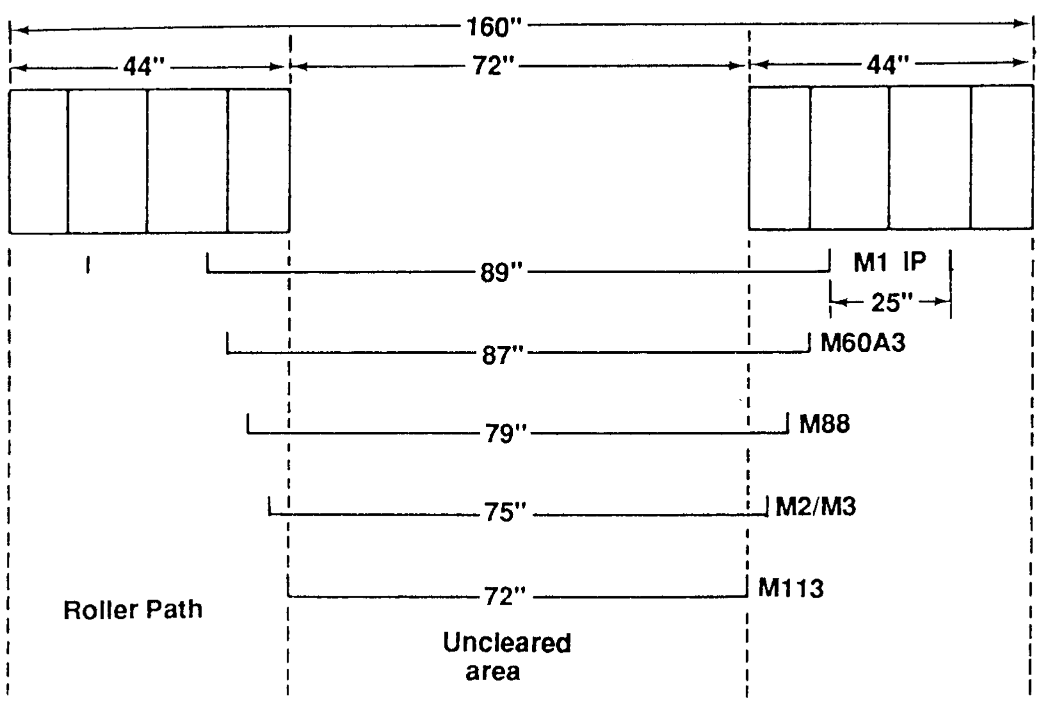


Figure 9-12. Mine roller width compared to track vehicle widths

path because tight turns may cause the roller to deviate from the path of the track and leave the tank vulnerable to mines. Ground fluctuations, bumps, or berms may cause the roller to lift from the ground and miss mines. The MCR is not designed to negotiate gaps on its own; however, it can be used on an AVLB caution crossing. In this situation, the bridge curbing is removed. To prevent bridge hydraulic line damage, the tank driver uses a strap to lift the dog bone and chain when crossing the bridge. The main gun must be traversed to the rear or side when a mine encounter is possible or imminent, because a mine blast can throw the roller or parts of the roller violently into the air and damage the tube.

When the situation and mission permit, MCRs may be employed as lead vehicles to detect minefields. This is most viable when the supported element is traveling in a column. The roller may also be used to lead a supported element traveling in a tactical formation other than a column, but it is less effective than other methods because–

- Vehicles not directly behind the roller may encounter mines passed by the roller.
- The roller may travel well into or completely through a widely spaced minefield without encountering a mine, thus giving the formation a false sense of security.
- The mine encountered by a roller may not be on the leading edge of the minefield.
- The roller is extremely vulnerable, because it cannot effectively use its weapon system.

Rollers are best used to proof lanes in obstacles breached by other means, such as the MICLIC or MCB. A roller pulling a trailer-mounted MICLIC can proof a lane created by a MICLIC launched by another vehicle. The roller then fires the second MICLIC and proofs its own lane.

If rollers participate in a deliberate breach operation, or if the force incorporates rollers into in-stride breach plans, rollers should be mounted before rehearsals. If left unmounted, rollers are carried in the TF formation on M916 tractor-trailers. Rollers require lift capability (such as an M88), a secure location, and 30 to 60 minutes to mount on a tank that is fitted with a mounting kit.

Cleared Lane Marking System.

The CLAMS (Figure 9-13, page 9-14) allows rapid, remote marking of a breached lane so it can be seen at night. It can be mounted on the rear of an M1/M60 tank having the proper adapter assembly. Marking is only adequate for the initial assault, and it must be replaced and improved as soon as possible with marking procedures discussed later in this chapter.

Combat Engineer Vehicle with Full-Width Mine Rake.

This system consists of a wedge-shaped rake mounted to a CEV blade (Figure 9-1 4, page 9-14). The rake weighs 2 tons. The rake is lifted off the transport vehicle with a HEMTT, wrecker, an M88, or a CEV boom. Then, the CEV crew installs it in 30 minutes using basic issue item tools. The rake has a skidshoe to maintain a raking depth of 12 inches. It provides vehicle-width clearance (15 feet) at 5 to 10 kph. The rake has a quick disconnect feature. It lifts surface-laid mines and mines buried up to 12 inches, and it pushes the mines off to both sides. The CEV with full-width mine rake is used to clear lanes during minefield breaching. Since it is full width, it is preferred over the MCB. While the CEV can be employed as the first breaching asset into a minefield, a MICLIC should be used first to eliminate as many mines as possible. The rake is then used to proof the lane. The CEV with rake can pull a MICLIC and fire it before proofing. Raking begins 100 meters before the minefield and continues 100 meters beyond the suspected limit. The CEV maintains a straight course through the minefield. If the skidshoe is damaged, the operator reduces speed and manually controls the blade depth. This is very difficult and risky. The rake performs well in sandy soil, but its effectiveness may be considerably reduced in loamy or clayey soil.

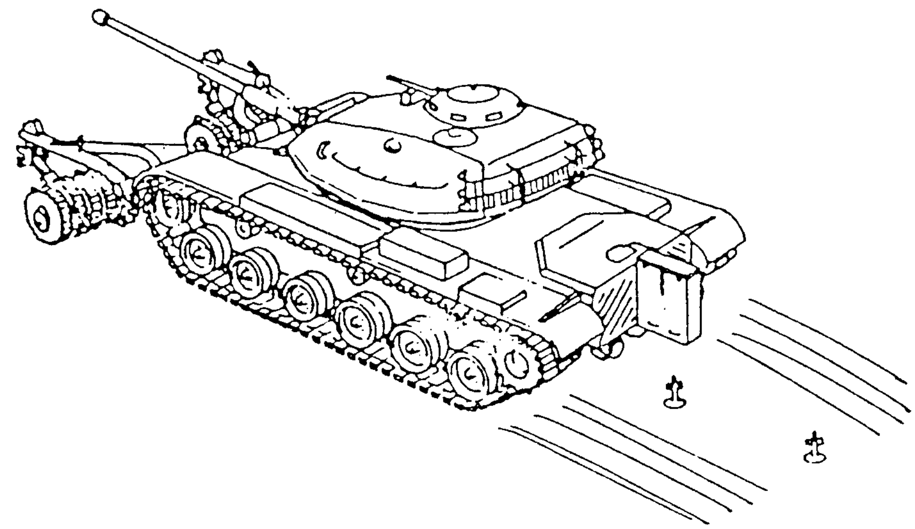


Figure 9-13. Cleared Lane Marking System (CLAMS)

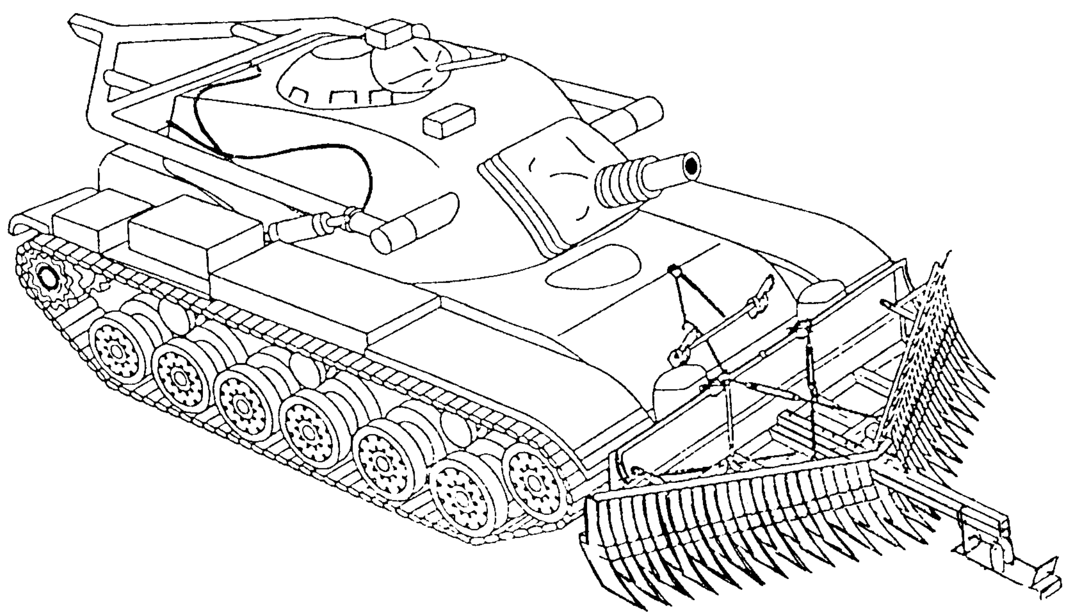


Figure 9-14. CEV with full-width mine rake

Manual

When advanced mechanical equipment is unavailable, manual breaching procedures provide a backup. Manual obstacle reduction is the only method that works in all situations and under all conditions. Certain types of terrain, weather, and sophisticated fuzes can severely degrade the effectiveness of rollers, plows, and line charges. Engineers use hand-emplaced explosives, grapnel hooks attached to ropes, probes, mine detectors, and hand-emplaced marking equipment to breach obstacles.

Surface-Laid Minefields.

The Soviets possess a significant mechanical mine-burying capability. They also have the capacity and propensity for the labor-intensive effort required to bury mines by hand. However, they often lay mines on the surface. Buried mines are usually found in a prepared defense requiring a deliberate breach operation. Training and execution of surface and buried minefield breaches should always assume the presence of AHDs and trip wires until it is proven otherwise.

From covered positions, engineers first use grapnel hooks to check for trip wires in the desired lane. The limited range of the tossed hook requires the procedure to be repeated through the estimated width of the obstacle. A demolition team then moves through the desired lane. The team places a line main down the center of the lane, ties the line from the explosives into the line main, and places blocks of explosives next to surface-laid mines. After mines are detonated, the team makes a visual check to ensure all mines were cleared before directing a proofing roller or other traffic through the lane.

As a variation of this procedure, blocks of explosives are preprinted with a fixed length of time fuze set for an SOP time, such as 5 minutes. The team moves through the surface-laid obstacle. Team members light the time fuze on the blocks of demolitions, set it next to a surface-laid mine, and then move to the next mine. This procedure is much faster than the line-main method, but it does have drawbacks. A higher chance of misfire exists with individually primed demolitions. Possible injuries in the minefield containing initiated firing devices can defeat the closely timed breach, and detonations occurring at different times can dislodge charges placed next to other mines. Use this technique only when speed and mission necessitate such risks. Manual procedures must be well-practiced no matter what the technique details are. Demolition team soldiers are assigned special tasks such as grappler, detonating cord man, and demolitions man. All engineers in the team should be cross-trained on all procedures. Demolitions are prepared for use before arriving at the breach site. An engineer platoon uses squads in series through the minefield to clear a lane for a company team. The platoon must rehearse reduction procedures until execution is flawless, quick, and technically safe. During the breach, the engineer platoon is exposed in the lane for 5 to 30 minutes or more depending on the mission, minefield depth, and their level of training.

Buried minefields.

Manually breaching a buried minefield is extremely difficult to perform as part of an in-stride breach operation. It is usually part of a deliberate breach. If mine burrows are not easily seen (as they are after moisture falls on a recently buried, poorly compacted hole), mine detectors and probes must be used to locate mines. Mines are then destroyed by hand-emplaced charges. As an alternative, mines can be removed by using a grappling hook and, if necessary, a tripod.

The engineer platoon leader organizes soldiers into teams with distinct, rehearsed missions including grappling, detecting, marking, probing, demolitions, and detonating cord emplacing. The platoon is exposed in the obstacle for long periods of time.

Grappling Hook (Grapnel).

The grappling hook is a multipurpose tool with important use in manual obstacle reduction. Soldiers use it to detonate mines from a standoff position by activating trip wires and AHDs. After the grappling hook is used to clear trip wires in a lane, dismounted engineers can move through the minefield, visually locate surface-laid mines, and prepare these mines for demolition. In buried minefields, soldiers grapple and then enter the minefield with detectors and probes. A 60-meter (or longer) cord is attached to the grapnel for hand throwing. The throwing range is usually no more than 25 meters. Excess rope is used for standoff distance when the thrower begins grappling. The thrower tosses the hook and seeks cover before the grapnel and rope touch the ground in case the impact detonates a mine. He then moves backward, reaches the end of the excess rope, takes cover, and begins grappling. Once the grapnel is recovered, the thrower moves forward to the original position, tosses the hook, and repeats the procedure at least twice. He then moves to the end of the grappled area and repeats this sequence through the depth of the minefield. Multiple grapplers can clear a lane of trip wires quickly and thoroughly, but they must time their efforts and follow procedures as simultaneously as possible.

Engineers carry extra hooks and cord because a hit on a trip wire or pressure fuze can destroy them.

PROOFING

Proofing verifies a lane is free of mines by passing a mine roller or another mine-resistant vehicle through the lane as the lead vehicle. The CEV with full-width mine rake or the MCB can be used to proof. This is only done when the risk of live mines remaining in the lane exceeds the risk of loss to enemy fire while waiting. Some mines are resistant to certain breaching techniques (for example, magnetically fuzed mines may be resistant to the MICLIC blast), so proofing should be done when time, threat, and mission allow.

During a limited clearing operation, proof upgraded breach lanes following a breach. After the minefield is completely cleared, proof the routes used through the area.

MARKING

After tactical lanes or bypasses are established in an obstacle, they must be marked and identified for follow-on forces. Mark and report reduced lanes immediately. Additionally, the tactical breach lane marking system must be standard throughout the division area. See FM 90-13-1, Appendix E, for detailed guidance.

The tactical lane marking system must be easily seen and recognized by a buttoned-up vehicle crew. It must be seen through smoke and dust and, if required, at night. It must also be constructed from materials readily available in the Army supply system. Modern tanks and infantry fighting vehicles have infrared sights that can see heat sources through smoke. Remember, though, the active battlefield will have many heat sources, and the tactical lane marking system must be easily seen under these conditions.

Markers and guides must be visible from a distance so the follow-on unit can initially get on the correct route. There is a V-shaped entrance (like a funnel) to guide the unit. The exit is marked so the unit does not deploy back into the combat formation while they are still in the obstacle system. This is extremely critical when the obstacle is complex and has depths greater than 100 meters.

The OPLAN identifies combat engineer units to expand tactically breached lanes, establish two-way traffic, and mark lanes using the standard minefield marking set #2.

The centerline marker must be eye-level (3 to 5 feet) and extremely visible. Mark the reduced (breached) lane at the entrance, along the left side, and at the exit (Figure 9-15, page 9-18). Entrance and exit markers are different from left-side markers and are easy to recognize. Again, it is critical that exit markers be different so the driver knows when he is out of the obstacle. The funnel-shaped entrance is spread over a 50- by 100-meter area. The outer opening is 100 meters wide and is 50 meters from the tactical lane entrance. This allows mounted forces to transition to a column formation. The far recognition marker is established like a traffic control post and has a guide to assist follow-on assaulting forces. This marker can be a maximum of one kilometer from the breached lane(s) and should be visible for at least one kilometer in open country. An unmanned, intermediate recognition marker is placed approximately 500 meters from the obstacle. If possible, left-side markers of the assault lane marking system are done from an armored vehicle to protect the sapper or infantry man from enemy fire.

A systematic improvement is required to the above minimum tactical lane marking system. First, markers are placed on the right side of the lane. Lane markers are moved to the edge of the reduced and cleared lane. (The MICLIC-cleared lane is 14 meters wide after it is proofed.) Next, a centerline is established and a funnel marking system is placed at the exit to allow two-way traffic (Figure 9-16, page 9-19). Finally, a follow-on combat engineer unit expands the lane and marks it with a more permanent marking system. The regimental engineer designates a combat engineer unit to accomplish this mission.

Criteria for adopting a division tactical lane marking system are as follows:

- The marker is visible by a buttoned-up driver and the TC in extensive dust and smoke.
- The marker is durable and able to remain upright in high winds.
- The marker can be quickly and easily emplaced, allowing the marking unit to move quickly through the reduced (breached) lane.
- Left-side lane markers are placed by a squad. The squad does not dismount when marking the lane. They can dismount to mark the entrance and exit.
- The marker can be easily modified for use during limited visibility.

Marking systems currently available are the HEMMS, standard traffic cones, highway markers, and locally fabricated *Tippy Toms.* (The Tippy Tom is a copy of an Israeli system and uses a fabricated base and HEMMS poles.) (See Figures 9-17 and 9-18, page 9-20.)

A sample division tactical marking system is shown in Table 9-1, page 9-21. Table 9-2, page 9-21, shows a sample division tactical marking system for a division that has an abundant supply of HEMMS and VS17 panels.

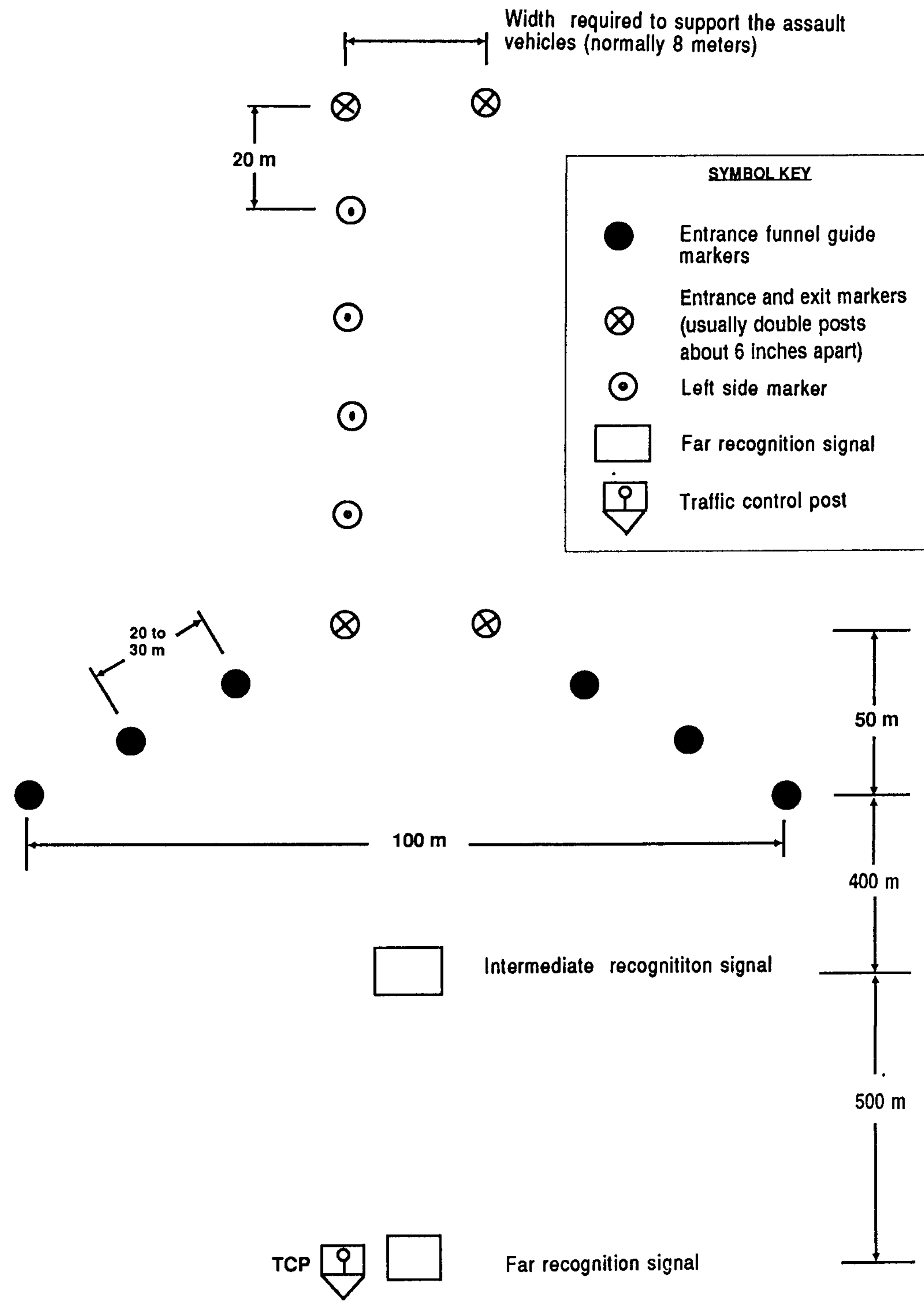


Figure 9-15. Tactical lane marking system

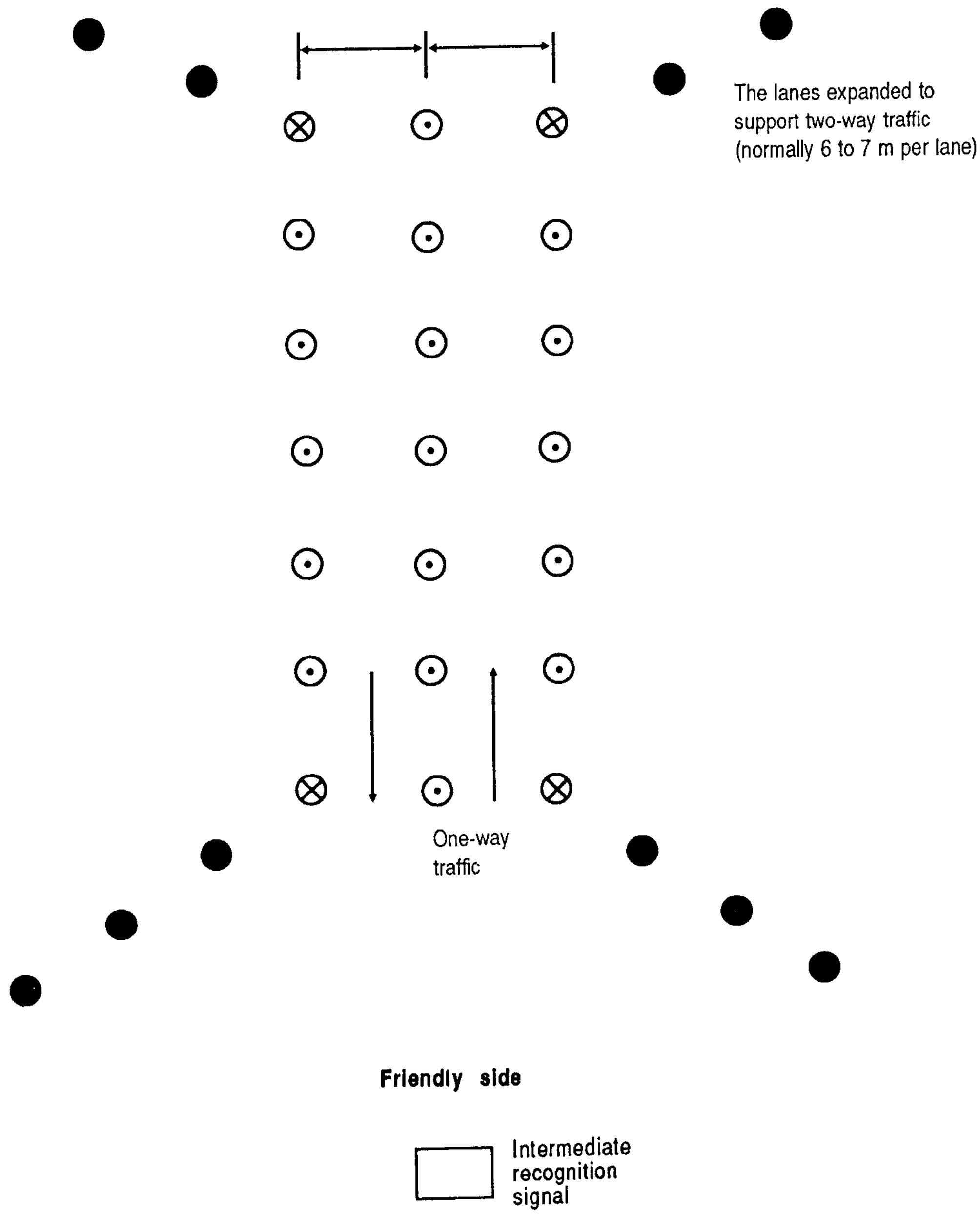


Figure 9-16. Expanded tactical lane marking system

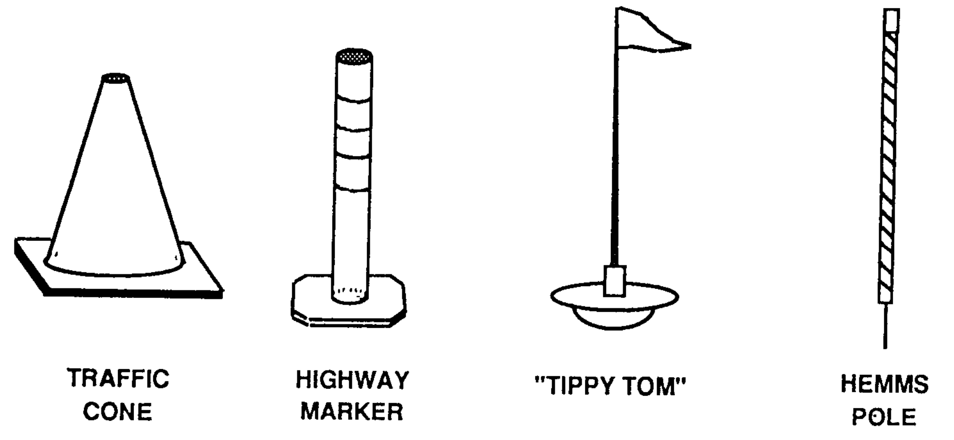


Figure 9-17. Currently available lane markers

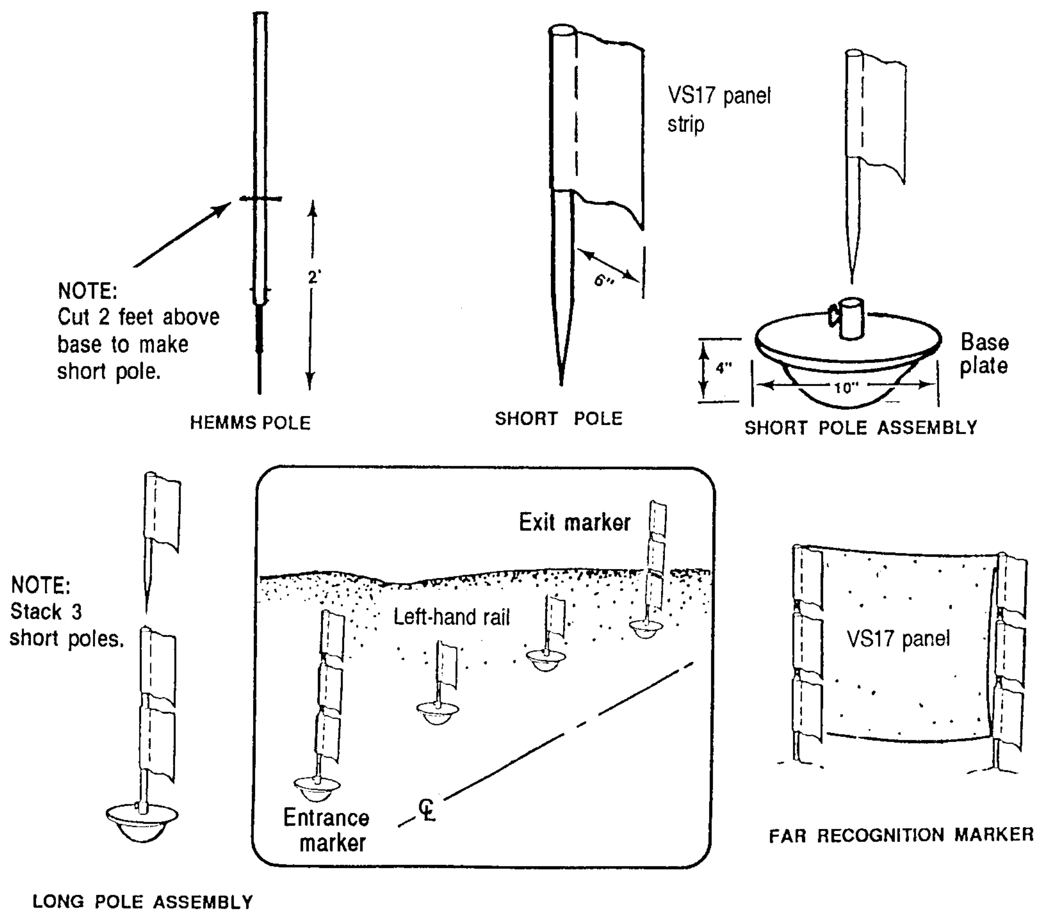


Figure 9-18. HEMMS and Tippy Tom marking combination

Table 9-1. 23rd Armored Division tactical lane marking system

Marker	Day	Night
Far recognition marker	TCP with 2 pickets holding 2 VS17 panels, orange side out.	TCP with green filter flashlights and four green filter flashlights across top of VS17 panels.
Intermediate recognition marker	Same as above, without TCP.	Same as above, without TCP.
Funnel guide markers	U-shaped pickets with inside U painted orange, facing friendly forces.	Place red filter flashlights on top of pickets, facing friendly forces.
Entrance/exit markers	2 U-shaped pickets with inside U painted orange.	Place 2 green filter flashlights on top of pickets on each side of the lane.
Left-side marker	Tippy Tom.	Green chem-light taped to top of Tippy Tom shaft.
Centerline marker	Highway marker.	White chem-light taped to top of highway marker.

NOTE: The division tactical lane marking system will be laid out as shown in Figure 9-15, page 9-18, and expanded to that shown in Figure 9-16, page 9-19.

Table 9-2. 52d Infantry Division (Mechanized) tactical lane marking system

Marker	Day	Night
Far recognition marker	TCP with 3 HEMMS long-pole assembly holding 2 VS17 panels, orange side out.	TCP with green filter flashlights and green chem-light in top of three HEMMS poles.
Intermediate recognition marker	Same as above, without TCP.	Same as above, without TCP.
Funnel guide markers	HEMMS, 6-foot-tall pole.	Red chem-light in top of HEMMS poles.
Entrance/exit markers	2 HEMMS 6-foot-tall poles with green flags on each side.	Green chem-lights in top of HEMMS poles, 2 lights on each side.
Left-side marker	HEMMS short-pole assembly "Tippy Tom."	Green chem-light in top of HEMMS poles.
Centerline marker	HEMMS short-pole assembly "Tippy Tom."	White chem-light in top of HEMMS poles.

NOTE: The divison tactical lane marking system will be laid out as shown in Figure 9-15, page 9-18, and expanded to that shown in Figure 9-16, page 9-19.

CHAPTER 10
ROUTE CLEARANCE

The ability to move forces and material to any point in an area of operations is basic to combat power and often decides the outcome of combat operations. Maneuver depends on adequate lines of communication (LOC) within the area of operations. It is necessary to conduct route and road clearance operations to ensure LOC enables safe passage of combat and support organizations. Route clearance is conducted by a sweep team.

SWEEP TEAM ORGANIZATION

Organizing a sweep team varies depending on the mission. There are two types of sweep operations-deliberate and hasty.

- A deliberate sweep is very thorough and includes a complete electronic and visual sweep of the road (shoulders, culverts, ditches, and bridges). It is made before a road is open to traffic. There is no set time limit. An average of 1 to 3 kilometers can be covered per hour.
- A hasty sweep consists of visual inspection, search, and use of mine detectors. The road surface, culverts, ditches, and bridges are inspected and searched. The sweep team looks for mines, wire, or any other sign of recent mining activity (such as disturbed earth and obstacles). Electronic detectors are used to check suspected areas. A hasty sweep is used when the METT-T analysis does not permit a deliberate sweep or when there is an urgent need for a road to be opened. Time and distance factors may be imposed. An average of 3 to 5 kilometers can be covered per hour. It is possible to bypass a well-emplaced mine or other explosive device using this sweep method.

A sweep team is a trained detection team that searches for mines and explosive devices. The organization of a sweep team depends on the type of mission and the length and difficulty of the road to be swept. Typical sweep team members include–

- One NCOIC.
- Two markers/probers.
- Four detector operators.
- One radio operator.
- One medic.
- Two demolition men.
- One vehicle driver.

Equipment used by a sweep team includes–

- One panel marker.
- One map.
- Four smoke grenades (minimum).
- Four detectors (includes two backup detectors) and extra batteries.
- Two grappling hooks and two 60-meter lengths of cord.
- One demolition kit or demolition bag per demolition man.
- Four probes.

The sweep team is escorted by a security element to provide security against the enemy. The security element composition is dictated by the tactical situation. The enemy often mines or remines areas recently cleared by sweep teams. Rear security elements must be alert to this technique and be prepared to react.

If a sweep team is attacked, immediately deploy men and return fire. The security element norreally assumes command upon enemy attack. The security element commander organizes the defense or counterattack and requests support as needed.

MINE LOCATIONS

The enemy normally places more than one mine in each mined area. Enemy mines are likely to be placed in-

- Frequently used roadways leading to and from construction sites.
- Brush and other traffic obstructions placed on roadways.
- Bridge bypasses.
- Obvious turnarounds and shoulders.

EMPLOYING ELECTRONIC MINE DETECTORS

Normally, mine detectors will only be used in a deliberate breach or to clear minefield after all covering fires have been suppressed. However, mine detectors can be employed by combat arms units.

The unit leader receives the mission, performs preliminary planning, and coordinates for required support. He then briefs personnel and organizes them into three teams—one to draw, prepare, and inspect demolitions; one to prepare and inspect mine detectors; and one to conduct a reconnaissance of the proposed breaching site. The unit leader inspects personnel and equipment. Teams walk through their tasks. If required, coordination is made with a security element. The unit moves to the mined area, marks the entrance, and prepares mine detectors.

CONDUCTING A SWEEP

For route clearing, the normal sweep team configuration is eight soldiers in a column. (See Figure 10- 1.) This configuration is best suited to sweep routes in friendly territories that are not under constant surveillance.

- Soldier 1 (mine detector operator) leads.
- Soldier 2 (marker / prober) and Soldier 3 (NCOIC) follow 25 meters (34 paces) behind Soldier 1.
- Soldiers 4 and 5 (demolition team) follow 25 meters behind Soldiers 2 and 3.
- Soldier 6 (relief mine detector operator) and Soldier 7 (radio operator) follow 25 meters behind Soldiers 4 and 5.
- Soldier 8 (rear security) follows behind Soldiers 6 and 7.

If the sweep team clears an entire minefield rather than a single lane or road, as discussed in Chapter 9, it is organized with several clearance teams working in echelon. The above sweep team configuration can be modified for manual minefield clearance operations. Two probers lead and each one clears a 1 -meter

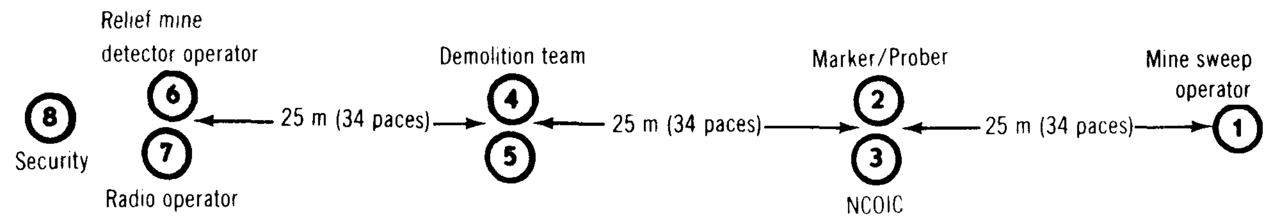


Figure 10-1. Sweep team in a column

path. They must overlap because buried plastic threat mines are difficult to locate with the AN PSS / 11 mine detector. The prober on the left dispenses a left-hand guide tape. The detector operator (located behind probers) proofs and locates deeply buried mines. (See Figure 10-2.) The actual distance between team members and the location of the security element depend on the tactical situation, terrain, and visibility.

A combination of the following detection methods make the most effective sweep:

- Visual detection.
- Electronic detection.
- Probing.
- MCRS.

MCRs can be used for detecting mines and are preferred for proofing. A CEV with mine rake or an MCB can be used for proofing. As a last resort, a 5-ton dump truck (loaded with sand or earth and driver floorboard and compart-

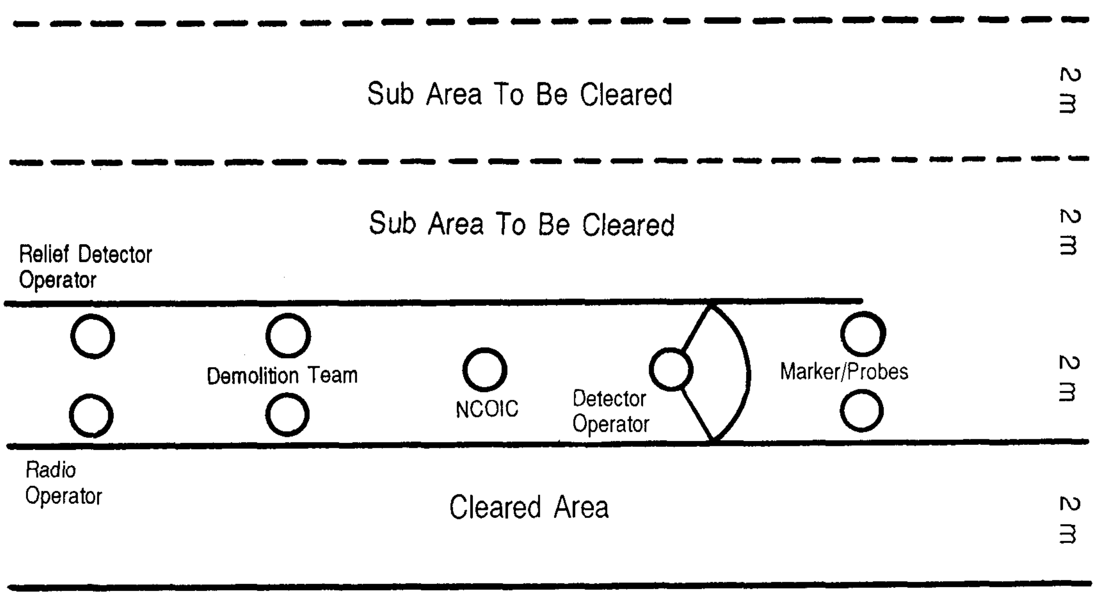


Figure 10-2. Sweep team in echelon

ment sandbagged) can be backed up in the lane to proof it.

Disposition of Suspected Mines

The sweep team takes the following actions when a suspected mine is found:

- Pinpoints mine location. Do not leave any mine unmarked.
- Searches for wires in the immediate area. Trace wires in both directions to determine if items are attached to them. If there is nothing attached, cut loose trip wires.

DANGER

Never cut taut trip wires. Alert the security element to search for an enemy manning a command-detonated mine. Keep troops away from the mine until all wires are traced and cut. Be alert for booby traps and ambush.

- Probes the suspected location and uncovers the object for identification. Expose enough of the object to see whether it is a mine or debris. Other personnel stay at least 25 meters away.
- If the object is debris, gets in a protected position and carefully removes debris with a grappling hook and rope. Be alert for booby traps or AHDs wired to debris.
- If the object is a mine, withdraws and notifies the OIC who decides whether to bypass it, destroy it in place, remove it with a grappling hook and rope, or notify EOD personnel for removal by hand (this action is seldom taken).

Mine-Removal Techniques

After a mine is located, it can be clearly marked and bypassed, detonated in place, removed by rope or wire, or neutralized and removed by hand. The method used depends on the location of the mine, the identity of the mine and fuze, and the tactical situation.

Trip-wire and tilt-rod fuzed mines can be detonated by using a grappling hook and rope as discussed in Chapter 9. Grapnels can be improvised from any available material (such as a bent drift pin or scrap).

★ Hand-emplaced charges are the standard demolition material used to destroy mines in place (see FM 5-250). A l-pound block of explosive placed close to the mine (without touching) is sufficient to detonate most types. A group of charges, placed next to several mines, can be connected with detonating cord and fired simultaneously.

Rope or wire can be used to pull a mine out of its installed position. This eliminates the potential hazard to personnel if a mine is equipped with AHDs. This is a safe method and only detonates mines equipped with AHDs. It also reduces noise and cratering. An expedient A-frame, designed to obtain a vertical lift on a mine, makes it easy to pull a mine out of a hole on the first attempt. Use the following procedures for removing mines with a rope:

- Uncover only enough of the mine to expose a handle or projection. Attach a 60-meter rope or wire to the mine or engage a grapnel. If there is no projection, engage a grappling hook on the bottom of the mine, opposite the direction of the pull.

DANGER

Do not move the mine while uncovering or attaching rope because it might detonate an AHD.

- Ensure covered area is not mined. Take cover or lie in a prone position at least 50 meters from the mine. Pull the mine from the hole.
- If mine type is unknown, wait 30 seconds before leaving cover and approaching the mine. This guards against the possibility of a delay-firing mechanism.

Hand Neutralization

Appendix A discusses procedures for hand neutralization of US mines. Foreign mines and booby traps should only be neutralized by EOD personnel.

Mines are neutralized by hand when–

- Conducting a covert breach.
- The mine is located on a bridge, building, or other facility required for use by friendly forces.
- Neutralization by other means is not allowed.
- The mine can positively be neutralized by hand and is required for reuse.
- The mine type is unknown and recovery must be attempted for intelligence purposes.
- Chemical mines are located in areas where contamination would restrict use of the area by friendly troops.

Safety

The following safety procedures should be observed:

- All sweep team members wear helmets and flak jackets to protect them against fragmentation.
- All vehicle floorboards are sandbagged.
- Vehicles are dispersed at 5 O-meter intervals when en route to and from a sweep area. (If a mine is detonated by one vehicle, it will not cause casualties in other vehicles.)
- Only one person at a time is allowed at a suspected mine location.
- Assume mines and explosive devices are equipped with AHDs until proven otherwise.
- Do not run; move only in previously cleared areas.

Reports

The spot report is submitted by the sweep team NCOIC to higher headquarters when any enemy mine or explosive device is discovered or detonated. A spot report is made on any enemy activity in the sweep area.

The NCOIC submits status of progress and completion reports until the team has completed the road sweep. Progress reports must be timely and accurate to permit effective movement by a reacting force, if needed, and to speed notification of road clearance to the parent unit.

The mine and booby trap incident report is given to the commander to document each mine and booby trap incident. It is forwarded through intelligence channels at the end of the sweep operation.

CHAPTER 11
REACTIONS TO SCATTERABLE MINES

NEW THREAT

The tactical employment of scatterable mines is a relatively new battlefield threat that US forces have not yet encountered. Consequently, an enemy's use of scatterable mines may constitute a significant advantage. Our forces must be trained and prepared to breach and clear routes through scatterable minefield. They must also be able to conduct extraction from scatterable minefield. Scatterable mines can be encountered at **any** conflict level in **any** theater of operations (TO).

Combat units must maintain a high tempo of mobility in spite of scatterable mine presence. Combat support (CS) and CSS units are especially vulnerable to scatterable mines because countermine doctrine and equipment have traditionally focused on close combat breaching operations. CS and CSS units must have freedom of mobility through a limited organic, self-protection capability. Any unit that cannot self-extract from scatterable minefield risks being fixed in place and destroyed by other enemy fires. Engineer units provide breaching and clearing capability but are unable to cope with the quantity of scatterable mines expected.

In addition to scatterable mines, our forces can expect to encounter a variety of submunitions (for example, cluster bombs). These submunitions, while not technically mines, have a similar effect. They have several fuzing methods including trip wires, time delays, and magnetic influence. Submunition littered areas are minefield. The same countermine tactics, techniques, and procedures are employed against submunitions.

WORLDWIDE THREAT

A nation does not have to possess the technical infrastructure to build scatterable mines. Scatterable mines and delivery modes are readily available in the retail arms market. The following armies have known scatterable mine capability:

- Argentina
- Austria
- Belgium
- Brazil
- China
- Egypt
- France
- Germany
- Greece
- Iraq
- Israel
- Italy
- Japan
- Poland
- Portugal
- Singapore
- Spain
- Sweden
- Switzerland
- Russia
- United Kingdom
- United States
- Yugoslavia

Intelligence estimates credit additional nations with having or developing scatterable mine manufacturing capabilities. Some nations produce mines for an export market. US forces can expect to encounter scatterable mines in a low-intensity operation. Scatterable mines are ideally suited to the needs of military forces who import their weapon systems because scatterable mines can be rapidly employed and present a low risk to the user. Artillery, helicopter, and ground-vehicle delivery systems are readily available. Sophisticated delivery systems are not required because some scatterable mines may be employed by hand. Insurgent and guerrilla forces may employ scatterable mines to counter the high mobility of civil and military security forces.

DELIVERY MEANS

The enemy may use a variety of systems to employ scatterable mines—artillery, multiple rocket launcher (MRL), helicopter, fixed-wing aircraft, and ground vehicle delivery. As already mentioned, scatterable mines may also be employed by hand.

EXPECTED DENSITY OF SCATTERABLE MINES

The density of scatterable minefield depends mainly on the delivery means. Short-range, vehicle-launched scatterable mine systems may have densities comparable to conventional minefield. Artillery-, rocket-, or aerial-launched scatterable minefield cover a larger area and have less density; although concentration on a specific target increases density.

LOCATION OF SCATTERABLE MINES

All scatterable mines lie on the ground surface. Depending on soil conditions, mines are visible on roads, hard surfaces, and level ground; but they are difficult to locate in broken ground or undergrowth. A detailed ground reconnaissance is time-consuming. The enemy can emplace scatterable mines with precision in the close combat area, in our rear areas, or in his own rear areas to protect his facilities from our deep operations. An enemy's use of scatterable mines can seriously jeopardize the early stages of an airborne, air assault, or amphibious operation when the initial assaulting force and the lodging areas are small. The enemy can project a scatterable minefield in front of, behind, to either side of, or on top of a unit. The ability to employ scatterable mines on top of a unit represents a new war-fighting situation. Once a unit's position has been mined, movement within the area is restricted. The unit must self-extract from the minefield site to resume its operations. Enemy scatterable minefield, depending on their location, are covered by indirect fire and may be covered by direct fire. If units remain in the minefield until it is cleared, casualties may occur due to direct fire, indirect fire, or mine self-destruct sequence. US forces may encounter scatterable mines under the following circumstances:

- Enemy scatterable mines (delivered by indirect fire or aircraft) used to *reseed* previously breached obstacles.
- Entire or remnant *hasty* obstacle enemy scatterable minefield that have been bypassed or incompletely cleared by friendly combat forces as they advance. (The mines have not yet self-destructed.)
- Enemy scatterable minefield delivered as counterbattery fire to destroy friendly artillery or to fix friendly artillery in place for destruction by other fires.
- Entire or remnant scatterable minefield emplaced by friendly forces, intended for countermobility operations against the enemy, and subsequently uncovered by friendly forces. (The mines have not yet self-destructed or self-neutralized.)
- Scatterable minefield used as an area denial obstacle.
- Friendly and enemy scatterable mines that have fallen outside of their intended target area.

DETECTION

Detection is the first step in countering scatterable mines during combat. At night or during periods of limited visibility (due to smoke or dust), small, surface-laid mines are very hard to see. Combat vehicle crewmen traveling cross-country in a buttoned-up vehicle are unable to see scatterable mines or to avoid running over them. The IPB indicates if scatterable mines are expected to be employed against US forces. The unit detecting a mine or minefield, scatterable or conventional, is responsible for marking it, reporting its location to higher headquarters, and clearing or breaching it (if so directed by higher headquarters). All units mark encountered enemy minefield, and they remain marked until they are cleared. Rear area units are trained and equipped to mark minefield in their operating areas. Scatterable mines in rear areas are an element of area damage control (ADC) and are reported to the rear area operations center (RAOC).

BREACHING AND CLEARING LANES

The combined arms breach of a scatterable minefield is executed according to FM 90-13-1. The first option is to bypass the minefield.

Heavy Force Breaching Techniques

The preferred breaching technique for scatterable mines is using a MICLIC, CEV with full-width mine rake, or mine plow. Breaching techniques are the same as those used for conventional minefield. After using the MICLIC, proof with a CEV with full-width mine rake. If scatterable mines are magnetic- or seismic-influence AT mines, the roller or plow will not eliminate mines in the center between the roller and plow unless an improved dog bone assembly is used. When proofing with a roller or plow, straddle the cleared centerline of the MICLIC path. Multiple MICLICS may be required.

The CEV, ACE, and dozer blades were not designed for breaching minefield and should only be employed as a last resort to clear a path through AT scatterable mines. This is extremely dangerous to the crew and equipment. However, the CEV or ACE can effectively clear a lane through AP scatterable minefield, since they sustain little or no damage and offer protection to the crew. When using a dozer to clear a path through AT or AP scatterable mines, the operator is exposed to mine effects. Before clearing begins, the operator's cabin should be sandbagged, and the lane cleared of trip wires with grapnel hooks. When using an engineer blade for clearing a path through a scatterable minefield, use the skim technique (see Figure 11-1, page 1 1-4).

Light /Dismounted Force Breaching Techniques

Breaching with hand-emplaced explosives is the preferred dismounted breaching technique for scatterable minefield. Mine detection in the desired lane is critical in the breaching drill. Even though scatterable mines lie on the surface, vegetated areas make detection difficult. Use grapnel hooks to clear trip wires before moving forward to emplace demolition charges by hand. Do not disturb the mine when emplacing demolition charges.

Destruction Using Direct Fire

Scatterable mines and small submunitions can be destroyed or disabled using aimed, single shots from a standard service weapon with issue ammunition. The goal of the technique is to rapidly produce a disabling munition reaction that reduces or eliminates the designed effect of the mine or submunition. Bullet penetration of an HE-filled munition frequently results in a low-order detonation. Other disabling reactions include mechanical breakup, burnout, and a high-order detonation. Service

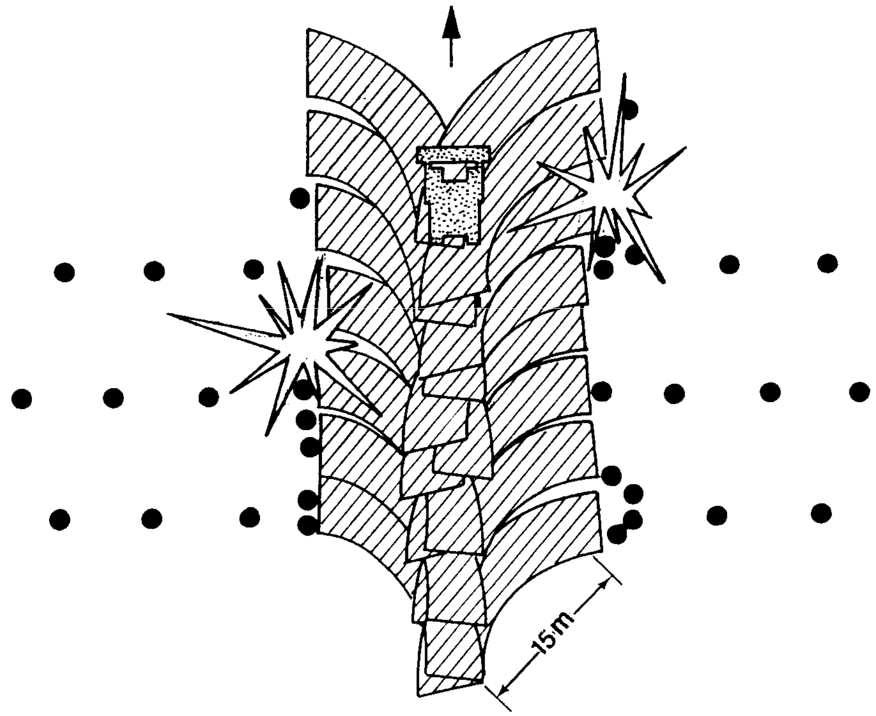


Figure 11-1. Engineer blade skim pattern

weapons (5.56 mm, 7.62 mm, .50 caliber, and 25 mm) will likely produce a desired effect on a scatterable mine or submunition. The marksman should approach no closer than 25 meters to a scatterable mine or submunition and aim for center of mass. The technique has risks. Table 11-1 shows the reasonable expectations of effects.

Table 11-1. Munition reaction

	Disabling munition reaction			
No apparent reaction	Mechanical breakup	Burnout	Low-order detonation	High-order detonation
21%	15%	13%	49%	2%

EXTRACTION FROM SCATTERABLE MINEFIELDS

Combat, CS, and CSS units use the following procedures and techniques when they receive a scatterable mine attack on their position.

Minimize Confusion

When an operating area becomes the center of a minefield, a certain amount of confusion is understandable. Therefore, a recognized and rehearsed system of alerting personnel to danger and orders on how to evacuate the area are essential. Alerting systems may include loudspeakers, radios, or runners. Loudspeakers minimize exposure but may be precluded by other noises. Radios are efficient, but they are not available at every location. Runners are likely to become casualties when moving about. A combination of systems may be the most effective. The unit field SOP includes procedures to evacuate an area and reestablish operations.

No Standard Solution

No single device or technique neutralizes every scatterable mine in every possible situation. The differences in AP and AT mines, fuzing, self-neutralization, terrain, unit mission, and other variables mean clearing must be approached with multiple systems and techniques. Mines are bypassed whenever possible. When bypass is impossible, mines are explosively, electromagnetically, or mechanically neutralized; or they are contained.

Rehearsed Reaction Drills

Operations require special techniques adapted from drills to react to enemy artillery and from drills designed to breach minefield. An enemy may employ scatterable mines for two reasons—to fix a unit in place for destruction with other fires or to deny fiendly maneuver in a particular area.

The first reason presumes enemy reconnaissance, surveillance, and target acquisition have overcome our operations security (OPSEC) and deliberately targeted the unit. However, a unit that receives scatterable mine fire may not know it has been pinpointed. It may be in an area that the enemy seeks to deny to our maneuver. The unit must presume that more fires are coming. The drill is to evacuate, move through the area to resume operations, or continue the maneuver. Normally, a scatterable mine reaction drill resembles an in-stride breach described in Chapter 8 and FM 90-13-1. Units conducting movement operations use route clearance procedures to force a cleared lane through a minefield.

Combat Units

Marching combat unit elements that have assets to conduct an in-stride breach reduce the obstacle for the remainder of the force and continue in the original direction of the march.

Combat Support and Combat Service Support Units

The OPORD designates alternate support areas. The unit submits a scatterable mine report. Their parent unit coordinates alternate support areas to be occupied by the rear command post (CP). The unit employs its organic mine detection and clearing teams (may be limited to the use of grapnel and marking lanes) to create cleared lanes to the nearest roads in the direction of the alternate support area. If in march order, the unit continues in the original direction of the march.

COUNTERMEASURES

Preventive Measures

Preventive measures are designed to minimize the risk of casualties, although maintenance of momentum will be more important on occasion. Preventive measures include–

- Reducing the risk of attack through survivability techniques such as camouflage, concealment, local dispersion, and deception.
- Reducing the risk of casualties in the event of an attack by using man-made or natural features (roads, tracks, or level ground) and buildings as protection.
- Immediately reporting, rapidly disseminating, marking, and recording a minefield to prevent other friendly forces from entering an area known to contain explosive devices.

Immediate Action Drills

The priorities for immediate action normally conform to the unit SOP. For specific operations, priorities vary and are covered in OPORDs. In general, immediate action drills follow the sequence given below:

- Warn other vehicle crewmen and dismounted personnel in the vicinity by the fastest possible means.
- Report the attack to the next higher headquarters.
- Locate and mark individual scatterable mines in the immediate area.

Assessment

Assessment action depends on the operational situation and the following tactical factors:

- Effect of delay on the mission.
- Threat from direct and indirect fire. The risk of casualties from direct or indirect fire may be greater than that from scatterable mines.
- Type of terrain (plowed fields, standing crops, woods, built-up areas, hard surfaces, low vegetation, rocks, or deep snow) determines the effectiveness of scatterable mines, their visibility, and consequently, the ease in which they can be avoided.
- Alternate routes or positions available.
- Degree of protection available.
- Availability of special support, such as engineer heavy equipment teams and EOD teams.

Subsequent Action

The options are–

- Accept the risk of casualties and continue the mission.
- Adopt preplanned procedures, such as column movement along paved roads or hard tracks.
- Adopt tactical breaching measures, such as deploying MCB, MCR, or MICLIC.
- Adopt preplanned alternate tactical plans.

Adopt Deliberate Countermeasures

In most situations, the following extraction techniques are considered; but in some situations, a deliberate hand-breaching operation may be necessary.

- Reconnoiter and mark a cleared route.
- Destruct using hand-emplaced charges.
- Remove/neutralize using engineer equipment.
- Destruct using direct fire.
- Contain.
- Activate fuzes using grapnel.

EXTRACTION

Destruct Using Hand-Emplaced Charges

Using hand-emplaced charges may be the only available effective method of clearance.

Advantages.

- Ensures complete destruction of scatterable mines.
- Can be used in most situations, and no special EOD skills are required. It is within the skills of combat arms units.

Disadvantages.

- Is labor-intensive and hazardous to those involved, particularity if dealing with magnetic- or delay -fuzed mines.
- Is very slow. Starting with identifying and marking, destruction of 15 mines can take 45 minutes.
- Cannot be used if detonation will cause unacceptable damage.

Remove/Neutralize Using Engineer Equipment

Consider using engineer equipment if scatterable mines must be cleared quickly and if engineer forces are available. Suitable equipment may include a dozer, CEV, ACE, or grader. If a dozer or grader is used, provide protection for the operator. It may be possible to sandbag the operating area.

Advantages.

- A large area can be cleared quickly.
- No special EOD skills are required. Equipment and operators can be provided by most engineer units.

Disadvantages.

- Equipment and operators may sustain damage or injury. If equipment is badly damaged, another item of equipment may have to remove it to allow continuation of the clearance operation.
- Equipment is likely to set off magnetic-fuzed mines.
- Equipment may only partially clear the area, requiring further reconnaissance and clearance.
- Equipment is unsuitable for working over soft, uneven ground.

Destruct Using Direct Fire

All units can destruct scatterable mines with direct fire for extraction from mined areas as previously outlined.

Contain

Scatterable mines contain a small explosive charge, so it is possible to protect the surrounding area against blast and fragmentation effects by using suitable materials. The conventional method is to build a sandbag wall (2 sandbags thick and 4 sandbags high) 1 foot from the scatterable mine. This is very labor-intensive, and it places a large number of soldiers at risk while the wall is constructed. Engineer dozers can also place a mound of loose spoil over the scatterable mine. A lot of spoil is required to give adequate cover; and the operator and equipment are at risk, particularly from magnetic-fuzed and AHD mines.

Advantages.

- Can be used by soldiers with little or no training.
- Scatterable mines can be left to detonate harmlessly, once the containment system is in place, without interrupting operations.

Disadvantages.

- Several containment systems are needed.
- Construction is slow and laborious.
- If a scatterable mine is located in the way of operations, containment may be impossible.

Moving Scatterable Mines

If a scatterable mine will self-destruct and is on or immediately adjacent to vital equipment or installations which cannot be protected, the mine may have to be moved before it can be dealt with. The risk of detonation due to movement must be considered. Ensure the mine is not picked up and moved by hand. The normal grapnel method may be employed as discussed in Chapter 9. Observe the following precautions:

- Do not move the mine while placing grapnel.
- Move the scatterable mine in one operation. The distance moved should allow detonation or neutralization by another method.
- Observe normal safety distances.
- Use EOD robotic equipment to pick up a mine and move it elsewhere. (This procedure is likely to be too slow for use in a tactical situation.)

Advantages.

- Used only if the device cannot be detonated in place or contained.

Disadvantages.

- Detonation occurs if an AHD is employed.
- Placing the grapnel is a hazardous operation.

ESTABLISHING DRILLS FOR EXTRACTION FROM SCATTERABLE MINES

An established and drilled evacuation plan reduces personnel and vehicle losses. The plan depends on the particular environmental scenario (trees, roads, and water). In some cases, it may be advantageous for the unit to be Situated in a wooded area. If delivered mines are attached to parachutes to soften the impact, many of them are caught in tree branches. When laying out work sites and facilities, you must consider the scatterable mine threat. Roads are critical for evacuation of scatterable minefield because mines are easily detected and cleared on them. An evacuation plan may consider a procedure for unit elements to clear and mark a safe path. It may also include a plan to link safe paths from other unit positions to their position and to the nearest road. Several techniques are considered for safe evacuation from scatterable minefield. Vehicles are parked in a march order that minimizes post-attack movement. Vehicles equipped with scatterable mine breaching devices are parked at the head of a column. The breaching vehicle establishes a cleared lane. Driving should be carefully aligned when driving on a cleared lane because the breaching vehicle may have pushed mines aside and created a windrow that increases the likelihood of misaligned vehicles contacting a mine.

Part Four. Special Mining Operations

CHAPTER 12
SPECIAL MINING OPERATIONS

EXPEDIENT MINES

Expedient mines are constructed in the field with locally available material. They are employed against vehicles or personnel in the same manner as conventional mines. In addition, expedient mines accomplish the following special tasks:

- Supplement a unit's low supply of conventional mines.
- Hinder reconnaissance, clearance, and neutralization of minefield.
- Create enemy attitudes of uncertainty and suspicion, which lowers morale and slows movement.

Authorization

Because expedient mines have nonstandard design and functioning, take special precautions to protect friendly forces. Consider neutralization, disarming requirements, and adequate marking procedures. The commander who authorizes expedient mine employment is also the employment authority for the type of minefield being emplaced. For example, if expedient mines are to be used in a hasty protective minefield, the employment authorization comes from the brigade commander. The brigade commander can delegate the authority down to battalion or company level. Booby traps are normally employed as interdiction devices, and their use is authorized by the corps commander.

Employment and Construction Techniques

If conventional issue mines are not readily available on the battlefield, expedient mines are manufactured in the field. Mine construction varies based on available materials and the ingenuity of personnel fabricating the mines. Expedient mines pose a potential safety hazard to friendly forces—both to those who are constructing them and to those who may later encounter them. Construction should be performed by personnel who are familiar with the materials being used. Innovative designs are checked and tested before arming and emplacing mines. As a minimum, test the fuzing mechanism separately to ensure that it functions as designed. Improper fuze operation is the most common cause of malfunction. Also, test the fuze and firing chain (base charge, blasting cap, and detonating cord) without the main charge to ensure proper operation. Emplace the mine after satisfactory performance of the firing mechanism. First, emplace heavy items, such as artillery shells, used as the main charge. Later, add the firing mechanism. Take care when moving or emplacing expedient mines because their nonstandard manufacture and potentially faulty construction make them highly sensitive to jars and shocks. Construct mines at the emplacement site whenever possible. Detailed instructions on the manufacture and use of booby traps are found in Chapter 13.

Expedient mines are prepared in the field using standard US firing devices, detonators, and demolition materials. While all mines discussed in this chapter can be made to function electrically or nonelectrically, most examples show nonelectric firing systems. Electric firing systems allow a mine to be command-detonated. In order to change from a nonelectric to an electric firing system, substitute an electric cap and power source for the nonelectric system.

High Explosive Artillery Shell Antitank Mine

The HE artillery shell (Figure 12-1) is readily adapted to expedient mining. Remove the artillery fuze and replace it with a standard firing device, length of detonating cord, priming adapter, and nonelectric blasting cap. A properly assembled destructor may also be used. If a destructor is not available, firmly pack the detonating cord and nonelectric blasting cap into the fuze well with C4 explosive.

The mine can be activated by a variety of methods depending on the type of firing device used. Firing devices with nonelectric blasting caps that are activated by pressure or a trip wire are the most likely means. The mine can also be adapted to function electrically by adding an electric cap and power source.

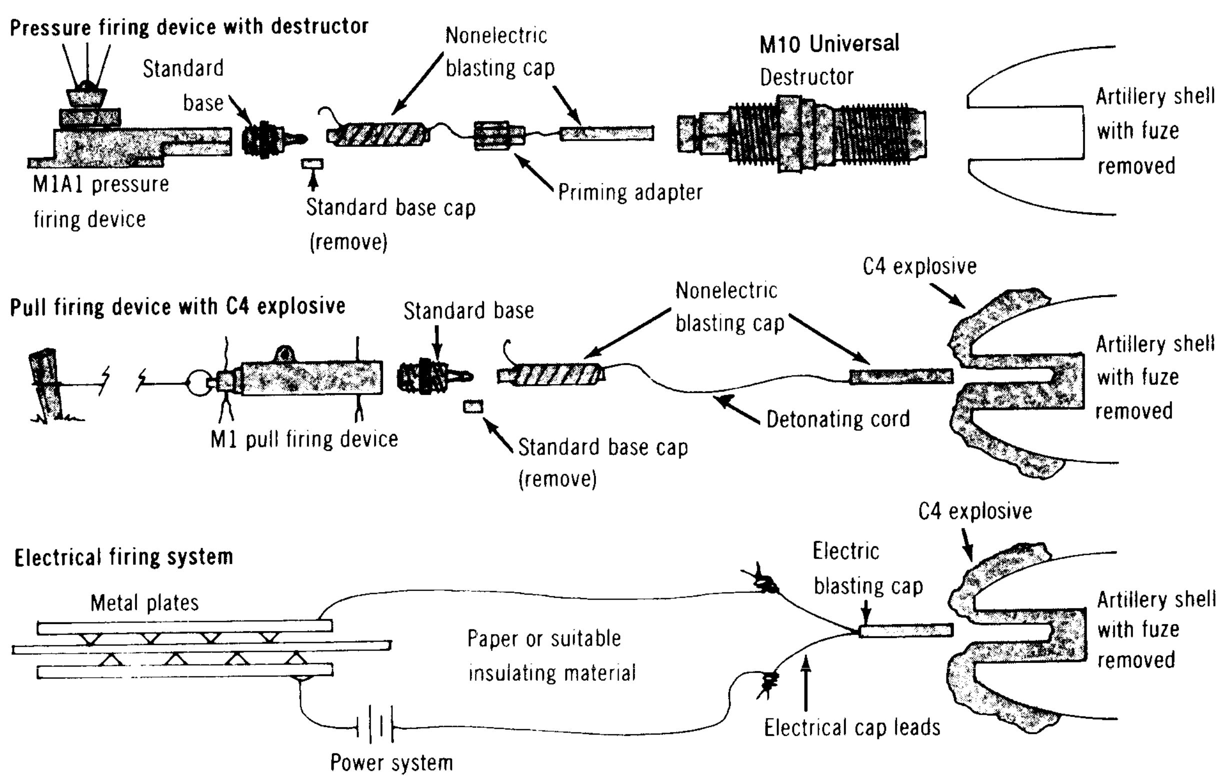


Figure 12-1. HE artillery shell antitank mine

Platter Charge

The platter charge (Figure 12-2) consists of a suitable container filled with explosive that is packed uniformly behind a platter. The platter is metal (preferably round but square is satisfactory) and weighs 2 to 6 pounds. The explosive required is equal to the weight of the platter. A container is not necessary if the explosive can be held firmly against the platter (tape can be used). The charge is primed from the exact rear center. The blasting cap is completely covered with a small amount of C4 explosive to ensure detonation.

The charge is aimed at the direct center of the target. The effective range (primarily a matter of aim) is approximately 35 meters for a small target. With practice, experienced personnel can hit a 55-gallon drum (a relatively small target) at 25 meters with 90-percent accuracy. The platter charge can be used as an AT or AP mine. It can be command-detonated (electric], or target-detonated (nonelectric).

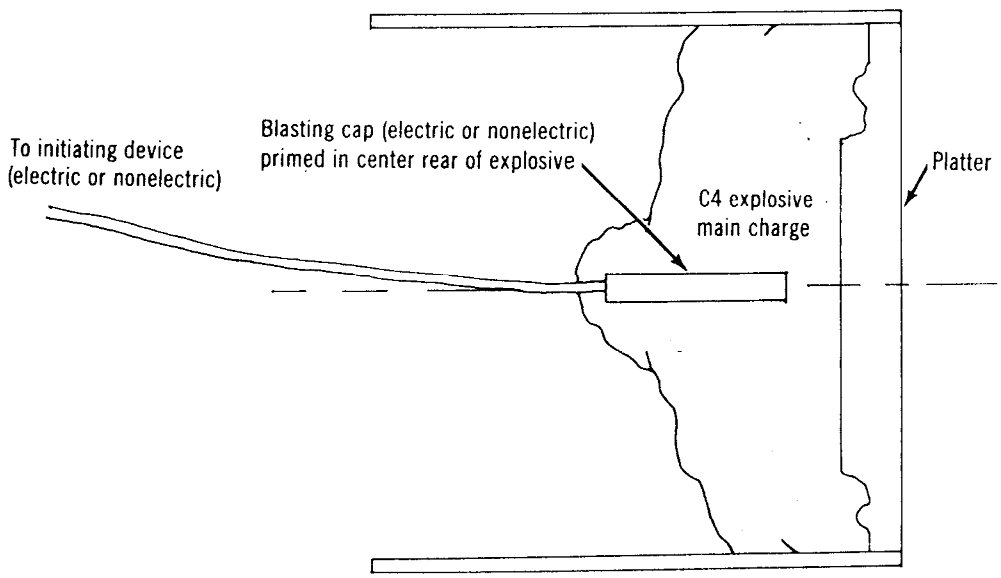


Figure 12-2. Platter charge

Improvised Claymore

For the improvised Claymore (Figure 12-3) a layer of plastic explosive is attached to the convex side of a suitably dense, curved base (such as wood or metal). A hole is made in the exact rear of the base. A blasting cap is placed in the hole to prime the mine. Shrapnel is fixed to the explosive with cloth, tape, or mesh screen.

The mine can be command- or target-detonated. Command detonation is best achieved by electrical priming. A blasting device is attached to the electric cap via firing wires laid at least 50 meters from the mine. Ensure firing personnel have adequate cover when detonating the mine. The mine can also be target-detonated by using nonelectric caps, detonating cord, and a suitable firing device (usually pull or tension release).

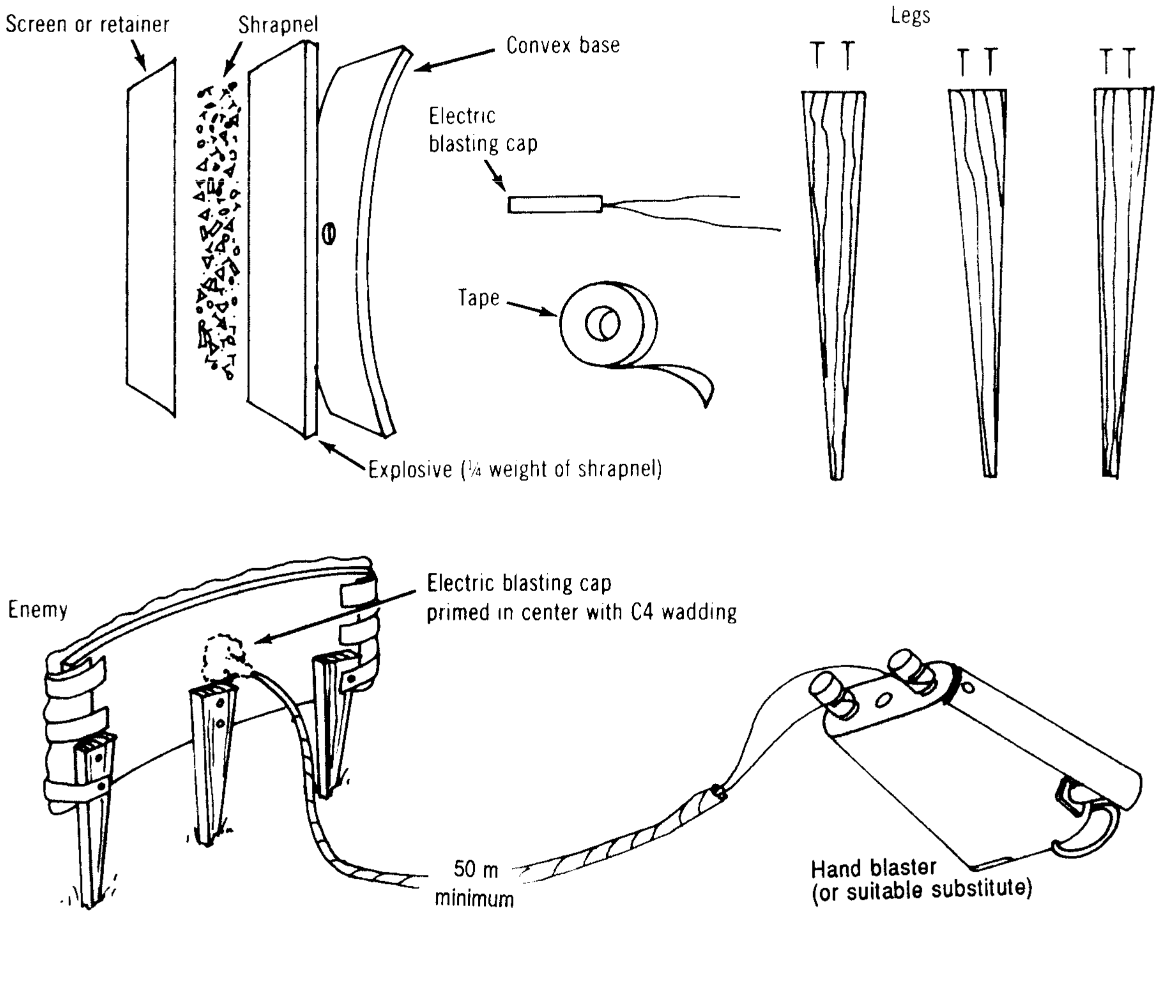


Figure 12-3. Improvised Claymore mine

Grapeshot Antipersonnel Mine

For a grapeshot AP mine (Figure 12-4), shrapnel is placed in the bottom of a cylindrical container. The shrapnel is tamped and held in place by a suitable separator (wadding). Explosive is then packed to a uniform density behind the wadding and is approximately one-fourth the weight of the shrapnel. The mine is primed in the center of the explosive with an electric or nonelectric cap.

This mine can be command- or target-detonated by an electric or non-electric firing system. The explosive propels the shrapnel outward from the container. This mine is very effective against personnel targets.

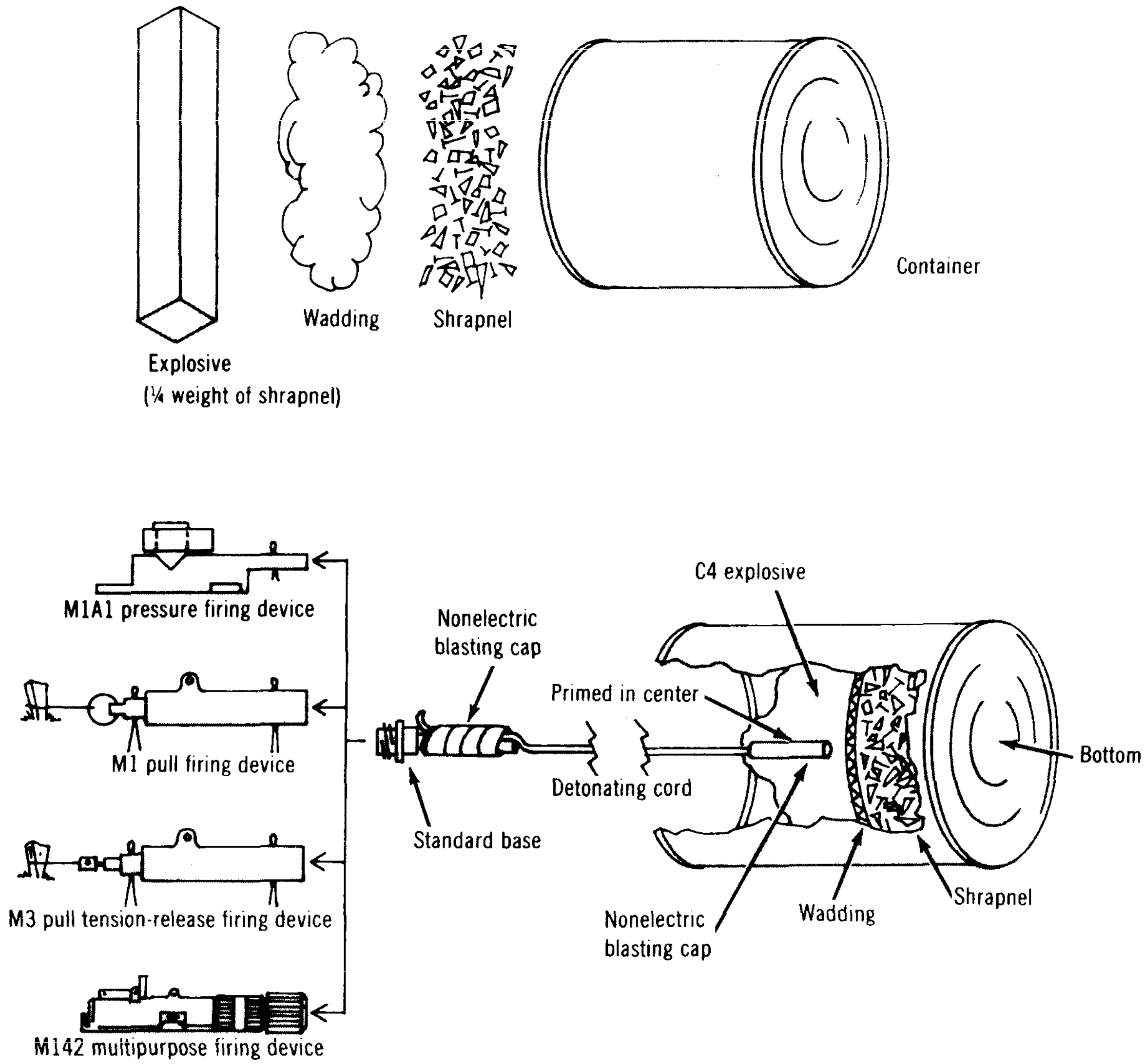


Figure 12-4. Grapeshot antipersonnel mine

Barbwire, Antipersonnel, Fragmentation Mine

One roll of standard barbwire is placed into position, and one block of Composition C4 is placed in the center of the roll and primed.

This mine can be made directional by placing the wire against an embankment or fixed object. This causes the force of the explosion to expel the barbwire fragments in the desired direction. (See Figure 12-5.)

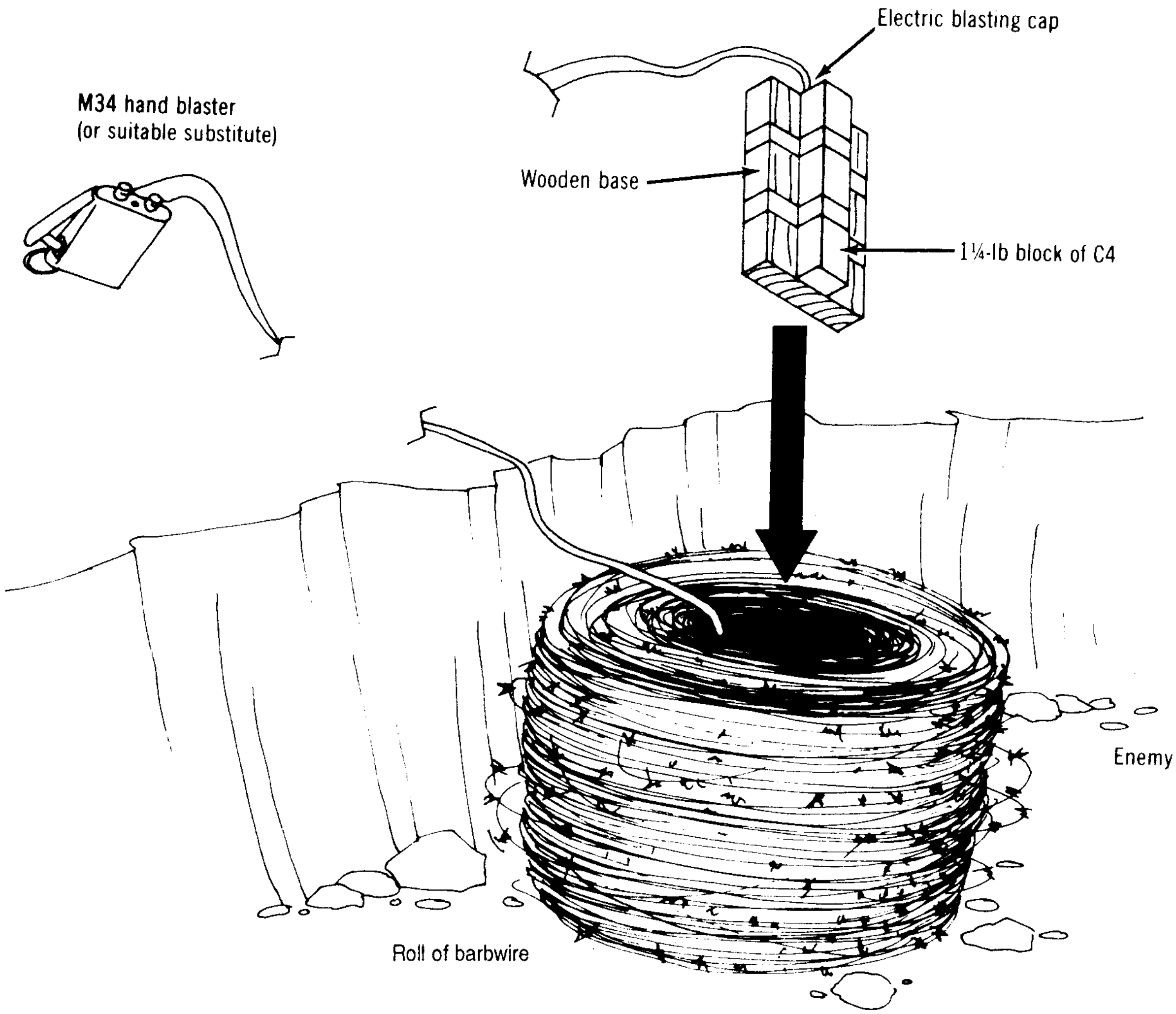


Figure 12-5. Barbwire antipersonnel mine

Fragmentation Grenade

Any fragmentation grenade (M67, M26, or M33) can be used to prepare this mine. Attach the grenade securely to a fixed object (tree, branch, rock, or stake). Remove the safety pin and replace it with a smaller, straight, metal pin. The replacement pin should pull out easily without the frictional resistance of the original safety pin. A paper clip with a loop in the end is ideal because a trip wire can be attached, and the paper clip can be easily withdrawn from the grenade.

Attach a trip wire (ideally, a clear, monofilament fishline) to the replacement pin. Then stretch the trip wire across a suspected enemy approach and securely tie the other end. Pull or tension on the trip wire removes the pin and detonates the grenade. (See Figure 12-6.)

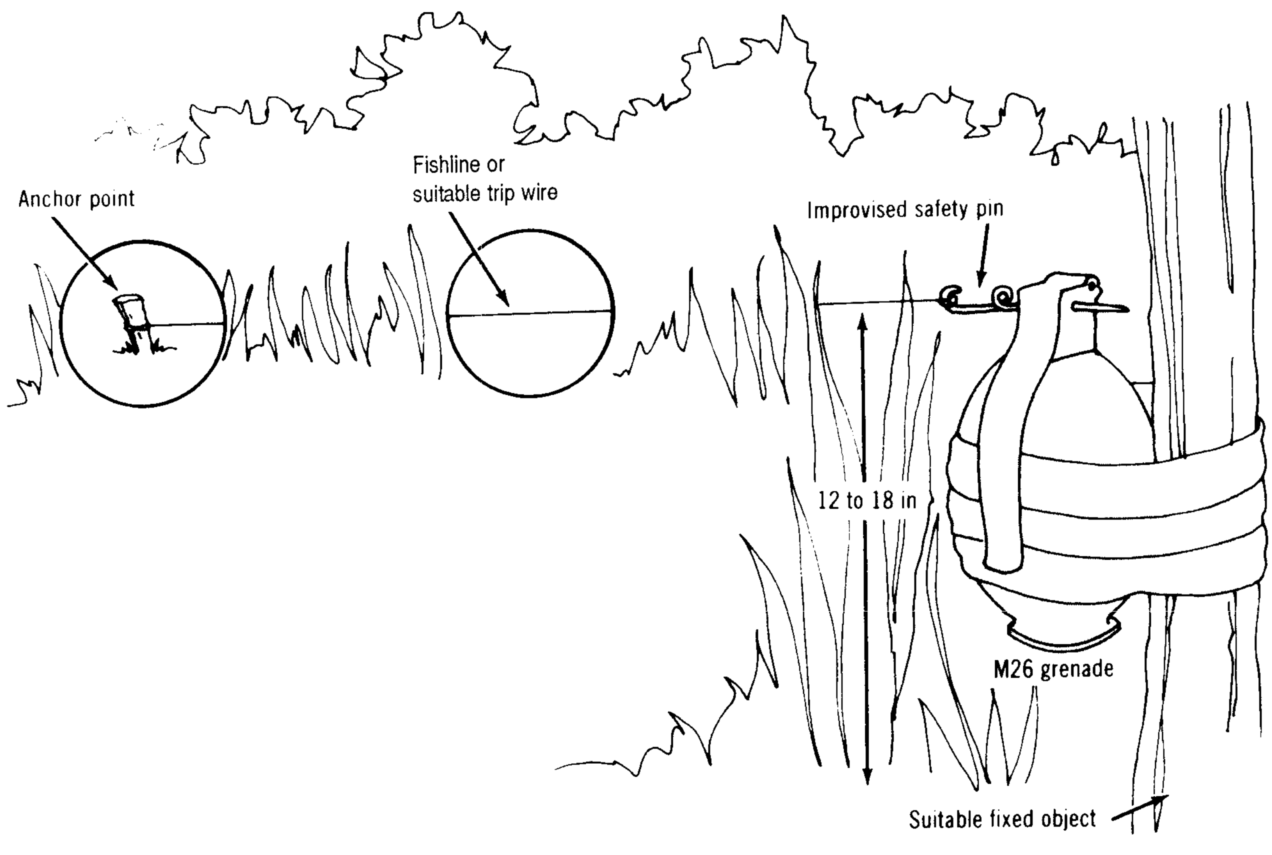


Figure 12-6. Fragmentation grenade

Improvised Flame Mine

Exploding flame devices and flame fougasses employed for target or command detonation are considered improvised flame mines. These mines normally consist of a container, an incendiary fuel (usually thickened gasoline), and a firing system to scatter and ignite the fuel. The size of the covered area depends on the container size and firing system. The mine may be detonated by an M4 incendiary burster or by another available explosive. Preferably, the white phosphorous (WP) hand grenade serves as an igniter. Variations and adaptations of the basic flame field expedients are limited only by the imagination and initiative of the combat personnel preparing them. (See Figure 12-7.)

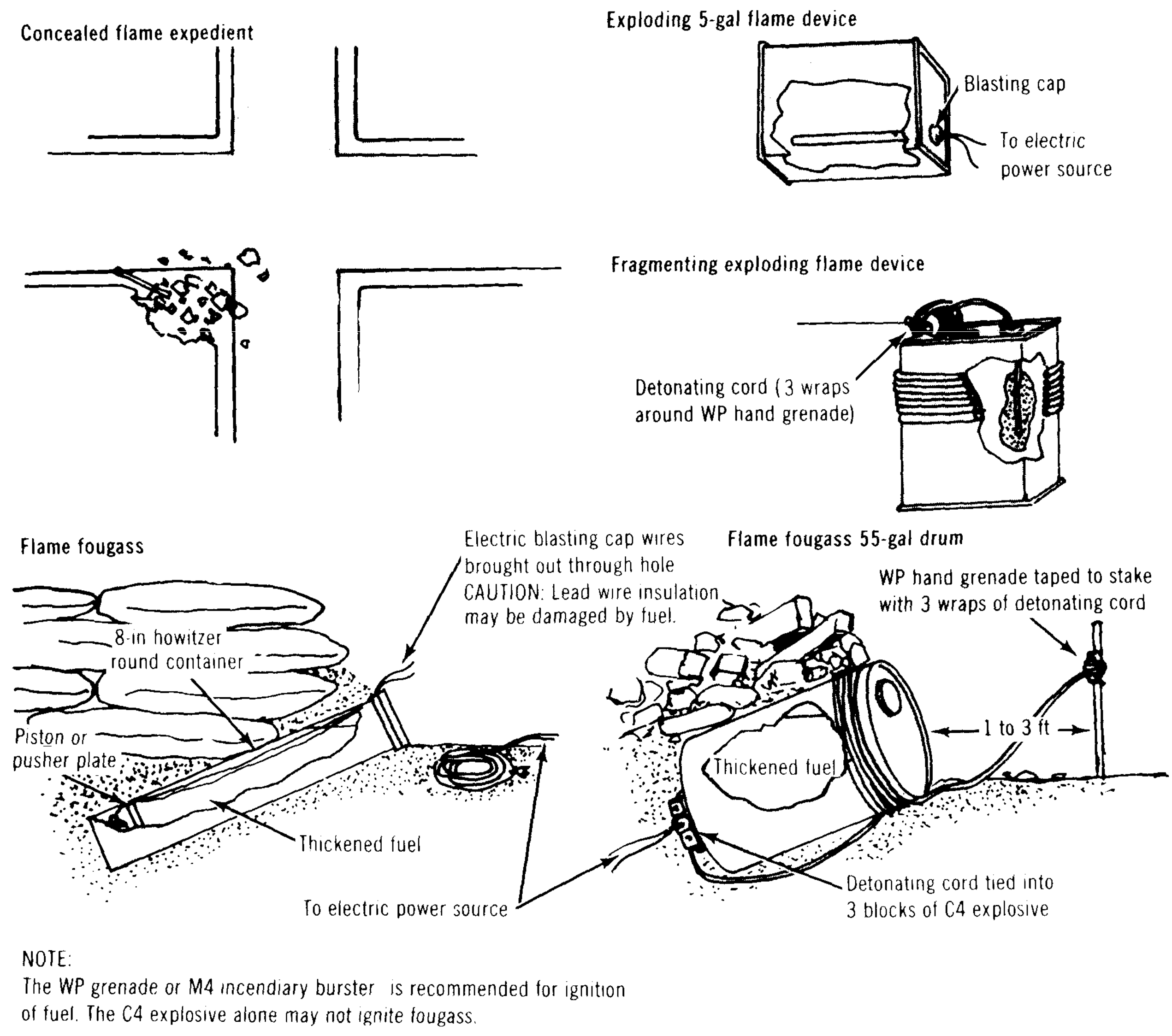


Figure 12-7. Improvised flame mine

CHEMICAL MINES

Employment

Chemical land mines are AP mines with target- or command-detonated fuzes. They are filled with a persistent chemical (nerve or blister) agent. National policy, as announced by the theater commander, governs the use of chemical mines in the theater area of operations. When authorized, chemical mines are normally used in defense and retrograde operations. They are mixed with HE mines to form an HE chemical minefield. Chemical mines can be used in tactical or nuisance minefield but cannot be used in protective minefield. When an integrated HE chemical minefield is laid, it serves the following purposes:

- Chemical mines discourage the use of explosive, rapid mine clearing devices because they create a chemical hazard in the area.
- HE mines reduce the speed of enemy forces crossing the minefield. Speed is further reduced by forcing the enemy to use protective clothing and masks.

Emplacement

Adding chemical mines to existing HE minefield is done by laying additional strips of chemical mines in a random pattern or by adding HE chemical strips or rows to the front or rear of existing fields. (See Figure 12-8.)

WARNING

Do not reenter the existing minefield in order to lay chemical mines.

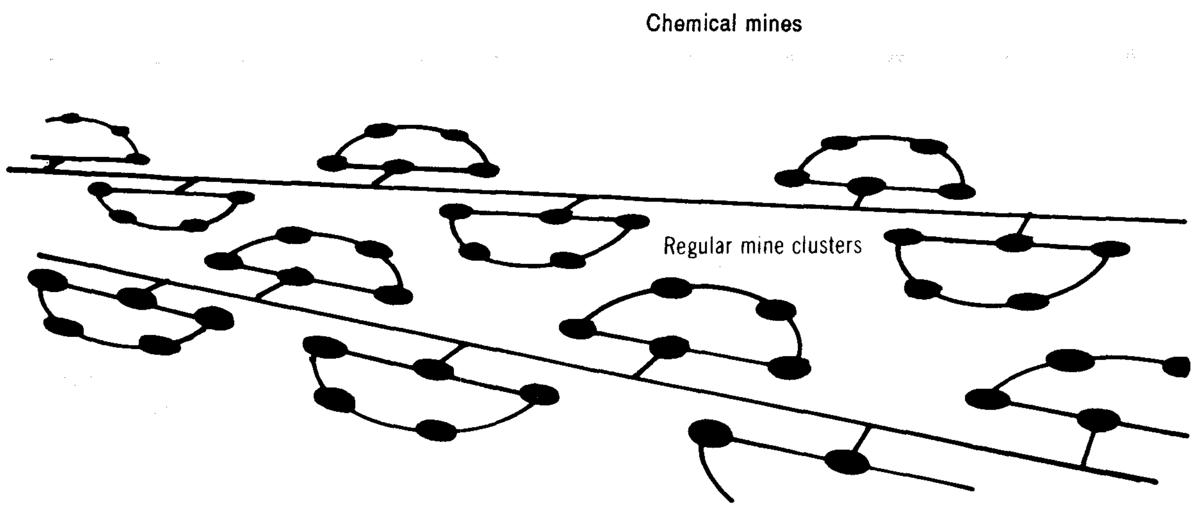


Figure 12-8. Chemical mine placement

No particular branch is responsible for emplacing and clearing chemical mines. Planning chemical mine-warfare operations is a corps-level responsibility. Actual authorization for employment must come from the President of the United States. Once use is authorized, request advice from the staff chemical officer and other principal staff members as needed. When using chemical mines, consider prevailing and expected wind conditions. The responsible commander must ensure friendly troops are protected when chemical agents are released. Release of chemical agents occurs as a result of enemy fire or enemy breaching attempts. Contact-actuated chemical mines are not likely to create a major downwind hazard because only single mines or small groups of mines can be set off at one time. Artillery or aircraft is used to add chemical agents to a minefield as an alternate way of establishing a contaminated obstacle.

M23 Chemical Agent Mine, VX

The M23 chemical mine is prefilled and used to disperse a nerve agent (VX). It can be fuzed for contact or remote detonation and is used as an AP mine. The mine is similar in size and shape to the M15 AT mine. It is distinguished by sight and touch from the M15 AT mine by four pairs of raised projections spaced at 90-degree intervals around the top periphery. An M603 fuze is used for primary fuzing. To equip the mine with AHDs, insert an M 1 activator and firing device in the secondary fuze wells located in the bottom or side of the mine. The mine is 5 inches high and 13 inches in diameter. It weighs 22.75 pounds unfuzed, of which 11.5 pounds (2 gallons) is the chemical agent. (See Figure 12-9.)

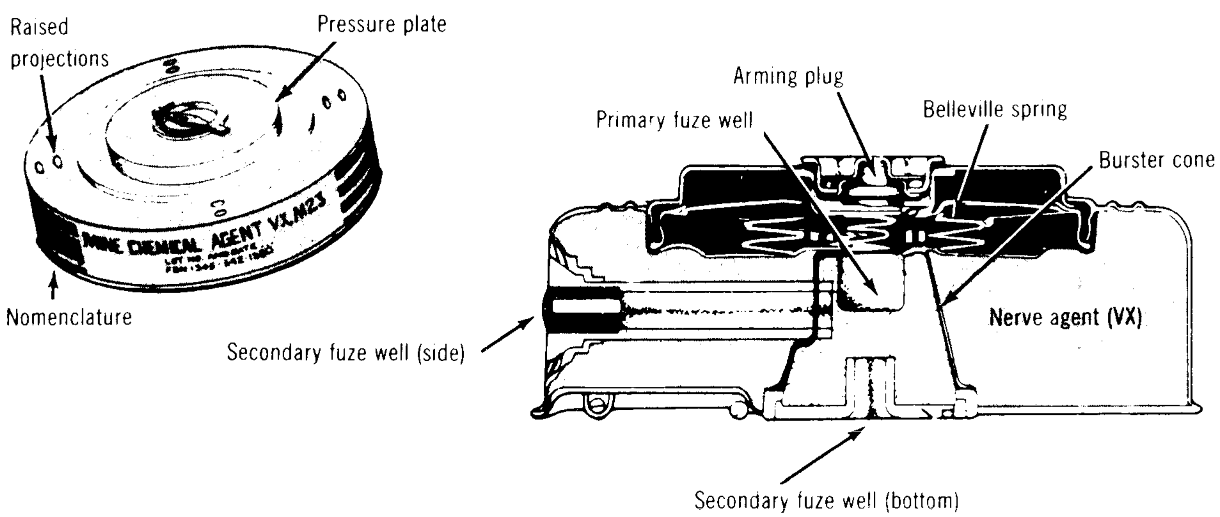


Figure 12-9. M23 chemical agent mine

Chemical Land Mine, 1-Gallon

The 1 -gallon, chemical land mine may be filled with a chemical agent in the field. Chemical contents are dispersed by an added external charge of detonating cord secured to the side of the container with two copper wires soldered on one side. Authorized fillings are mustard (H) or distilled mustard (HD). Molasses residuum (MR) can be used for training purposes. (See Figure 12- 10.)

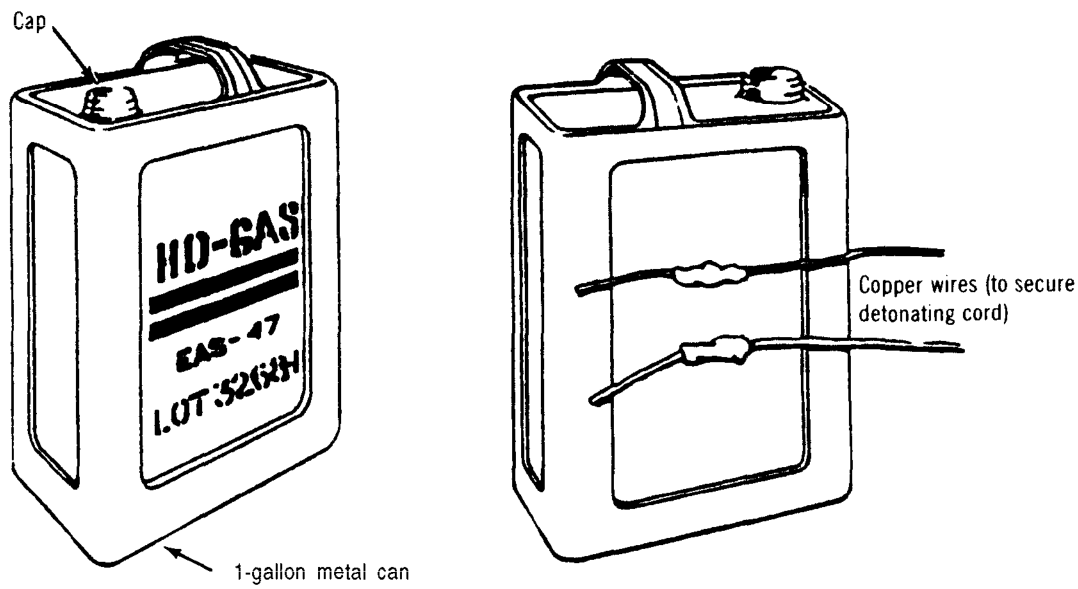


Figure 12-10. Chemical land mine, 1-gallon

STREAMBED AND RIVER MINING

AT mines are much more effective in water than on land because water transmits the shock effect better than air. Vehicle support members, tracks, and wheels are damaged by a mine blast. Small vehicles are overturned and almost completely destroyed. Because water amplifies and transmits shock waves, mines equipped with pressure-actuated fuzes are subject to sympathetic detonation at greater distances in water than on land. To avoid sympathetic detonation, M 19 and M 15 AT mines must be at least 14 meters apart in water less than 2 feet deep, and at least 25 meters apart in water 2 feet deep and deeper. The M21 AT mine is not recommended for underwater use. Mined areas are chosen to take advantage of stream and adjacent area characteristics. Water depth within the minefield should not exceed 4 feet because it is difficult to work in deeper water, and pressure-actuated fuzes are usually ineffective against waterborne vehicles. Because it is difficult to maintain footage and balance in rapidly flowing water, current velocity should not exceed 5 feet per second. Since sand in inland waters continuously moves downstream, it is difficult to locate and remove mines planted on or downstream from sandbars. If the site has a muddy bottom, the mud depth should not exceed 18 inches and there must be a hard base underneath. The enemy is unlikely to choose a fording point where vehicles mire easily. If underwater obstacles (gravel, rock, or stumps) are bigger than the mine, the area cannot be easily mined. If such areas must be used, place mines so they are exposed to vehicle wheels or tracks. Armored vehicles usually enter and exit streams at points where the incline is less than 45 percent. After entering a stream, vehicles often travel upstream or downstream before exiting. Carefully examine riverbank formations and underwater obstacles to predict the trail a vehicle will use to ford the stream.

Emplacement

When emplacing mines in streams and rivers, always work in pairs. Prepare the mine on land near the emplacement site. Coat fuze threads and wells with silicone grease (a waterproof lubricant) or heavy grease to minimize the chances of water leaking into the mine. Also, waterproof joints between the pressure plate and mine case. Use the following outrigger techniques to stabilize the mine:

- Materials needed to construct field-improvised outriggers are—
  - Two green tree limbs, approximately 1 inch in diameter and 3 feet long. (Steel pickets, signposts, fence rails, or similar items with proper dimensions can also be used.) Green limbs are recommended because they are stronger and less likely to float than dried, dead limbs.
  - Two pieces of rope, clothesline, twine, or similar material, approximately 3 feet long.
- Fasten limbs to the bottom of the mine perpendicular to each other and secure them with rope.
- Approach the emplacement position from the downstream side. To prevent dragging the outrigger or contacting objects in the stream, carry the mine by grasping its sides, not by its carrying handle.
- Place the mine and outrigger on the stream bottom, place sandbags or large rocks on outriggers for better anchorage, and arm the fuze by moving the knob clockwise from the S (safe) position to the A (armed) position. (See Figure 12- 11.)

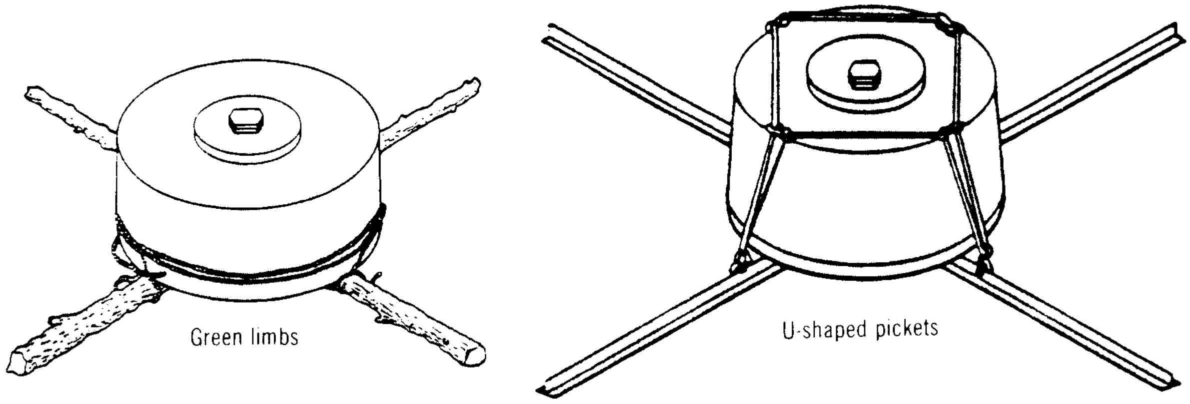


Figure 12-11. Outrigger techniques

Recovery

> **WARNING**
> **Mines may have drifted downstream and/or been tampered with by enemy forces. Removal by methods other than explosive breaching (refer to TM 9-1375-213- 12) is extremely hazardous and is not recommended. If the situation demands recovery by hand, proceed with utmost caution.**

Use the following procedures when recovering mines by hand:

- A two-person recovery team proceeds slowly 2 meters downstream from where the mine was emplaced and carefully probes for the mine.
- Once the mine is located, remove any foreign material from the top of the mine. Disarm the mine by turning the knob counterclockwise to the S position.
- Carry the mine ashore and remove the fuze and detonator.

The mine can be reused if it or the fuze show no evidence of damage or deterioration.

Recording

The minefield is recorded on DA Form 1355 (Figures 12-12a and 12-12b, pages 12-14 and 12-15).

Safety

In addition to normal water safety measures, underwater mining requires evaluation of the tactical situation and application of special safety techniques. Water turbidity, velocity, depth, and bottom conditions require laying party personnel who can swim. Prolonged immersion of personnel, especially in cold temperatures, must be avoided. Sudden drop-offs, rocks, and other objects can cause personnel to lose their footing. Other safety measures include the following–

- Work in pairs.
- Emplace mines from upstream to downstream to prevent personnel and equipment from being swept into the mined area.
- Stay on the downstream side of the mine when arming the fuze.
- Place the mine as flat as possible on the bottom to prevent drifting. Use green saplings or other nonbuoyant material for outriggers, or anchor the mine using pickets.
- Do not arm the mine before it is laid.
- Carry the mine horizontally or edgewise to the current to reduce water resistance on the mine's pressure plate.

URBAN TERRAIN MINING

Characteristics

Characteristics of urban areas (such as a high proportion of hard-surfaced roads) prohibit a simple transition from open- to urban-area mine deployment techniques and doctrine. The advantages of abundant cover and concealment, maneuver restrictions, and observation already possessed by the defender of an urban area can be significantly enhanced by the proper use of mines. Terrain modified through the process of urbanization provides a unique battle environment. The following characteristics of urban terrain are likely to impact on mine warfare:

- Multistoricd buildings add a vertical dimension to the battle. Basements and floors become part of the battle scene. Combat vehicle vulnerability increases because attack from above or below is likely.
- Fighting is done at close range, often face-to-face, and seldom exceeds 50 meters. Some weapons, particularly large-caliber weapons, are unsuitable at short range.

SAMPLE

~~SECRET~~ (when completed)

MINEFIELD - RECORD

1	AUTHORITY: CG 2nd INF DIV	2	DATE AND TIME — START: 090630Z JAN 90
	LAYING UNIT: B Co 2nd ENGR BN 3rd PL		COMPLETION: 091200Z JAN 90
	OFFICER IN CHARGE: LT T.P. SMITH 987-65-4321		RECORDER: SSG K.J YATES 863-21-1362
3	Copy No. 1 of 3		Sheet No 1 of 1
4	MINEFIELD NUMBER: 2XX(INF)3-E		
5	MAP: SERIES, NO. AND SCALE: H754 1:50 000		SHEET NO. (OR NAME): NJ 2015 MUNSAN

6 LANDMARKS

NO.	COORDINATES	DESCRIPTION
1	UT 45877236	WEST CORNER ROAD JUNCTION
2	UT 46137367	U-SHAPED PICKET 3" ABOVE GROUND
3		
4		

7 INTERMEDIATE MARKERS

NO.	DESCRIPTION
1	
2	
3	
4	

8 DESCRIPTION OF BOUNDARY FENCE OR MARKING: STANDARD ON BANK / NAVIGATION LIGHTS IN WATER

9 NO. OF STRIPS/ROWS: ....
DESCRIPTION OF STRIP/ROW MARKERS: NONE

10 LANES

NO.	WIDTH	HOW MARKED	METHOD OF CLOSING
1			
2			
3			

11 TACTICAL MINEFIELD / NUISANCE MINEFIELD / PHONEY MINEFIELD

MINES		ANTITANK MINES (AT) TYPE	TYPE	TYPE	TYPE	TYPE	TYPE	TOTAL AT MINES	ANTI-LIFT DEV	ANTIPERSONNEL MINES (AP) TYPE	TYPE	TYPE	TOTAL AP MINES
		M19											
		NO.	NO.	NO.	NO.	NO.	NO.	NO.	NO.	NO.	NO.	NO.	NO.
~~BURIED~~ UNDER WATER AND SURFACE LAID	IOE												
	A	270						270					
	B												
	C												
	D												
~~IN STRIPS~~ ~~IN ROWS~~ W/O PATTERN	E												
	F												
	G												
	H												
	J												
TOTAL		270						270					

12 NOTES

1. MINE CLUSTERS AT .... METRES/PACE SPACING
2. MINES LAID FROM BOAT IN WATER, 120 MINES
3. MINES SURFACE LAID ON BANK, 150 MINES
4. NO AHD'S USED.
5. RIVER NAVIGABLE BY SHIPS (NOT RECOGNIZED AS A SEA GOING SHIPPING ROUTE)
6. CORNER POINTS
   Point 1 - UT 45767383
   Point 2 - UT 46207381
   Point 3 - UT 46117400 (NAVIGATION MARKER)
   Point 4 - UT 45797396 (NAVIGATION MARKER)
7. ALL MINES RANDOM LAID WITHIN BOUNDARIES

SIGNATURE (OFFICER IN CHARGE): Terry P. Smith LT
DATE: 9 Jan 90

DA FORM 1355, MAR 87
EDITION OF JUL 67 IS OBSOLETE

SAMPLE

~~SECRET~~ (when completed)

Figure 12-12a. River mining - sample DA Form 1355 (front side)

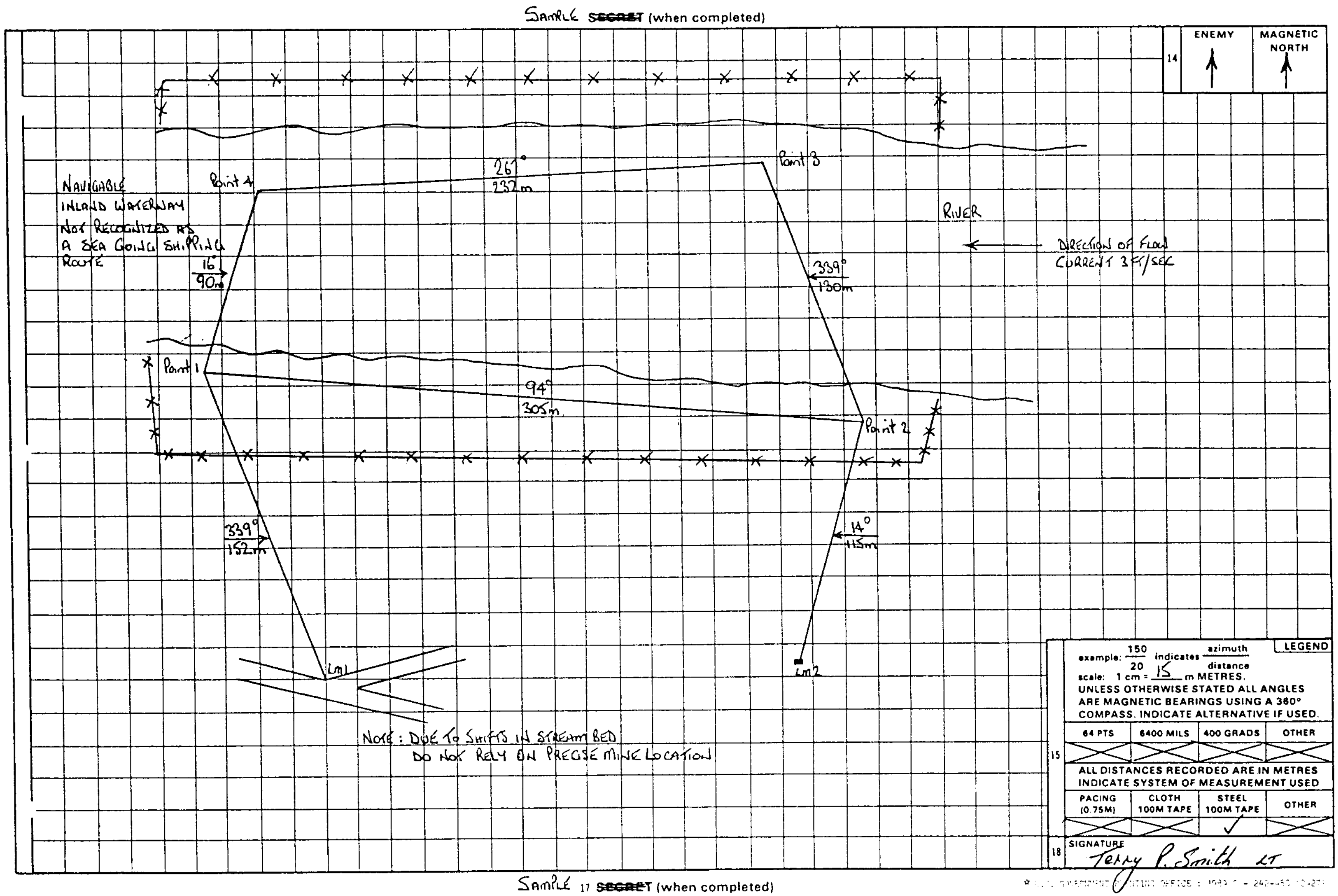


Figure 12-12b. River mining - sample DA Form 1355 (inside)

- Sewers, subways, and tunnels provide covered and concealed passageways for movement of troops on both sides. Detailed knowledge of the location and status of these tunnels is needed to successfully wage an urban battle.

- Streets and parking lots are modified to withstand continuous use by vehicles. Major routes and lots are paved. A high density and complex pattern of streets provide numerous avenues of advance. Burying mines is extremely difficult. Most mines are surface-laid and camouflaged with rubble and debris to avoid detection.

- Movement by vehicle is difficult. Streets are littered by rubble and cratered if the city has been bombed or subjected to artillery attack. Bridges and overpasses are likely to be destroyed or blocked. Traffic flow is highly channelized.

- Extensive map and chart data is needed by the commander. For example, the commander should know the location of telephone, electric, gas, water, and sewer connections; substations; and generating and pumping stations.

Conventional Antipersonnel Mines

AP mines are emplaced to block infantry approaches through or over underground passageways; open spaces; street, roof, and building obstacles; and dead spaces.

Underground passageways. Subways, sewers, cellars, and utility tunnels provide protected movement routes for large numbers of troops. In large cities where underground systems are numerous and complex, limited manpower resources dictate that careful consideration be given to designating key passageways for blocking with wire and AP mines. (See Figure 12- 13.)

Open spaces. Open spaces include gaps between buildings, courtyards, residential yards, gardens, parks, and parking lots. They are found in all urban areas. In some cases, mines can be concealed in rubble or buried. However, characteristics of most terrain surfaces, coupled with limited time and resources, dictate that mines be surface-laid. (See Figure 12-14.)

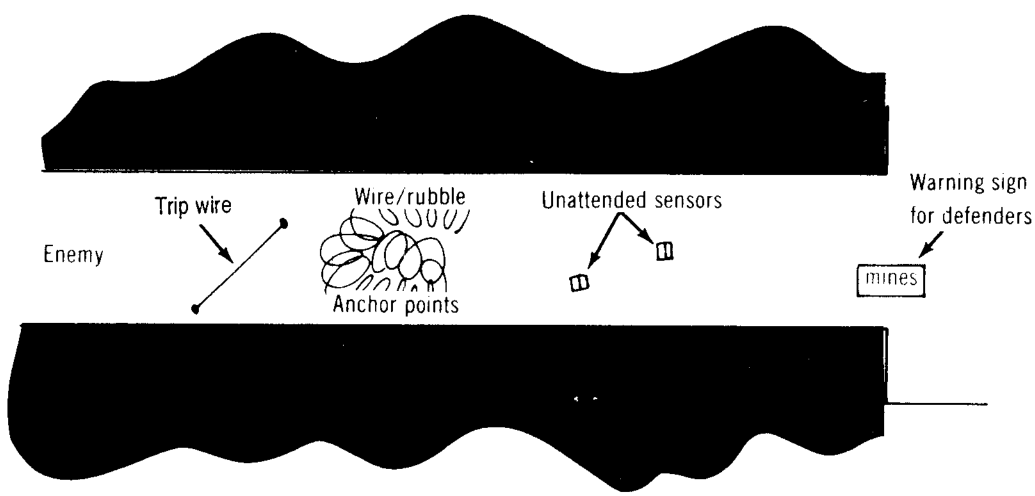


Figure 12-13. Underground passageway

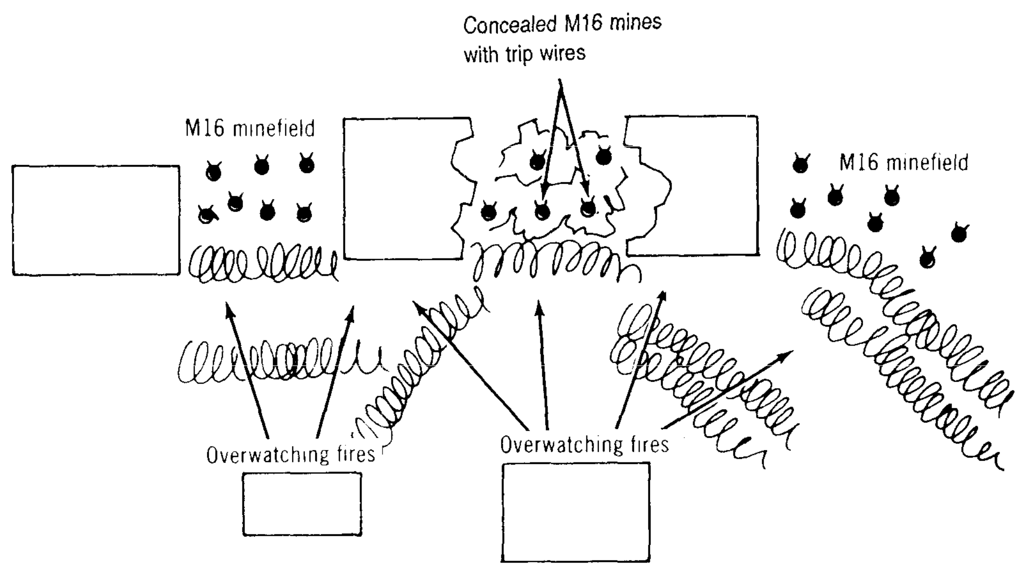


Figure 12-14. Open spaces

Street obstacles. In addition to hand-emplaced AP mines on street surfaces, railroad lines and areas along shallow waterways offer good mine concealment and are likely enemy avenues of advance. (See Figure 12- 15.)

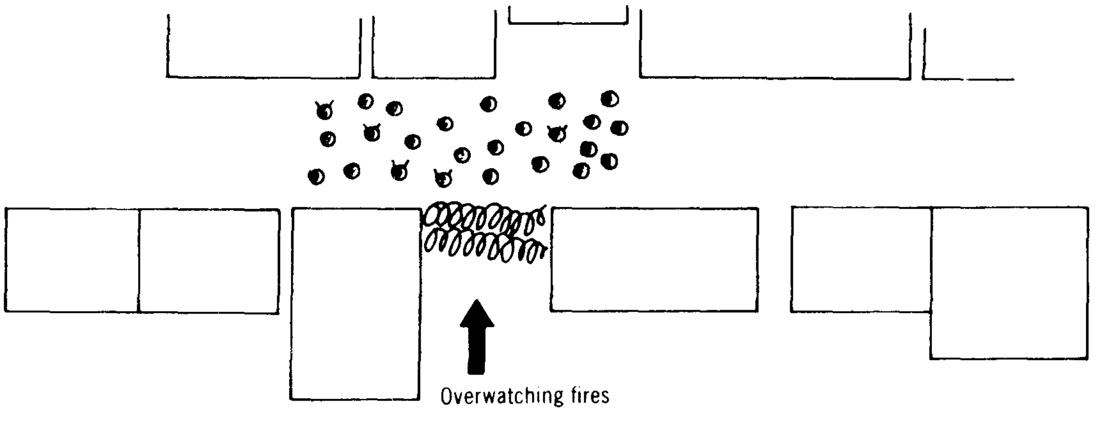


Figure 12-15. Street obstacles

Roof obstacles. Mines and booby traps supplement wire obstacles to deny enemy operations that require air assaults onto rooftops. They also prevent enemy occupation on roofs that afford good observation points and fields of fire. (See Figure 12- 16.)

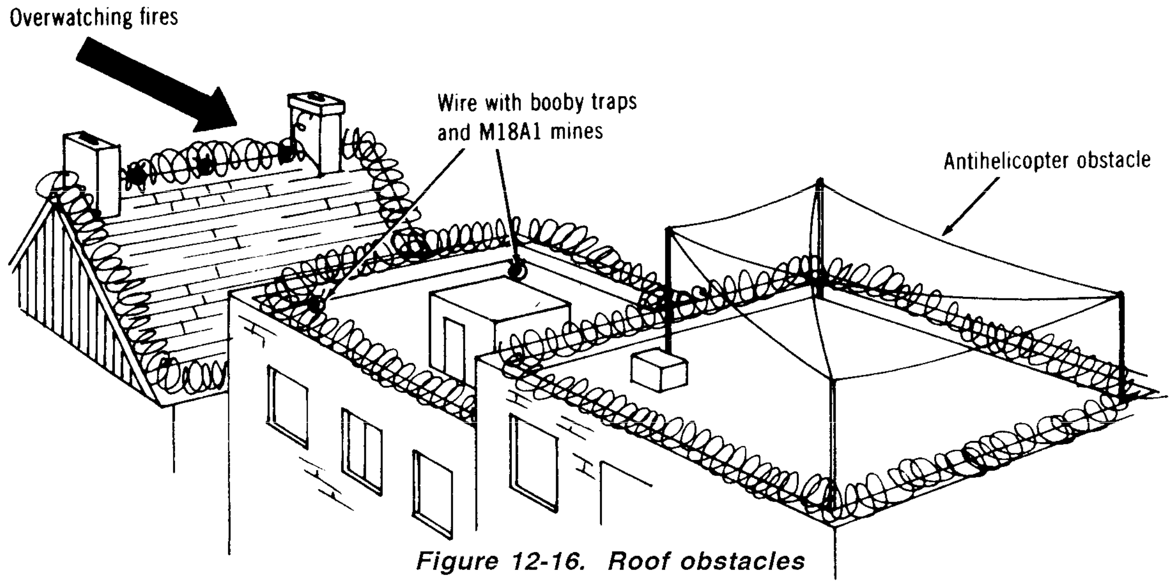


Figure 12-16. Roof obstacles

Building obstacles. Building obstacles include areas within and adjacent to buildings. Mines are laid in conjunction with wire obstacles to deny enemy infantry covered routes or weapon positions in the proximity of defensive positions (Figure 12- 17). Mines are recorded on DA Form 1355 (Figure 12-18).

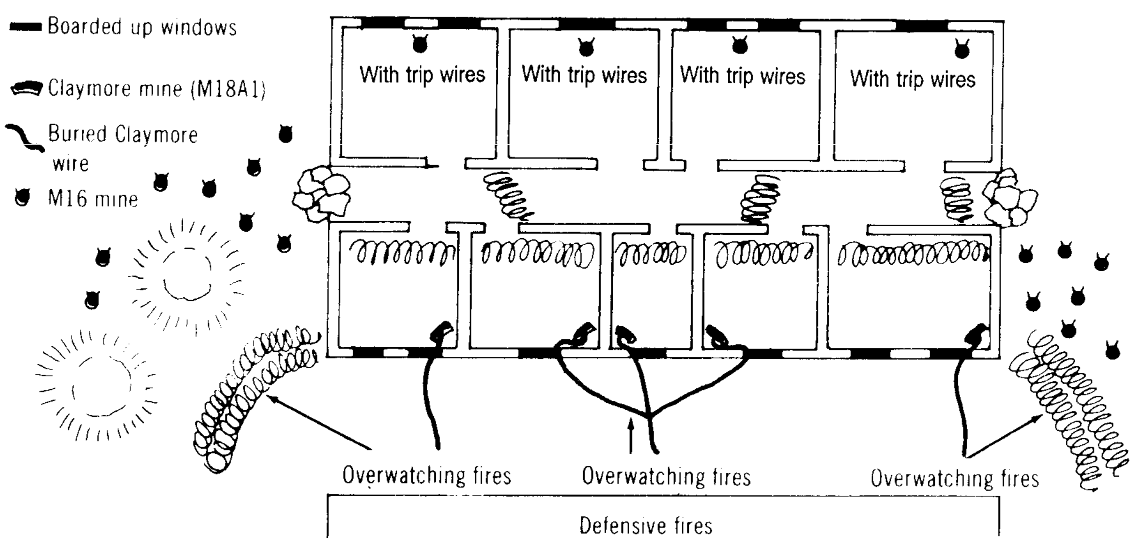


Figure 12-17. Building obstacles

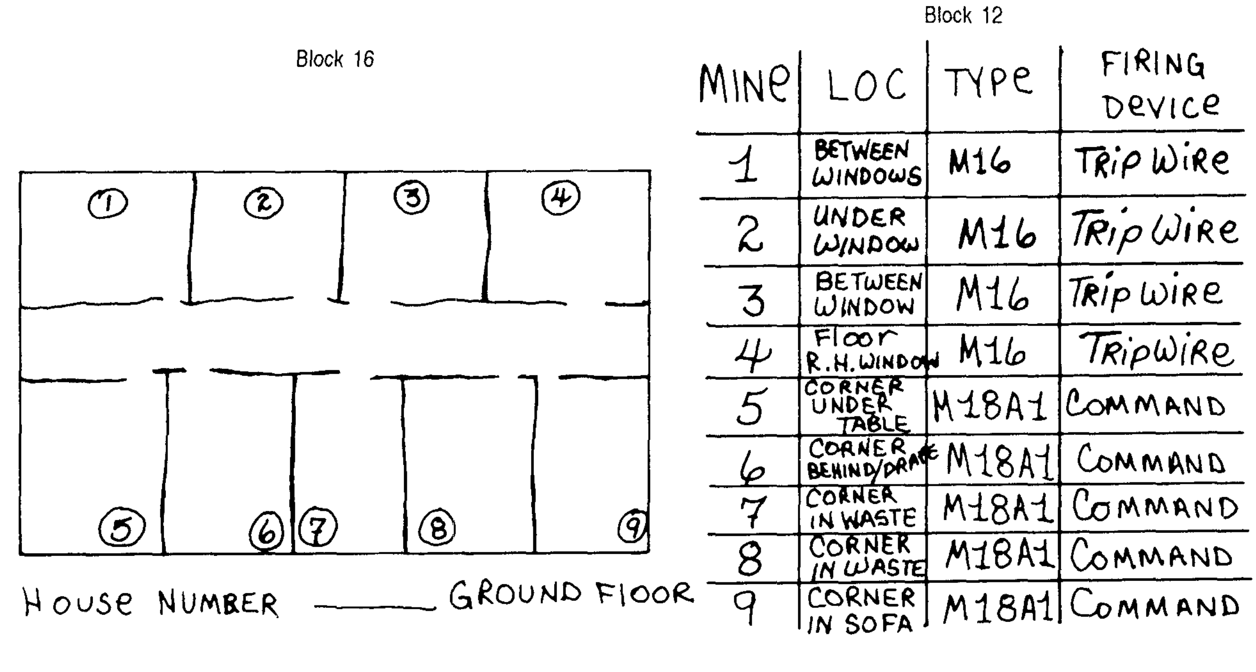


Figure 12-18. Building sketch and mine plan (DA Form 1355)

Dead spaces. Mines and other obstacles must be emplaced to restrict enemy infantry movement in areas that cannot be observed and in those protected from direct fire.

The following AP mines are effective in urban terrain:

- M14. Its small size makes it ideal for obscure places, such as stairs and cellars. It can be used in conjunction with metallic AP and AT mines or with chemical mines to confuse and hinder breaching attempts. (See Figure 12-19, page 12-20.)
- M16. With trip-wire actuation, its large lethal radius covers large areas such as rooftops, backyards, parks, and cellars. An added advantage can be gained by attaching twine or wire to the release pin ring to expediently rig the mine for command detonation. (See Figure 12-20, page 12-21.)
- M18A1 (Claymore). Numerous innovative applacations of Claymore mine deployment can be found for defensive warfare in urban areas. With remote firing, a series of Claymore mines along a street establishes a highly effective ambush zone. Mines can also be employed on the sides of buildings, in abandoned vehicles, or in any other sturdy structure. Numerous opportunities exist for effectively sited, well-concealed mine employment above the terrain surface. The Claymores can be used to fill the dead space in the FPF of automatic weapons. They present a hazard when used in confined, built-up areas. Exercise caution when using them close to friendly forces because there is a danger of back blast. (See Figure 12-21, page 12-22.)

Conventional Antitank Mines

Enemy tanks, infantry fighting vehicles (IFVs), and direct fire support weapons are restricted to streets, railroad lines, and, in some instances, waterways. (See Figure 12-22, page 12-23.) M15, M19, and M21 mines are used primarily in tactical and nuisance minefield, but they are occasionally used in protective minefield. They should be employed with other obstacles

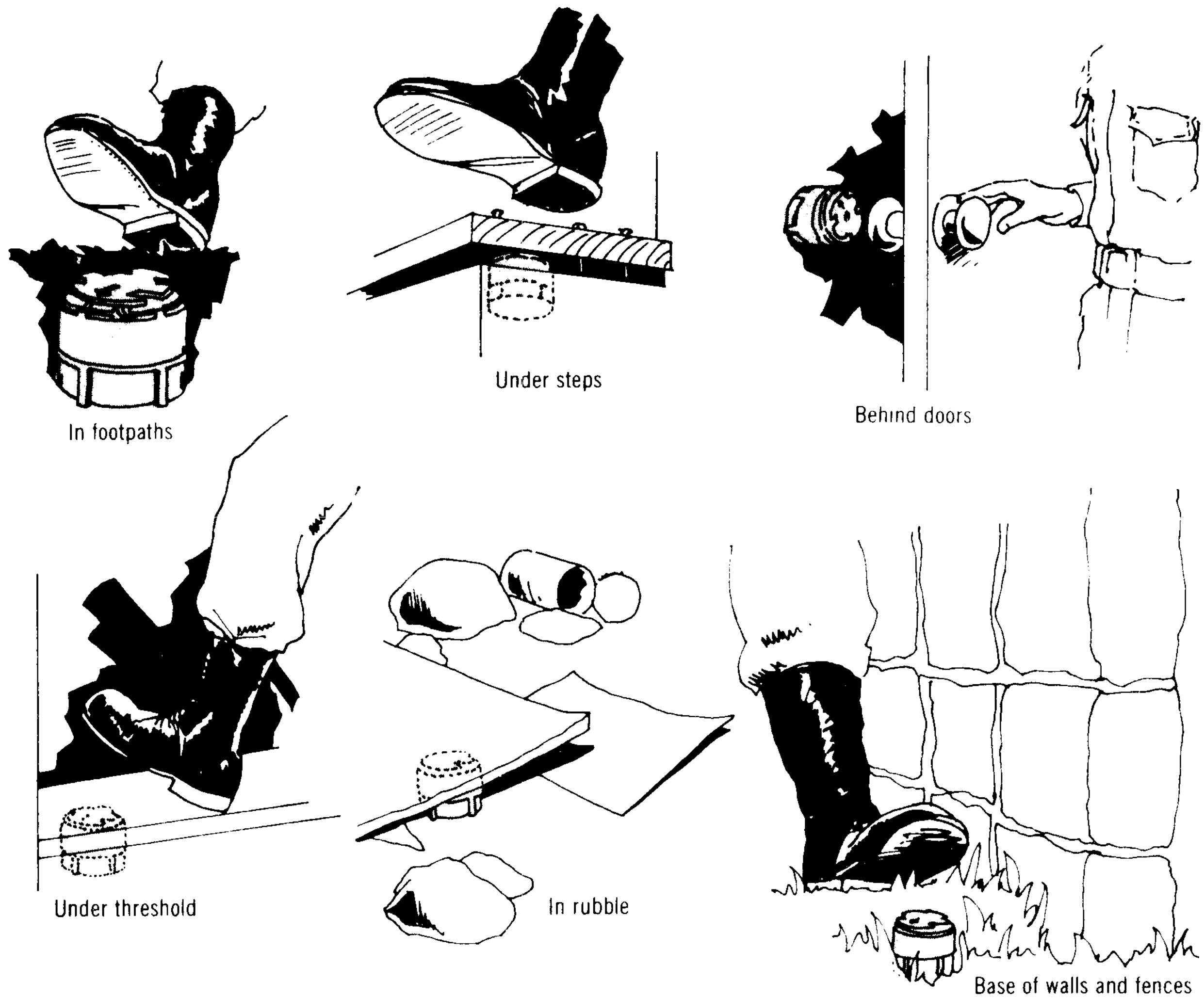


Figure 12-19. M14 antipersonnel mine placement

and covered by fire. Conventional AT mines emplaced in streets or alleys block routes of advance in narrow defiles. Concealing large AT mines is done by placing them in and around rubble and other obstacles. Extensive labor requirements generally prohibit burying mines in difficult terrain types. The MOPMS offers excellent urban area applications similar in nature to the AP application of the Claymore mine.

In dispersed residential areas, obstacles are required to reduce enemy infantry mobility through and between houses and in open areas. They also prevent armored vehicles from moving between houses and along streets. AT minefield patterns should extend outward from streets and incorporate open areas between buildings and streets in order to prevent easy bypass. As in urban terrain, AT mines supplement other street obstacles.

Significant labor and materials are required to deploy conventional mines between widely spaced buildings, in high-rise construction, and in industrial and transportation areas.

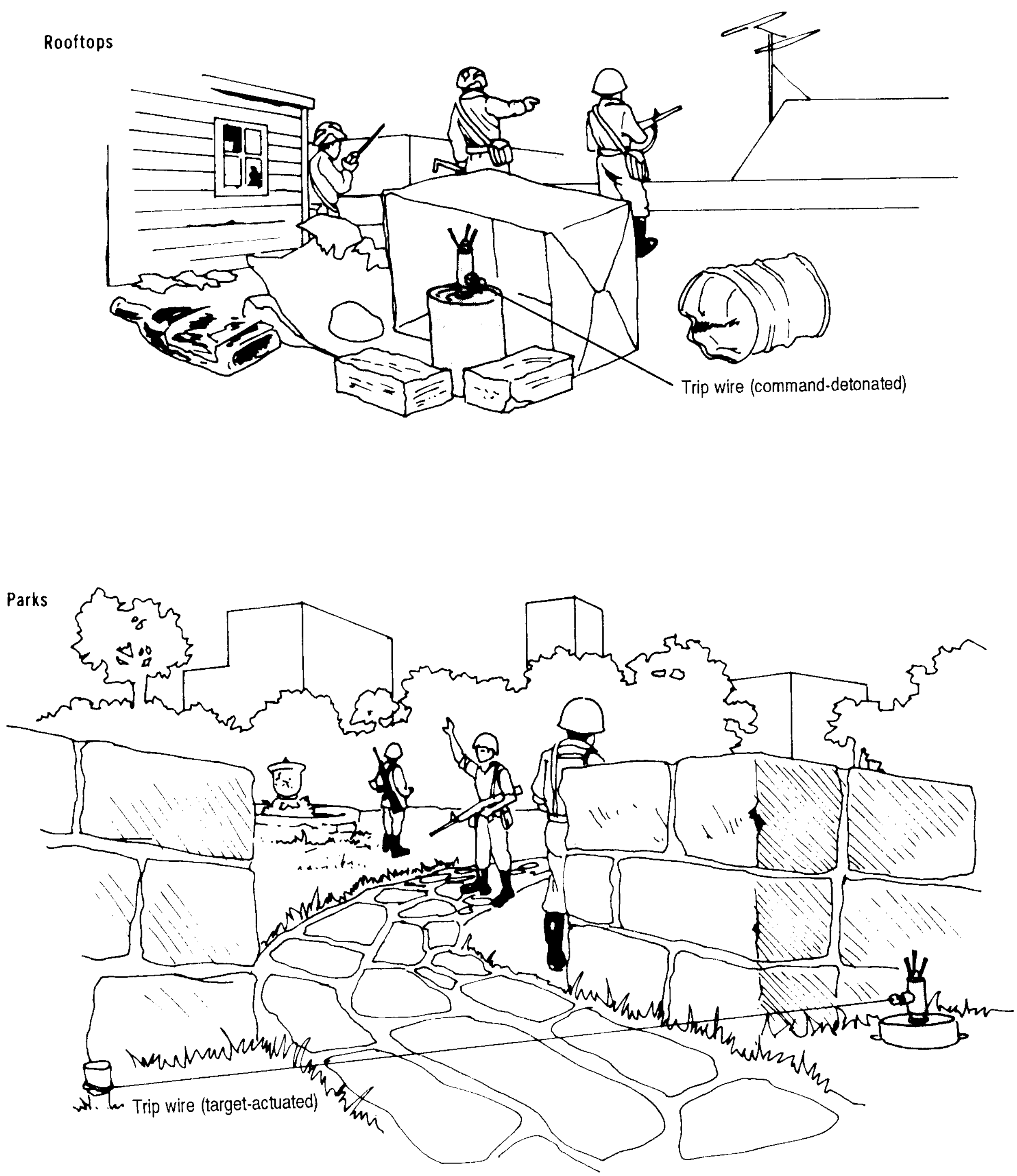


Figure 12-20. M16 antipersonnel mine placement

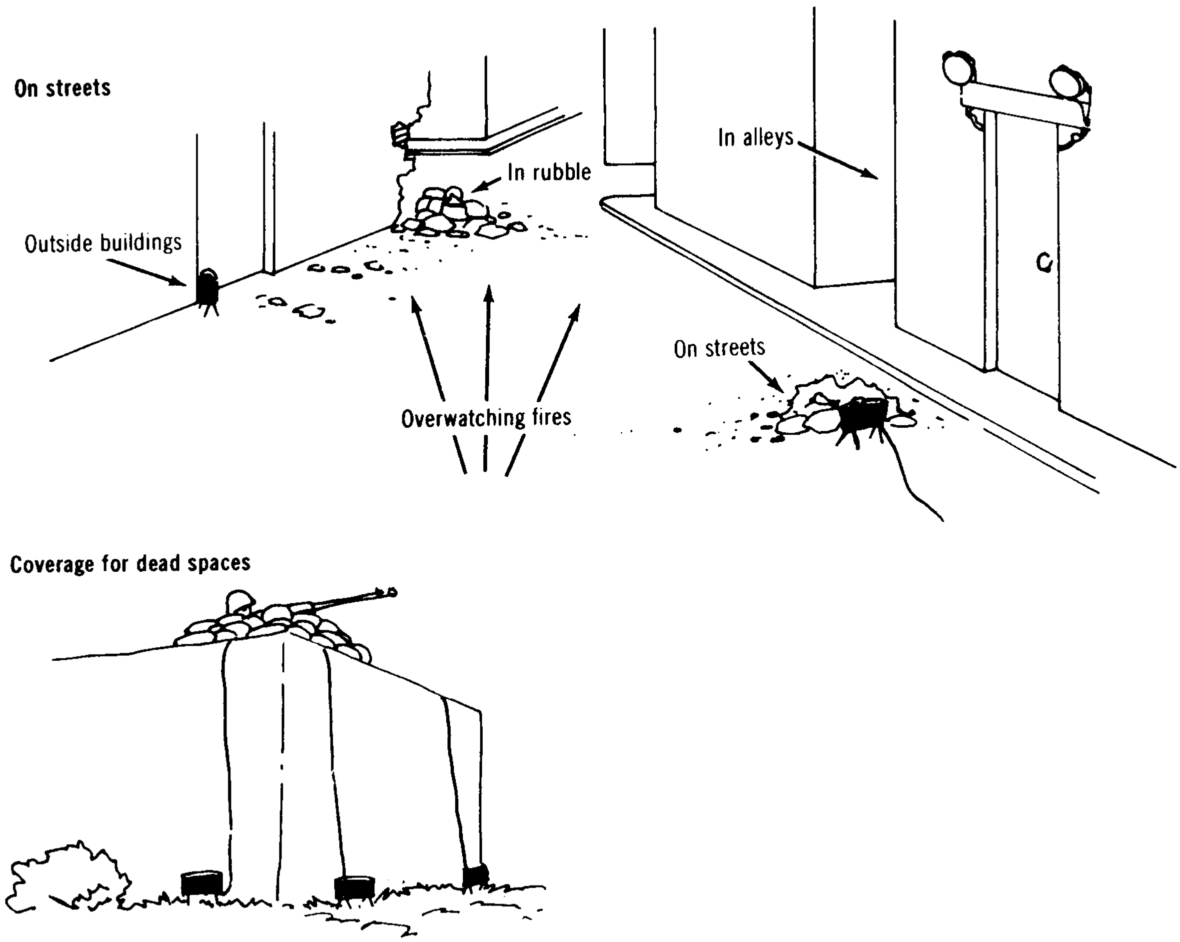


Figure 12-21. M18A1 (Claymore) antipersonnel mine emplacement

Therefore, scatterable mines should be seriously considered as viable alternatives to conventional mines. Some situations, such as the one depicted in Figure 12-23, provide opportunities for effective employment of conventional mines in tactical and nuisance minefield.

Deception Measures

Phony minefield can be established rapidly with negligible effort and cost. They have the distinct advantage of blocking the enemy but not the friendly forces. Although it is difficult to fake a surface-laid minefield, expedients such as soup pans, seat cushions, and cardboard boxes have historically proven effective in delaying and channelizing attacking forces. These objects, as well as other ones readily available in urban areas, can be used as phony minefield or used to cover real mines. A more realistic urban terrain phony minefield can be created with inert or training land mines.

Inadequate minefield camouflage in urban terrain is viewed as a critical constraint in deploying conventional and scatterable mines. Smoke can be deployed from various dispensers, but it must be dense and accurately employed and released.

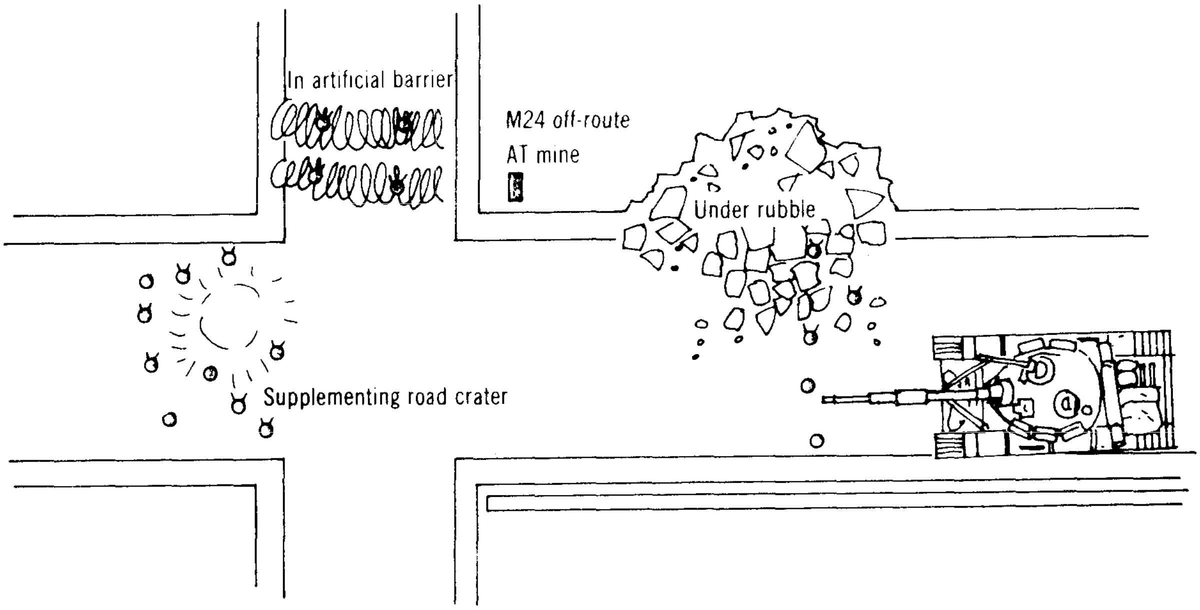


Figure 12-22. Conventional antitank mine emplacement - urban areas

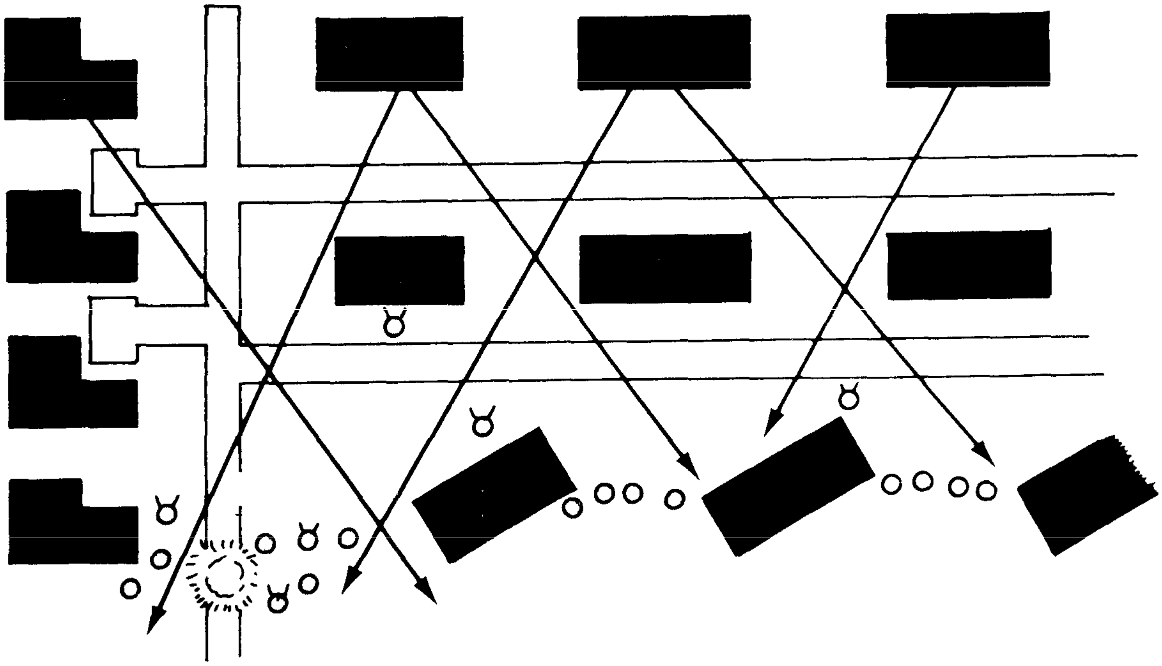


Figure 12-23. Conventional antitank mine emplacement - industrial and transportation areas

Scatterable Mine Systems

Area Denial Artillery Munition and Remote Antiarmor Mine.

in addition to advantages (such as reducing required resources and emplacement time) applicable to all scatterable mine systems, ADAM and RAAM have two specific advantages. As mentioned in Chapter 6, these are the most rapidly deployed scatterable systems. Preplanning artillery-delivered minefield increases the rate at which nuisance minefield can be emplaced. Secondly, these mines can be delivered under enemy fire. Employment of ADAM and RAAM is most effective when the enemy's intentions are known and when their forces are committed to an avenue of advance. (See Figure 12-24.)

The use of ADAM/RAAM in urban terrain involves five specific problem areas:

- Difficulty in precise minefield siting. Accurate siting is extremely critical due to the typically restrictive avenues of advance. It may be futile because it is difficult to adjust artillery rounds in an environment that obscures observation. Further, buildings tend to create unmined shadow zones.
- Uncertainty of ADAM and RAAM survivability upon impact with hard building and ground surfaces.
- Likely availability of artillery firing units for ADAM/RAAM. ADAM/RAAM emplacement may not be a priority of the maneuver commander, and available 155 mm FA units may not have enough ADAM/RAAM munitions on

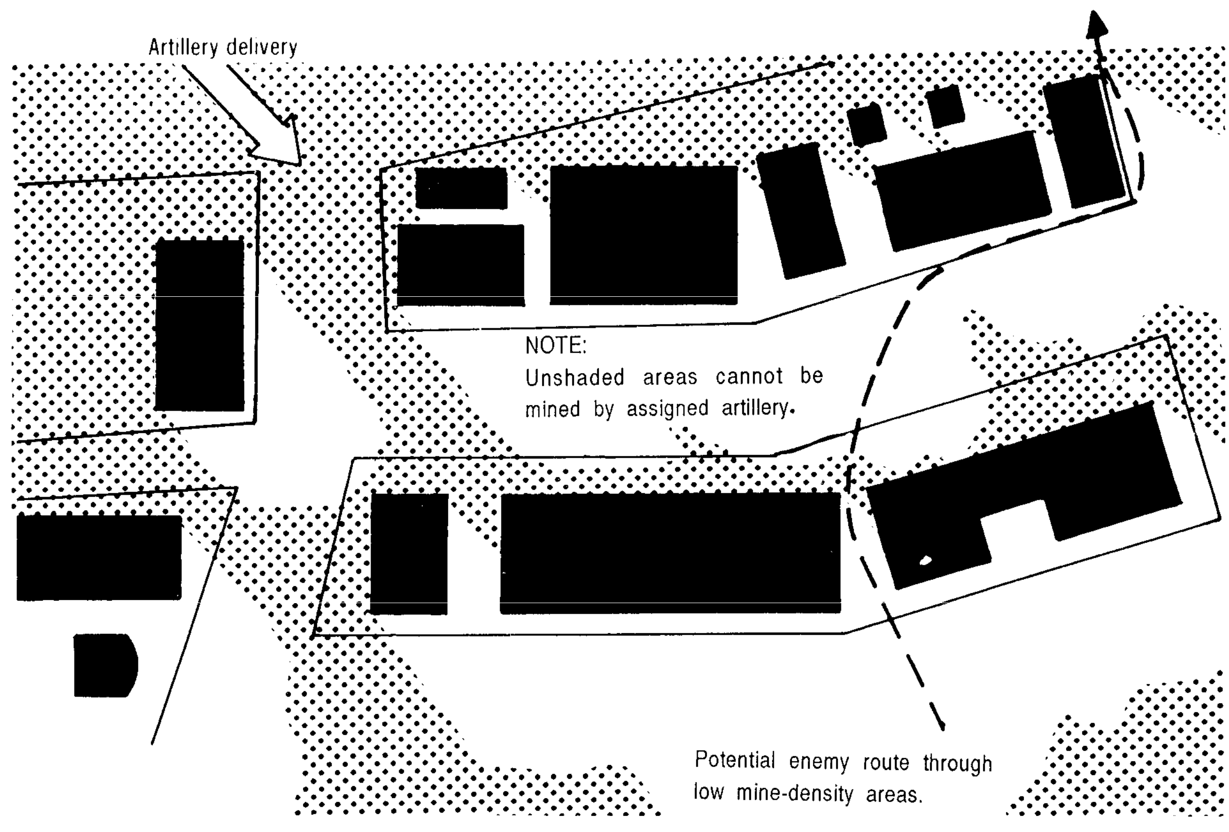


Figure 12-24. ADAM/RAAM employment

hand. Assuming the availability of artillery assets for this mission could prove disastrous for defending forces.

- High detectability of these mines on bare and lightly covered surfaces. This permits the enemy to seek out unmined passageways or pick through lightly seeded areas. If doctrinal guidelines are followed for emplacing artillery-delivered mines on top of the advancing enemy or immediately in front of them, the desired obstacle intent (disrupt, turn, fix, or block) and enhanced weapon systems fires are achieved.
- Difficulty in achieving a good random pattern. Hard surfaces cause mines to bounce and roll. Some mines (especially AT mines) land on top of buildings and are ineffective.

Air Volcano Mine Dispensing System.

The primary advantage of the Volcano system is its capability to site and emplace minefield accurately. This depends on the helicopter's maneuverability over selected minefield terrain and proper coordination between ground forces and aviation support. Disadvantages include vulnerability and the high cost of the helicopter. However, in view of the system's operational concept, employment in urban terrain (which provides little helicopter exposure) actually increases the practicality of deploying this system in urban areas, Another potential problem is the mine survival rate on impact with a hard surface. Finally, the Volcano system is not as responsive as other systems. Since Threat doctrine focuses on massive surprise attacks from the line of march, this last factor is particularly critical.

Ground-Emplaced Mine Scattering System /Flipper/ Ground Volcano.

Three aspects of GEMSS and ground Volcano further distinguish them from other scatterable mine systems.

- Dispenser is organic to supporting combat engineers, making it readily available to support the maneuver commander's defensive plan.
- Minefield delivery siting is accurately pinpointed to the ground.
- Better opportunities exist to record the presence of a minefield. In contrast to the artillery-delivered and air Volcano system, the GEMSS and ground Volcano are delivered by engineers who are normally located with and report directly to the maneuver commander.

Three primary factors may degrade GEMSS and ground Volcano deployment in urban terrain. Most significant Is probably the requirement to emplace minefield before an actual attack in order to reduce system vulnerability. This makes the minefield detectable and provides more reaction time for the enemy to alter their scheme of maneuver. The delivery of mines depends on terrain trafficability. The prime mover, towed dispenser, and launch vehicle must be able to negotiate the terrain where mines are dispensed. Logistical constraints on ammunition resupply into urban areas may limit the system's usefulness.

Modular Pack Mine System.

The MOPMS is ideally suited for employment in urban terrain. (See Figure 12-25, page 12-26.) The module can be hidden from enemy view, and mines can be dispensed after attackers are committed to a route of advance. Additionally, mines can be emplaced rapidly under enemy fire. Since the MOPMS has no delivery error, a commander might choose to detonate mines directly on top of the enemy, thus seriously disrupting the attack. In contrast to other scatterable mine systems, the commander controls when and where mines are dispensed and how they are detonated, regardless of the enemy situation.

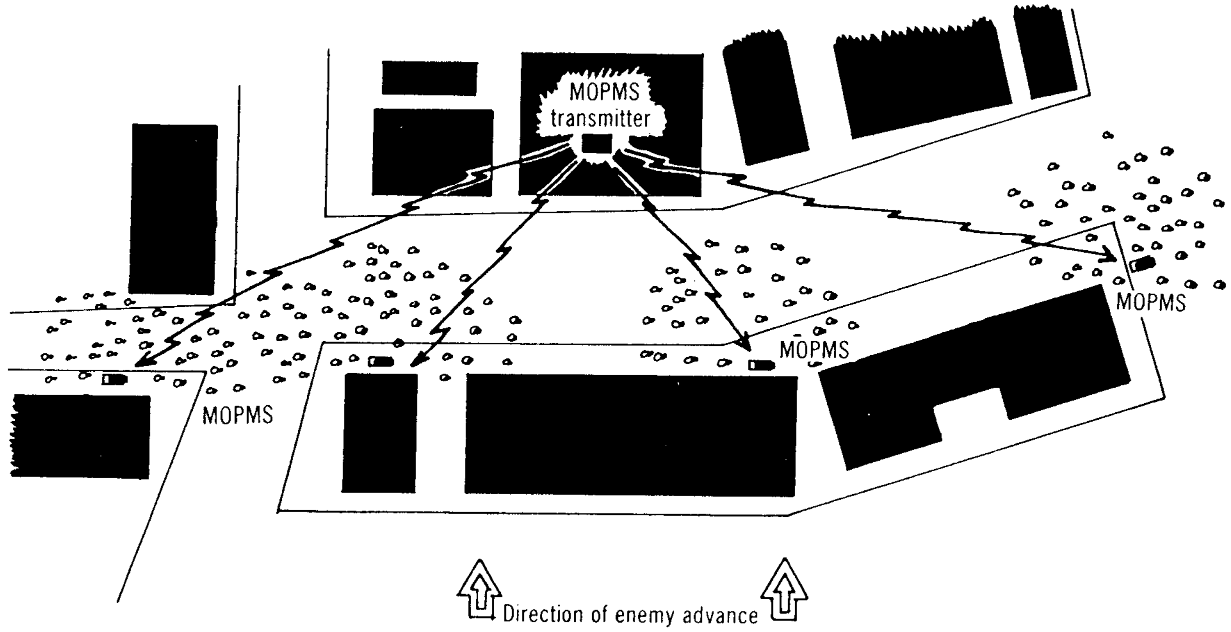


Figure 12-25. MOPMS employment

Gator.

When considered for deployment in urban area defenses, high-performance, aircraft-delivered mines encompass the same problems as artillery-delivered and air Volcano mine systems.

SPECIAL ENVIRONMENTS

Cold Regions

Mine employment in cold regions poses special problems-the principal one being emplacement. In cold regions, mine burial is extremely difficult because of frozen ground. The freezing water in soil causes it to have high strength and penetration resistance, so that digging times are greatly increased, if not impractical. However, there are several ways to overcome this problem. In some cases, a minefield can be laid out before the soil freezes. To do this, dig holes for each individual mine and insert a plug into the hole to protect its shape and to prevent it from being filled in. A wide variety of materials can be used for plugs. Ideally, the plug should be economical, easy to remove, and rigid enough to maintain the depth and shape of the hole. Plastic bags filled with sand or sawdust, logs, and sandbags make excellent plugs. If the minefield cannot be prechambered, mechanical means can be used to dig holes. When available, civilian construction equipment (particularly large earth augers) can be used to drill holes for mine emplacement.

To ensure detonation, buried, pressure-actuated mines are placed in a shallow hole so the pressure plate is clearly above ground. Covering spoil should be a maximum of 1 centimeter deep.

When burial is impossible, mines are placed on the surface. Heavy snow may reduce the effectiveness of buried and surface-laid mines by causing them to be bridged. Mines laid in deep snow should be placed as close as possible to the surface and supported by boards or compacted snow. Waterproof mines before emplacement in cold regions. Mines can also be placed in plastic bags before burial. In some cases, a layer of ice may form on top of the pressure plate. Although the load required to break the ice is slightly higher than that required to activate the fuze, thin layers of external ice have little effect on mine functioning. Tilt-rod actuated mines should be used in cold regions when possible, because they are less susceptible to ice and snow. Magnetic-fuzed mines are not significantly affected by snow conditions, although cold weather decreases battery life. When trip-wire actuated mines are employed in snow, the wire should be about 10 meters long with a slight amount of slack left in it. Trip wires should be supported approximately 46 centimeters above the ground to avoid degradation by snowfall.

Camouflaging minefield in cold regions is difficult. Paint mines white when snow is expected to remain on the ground for extended periods of time. Sweep away all tracks or make deliberate tracks to give the impression of a safe area.

Jungles

Fuzes and explosive components deteriorate very rapidly in jungle climates. As a result, mines and mine material require frequent, extensive maintenance and inspection. Waterproof mines that are employed in humid climates. The rapid growth of jungle vegetation hinders maintenance recovery and removal. Dense vegetation can cause mines to become inoperable or windblown foliage can detonate them, FM 90-5 provides detailed information on jungle operations.

Deserts

In desert climates, fuzes and explosive components do not deteriorate rapidly. The terrain and situation determine how mines are emplaced. Mine boards are normally required to provide support in soft, shifting sand. Mines emplaced in the desert have a tendency to shift position, and the spacing between mines and rows should be increased to prevent sympathetic detonation. Blowing sand causes exposure of buried mines or covers surface-laid mines. Sand may also cause mines to malfunction. ,It is difficult to accurately record minefield locations in vast, open desert areas void of recognizable terrain features. More mines are required for desert operations. Typically, desert minefield are much larger and have a lower density than those used in Europe or Korea. FM 90-3 provides detailed information on desert operations.

CHAPTER 13
BOOBY TRAPS

Section I. Setting

Booby traps are cunning devices and are usual - ly explosive in nature. They are actuated when an unsuspecting person disturbs an apparently harmless object or performs a presumably safe act. Booby traps are designed to kill or incapacitate. They are are strutted by using specially designed military enhancement and standard service ammunition, or they are improvised by using any suitable material.

Booby traps cause unexpected, random casualties and damage. They create an attitude of uncertainty and suspicion in the enemy's mind; thereby, lowering his morale and inducing a degree of caution that restricts or slows his movement.

In conventional operations, most booby traps in the combat zone are constructed by using military equipment and ammunition. Improvised traps are used during counterinsurgency missions in low-intensity conflicts.

The corps commander is the employment authority for booby traps. He can delegate this authority to the division commander.

TACTICS AND PLANNING

Booby traps are a psychological weapon. They make the enemy cautious and slow him down. These actions, in turn, cause enemy casualties. Do not waste time attempting to set elaborate traps that are undetectable or impossible to disarm. Also, do not waste time developing difficult sites. Simple traps usually have the same chance of catching the enemy. Even if booby traps are detected and cleared, their aim is achieved.

Booby traps and nuisance mines cannot be considered in isolation. Principles governing their use are identical, so consider using them in conjunction with each other. They have characteristics which make them suitable for use in different situations: (1) Mines are quicker to lay and safer to use than booby traps. They are suited for use in outside locations where they can be buried. (2) Booby traps are particularly suited for use in urban areas, in structures, and in places where mines are easily detected.

Booby traps and nuisance mines are used in offensive and defensive operations. Although booby traps can be used in offensive operations, they arc not suited to the attack. Exercise caution when using them in offensive operations because they can hinder the operation. In advance and pursuit operations, booby traps are primarily used by patrols and raiding parties. They slow down enemy follow-up action and hinder their repair and maintenance teams after raids.

Booby traps and nuisance mines are particularly suited for defensive operations. They are used to–

- Slow enemy advance.
- Deny the enemy use of facilities and material.
- Warn of enemy approach.
- Deter the enemy from using ground not covered by direct fire.

In offensive operations, booby traps and nuisance mines are set on an opportunity basis during raids and patrols. Formal instruction is not usually issued by the staff. The following considerations pertain to defensive operations, but many of them are relevant to offensive operations and must be considered when briefing troops.

Booby trapping is rarely given a high priority and is usually peripheral to other engineer tasks. Nuisance mines are more cost-effective than booby traps, unless booby traps are used in situations that allow their full potential. If nuisance mines can be used more easily, use them instead of booby traps.

To maximize the effect of booby traps and nuisance mines, the staff provides engineer commanders with the following information, if possible:

Purpose. Booby traps are time-consuming and dangerous to set. Do not waste time and effort setting traps that are unlikely to be actuated or are not specifically designed to achieve the required aim. For example, if traps are used against troops, small, simple traps designed to incapacitate will achieve the desired result just as well as complicated traps with large charges. If you aim to destroy vehicles, then use mines.

Location. The precise location of booby traps and nuisance mines is determined by the setting unit. Areas must be precisely delineated and recorded so there is no threat to friendly forces in the event of reoccupation.

Time the setting starts and amount of time available for setting. The setting start time effects other engineer tasks, and the length of time available for setting governs the number of men required.

Number of safe routes required. Safe routes are important during general withdrawals where authority has been given to booby-trap positions as they are evacuated. They provide safe avenues for the covering force to withdraw and safe areas for them to launch counterattacks.

Likelihood of reoccupation. Even if the enemy has not detonated booby traps, they might have interfered with them. Therefore, do not set booby traps when areas are being vacated to meet short-term tactical requirements and reoccupation is expected soon.

Intelligence

Intelligence personnel provide information to assist the setting unit in maximizing the effect of booby traps. The nature and types of traps required depend on the enemy unit. For example, while paying particular attention to dead space and defilade positions, use mines or widely dispersed traps (with large charges) against a mechanized enemy. Conversely, use small traps and AP mines (in places that afford cover) against an infantry enemy.

Recording

Booby traps and nuisance mines are reported and recorded on DA Form 1355 as discussed in Chapter 5.

SITING

If the first obstacle or installation the enemy strikes is booby-trapped or nuisance-mined, he is delayed while he clears it. The enemy is further delayed by an increased degree of caution. His troops know that additional traps or mines can be encountered.

Booby traps and nuisance mines are usually located in areas such as–

- In and around buildings, installations, and field defenses.
- In and around road craters or any obstacle that must be cleared.
- In natural, covered resting places along routes.
- In likely assembly areas.

- Near stocks of fuel, supplies, or materials.
- At focal points and bottlenecks in roads or rail systems (particularly the ones that cannot be bypassed).

The setting party commander is responsible for the detailed siting and design of booby traps. Consider all information about the enemy soldier and his operating procedures when selecting places and objects to trap. Also, consider the traps from the enemy's point of view, and assess the courses open to the enemy when he encounters them. This can expose weaknesses in the initial plan and bring about changes to the proposed layout, or it can result in a different location being selected. In addition, determine the effort required by the enemy to bypass the traps. This shows whether the imposed delay justifies the effort required to set booby traps in the selected location.

TYPES OF TRAPS

Booby traps are designed to: (1) be actuated by pm-sons carrying out their normal duties, or (2) take advantage of human nature. The first cannot be specifically guarded against because there is nothing about them or their situation to cause suspicion. The second can often be detected because they are designed LO make a person do something. The following traps fall in the second category:

Bait. Usually consists of objects that arouse someone's interest. They often consist of attractive or interesting items that have apparently been left behind or discarded during a rapid evacuation.

Decoy. The most common decoy consists of two traps—one designed to be detected, and the other designed to be actuated while the first is being dealt with. The first trap can be a dummy. A classic form of decoy is to place booby traps or nuisance mines in locations from which the decoy mine can be pulled.

Bluff. A bluff is a hoax and usually consists of a dummy trap.

Double bluff. A double bluff only appears to be a bluff. The person clearing traps thinks the trap is safe or can be disarmed. For example, the enemy can set a number of traps that are disarmed when the detonating cord is removed from the charge. The double bluff is achieved by setting another trap that appears to be the same, but it actually explodes when the detonating cord is removed from the charge. Double bluffs rely on a reduced awareness and alertness caused by repetition.

COMPONENTS AND PRINCIPLES

There arc two types of explosive booby traps—electric and nonelectric. Both types can be constructed using many different firing devices. Firing devices can be secured to the charge (direct connection) or located some distance from it (remote connection). They are actuated by one or more methods. It is impossible to describe every booby trap that can be encountered; however, most are constructed and operated by using components and principles similar to those listed below. Figure 13-1. page 13-4, shows how typical electric and nonelectric traps can be made.

- Firing device.
- Power source (battery, for example).
- Connection (usually detonating cord or electric wire).
- Blasting cap.
- Main charge.

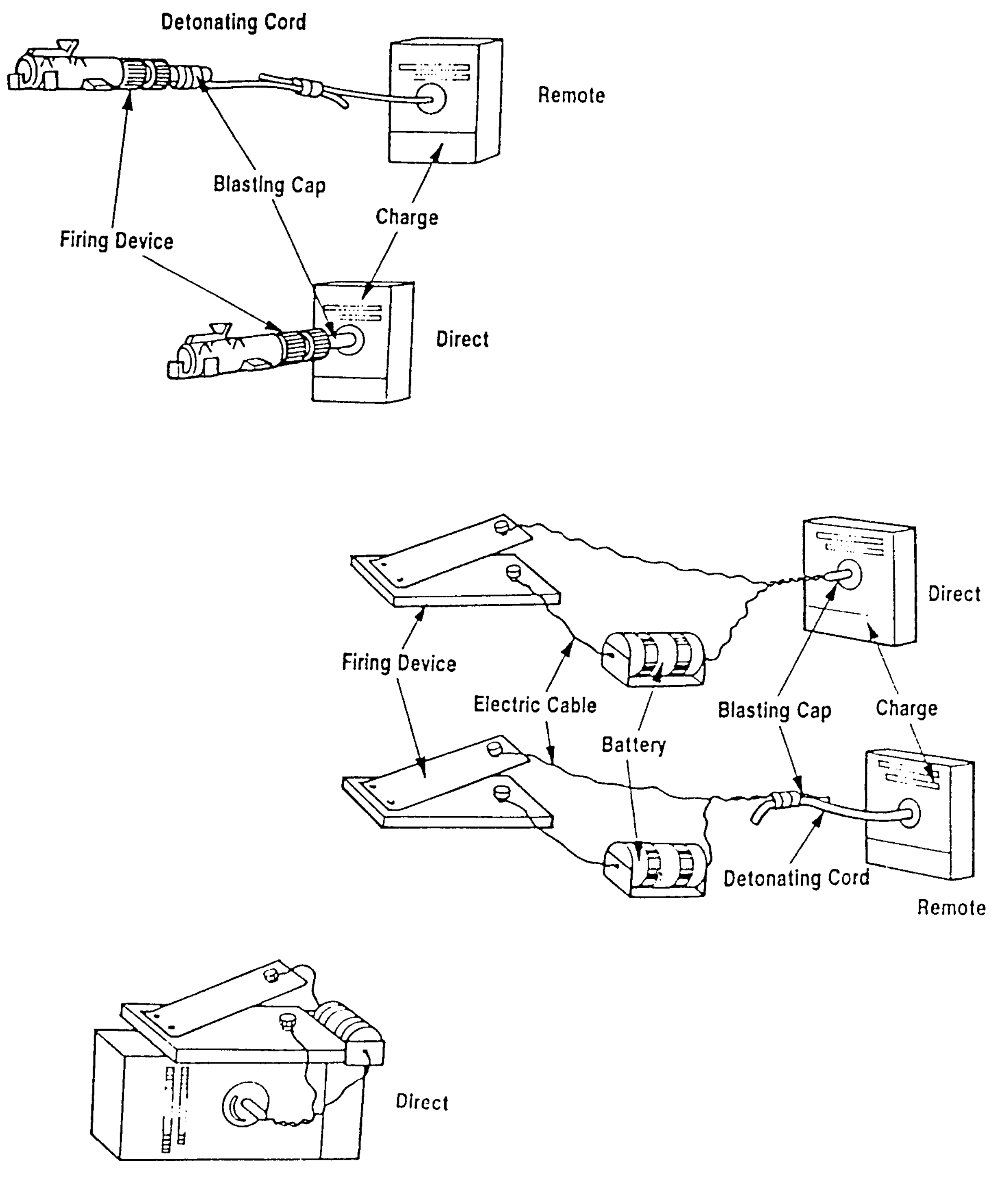


Figure 13-1. Typical electric and nonelectric booby traps

ACTUATION METHODS

Occasionally, booby traps are actuated by electric devices that detect interrupted light beams, variation in acoustic levels, or magnetic influence. Most firing devices found in the combat zone are simple mechanisms designed to be actuated by pull, pressure, pressure release, or tension release (Figure 13-2).

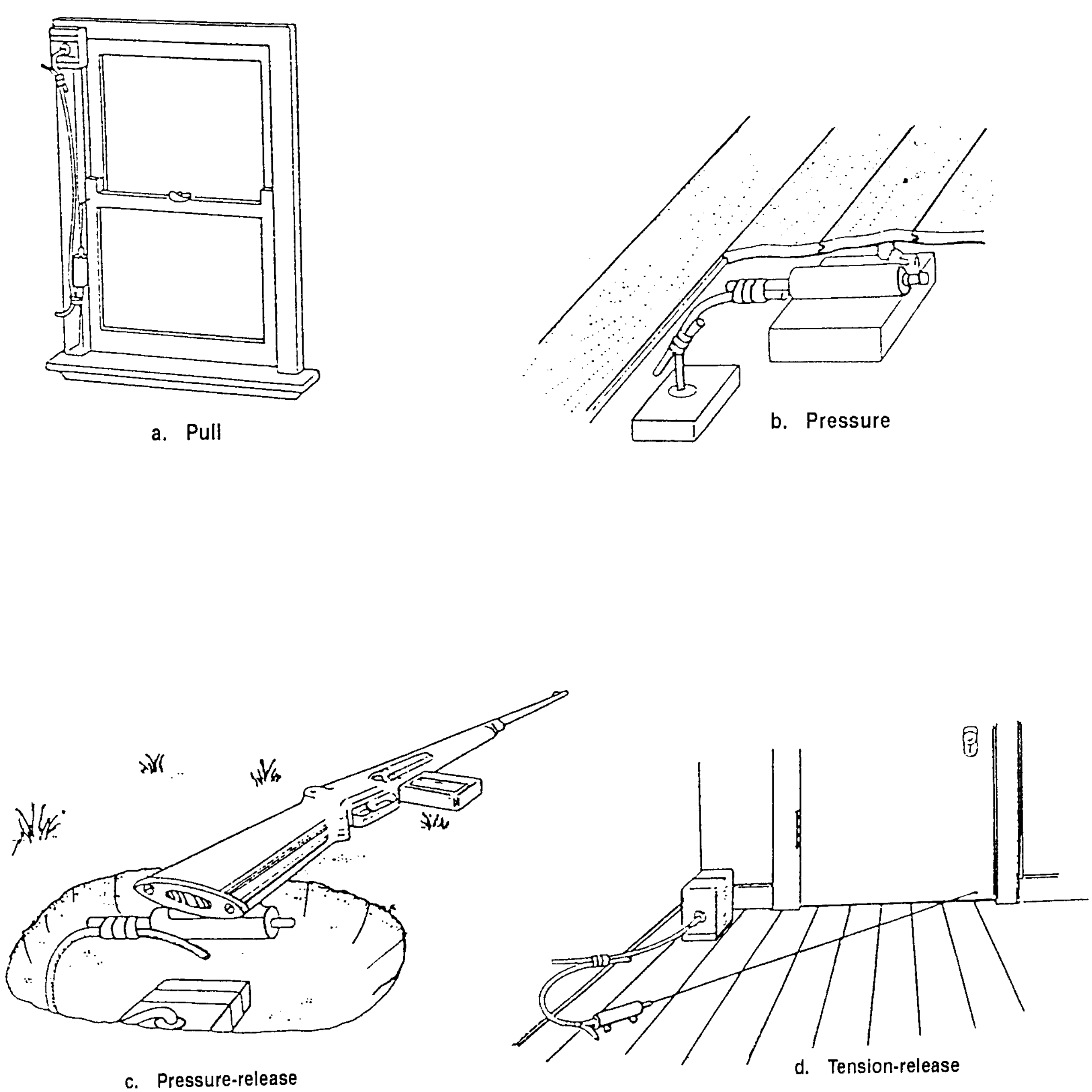


Figure 13-2. Methods of actuation

CONNECTION METHODS

Procedures can be varied when it is safer to do so. For example, instead of connecting the firing device to a charge already in position, preconnect trap components and then position the trap.

Small charges (up to 2 pounds) are sufficient for AP traps, but larger quantities can be used to increase their effect. Shrapnel can be produced by packing stones, scrap metal, nails, or other material around the charge. AT traps require large charges—up to 15 pounds for wheeled vehicles and 25 pounds or more for tracked vehicles.

Remote

Follow the procedures listed below when assembling a remotely connected trap using an M 142 firing device (similar to the illustration in Figure 13-3).

1. Design trap and collect necessary materials.
2. Test M 142 firing device.
3. Lay detonating cord from the charge location to the firing device location.
4. Position charge.
5. Connect detonating cord to charge.
6. Prepare coupler.
7. Tape a length (18 inches, minimum) of detonating cord to the coupler's blasting end.
8. Prepare and position the M 142, set it to operate in the desired manner, and remove the round- or square-headed pin.
9. Ensure the two detonating cords are not touching but can be conveniently connected when necessary.
10. Remove materials and other signs of laying. Fully camouflage the area.
11. Arm firing device by removing the positive safety pin.
12. Arm trap by connecting the two detonating cords.

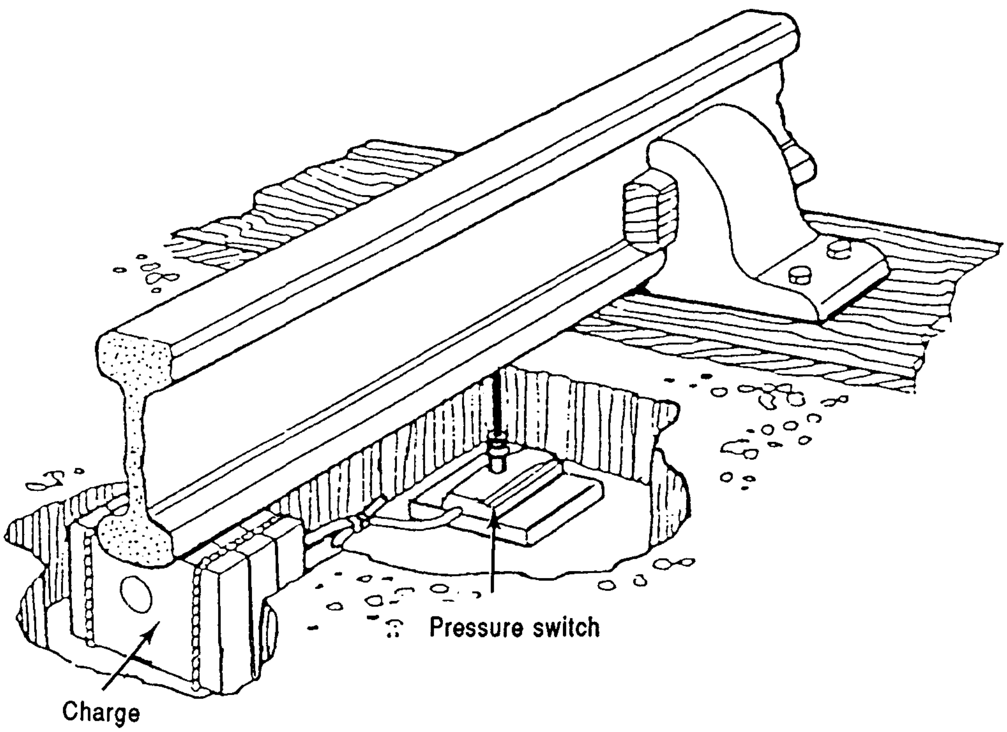


Figure 13-3. Remotely connected traps

Direct

Follow the procedures listed below when assembling a nonelectric, directly connected trap using an M 142 firing device (similar to the illustration in Figure 13-1, page 13-4).

1. Design trap and collect necessary materials.

2. Test M 142 firing device.

3. Prepare and position charge for coupling to the firing device: prepare explosive to) receive a blasting cap.

4. Prepare coupler and insert it into the charge.

5. Prepare M142, set it to operate in the desired manner, and remove the round- or square-headed pin.

6. Remove materials and other signs of laying. Fully camouflage the area.

7. Arm trap by removing the positive safety pin.

DANGER

Do not attempt to further camouflage an area after trap is armed.

PLANNING, SETTING, AND RECORDING

Timeliness

It is important that setting party commanders be given all available information and sufficient time to carry out a reconnaissance. This enables their plan and soldier's briefing to be as complete as possible.

Orders/Briefing

Once the commander has finished his reconnaissance, he makes a detailed plan, prepares his orders, and then briefs his men. The following points are covered:

- Enemy intelligence.
- Number and type(s) of traps to be set.
- Location and design of traps (precise or general).
- Tasking and allocation of areas.
- Recording, marking, and arming procedures.
- Control measures.
- Timings.
- Material/equipment availability.
- Rehersal and stores preparation.

Rehearsal

Whenever possible, a complete rehearsal is performed. Thoroughly exercise control and safety measures so any flaws in the system are discovered. Lay practice traps and carry out arming and recording procedures. If a rehearsal cannot be conducted at the trap location, hold it in a similar area.

Organization and Procedure

Setting booby traps is a dangerous task, and it must be carefully controlled. Exact drills cannot be prescribed, but the following procedures should be followed as closely as possible.

Control point. The commander must establish a control point upon arrival at the trap area. The control point forms a headquarters and material holding area. Also, safe routes start at the control point. If a rehearsal was conducted at another area, assemble troops at the control point before setting starts. At this time, relate the ground to the plan, confirm control measures, and check firing devices and equipment for serviceability and adequacy.

Controlling parties. A Setting party consists of one or two men. Clearly define the area in which each party will work (use tape, if necessary). Position traps so accidental detonation will not cause friendly casualties. Strictly control entry to the areas in which traps are being set. In most situations, only the commander, setting parties, and recorder enter these areas. Troops who are not assigned tasks should remain at the control point unless otherwise authorized by the commander.

Marking. As with nuisance minefield, mark booby-trapped areas until they are evacuated. Whenever possible, use standard booby trap signs (Figure 13-4). When signs are not available, use temporary marking (any barrier or fence] to clearly indicate a booby-trapped area. Remove the temporary marking after the area is evacuated and before the enemy reconnoiters the area.

Setting. Setting parties transport required explosives and material to the site. They do not arm firing devices or traps until ordered to do so. If a setting party consists of one man, he remains with the trap until it is armed or until the commander directs him to leave. In a two-man party, one man returns to the control point and reports completion of the task. Setting parties enter and leave areas by the same route. If the route is not clearly apparent, they lay tapes to guide the commander and recorder to their position.

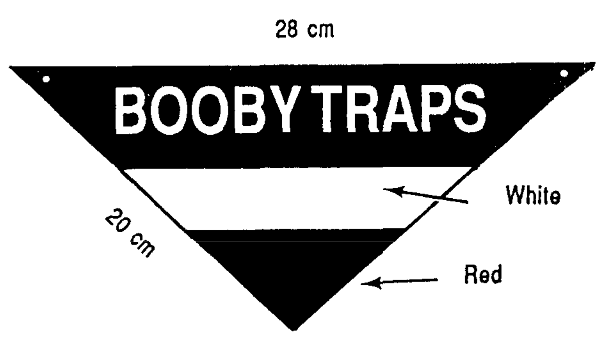


Figure 13-4. Standard booby trap sign

Inspecting and arming. The setting party commander inspects traps for safety and camouflage before giving the order to arm them. He devises a plan for arming the traps that enables the setting parties to withdraw to the control point in a safe and logical manner. For example, in open areas, start arming the traps furthest from the control point; in buildings, arm from the top down.

Reporting and Recording

Booby traps do not distinguish between friend and foe. Correct reporting and recording procedures must be observed to avoid friendly casualties. The procedures for recording booby traps are the same as those for recording nuisance mines. (See Chapter 5.) When traps are set in areas occupied by the enemy, they are not recorded. In this case, it is sufficient to note their location and type in after-action reports.

Tactical reports. Information about booby-trapped areas must be provided in stages from the time they are established until they are cleared. This procedure allows up-to-date trap information to be annotated on operational maps at all concerned units and headquarters. (See Table 13- 1.)

Booby trap records. The setting party commander compiles records for all booby-trapped areas on DA Form 1355 (Figures 13-5a through 14-5c, pages 13-10 through 13-12). Strictly observe the instructions printed on the back of the form. Booby trap records provide detailed information about the composition of an area. They allow the area to be cleared quickly and with minimum casualty risk. They contain complete information on the number and types of traps set, as well as accurate and precise details on the location and design of individual traps. If a single record is not large enough to record all traps set in a definable area, clearly note this fact and reference serial numbers of adjacent records. Submit the completed DA Form 1355, in triplicate, to the next higher headquarters.

Table 13-1. Tactical reports

Serial	Reports	By Whom and When Initiated	To Whom Forwarded	Details to Be Included
(a)	(b)	(c)	(d)	(e)
1 (Required)	Intention to set	Divisional commander, on deciding to set booby traps.	a. Corps HQ. b. Formation HQ controlling.	1. Purpose. 2. General area to be booby trapped (by grid coordinates). 3. Estimated number and types of traps. 4. Estimated starting date and time. 5. Estimated completion date and time.
2 (Optional)	Siting	a. Setting unit, on completion of reconnaissance. b. Division ordering setting (**only if materially different from intention report**).	a. Division ordering setting. b. Next higher formation HQ.	1. Boundaries of booby-trapped area (by grid coordinates). 2. Numbers and approximate positions of safe routes, if any. 3. Estimated number of traps and types of traps; for example, antipersonnel.
3 (Required)	Start of setting	a. Setting unit when setting starts. b. Division order setting.	a. Division HQ ordering setting. b. Next higher formation HQ.	1. Time setting started. 2. Estimated time of completion. 3. Numbers and types of traps being set. 4. Any change to the detail given in the siting report and whether as a result of orders or not.
4 (Required)	Completion	a. Setting unit, when setting is completed. b. Division HQ ordering setting.	a. Division HQ ordering setting. b. Next higher formation HQ.	1. A trace on the largest scale map available, showing the boundaries of the trapped area. 2. Full details of area and buildings trapped with sketch maps. 3. Full details of traps set including design and location. 4. Full details of all safe routes. 5. Full details of any marking. 6. Total number and type of traps. 7. Time and date of completion.
5 (Required)	Changes	Division HQ ordering change, if the trapped area is changed in any way.	a. Next higher formation HQ. b. Any other formation holding information on existing trapped traps.	Full details of change.

MINEFIELD - RECORD

3 Copy No. 1 of 3 Sheet No 1 of 1

1	AUTHORITY:	CG 2nd INF DIV
	LAYING UNIT:	B Co 2nd ENGR BN 1st PL
	OFFICER IN CHARGE:	LT R. YOUNG 762-01-1352
2	DATE AND TIME — START:	110600Z JAN 90
	COMPLETION:	110900Z JAN 90
	RECORDER:	SFC F. LING 550-82-1332
4	MINEFIELD NUMBER:	2XX (INF) A-E
5	MAP: SERIES, NO. AND SCALE	FT LEONARDWOOD SPECIAL 1:50 000
	SHEET NO. (OR NAME)	

6 LANDMARKS

NO	COORDINATES	DESCRIPTION
1	WM 18219034	TWO STOREY TIMBER BUILDING
2		
3		
4		

7 INTERMEDIATE MARKERS

NO.	DESCRIPTION
1	
2	
3	
4	

8 DESCRIPTION OF BOUNDARY FENCE OR MARKING

NONE

9 NO. OF STRIPS/ROWS: ....

DESCRIPTION OF STRIP/ROW MARKERS

NONE

10 LANES

NO.	WIDTH	HOW MARKED	METHOD OF CLOSING
1			
2			
3			

11

~~TACTICAL MINEFIELD~~ ~~NUISANCE MINEFIELD~~ ~~PHONEY MINEFIELD~~		ANTITANK MINES (AT) TYPE	TYPE	TYPE	TYPE	TYPE	TYPE	TOTAL AT MINES	ANTI-LIFT DEV	ANTIPERSONNEL MINES (AP) TYPE	TYPE	TYPE	TOTAL AP MINES
		NO.	NO.	NO.	NO.	NO.	NO.	NO.	NO.	NO.	NO.	NO.	NO.
MINES — BURIED AND SURFACE LAID	10E												
	A												
	B												
	C												
	D												
MINES — IN STRIPS IN ROWS W/O PATTERN	E												
	F												
	G												
	H												
	J												
TOTAL													

12 NOTES

~~1. MINE CLUSTERS AT .... METRES/PACE SPACING~~

RECORD OF BOOBY TRAPS LAID AT BUILDING 267

TRAP #1, TOP OF STAIRS TO RIGHT	TRAP #2 2nd FLOOR 2nd Window N/E
1. LOCATED UNDER FLOOR BOARDS IN DOORWAY - PRESSURE OPERATED	1. LOCATED ON WINDOW LEDGE PRESSURE RELEASE OPERATED
2. M1A1 FIRING DEVICE	2. M142 FIRING DEVICE
3. MAIN CHARGE M15 AT MINE BOOSTER CHARGE 4LB TNT	3. MAIN CHARGE - 1 SECTION OF BANGALORE TORPEDO.
4. REMOTE DET CORD CONNECTION TO TNT.	4. REMOTE DET CORD CONNECTION
5. TO NEUTRALIZE AND DISARM · REMOVE FLOORBOARD REPLACE PINS AND CLIPS.	5. TO NEUTRALIZE AND DISARM REPLACE PINS.

13 SIGNATURE (OFFICER IN CHARGE) Roger P. Young LT DATE 11 Jan 90

DA FORM 1355, MAR 87 EDITION OF JUL 67 IS OBSOLETE

Figure 13-5a. Booby trap record - sample DA Form 1355 (front side)

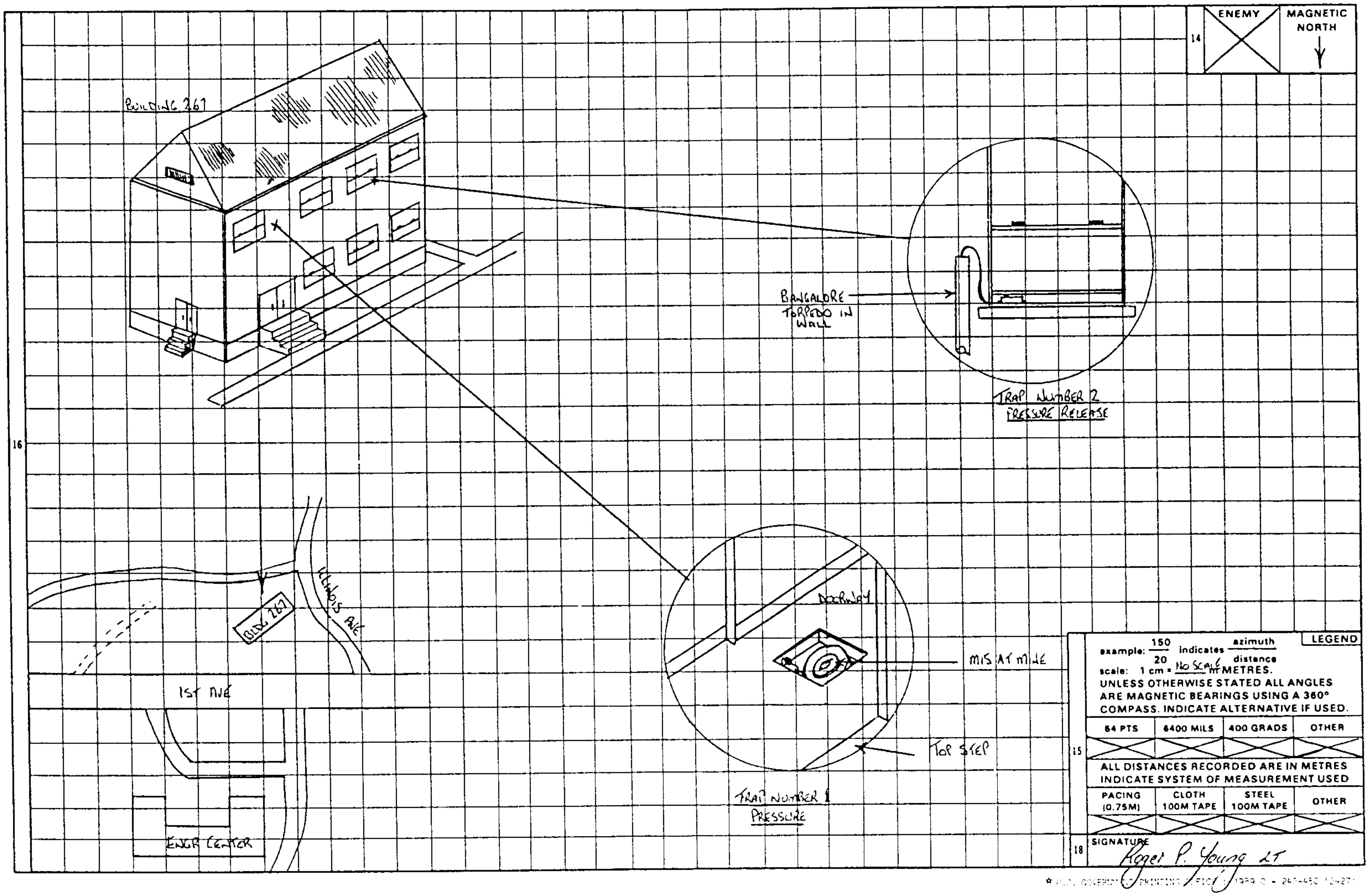


Figure 13-5b. Booby trap record - sample DA Form 1355 (inside)

MINEFIELD REQUIREMENTS COMPUTATION FORMULA

		AT	APF	APB
Desired Density		a____	b____	c____
IOE Representative Cluster		a____	b____	c____
Front ____ meters				
Depth ____ meters				
AHD ____ %				
*1. No. of IOE Clusters = Front ÷ 9	____			
2. No. of IOE clusters x IOE Representative Cluster		a____	b____	c____
3. Mines in Minefield = Front x Desired Density		a____	b____	c____
4. Subtotal of Mines Required = Line 2 + Line 3		a____	b____	c____
*5. Mine Rejections, Strip Length Variances = Line 4 x .1		a____	b____	c____
6. Total AT Mines Required = Line 4 + Line 5		a____	b____	c____
7. Add a + b + c of "Desired Density" =	____			
*8. Line 7 x .6 =	____			
9. AT Mine "Desired Density" x 3 =	____			
10. No. of Regular Strips = Highest No. of Line 8 or 9	____			
*11. No. of AHD = % AHD x Total AT Mines (Line 6)	____			
12. Strip cluster Composition = Desired Density x 3		a____	b____	c____

* NOTE: Round up to the next whole number.

	STRIP	AT	APF	APB	ROW TOTAL (Cannot exceed 5)
"CLUSTER	A	a____	b____	c____	____
	B	a____	b____	c____	____
	C	a____	b____	c____	____
	D	a____	b____	c____	____
COMPOSITION	E	a____	b____	c____	____
	F	a____	b____	c____	____
	G	a____	b____	c____	____
	H	a____	b____	c____	____
TABLE"	I	a____	b____	c____	____
	J	a____	b____	c____	____
	COLUMN TOTAL (Totals cannot exceed Line 12).	a____	b____	c____	____

TABULAR DATA (Numbers correspond to numbered blocks on front of form).
1. Enter complete data on authority of laying and on the laying unit. OIC blanks will include name, rank, and SSN.
2. Enter date-time groups for starting and completion times. Recorder blanks will include name, rank, and SSN.
3. Enter copy and sheet numbers. Number of copies will depend upon unit SOP and the classification of the minefield. The number of sheets will depend upon the length and the depth of the minefield versus scale.

4. Enter minefield number as follows:

Designation of unit authorizing installation
Number of obstacle
Status of obstacle
(E=Executed, P=Proposed, U=Under Construction). 3/147-Inf-2-E

5. Enter map data as stated on map(s) used.
6. Enter complete data on at least two landmarks with 8 digit grid coordinates. Cross out unused blocks.
7. Enter description(s) of any intermediate markers used. When a landmark is more than 200 meters from the minefield or the strip/row reference stake cannot be seen from the landmark, an intermediate marker must be used. If possible, the intermediate marker should not be closer than 75 meters to the strip/row reference stake. Cross out unused blocks.
8. Enter the word "Standard" when the standard marking fence is used; describe the boundary marking if other than the standard marking fence is used.
9. Enter the number of strips/rows laid other than IOE. Describe the strip/row markers (Line out words not applicable).
10. Enter the width, marking, and closing provisions for each lane; when appropriate, give the type and number of mines for closing. The location of these mines is described in the "Notes" (Line 12). Patrol lanes are 1 meter wide, one-way vehicular lanes are 8 meters and two-way vehicular lanes are 16 meters. Cross out unused blocks.
11. Enter type of minefield by crossing out lines not needed. Indicate method of laying by marking out incorrect descriptions. Enter types of mines as AT, APF, APB. (Enter chemical mines under AT mines). For each type of mine, enter number of mines and antihandling devices installed in the IOE and in each Strip or Row. Strips or Rows will be lettered serially, starting with the first one laid. Enter totals. Cross out unused blocks.
12. Enter under Notes information which would be useful to personnel clearing the minefield. Appropriate items include location of chemical mines, location of AT mines with antihandling devices, location AP mines with tripwires, clusters in IOE which contain mines, where safety devices are buried, strip cluster composition and numbered omitted clusters in regular strips.
13. OIC enters signature, rank and date.
14. Enter arrows for the direction of the enemy and magnetic north. The enemy arrow should always point within the top 180 degrees of the paper; the north arrow should follow one of the lines of the graph.
15. Enter scale of sketch for standard pattern minefields the sketch should be drawn to a scale of about 1cm=10 meters.
16. Sketch in the following, as applicable.
   a. Show directional arrows as follows:
      (1) Landmarks (or intermediate markers) to strip markers at starting and finishing points of the last strip laid or to the nearest or farthest mine in a group.
      (2) From landmarks (or intermediate markers) to fence or boundary markers.
      (3) From landmarks to intermediate markers, if used.
      (4) For each straight line section of a lane centerline.
      (5) Between markers of starting points of adjacent strips, including IOE, and between finishing points of adjacent strips, including (IOE).
      (6) For each segment of a strip or of the IOE, label all directional arrows with magnetic azimuth in degrees and distance in meters. Express as a fraction (247 degrees/90 meters). Recorded from friendly to enemy side and from right to left/or left to right.
   b. Show approximate location of protective fence or boundary markers.
   c. Show length and depth of minefield in meters. These dimensions indicate the extremities of the minefield.
   d. Show a grid intersection and give grid coordinates.
   e. Show trace of shoreline and direction and approximate rate in meters per second of water current, for mines laid underwater.
17. Enter security classification of the form. (If the form is used for training, enter the word SAMPLE.)
18. OIC enters signature and rank.

Figure 13-5c. Booby trap record - sample DA Form 1355 (back side)

Section II. Clearing

All soldiers must be aware of the threat presented by booby traps. They must also receive sufficient training to recognize locations and items that lend themselves to booby trapping. Avoid overemphasis and strike a balance between what is possible and what is probable. For example, in medium-level operations, overemphasis of booby-trap threat can be counterproductive by slowing momentum. This causes casualties that might otherwise have been avoided. In low-intensity conflicts, on the other hand, where the use of booby traps and improvised explosive devices are probably widespread, training must be given high priority and emphasized at all levels.

SITES

Although many booby-trapped sites are similar, the items selected, reason for their use, and scale of the threat are quite different. In medium-level conflicts, booby traps are mainly used in recently contested areas. Items selected and reasons for using traps are the same as those taught to our own troops. Therefore, by anticipating the presence of traps, it is possible to isolate and bypass trapped areas. If this is not practicable, you can plan countermeasures such as avoiding convenient and covered resting places along routes where mines can be located. At bridge or ferry sites that cannot be avoided, you must ensure they are free of traps.

In low-intensity conflicts where booby traps are used to cause casualties, delays, or disruptions, no items or areas can be considered safe. Quality collective training in booby trap awareness is necessary for all units. Rapidly disseminate booby trap incident reports to all levels. This allows personnel to develop an understanding of the enemy's method of operation and a feel for what might or might not be targets.

SAFETY

The following rules and safety procedures can save your life and the lives of others. Learn and remember them!

- Suspect any object that appears to be out of place or artificial in its surroundings. Remember, what you see might well be what the enemy wants you to see.
- Examine mines and booby traps from all angles, and check for alternative means of firing before approaching them.
- Only one man works on a booby trap.
- Do not use force. Stop if force becomes necessary.
- When tracing trip wires, check for further traps located along and beneath them.
- Do not touch a trip wire until both ends have been investigated and all devices are disarmed or neutralized.
- Treat all parts of a trap with suspicion because each part can be set to actuate the trap (see Figure 13-6, page 13-14).
- Wait at least 30 seconds after pulling a booby trap or mine. There might be a delay fuze.
- Mark all traps until they are cleared.
- Expect constant change in enemy techniques.
- Never attempt to clear booby traps by hand when pulling or destructing in place is possible and acceptable.

Figure 13-6. Traps with multiple means of intitiation

CLEARING SEQUENCE

The method used to neutralize or disarm a trap depends on whether it is electric or non-electric, its design, and the accessibility of its components. Remember, a trap cannot be considered safe until the blasting cap or detonating cord has been removed from the charge. This is your first objective and is particularly important for electric traps, which can contain a collapsing circuit.

Use the safest method to neutralize a trap. For example, if the firing device and detonating cord are accessible, it is usually safer to cut the detonating cord. This method does not actuate the trap, but inserting pins in the firing device might.

INDICATIONS

Successful booby trap detection depends on two things: (1) be aware of what might be trapped and why, and (2) be able to recognize evidence of setting. The first requirement demands a well-developed sense of intuition; the second, a keen eye. Intuition, like mine sense, is gained through experience and an understanding of the enemy's techniques an habits. A keen cye is the result of training and practice in recognizing things that indicate the presence of a trap. The presence of booby traps or nuisance mines is indicated by–

- Disturbances of ground surface or scattered, loose soil.
- Wrappers, seals, loose shell caps, safety pins, nails, or pieces of wire or cord.

- Improvised methods of marking traps, such as piles of stones or marks on walls and trees.
- Evidence of camouflage, such as withered vegetation or signs of cutting.
- Breaks in the continuity of dust, paint work, or vegetation.
- Trampled earth/vegetation or foot marks.
- Lumps or bulges under carpet or in furniture.

DETECTION

Detection methods depend on the nature of the environment. In open areas, methods used to detect mines can usually detect booby traps. Look for trip wires and other signs suggesting the presence of an actuating mechanism. In urban areas, mine detectors are probably of little use. You have to rely on manual search techniques and, if available, special equipment.

COMBAT CLEARANCE

Engineers have primary responsibility for clearing booby traps and nuisance mines in the area of operations. Therefore, engineer advice is important during the planning stages of any operation where booby traps are likely to be encountered or where mine clearance is necessary. intelligence regarding the possible presence and types of traps must be provided to engineer units as soon as possible. This allows the unit time to take necessary action and provide relevant training. Booby trap clearance can not be undertaken as a secondary task. Engineer clearing teams might require protection necessitating combined arms training. Before engineer planning can start, the staff provides commanders with the latest intelligence and, if possible, the following information:

- Amount of clearance required.
- Acceptable damage.
- Timings.
- Availability of special equipment.
- Security requirements.

Intelligence

Intelligence regarding the possible nature, density, type, and location of traps has a direct bearing on the number of clearing parties and the degree of protection required, if any. For example, in built-up areas where traps will likely be in buildings that offer protection from enemy fire, direct protection is usually provided by the normal combat situation. On the other hand, in open areas where clearing parties are required to clear traps covered by direct enemy fire, protection arrangements have to be more specific.

Timings

Engineer commanders must be aware of the time needed to clear various types of traps in differing terrain situations. Remember, increasing the number of clearing parties does not necessarily reduce the time required to clear traps. This is particularly true when traps are set closely together or set deeply along a narrow front that is the only available route.

Extent and Degree of Clearance

Initially, clear areas of immediate tactical importance or traps presenting a specific threat. For example, clear only the portion of a building required for observation and those traps presenting an immediate hazard. This enables clearing parties to concentrate on other areas of tactical importance.

Acceptable Damage and Security

Clearing traps by hand is the only way damage can be avoided and security guaranteed. This should only be attempted when it is vital to maintain silence (and thus conceal the operation from the enemy) or to avoid equipment or structure damage. It is often necessary to balance the requirement to remain silent and avoid damage with the requirement to maintain momentum.

Equipment

When traps are being cleared in direct support combat situations, they normally have to be dealt with by using unit resources and locally manufactured or acquired aids. Specific equipment is rarely available. Equipment varies with each situation but usually consists of selected items from Table 13-2. In areas with a high incidence of booby traps, assemble and reserve special clearing kits.

Table 13-2. Mine-clearance equipment

Serial	Item	Remarks
(a)	(b)	(c)
	Unit Equipment	
1	Mine detector	
2	Mine probe/knife/bayonet	
3	Eye protection	
4	Body armor	Flak jacket, Kevlar helmet
5	Booby trap signs	
6	Mine marking tape	
7	Mine markers	Chalk, felt-tip pens
8	Electrician's adhesive tape	
9	Flashlight	
10	Tape measure	
11	Mine marking cones	
12	Tradesman's tools	Saws, pliers, hammer, screwdrivers
13	Instant camera	
	Locally Manufactured/Acquired	
1	Trip-wire feeler	
2	Grapnel and cable	
3	Hand mirrors	
4	Pins, wire, nails	For use as safety pins
5	Meat hooks	For use as block and tackle

CLEARANCE IN SECURE AREAS

Policy and Planning

Formal clearing procedures must be followed in secure areas. This type of clearance can be done by engineer or EOD personnel. It is subject to time constraints when traps or suspected traps are located in urgently required installations or facilities (such as fuel supply dumps and telecommunications centers).

Commanders reconnoiter their areas of responsibility, make detailed plans, prepare orders, and brief their men. The following points are covered:

- Intelligence.
- How the operation is to be conducted (include acceptable damage and method(s) of clearing).
- Action on finding traps.
- Marking.
- Disarming procedures.
- Tasking and allocation of areas.
- Equipment available.
- Control measures.
- Timings.
- Rehearsal and equipment preparation.

Control Point

The operation commander establishes a control point upon arrival at the area to be cleared. The control point functions as the headquarters and material holding area. It is also the point from which all clearance starts. Its suitability might not have escaped the enemy's notice, so it must be cleared before it can be used.

Control and Size of Parties

The size of clearing parties varies depending on the location being cleared. The following rules apply:

- Each party is controlled by an NCO.
- Only one party works in a particular subarea.
- The distance between parties is sufficient so detonation in one area does not endanger persons in other areas.
- The NCOIC of each party is in visual, radio, or voice contact with every person in his party.
- Only one person works on each booby trap.

Marking

Booby traps and nuisance mines can be placed in diverse locations. It is impossible to standardize a method for marking areas, individual traps, or safe routes. Any form of prominent, permanent marking can be used.

Uncleared areas. Perimeter marking of uncleared areas can take any clearly recognized form. Standard minefield or booby-trap signs suspended from a single-strand fence are recommended. The spacing of the signs is the same as standard minefield marking. (See Chapter 7.) As the area is cleared, progressively move the fence.

Individual traps. Because booby traps can have more than one means of actuation, do not attempt to place a cone or other marker over any part of a trap. Use sufficient signs to ensure the trap can be detected and accurately located. In buildings, clearly mark rooms containing traps and, where possible, indicate the exact location of traps.

Internal marking. The internal marking system depends on the area being cleared. One good system is to divide the total area into subareas, clear and mark safe lanes between the subareas, and then use the lanes as safe routes from which clearing parties can operate.

Clearing of Open Areas

Roads, road shoulders, bridges, obstacles, and other structures must be cleared in open areas. The main threat comes from nuisance mines, so regard each potential site as a nuisance minefield and use established minefield clearing procedures. After the site is cleared, adapt the drill to suit the situation.

Clearing of Buildings

Buildings are excellent locations for enemy booby traps. They are concentrated inside the building, so carefully organize searching and clearing procedures. In most cases, buildings are required for use and excessive damage must be avoided.

A two-man clearing party can clear an average-size structure. No one else enters the building until it is cleared. In very large buildings, two or more parties can be employed if they work as far apart as possible and have clearly defined boundaries. As a general rule, two walls or two floors is the minimum distance between parties.

Exterior Reconnaissance and Entry

Before approaching a building, check the surrounding area for booby traps and nuisance mines. The team leader then carries out a reconnaissance to determine the point of entry and clears the way to it. When selecting the point of entry, consider the following points:

Doorways. Never consider doorways to be safe, unless the door is fully open and the entrance is clear. For example, if a house is built on a concrete slab, it is not likely to have a pressure firing device located in the floor.

Windows. Windows are excellent locations for booby traps. Pay particular attention to the ground outside and the floor inside because they are classic sites for pressure firing devices. Use the following procedures if access must be gained through a window:

- Pull the window if it is unsecured and can be moved. If it is secure, use a small charge or a heavy object to break the glass.
- If there is a choice between a window that can be opened and one that cannot, select the latter.
- Deal with blinds and curtains in a manner similar to procedures used for windows.

Mouse holes. If you decide not to enter the structure through a door or window, use explosives (if possible) to make a mouse hole in the wall, roof, or floor. This offers a remote, safe method of creating an access point, but it can also detonate nearby traps. Exercise caution if entering through the roof of a two-story building because it is far more difficult to clear booby traps while going down stairs than it is while going up them.

Search Techniques

It is impossible to establish a search drill that is suitable for use in all buildings. It is essential, however, for each working party to develop its own drill and follow it. Domestic dwellings should be searched in the following order:

1. Floors and furniture.

2. Walls (including doors, windows, fireplaces, and cupboards).

3. Fittings (including light switches and pictures).

4. Ceilings.

Mark each area or item *safe* as it is cleared. This can be conveniently done by using chalk or a thick, felt-tipped pen.

Precautions During Search

Use the following techniques and precautions when searching buildings. They can save your life; learn and remember them !

- Check both sides of a door before opening it. This can be done by drilling a hole through the door and using a mirror to check the other side. Doors can be further checked or opened by pulling or by blowing the lock and hinges with a small charge.

- Examine floor coverings for signs of disturbance. The presence of firing devices is often indicated by loose floorboards, bulges / tears in carpets, or loose tiles.

- Use a pulling cable to move furniture and to open cupboard doors and drawers.

- Check upholstered furniture and beds by remotely dropping a heavy object onto them.

- Since electrical wiring provides a ready-made circuit for booby traps, treat every switch with suspicion. To explode all traps connected to the normal power supply, disconnect the power at the fuze board, turn all switches on, and then reconnect the power. Repeat the procedure with the switches turned off in case the switch has been reversed. Remember, this procedure will not disclose traps that use a battery. Exercise caution when using switches, even if the power is disconnected.

- After doors, windows, cupboards, and drawers have been cleared, leave them open.

- Clearly mark all routes, areas, and items that have been cleared.

- Check plumbing by remotely turning on all water taps and allowing the water to run for at least one minute.

- Check toilet tanks before flushing.

- In dark places, such as attics and chimneys, beware of light-sensitive devices.

- After pulling anything, allow at least 30 seconds for an explosion because there might be a delay fuze.

Clearing Installations and Facilities

Clearing by hand is necessary in installations and facilities (such as fuel dumps, ammunition dumps, and electric substations) where an explosion will result in the loss of resources. In other situations, the item's importance or the resulting damage might not be obvious. For example, a small charge placed against the penstock control valves of a dam or against the main cable entering a telephone exchange results in unforeseen damage that can take days to repair. Therefore, you should seek a specialist's advice, if possible, when clearing booby traps in industrial areas and unfamiliar locations.

Clearing Obstacles

If an enemy has time to create obstacles, he also has time to set booby traps and lay nuisance mines. The obstacle itself must be clear of traps to encourage a false sense of security and lead troops into more dangerous areas. Therefore, regard all obstacles as trapped until proven otherwise. Untrapped obstacles must also be regarded with suspicion. The simplest, safest way to deal with movable obstacles is to pull them; or if you know the area is clear of mines, drive an armored vehicle through them. Before an obstacle can be pulled, you must first clear the area from which the pull will be made.

Clearing Secure Areas

When clearing secure areas and time is not a major factor, use specialized clearance equipment as much as possible. The following equipment might be available for use:

- Cameras. Cameras have a wide range of applications. They can be used with different types of film, such as infrared and ultraviolet, to disclose evidence that is indiscernible to the naked eye. For example, infrared photography reveals differences in the heat emitted by objects and can often disclose recent digging and buried or concealed objects.

- Explosive detector dogs (EDDs). Although EDDs can detect minute quantities of explosives and the presence of trip wires, they are trained to detect the charge and not the firing device. This extremely limits their usefulness in detecting booby traps. They also tend to become confused if the area contains explosive odors other than those emitting from booby traps.
- ECM. ECM can be used to explode electric booby traps and to prevent remotely controlled, improvised explosive devices from being detonated by radio.
- Robots. In their simplest form, robots can be used to detonate or neutralize booby traps. More sophisticated models can be remotely controlled to carry out simple tasks such as videotaping or cutting wires.
- Body armor.
- Electric meters.
- X-ray equipment.

CLEARANCE METHODS

Pulling. This method uses a cable and grapnel to pull the trap. It is used when the resulting damage is acceptable. It is the safest method and is particularly applicable to traps set in open areas. Do not disturb any part of a booby trap when placing the grapnel and pulling the cable. Carefully select the site from where the pull is to be made because it might be mined or trapped. When a booby trap is pulled and does not explode, wait at least 30 seconds before approaching it in case delay devices have been used. Disposal of unexploded traps depends on their condition when inspected. The procedure for pulling booby traps is similar to that for pulling mines. (See Chapter 9.)

- Trip wires. Check the cover area for AP devices before proceeding. Place the grapnel hook as close as possible to the trip wire. Do not touch the trip wire until the pulling party is behind cover.
- Pull and release. Pull away objects that conceal and operate pull and release mechanisms.
- Pressure mechanism. Pull pressure mechanisms out from under objects that conceal and operate them. If this is not possible, blow them in place.
- In many cases, it might be easier to pull the charge than the firing device. Take extreme care when attempting this. Additional mechanisms are often concealed in or under the main charge.

Destructing in place. When destructing booby traps in place, explode a small charge near the booby trap's charge. Again, use this method only if damage from the explosion is acceptable. When it is impossible to place the explosive close enough to ensure actuation of the main charge, carefully place it alongside the mechanism. Do not assume the main charge is safe to handle just because the mechanism has been destroyed. Actuate pressure mechanisms by suspending one-half pound of explosive above the pressure plate.

Clearing by hand. This method involves neutralizing, disarming, removing, and disposing traps without causing damage. It is extremely hazardous and should only be used when pulling or destructing traps in place is impossible or unacceptable. Carefully examine all aspects of the trap before deciding how to clear it.

Explosive line charge. Using this device produces quick results when only a narrow path is required through a booby-trapped area. It only gives clearance for the same distance to either side, as it will against mines, and then only where it is in contact with the ground.

Armor. This method is used where traps with small charges (designed as AP devices) are located in open areas. Armored vehicles track back and forth over the area. This shortens the clearing time with little risk of casualties.

Fire. If traps arc set in grass or dense vegetation, fire can be used to burn away camouflage material and expose traps. In most cases, sufficient heat is generated to burn or explode the traps. Unexploded traps are considered extremely sensitive and must not be cleared by hand.

Animals. You can drive a herd of animals through a trapped area to clear mines. This provides a comparatively safe path, and the size can be increased by repeatedly traversing the herd through the area.

IMPROVISED TRAPS

In low-intensity conflicts, there in a high incidence of enemy improvised mines and booby traps. It is impossible to provide a complete list of firing devices and improvised demolition material that can be used. However, most improvised traps are variations of those described below.

An electric firing device only requires a current to be passed between two contacts. The ways in which this can be achieved are limited only by the imagination. Examples of simple electric firing devices that can be manufactured using household items or appliances are illustrated in Figure 13-7, page 13-22. Examples of improvised mechanical firing devices are shown in Figures 13-8 and 13-9, pages 13-23 and 13-24.

The simplest and most accurate method of incorporating delay is to use some form of clock or timer. However, any mechanism or chemical reaction that takes a measurable time to complete its function can be used. Examples of simple improvised delay devices are shown in Figures 13-10 and 13-11, pages 13-25 and 13-26.

NONEXPLOSIVE TRAPS

Nonexplosive traps are typically used in tropical or rain forest regions. Ideal construction materials abound, and concealment in surrounding vegetation is relatively easy. No prescribed procedures exist for clearing nonexplosive traps. Each trap must be cleared according to its nature. The following nonexplosive traps have been encountered:

Punji. The punji (Figure 13-12, page 13-27) is one of the simplest traps. It is normally made from locally available material such as sharpened stakes, nails, or heavy gauge wire. It is placed in concealed pits or in places that give cover from fire. The enemy normally smears the spikes or cutting edges with excrement or poison. You should immediately sterilize cuts and abrasions received while clearing a punji and see a medical officer as soon as possible.

Closing trap. The side-closing trap (Figure 13-13, page 13-27) consists of two wooden slats that are studded with spikes. The slats slide along a pair of guide rods controlled by heavy bands. When the prop holding the slats apart is dislodged, the slats spring together implanting the spikes into the portion of the body passing between them.

Spike board. The spike board (Figure 13-14, page 13-27) is used in a pit and consists of a treadle board with one end spiked. When a man steps on the board, the spiked end flies up striking him in the face or chest.

Venus fly trap. The venus fly trap consists of a rectangular framework with overlapping barbs emplaced in a pit. The one illustrated in Figure 13-15, page 13-27, is made from a metal container, sunk into the ground until the top is flush. It is then covered with grass and/or leaves. The barbs inflict injury, especially when the victim attempts to withdraw his leg from the trap. These traps are typically located on tracks and along road edges.

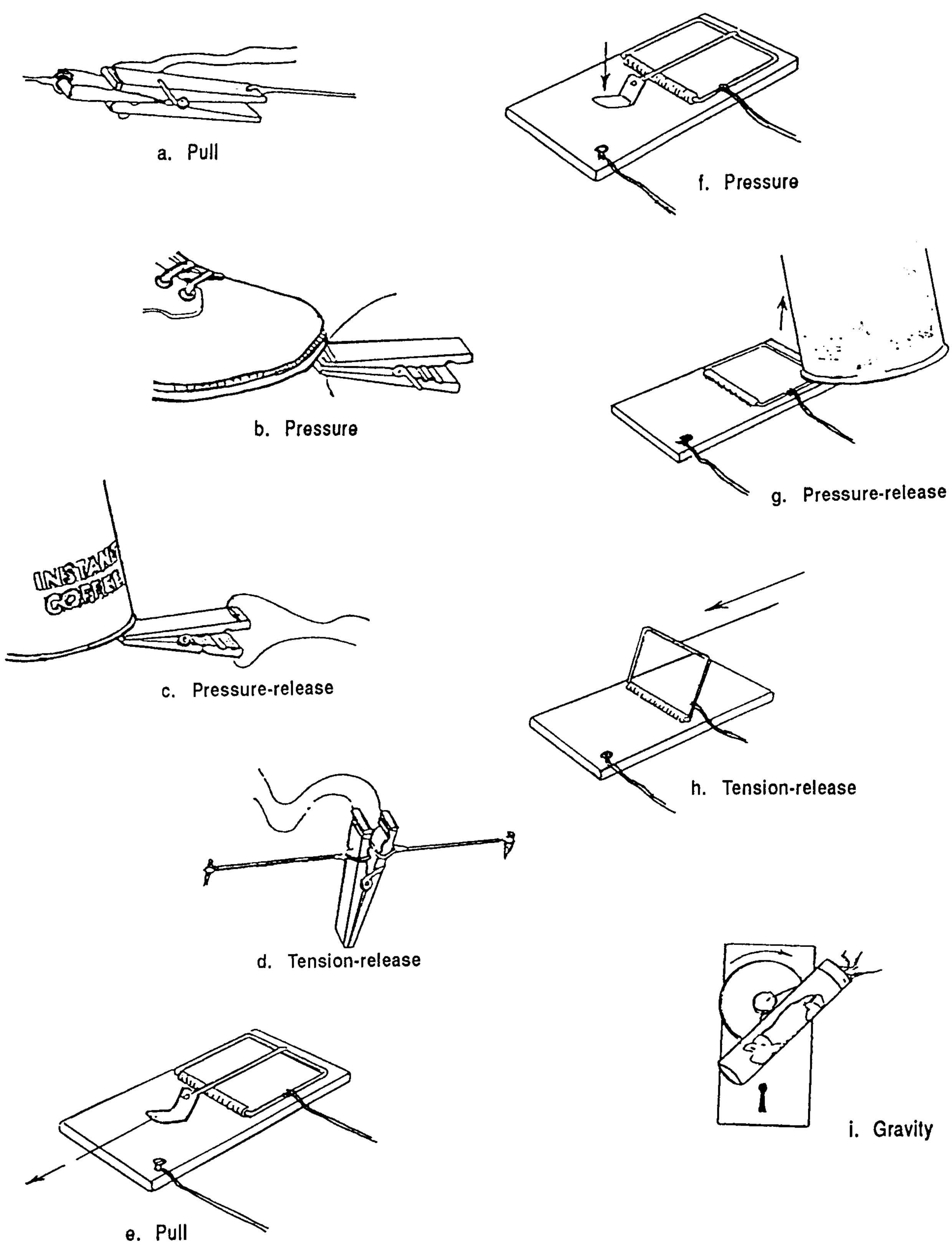
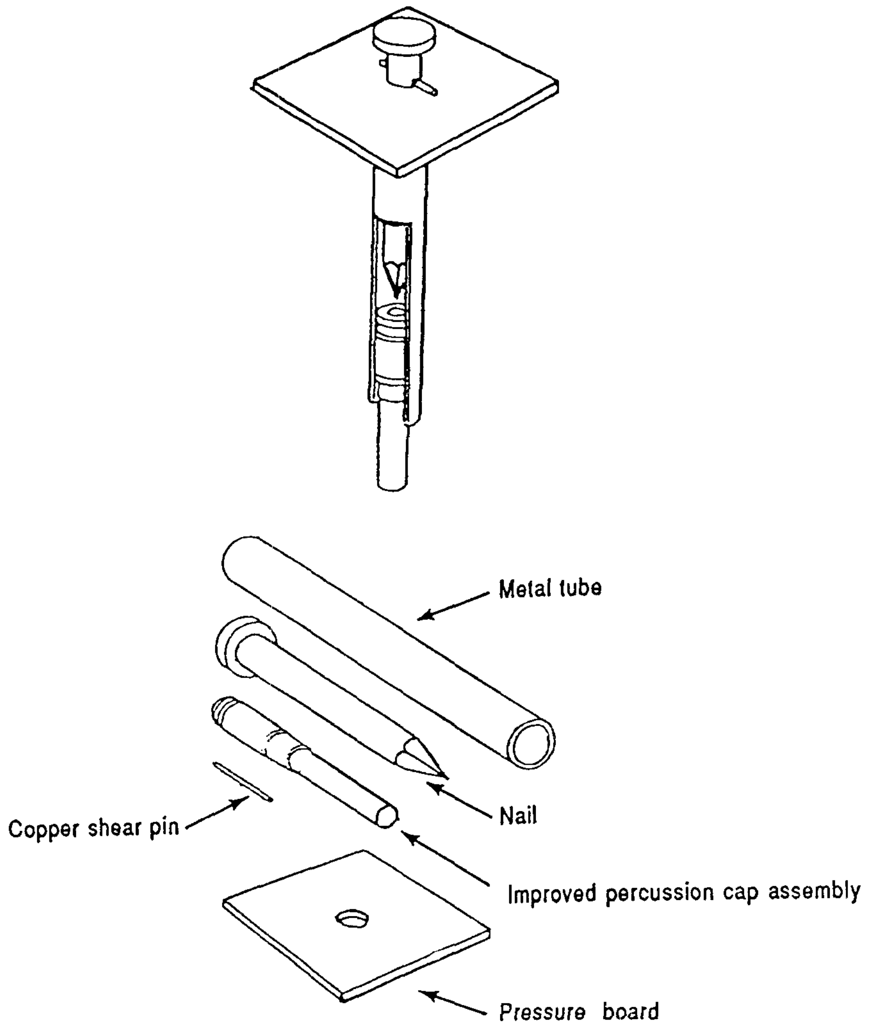


Figure 13-7. Improvised electrical firing devices



NOTE:
Improvised percussion cap assembly consists of small arms round and a nonelectric blasting cap.

Figure 13-8. Improvised nonelectric firing devices (shear-pin operated)

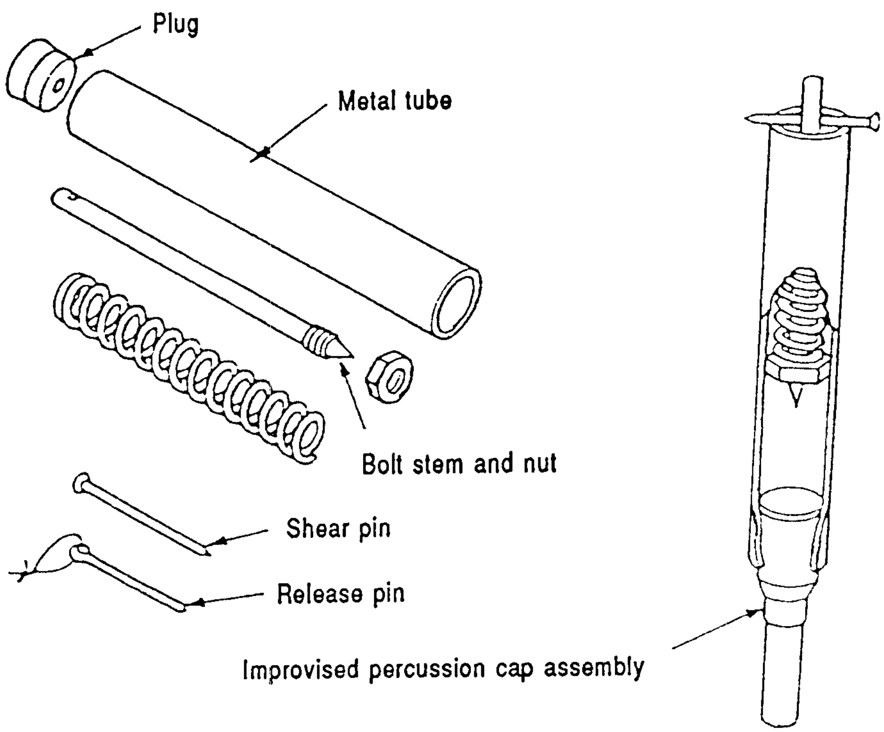


Figure 13-9. Improvised nonelectric firing devices (spring-operated)

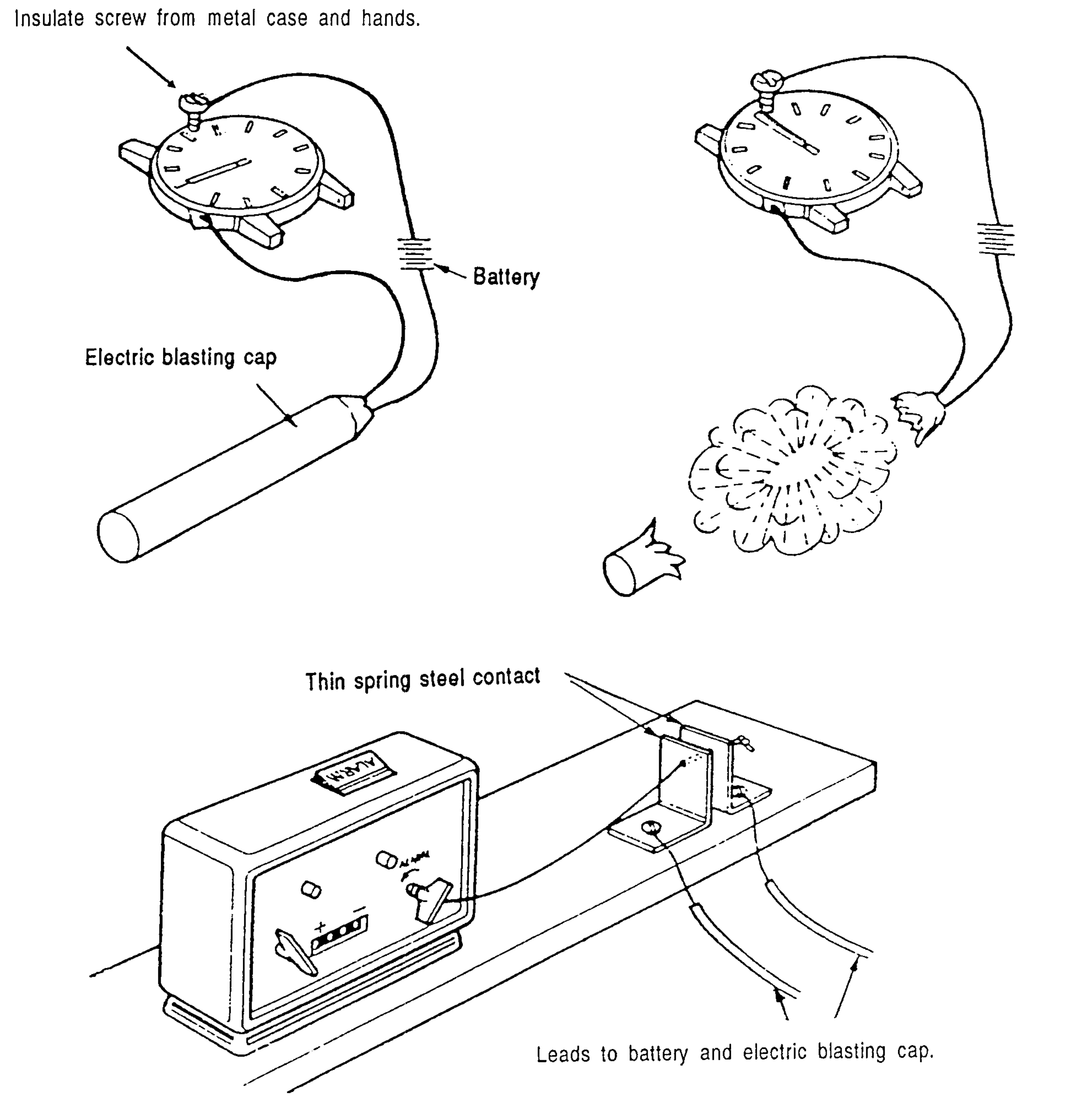


Figure 13-10. Improvised electric delay devices

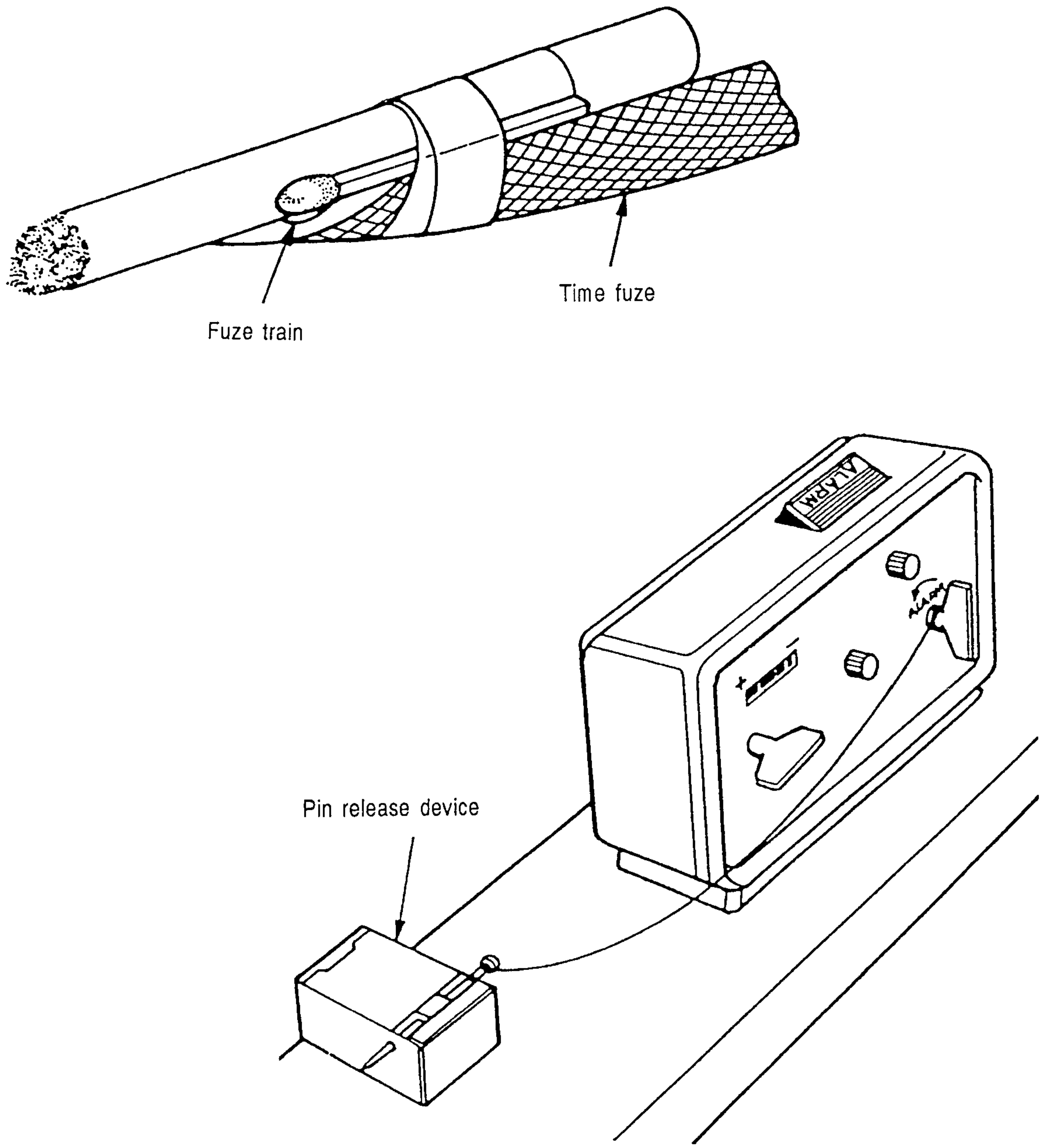


Figure 13-11. Improvised nonelectric delay devices

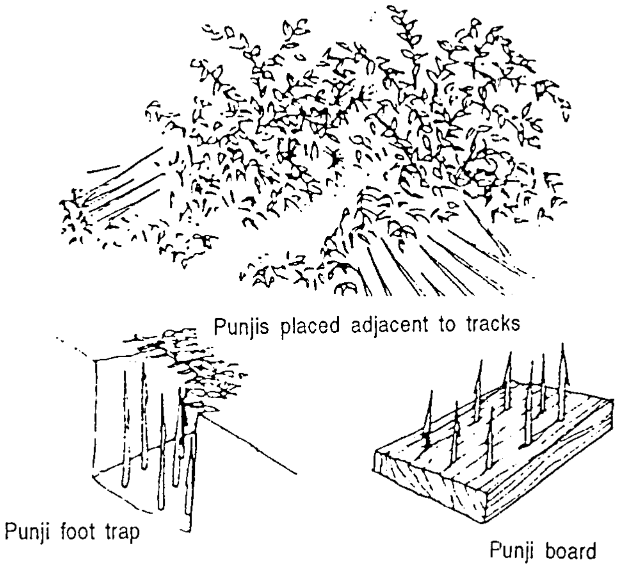


Figure 13-12. Typical punjis

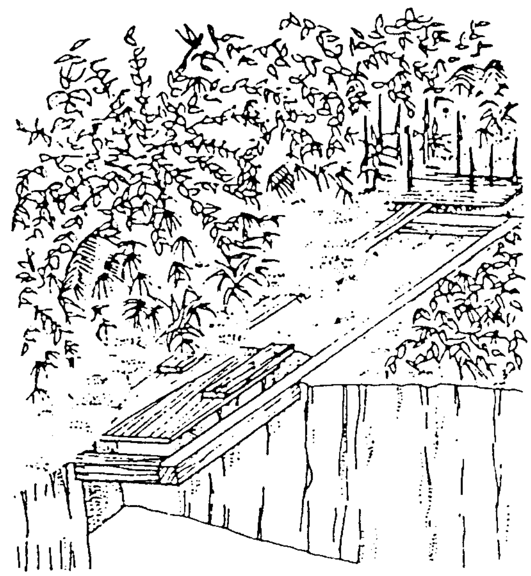


Figure 13-14. Spike board

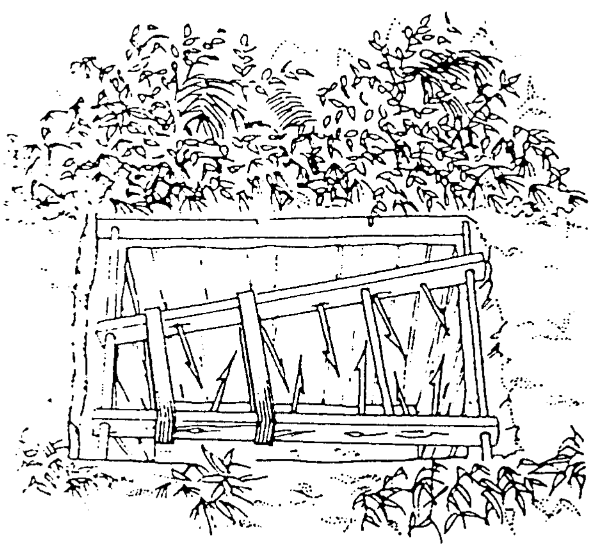


Figure 13-13. Side-closing trap

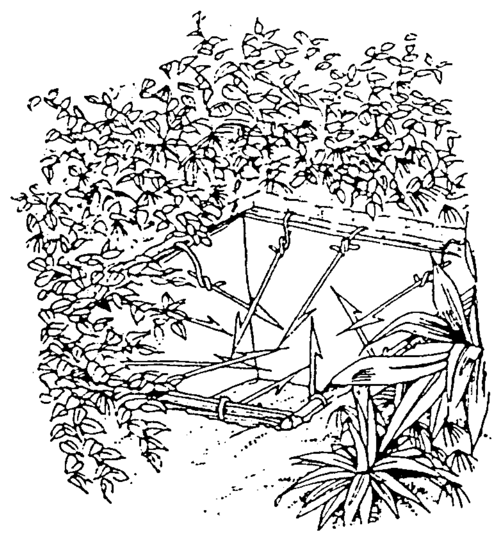


Figure 13-15. Venus fly trap

APPENDIX A

INSTALLATION AND REMOVAL OF US MINES AND FIRING DEVICES

Warnings

1. If there is a problem when performing any installation or removal step, notify the NCOIC.

2. If you hear a click when removing the safety clip, or if the pressure plate snaps downward so it is level with the body of the mine, notify the NCOIC. DO NOT use the mine.

3. If the safety clip cannot be reinserted, notify the NCOIC.

4. Do not apply pressure to the pressure plate, tilt rod, or fuze at any time.

5. Before attempting to disarm and remove the mine, check for booby traps, damage, and malfunctions. If any of these conditions exist, notify the NCOIC. DO NOT attempt to disarm the mine.

6. If you feeI a jar or hear a metallic click when removing the locking safety pin, stop and notify the NCOIC. The firing pin has gone forward and is resting on the positive safety pin. DO NOT remove the positive safety pin.

7. After removing the positive safety pin, proceed with extreme caution. The slider pin can detonate the mine if it is accidently pushed in.

8. When attaching trip wires to the release pin ring on the fuze, leave a little slack in the wires. This prevents pull on the release pin ring, which could set off the mine when the safety pins are removed.

9. Ensure the extension rod is vertical and is not tilted in any direction. A 20-degree tilt of the extension rod will detonate the mine.

10. Ensure the safety fork moves freely. If there is pressure on the fork, DO NOT remove it.

11. Do not apply pressure to the pressure plate of the fuze when inserting it into the fuze well.

12. If the setting knob is difficult to turn, do not force it. Notify the NCOIC.

13. Do not adjust the setting knob while the detonator is in the detonator well.

14. If any cracks are noted in the plastic collar, slowly and carefully reassemble the stop and safety pin on the fuze. Carefully remove the extension rod and the fuze from the mine. Give the fuze to your NCOIC and replace it with a new fuze.

15. Before cutting loose trip wires, look at each end to ensure there are no electric-producing devices that might initiate another system.

Section I. Antipersonnel Mines

MINE, ANTIPERSONNEL, NONMETALLIC, M14

The M 14 mine (Figures A-1 and A-2) is a nonmetallic, blast-type AP mine. It has a plastic body and an integral plastic fuze with a steel firing pin.

M14 CHARACTERISTICS

Main Chg	Dia	Ht	Wt	No Mines Per Box	Wt Per Box
Tetryl 1 oz	2.19"	1.56"	3.5 oz fuzed	90	44 lb

- **Employed in protective, tactical, and nuisance minefields.**
- **Size allows for employment in large numbers, and rapid concealment is possible.**
- **Bury mine to prevent target from knocking it over.**
- **Not designed to kill, but to penetrate boot and foot.**
- **Difficult to detect because of plastic construction.**
- **Operating force of 20 to 25 pounds to activate.**

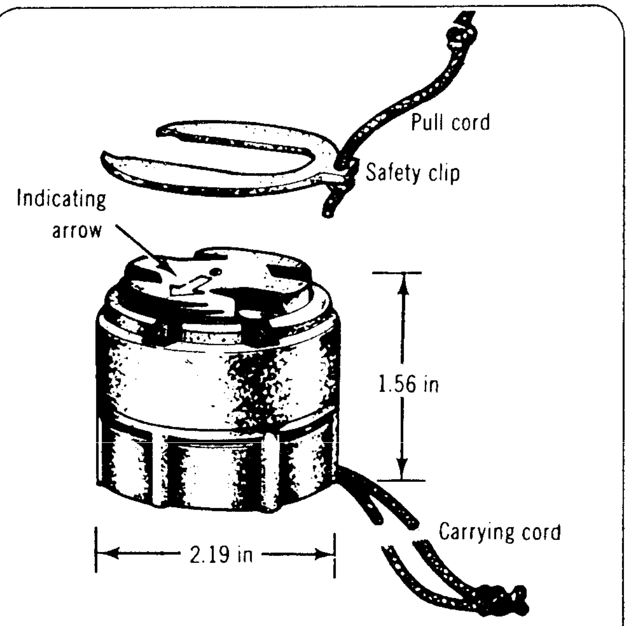


Figure A-1. M14 antipersonnel mine

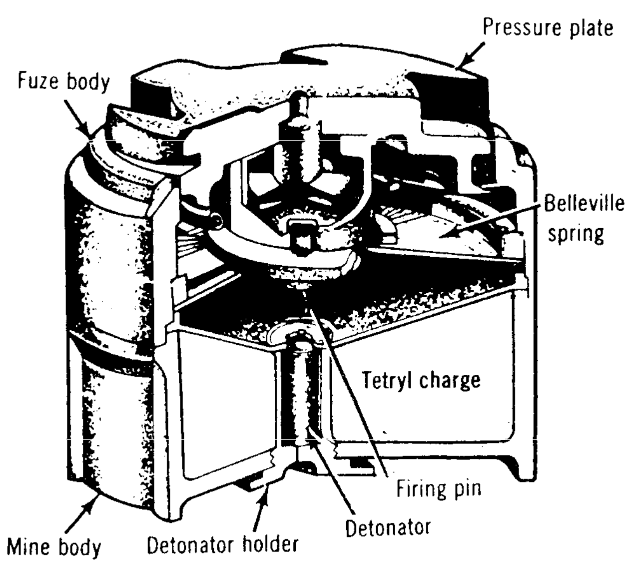


Figure A-2. M14 antipersonnel mine

INSTALLATION

1. Inspect the mine.

a. If the mine is dented, cracked, or damaged, DO NOT USE IT.

b. Use the M22 wrench (Figure A-3), packed in the box with the mines, to unscrew the white plastic shipping plug from the detonator well in the bottom of the mine.

c. Inspect the position of the firing pin. If it extends into the detonator well, it is unsafe to use. DO NOT USE IT.

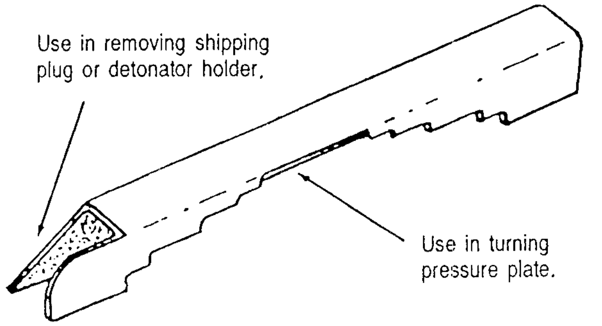


Figure A-3. M22 arming wrench

d. Inspect the detonator well for foreign material. If foreign material is present, remove it by carefully tapping the mine against the palm of your hand. If it cannot be removed, replace the shipping plug. DO NOT USE IT.

2. ***Test the pressure plate.***

a. Ensure the arrow is in the SAFE (S) position.

b. Use the M22 wrench to turn the pressure plate from the SAFE (S) to the ARMED (A) position (Figure A-4).

★ c. Grasp the mine in one hand and with the other hand remove the safety clip. (This procedure is necessary to listen for the click that indicates the firing pin has dropped.) Recheck the fuze well (Figure A-5).

d. Replace the safety clip.

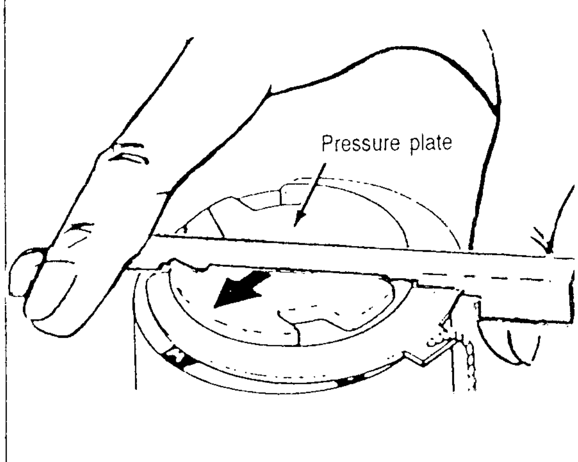


Figure A-4. M14 mine in ARMED positi

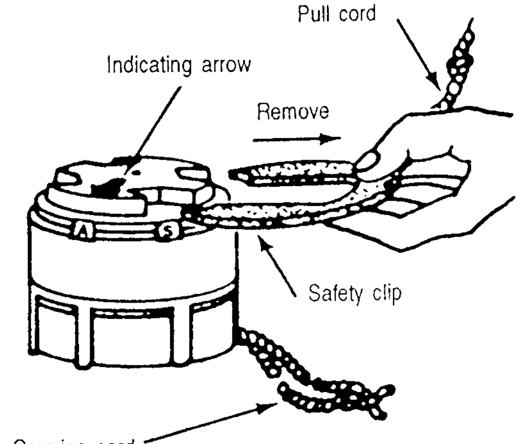


Figure A-5. Removal of safety clip

e. Use the M22 wrench to turn the pressure plate back to the SAFE (S) position.

3. ***Screw the 6-sided detonator into the weU on the bottom of the mine*** **(Figure A-6).**

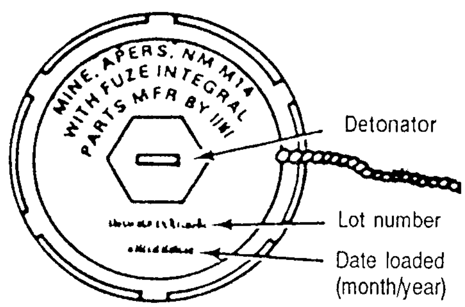


Figure A-6. Bottom view of M14 mine

NOTE: Ensure the rubber gasket is tightly wedged between the detonator and the body of the mine so water cannot enter the mine.

4. *Dig a hole to fit the mine.*

a. Dig a hole about 4 inches in diameter and deep enough (about 1 1/2 inches deep) so the pressure plate extends above the ground.

b. Check the ground surface at the bottom of the hole.

(1) Ensure the ground is hard enough to support the mine when pressure is applied to the pressure plate.

(2) If the ground is too soft, place a nonmetallic object in the bottom of the hole for the mine to rest on. Allow additional depth for the object.

5. *Arm the mine with an M22 wrench by turning the pressure plate to the ARMED (A) position* (Figure A-5, page A-3).

6. *Place the mine in the hole.*

7. *Carefully remove the safety clip while holding the mine* body firmly in *the hole.*

8. Camouflage the mine.

a. Carefully camouflage the mine and remove the extra soil from the area.

b. Give the safety clip and the shipping plug to the NCOIC.

REMOVAL

★ ***9. Disarm the mine.***

a. Carefully clear the soil away from the mine.

b. Grasp the body of the mine firmly with one hand, and insert the safety clip with the other hand,

c. Remove mine from hole.

d. Use the M22 arming wrench to turn the pressure plate until the arrow points to the SAFE (S) position.

★ **10. *Remove the mine from the hole.***

a. Turn the mine over and carefully remove the detonator from the detonator well.

b. Screw the plastic shipping plug into the detonator well.

c. Give the detonator to the NCOIC.

MINE, ANTIPERSONNEL, M16A1

The Ml6A1 (Figures A-7 and A-8) is a bounding fragmentation-type mine. Once actuated, the mine is propelled out of the ground (to a height of approximately 6 feet) and explodes. The mine consists of an M605 fuze, a propelling charge, and a projectile. They are contained in a sheet-steel case. The fuze is screwed into the top of the case and extends through the center of the projectile to the bottom of the case where the propelling charge is located, The remaining space inside the case is occupied by the projectile. Earlier versions of the mine are also available for issue. The principal difference between the old and new version is the construction of detonators and boosters.

M16A1 CHARACTERISTICS

Main Chg	Dia	Ht	Wt	No Mines Per Box	Wt Per Box
TNT (1 lb)	4"	4.7"	8 lb.	4	45 lb

- **Employed in protective, tactical, and nuisance minefields.**
- **Used to defeat dismounted assaults and breaching operations.**
- **Mine is either pressure- or pull-actuated. Eight to 45 pounds of pressure in pressure mode; 3 to 15 pounds of pull in trip-wire mode.**
- **The M16A2 has a casualty radius of 30 meters. The M16 and M16A1 have a casualty radius of 27 meters. Danger radius for friendly forces is 183 meters for both mines.**

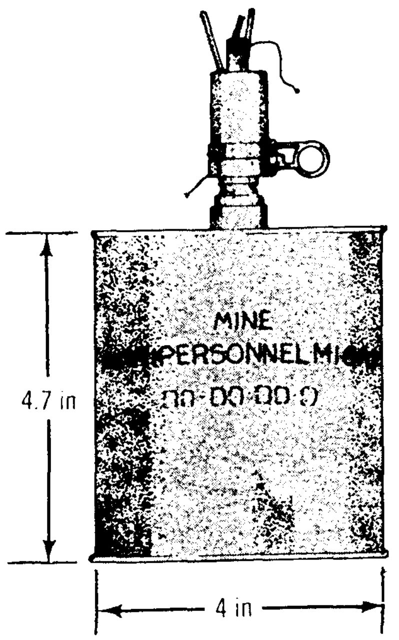


Figure A-7. M16A1 antipersonnel mine

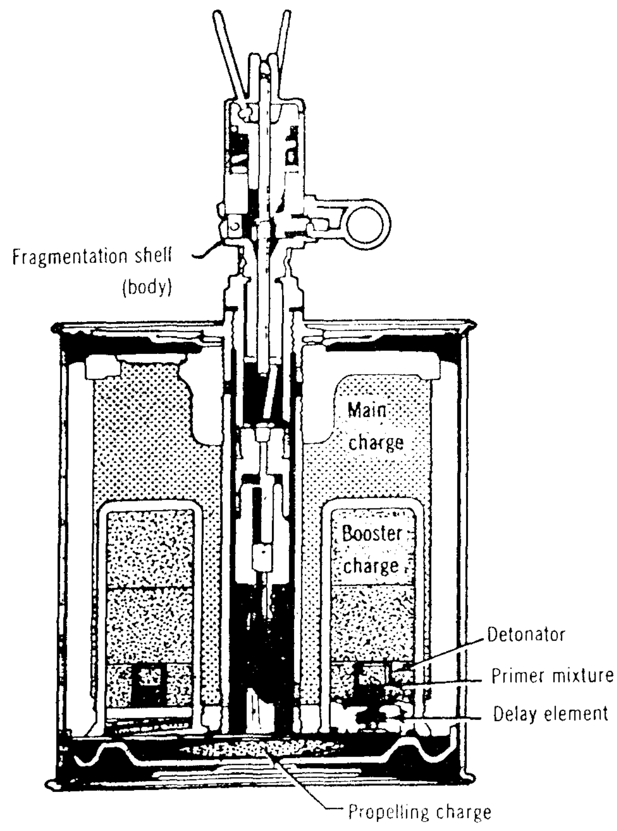


Figure A-8. M16A1 antipersonnel mine

INSTALLATION

1. *Inspect* the mine.

a. If the mine is dented, cracked, or damaged, DO NOT USE IT.

b. Use the closed end of an M25 wrench to unscrew and remove the hexagonal shipping

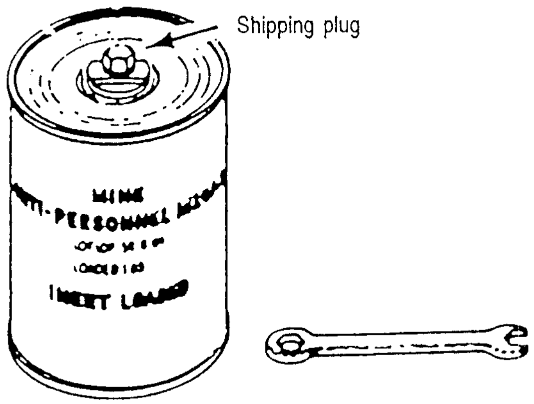


Figure A-9. M16A1 mine and M25 fuzing wrench

plug from the fuze well of the mine (Figure A-9).

c. Examine the fuze well for foreign material. If foreign material is present, turn the mine upside down and gently tap the bottom with your hand to dislodge it. If it cannot be removed, replace the shipping plug. DO NOT USE THE MINE.

d. Carefully examine the fuze assembly for evidence of damage or missing safety pins. Ensure the safety pins move freely in the safety-pin holes. Ensure the rubber gasket is around the fuze base (Figure A- 10).

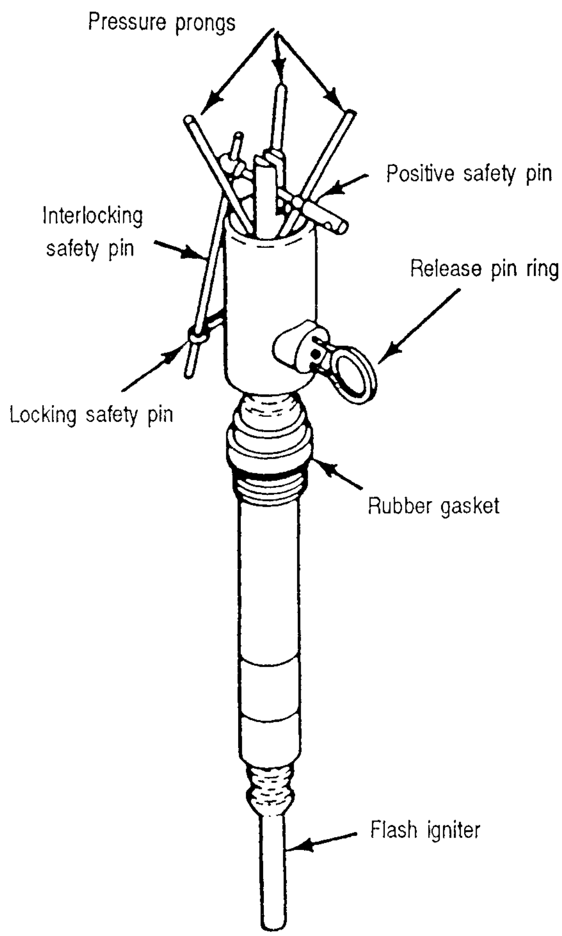


Figure A-10. M605 fuze

2. Fuze the mine.

a. Use the open end of the M25 wrench to tighten the bushing adapter on the fuze well.

b. Screw the fuze assembly into the fuze well by hand. Using the wrench, ensure that the fuze is tight and the rubber gasket is between the fuze body and the bushing adapter.

NOTE: For long-term use, smear a thin layer of silicone grease or similar lubricant on the fuze and threads.

3. *Dig a hole to fit the mine.*

a. For pressure installation, dig the hole so only the pressure prong tips are above ground level.

b. For trip-wire installation, dig the hole so the release-pin ring is above ground level.

4. Emplace the mine.

a. Place the mine in the hole and ensure the safety pins remain in place.

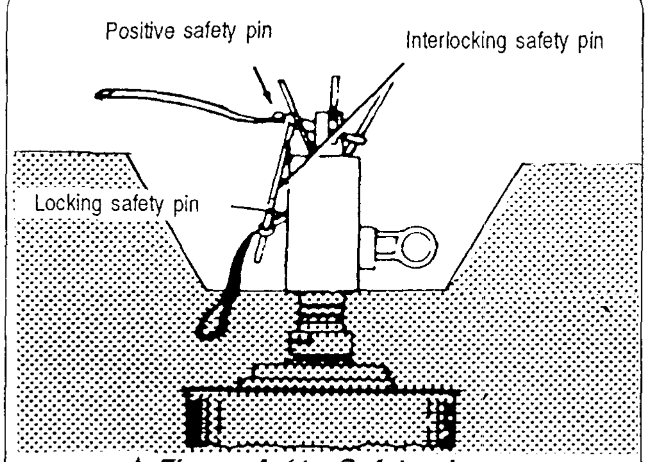
b. Cover the mine with soil to the bottom of the release-pin ring.

c. Press the soil firmly around the sides of the mine.

NOTE: Proceed to paragraph 6 for trip-wire installation. Continue to paragraph 5 for pressure-role installation.

5. *Perform pressure-role installation.*

a. Remove the locking safety pin (Figure A- 11). The interlocking safety pin will come free.



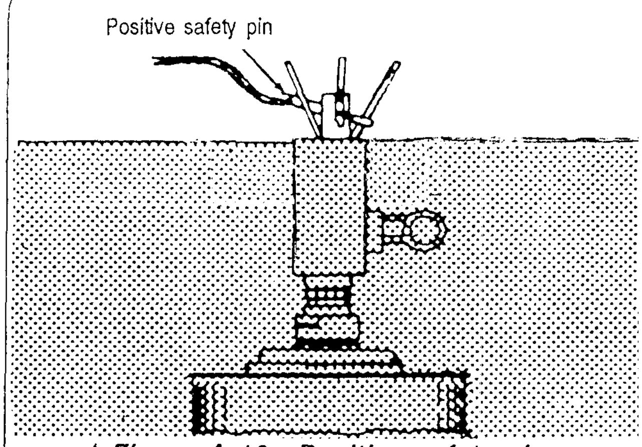
★*Figure A-11. Safety pins*

b. Arrange the pull cord on the positive safety pin so it withdraws easily.

c. Finish covering the mine with soil until only the pressure prongs are above ground level.

d. Camouflage the mine, place excess soil in sandbags, and remove them from the area.

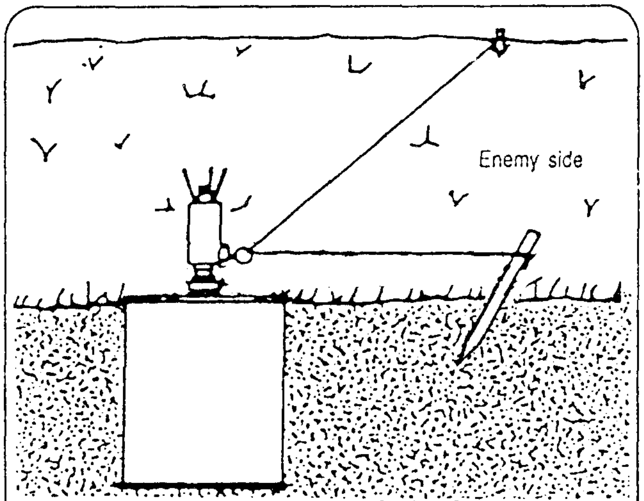
e. Arm the mine by removing the positive safety pin (Figure A- 12).



★*Figure A-12. Positive safety pin*

f. Give the safety pins and shipping plug to the NCOIC.

6. *Perform trip-wire installation (Figure A-13).*



★*Figure A-13. Buried mine (trip-wire installation)*

a. Cover the mine with soil, pressing it firmly around the sides of the mine. Leave the release-pin ring and the pressure prongs exposed.

b. Tie off trip wires approximately 10 meters from the mine. The wires should form a wide V with the opening toward the enemy.

c. Attach the trip wires to the release-pin ring on the fuze.

d. Remove the locking safety pin. The interlocking safety pin will come free.

e. Arrange the pull cord on the positive safety pin so it withdraws easily.

f. Camouflage the mine. Place excess soil in sandbags and remove them from the area.

g. Arm the mine by removing the positive safety pin.

h. Give safety pins and shipping plug to the NCOIC.

REMOVAL

WARNING
Before attempting to disarm and remove the mine, ensure the metal collar (Figure A-14) over the top of the striker on the M605 fuze is in place

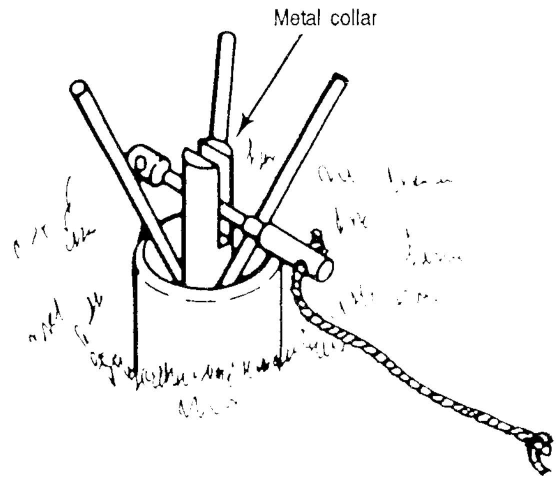


Figure A-14. Metal collar on M605 fuze

7. Disarm the mine.

a. Carefully clear the soil from the top of the fuze.

b. Insert the positive safety pin through the positive safety-pin hole.

c. Insert the locking safety pin through the locking safety-pin hole.

d. Cut the slack trip wires attached to the release-pin ring.

8. Check for AHDs.

a. Hold the mine body firmly in place with one hand.

b. With the other hand, feel for AHDs by digging around the sides and underneath the mine.

9. Remove the mine.

a. Remove the mine from the hole. Ensure the safety pins remain in place.

b. Unscrew and remove the M605 fuze with the M25 wrench.

c. Replace the shipping plug in the fuze well.

Section II. Antitank Mines

AT mines are designed to immobilize or destroy tanks, vehicles, and their crews. They perform this function by producing either an M-Kill or a K-Kill. An M-Kill is achieved by destroying one or more of the vehicle's vital drive components (usually breaking the track on a tank), which causes the target to be immobilized. With an M-Kill, the weapon system and crew are not destroyed. The weapon system, although immobile, continues to function. A K-Kill results when the weapon system or crew is destroyed, and the vehicle can no longer perform its intended mission.

Conventional AT mines are distinguished by their warheads and the type of fuzing mechanism used, Blast AT mines, such as the M 15 and M 19, derive their effectiveness through the blast caused by detonation of an HE. These mines usually produce an M-Kill, but a K-Kill can result. SFF mines, such as the M21, utilize a direct energy (shaped charge-like) warhead designed to penetrate the underside of a vehicle's armor. It sprays shrapnel throughout the inside of the vehicle, and kills the crew. A K-Kill normally results.

MINE, ANTITANK, HE, HEAVY, M l5

The Ml 5 mine (Figures A- 15 and A- 16) is a blast-type, AT mine contained in a round, sheet-steel casing. The primary fuze well is located in the top center of the mine. There are also two secondary fuze wells - one on the side and one on the bottom of the mine. The primary fuze well accepts an M603 pressure-actuated fuze. A standard firing device (FD) can be used in the secondary fuze wells with the Ml activator. The M624 tilt rod-actuated fuze can also be used with this mine.

M15 CHARACTERISTICS

Main Chg	Dia	Ht	Wt	No Mines Per Box	Wt Per Box
Comp B (22 lb)	13.13"	4.88"	30 lb	1	40 lb

- Employed in protective, tactical, and nuisance minefields.
- Emplaced on the surface or buried by hand.
- A force of 350 to 750 pounds is required to detonate the M603 fuze. A force of 3.75 pounds is required to deflect the tilt rod and detonate the M624 fuze.
- Designed to defeat heavy tanks.
- Produces an M-Kill upon contact with the track or tilt rod.
- Twenty-two pounds of composition B is sufficient to penetrate the belly armor of most threat vehicles.

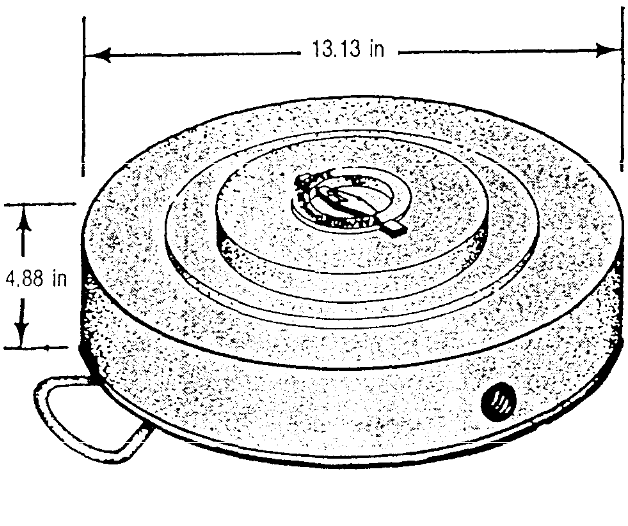


Figure A-15. M15 antitank mine

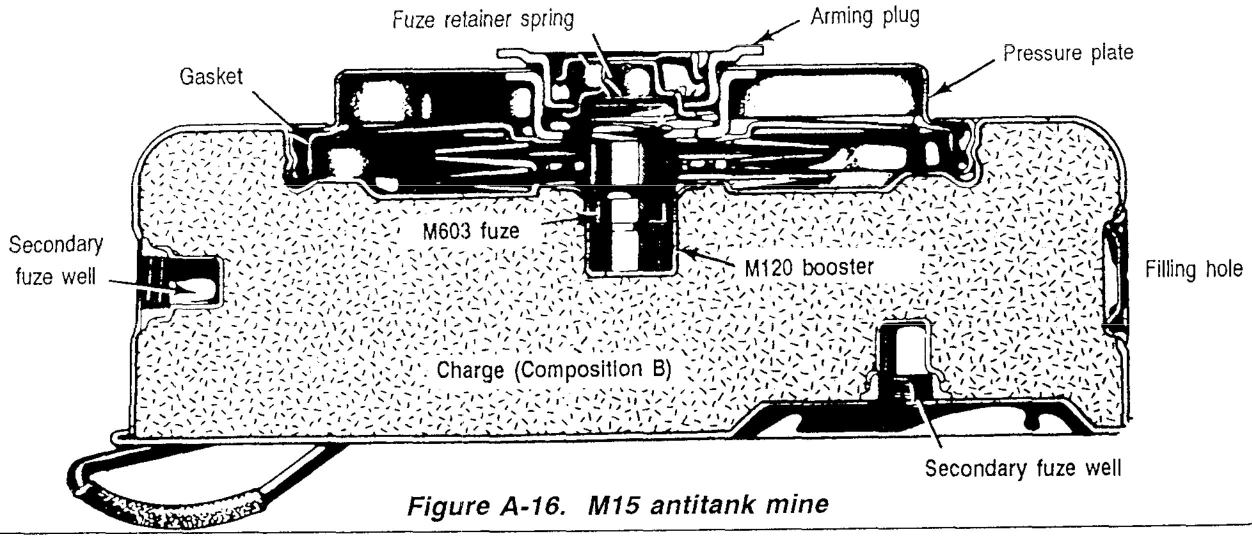


Figure A-16. M15 antitank mine

INSTALLATION USING THE M624 FUZE

1. Inspect the mine.

a. If the mine is dented, cracked, or damaged, DO NOT USE IT.

b. Use the M20 arming wrench to unscrew and remove the arming plug from the mine (Figure A- 17).

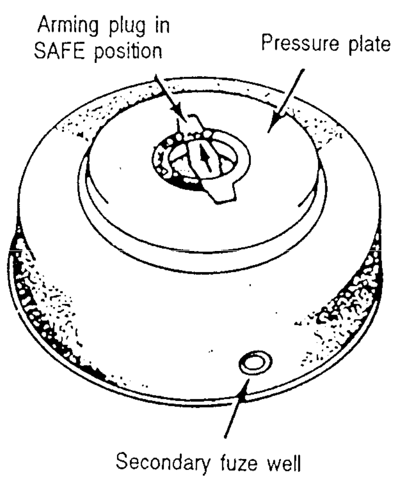


Figure A-17. M15 antitank mine

c. Examine the fuze well for foreign material. If foreign material is present, turn the mine upside down and gently tap the bottom with your hand to dislodge it. If it cannot be removed, replace the arming plug. DO NOT USE IT.

d. Ensure the booster retainer ring is seated in the fuze well. If the retainer ring is missing, replace the mine.

2. Inspect the fuze.

a. Before removing the M624 fuze from its metal shipping container, inspect it for ser - viceability.

b. Inspect the plastic collar of each fuze by looking down through the top of the pressure ring. If the safety pin is missing or improperly

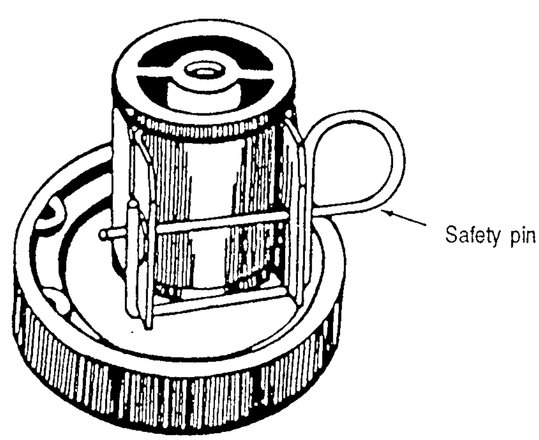


Figure A-18. Correct safety pin configuration

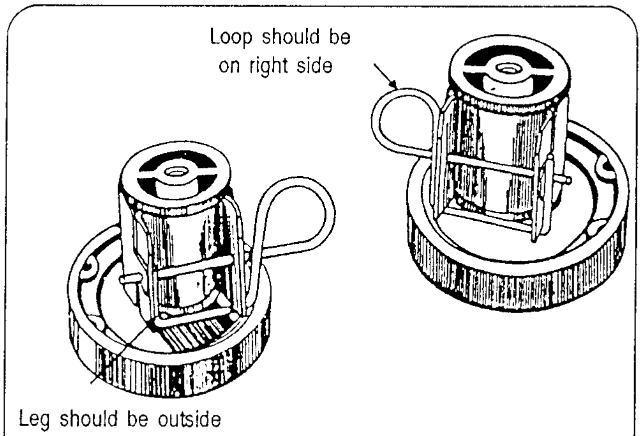


Figure A-19. Incorrect safety pin configuration

assembled, DO NOT USE IT (Figures A- 18 and A-19).

c. If the plastic collar appears cracked, DO NOT USE IT.

3. Fuze the mine.

a. Remove the M624 fuze from its fiber sleeve,

NOTE: For long-term emplacement, coat the fuze threads and gasket with silicone grease before removing the end closure (Figure A-20).

b. Unscrew and remove the end closure on the M624 fuze.

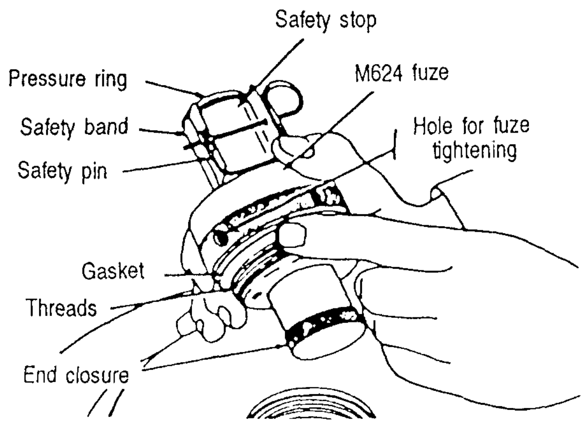


Figure A-20. Greasing of M624 fuze

c. Screw the fuze hand-tight into the threaded fuze well of the M 15 mine.

d. Remove the extension rod from its packaging.

e. Tighten the fuze by inserting one unthreaded end of the extension rod piece into a hole on the side of the fuze. Turn the fuze a quarter turn (Figure A-21).

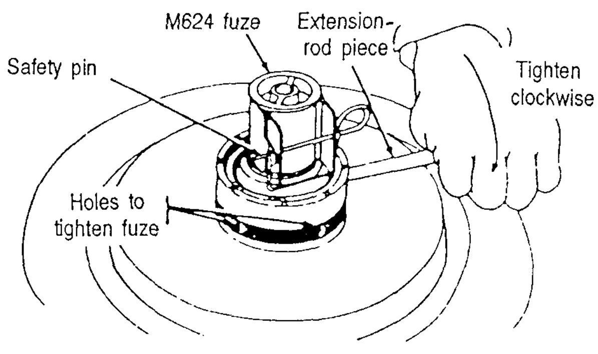


Figure A-21. Tighten fuze with the extension rod

f. After the fuze is secure, remove the exten - sion rod for further use.

NOTE: The M15 AT mine with the M624 fuze can be buried or surface-laid.

4. Dig a hole to fit the mine.

a. Dig a hole deep enough so the top of the mine pressure plate will be at ground level.

b. Dig the sides of the hole at a 45-degree angle to prevent vehicles from bridging the mine.

5. Emplace the mine.

a. Place the mine in the hole.

b. Cover the mine with 1 inch of soil (Figure A-22).

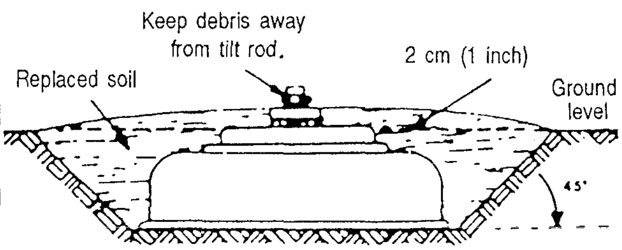


Figure A-22. M15 mine in hole

NOTE: The Ml 5 AT mine (with the M624 fuze) can be used in the tilt-rod role or set up in the pressure role.

c. For tilt-rod role, assemble all three pieces of the extension rod (Figure A-23).

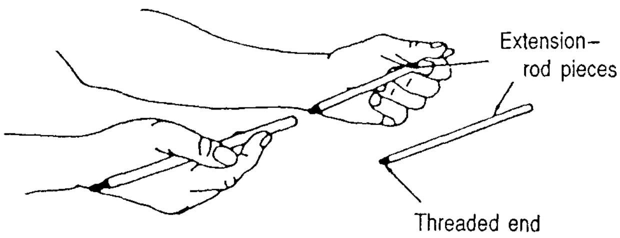


Figure A-23. Extension rod assembly

NOTE: For surface emplacement, only use the first two sections of the extension rod.

d. Thread the extension rod into the threaded pressure ring of the fuze (Figure A-24).

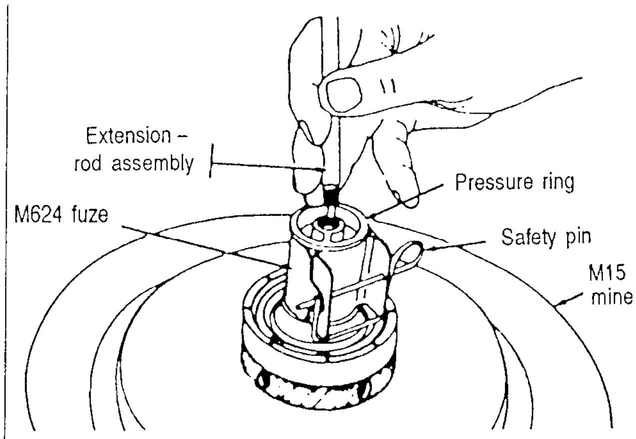


Figure A-24. Assembly of extension rod into fuze ring

NOTE: For pressure role, do not assemble or thread the extension rod into the fuze.

6. *Arm the mine.*

a. Raise the safety pin to the horizontal position, and grasp the safety band and safety stop with the left hand (note position of thumb) (Figure A-25).

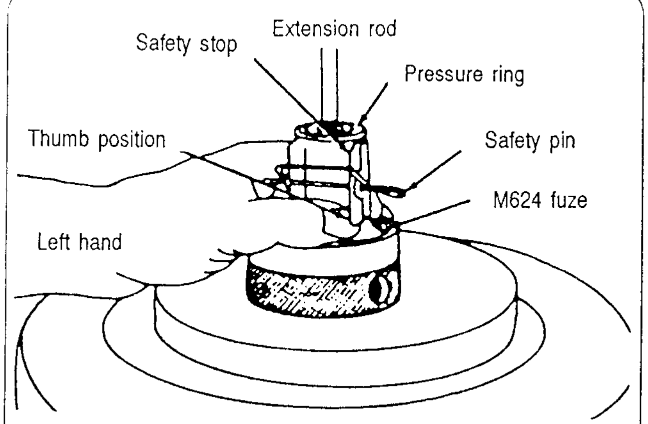


Figure A-25. Left hand grasping fuze

b. With the right-hand index finger, pull the safety pin out while sliding it to the right (Figure A-26).

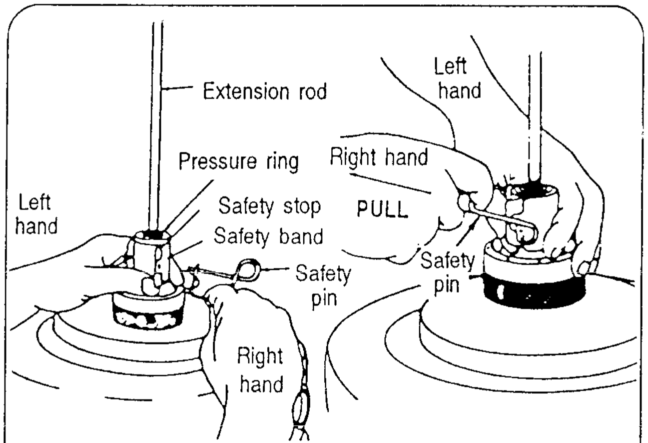


Figure A-26. Removal of safety pin

c. Carefully remove the safety stop while holding the safety band in place.

d. Remove the safety band (Figure A-27). The fuze is now armed.

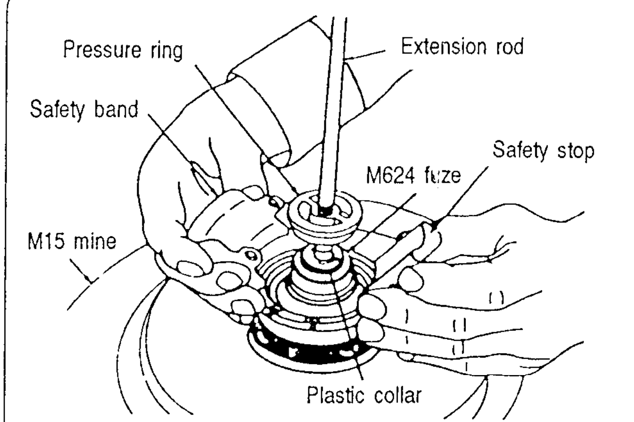


Figure A-27. Remove safety band and stop

7. *Camouflage the mine.*

a. Add twigs, grass, or other materials natural to the area. Ensure no pressure is applied to the tilt rod or the fuze.

b. Place excess soil in sandbags and remove them from the area.

NOTE: Mines with extension rods are placed in tall grass, if possible.

c. Give the band, stop, pull ring assembly, arming plug, and end closure to the NCOIC.

REMOVAL USING THE M624 FUZE

8. Disarm the mine.

a. Carefully clear camouflage away from the mine.

b. Assemble the band, stop, and safety pin assembly on the fuze so the pressure ring is immobilized.

c. Unscrew and remove the extension rod.

9. Check for AHDs.

a. Without putting pressure on the fuze, hold the mine firmly in place with one hand.

b. With the other hand, feel for AHDs by digging around the sides and underneath the mine.

10. Remove the mine.

a. Remove the mine from the hole.

b. Remove the fuze from the mine (use the extension rod, if necessary).

c. Replace the end closure on the fuze.

d. Install the arming plug into the fuze well of the mine.

INSTALLATION USING THE M603 FUZE

1. Inspect the mine.

a. If the mine is dented, cracked, or damaged, DO NOT USE IT.

b. Use the M20 wrench to unscrew and remove the arming plug from the mine (Figure A-28).

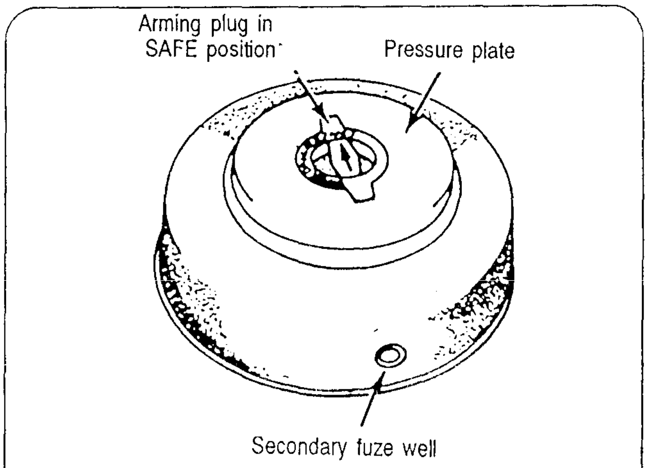


Figure A-28. M15 antitank mine

c. Examine the fuze well for foreign material. If foreign material is present, turn the mine upside down and gently tap the bottom with your hand to dislodge it. If it cannot be removed, replace the arming plug. DO NOT USE IT.

d. Ensure the booster retainer ring is seated in the fuze well. If the retainer ring is missing, replace the mine.

2. Perform a function check with the arming plug.

a. Turn the setting knob to the ARMED (A) position. Ensure the shutter bar moves across the bottom of the arming plug (Figure A-29).

NOTE: A spring coil may not be present in older models.

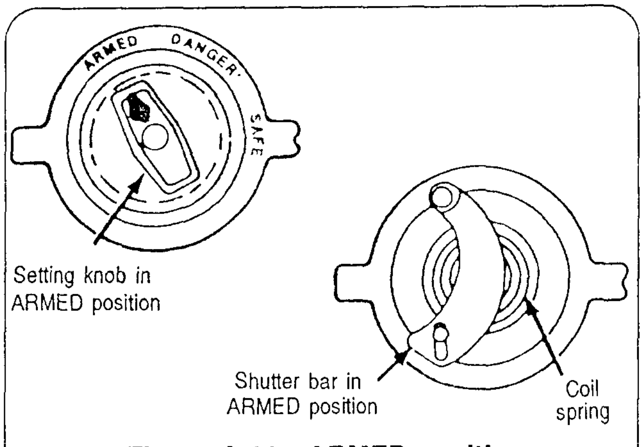


Figure A-29. ARMED position

b. Turn the setting knob to the SAFE (S) position. Ensure the shutter bar moves back across the bottom of the arming plug (Figure A-30).

NOTE: If the shutter bar does not go into the SAFE (S) or ARMED (A) position, notify the NCOIC.

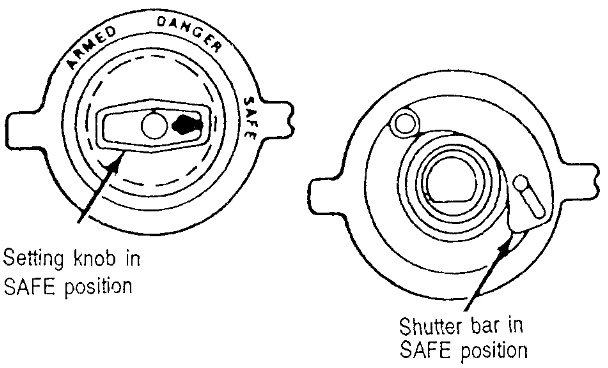


Figure A-30. SAFE position

3. Fuze the mine.

a. After removing the M603 fuze from its metal shipping container, inspect it for serviceability.

NOTE: The green end of the detonator must show in the bottom of the fuze.

b. Remove the safety fork. If necessary, use the hooked end of an M20 wrench (Figure A-31).

c. Carefully insert the fuze into the fuze well until it seats securely on top of the booster retaining ring.

d. Perform a clearance test using the tab end of the M20 arming wrench (Figure A-32).

NOTE: For long-term emplacement, smear a thin layer of silicone grease or similar lubricant on the arming plug, threads, and gasket.

e. Ensure the setting knob is in the SAFE (S) position.

WARNING
If the fuze pressure plate interferes with the tab end of the M20 arming wrench, investigate the cause and notify the NCOIC. Do not arm the mine.

f. Screw the arming plug into the mine by hand. Ensure a watertight seal by tightening the arming plug with the N120 arming wrench.

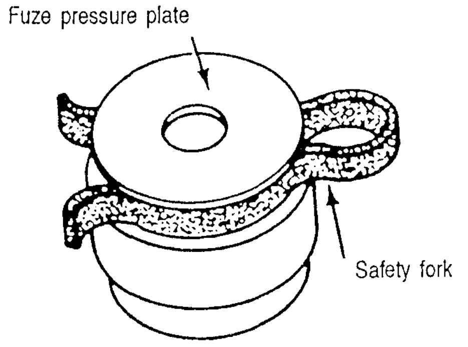


Figure A-31. Remove the safety fork using the M20 arming wrench

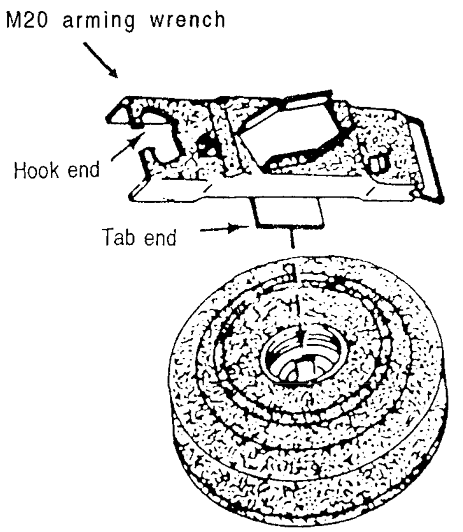


Figure A-32. Fuze clearance check using the M20 arming wrench

4.* Dig *a hole to fit the mine.

a. Dig a hole deep enough so the top of the mine pressure plate will be about 1 1 /2 inches below ground level.

b. Dig the sides of the hole at a 45-degree angle to prevent vehicles from bridging the mine (Figure A-33).

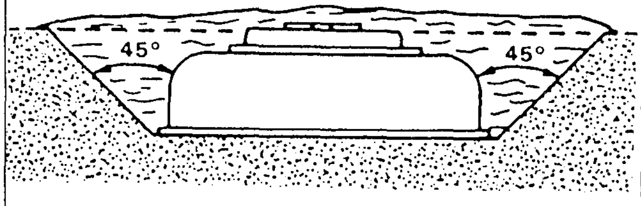


Figure A-33. M15 mine in the hole

5. Emplace the mine.

a. Place the mine in the hole.

b. Cover the mine with soil until it is level with the top of the pressure plate.

6.* Use the M20 arming wrench to arm *the* mine by turning *the* setting knob from the SAFE (S) position to *the* ARMED (A) *position.

7. Camouflage the mine.

a. Cover the mine with 1 to 2 inches of soil.

b. Camouflage the mine. Place excess soil in sandbags and remove them from the area.

c. Give the safety clip to the NCOIC.

REMOVAL USING THE M603 FUZE

8. Disarm the mine.

a. Carefully clear the soil from the top of the mine.

b. Without putting pressure on the pressure plate, hold the mine firmly in place with one hand.

c. With the other hand, feel for AHDs by digging around the sides and underneath the mine.

d. Use the M20 arming wrench to turn the setting knob to the SAFE (S) position.

9. Remove the mine.

a. Remove the mine from the hole.

b. Use the M20 arming wrench to turn the arming plug counterclockwise and remove it.

c. Remove the M603 fuze from the fuze well and replace the safety fork.

d. Install the arming plug.

MINE, ANTITANK, HE, NONMETALLIC, M19

The M 19 (Figures A-34 and A-35, page A-16) is housed in a square, plastic case. It is easily identified in the dark by its box shape. The mine holds 21 pounds of composition B (HE charge). It consists of an M606 integral pressure fuze and two secondary fuze wells-one located in the side and one on the bottom. The fuze body contains the pressure plate, Belleville spring, setting knob, step plate, firing pin assembly, and detonator.

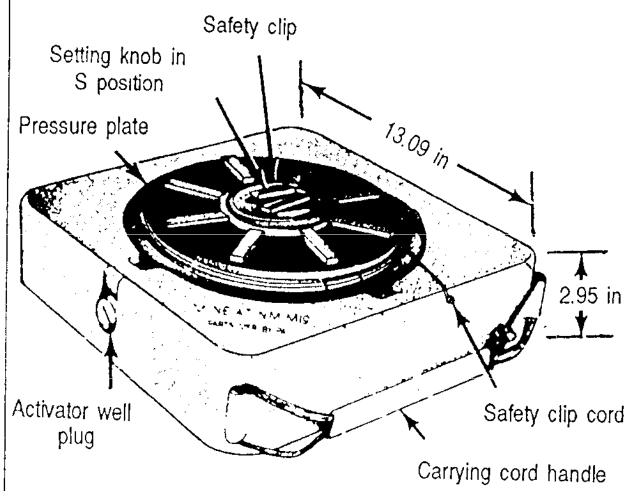


Figure A-34. M19 antitank mine

M19 CHARACTERISTICS

Main Chg	Dia	Ht	Wt	No Mines Per Box	Wt Per Box
Comp B (21 lb)	13.09"	2.95"	28 lb	2	72 lb

- **Employed in protective, tactical, and nuisance minefields.**
- **Can be buried or surface-laid.**
- **A force of 300 to 500 pounds is required to detonate it.**
- **Standard FD can be used with the M2 activator in any of the secondary fuze wells.**

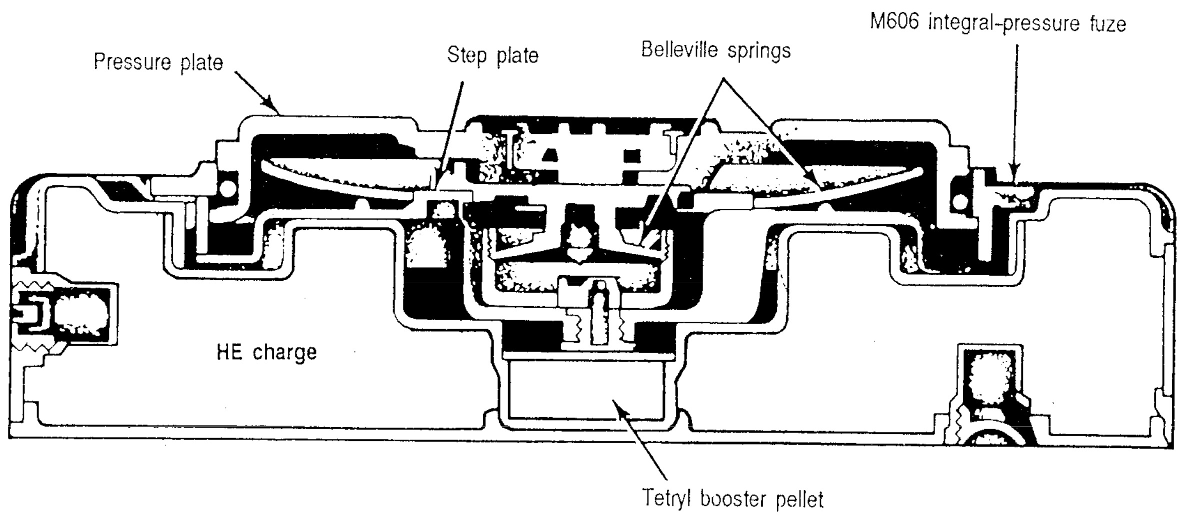


Figure A-35. M19 antitank mine

INSTALLATION

1. Inspect the mine.

a. If the mine is dented, cracked, or damaged, DO NOT USE IT.

b. Remove the M606 fuze from the fuze well by turning it counterclockwise 1 1/4 turn (Figure A-36).

c. Ensure the rubber gasket is on the M606 fuze.

d. Remove any foreign material found in the fuze well.

e. Ensure the setting knob is in the SAFE (S) position and the safety clip is in place.

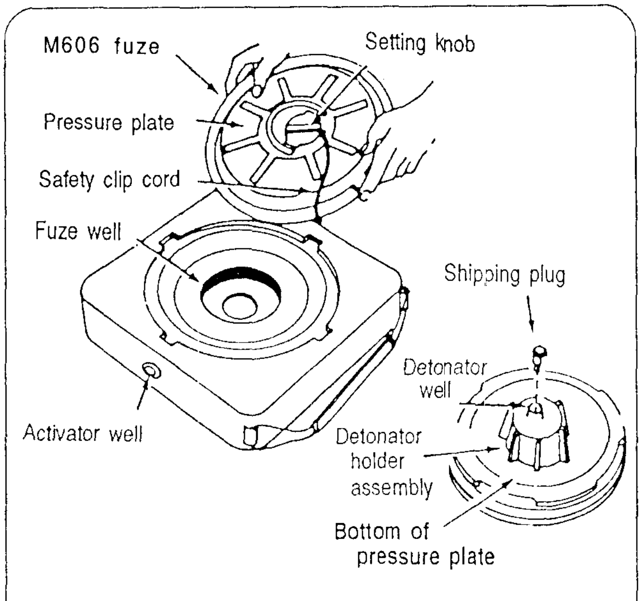


Figure A-36. Pressure plate removal

f. Use the M22 wrench to remove the shipping plug from the detonator well (Figure A-36).

g. Examine the detonator well for foreign material. If foreign material is present, gently tap the pressure plate with your hand to dis - lodge it.

2. Test the position of the firing pin (Figure A-37).

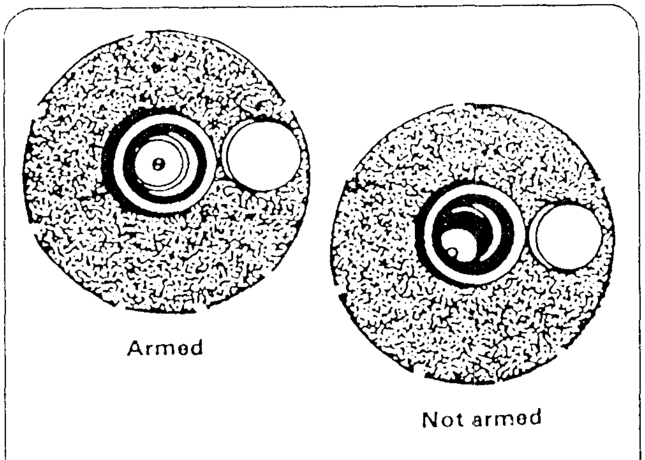


Figure A-37. Firing pin

a. Visually check the position of the firing pin. Ensure the firing pin is at the edge of the well when the setting knob is in the SAFE (S) position.

NOTE: If the pin is in the middle of the well, notify the NCOIC.

b. Remove the safety clip.

c. Use the M22 wrench to turn the setting knob to the ARMED (A) position. Ensure the firing pin is in the center of the well.

d. Use the M22 wrench to turn the setting knob back to the SAFE (S) position Ensure the firing pin moves back to the side of the well.

NOTE: If the firing pin is not in the correct position when the setting knob is in either the ARMED (A) or SAFE (S) position, notify the NCOIC.

e. Replace the safety clip.

3. Use the M22 arming wrench to screw the M50 detonator into the detonator well.

4. Use the M22 wrench to tighten the M606 fuze into the fuze well.

5. Dig a hole to fit the mine.

a. Dig a hole deep enough so the top of the mine pressure plate will be even or slightly below ground level.

b. Dig the sides of the hole at a 45-degree angle to prevent vehicles from bridging the mine.

6. Emplace the mine.

a. Place the mine in the hole.

b. Cover the mine with soil until it is level with the top of the pressure plate.

7. Arm the mine.

a. Remove the safety clip.

b. Use the M22 wrench to turn the setting knob from the SAFE (S) to the ARMED (A) position.

8. Camouflage the mine.

a. Cover the mine with 1 1/2 inches of soil.

b. Camouflage the mine. Place excess soil in sandbags and remove them from the area.

c. Give the safety clip and the shipping plug to the NCOIC.

REMOVAL

9. Disarm the mine.

a. Carefully clear the soil from the top of the mine.

b. Without putting pressure on the pressure plate, hold the mine firmly in place with one hand.

c. With the other hand, feel for AHDs by digging around the sides and underneath the mine.

d. Use the M22 wrench to turn the setting knob to the SAFE (S) position.

e. Replace the safety clip on the M606 fuze.

10. Remove the mine.

a. Remove the mine from the hole.

b. Use the M22 wrench to remove the M606 fuze by turning it counterclockwise and lifting it out of the fuze well.

c. Use the M22 wrench to remove the detonator from the detonator well.

d. Replace the shipping plug in the detonator well.

e. Replace the pressure plate in the mine.

MINE, ANTITANK, HE, HEAVY, M21

The M21 (Figures A-38 and A-39) utilizes a direct-energy warhead designed to produce a K-Kill. It is used in conjunction with the M607 fuze. The M21 produces a K-Kill against threat heavy tanks. When used with a tilt rod, the mine should be buried. If surface-laid and used with a tilt rod, the mine must be staked to prevent it from being knocked over and causing the warhead to be directed away from the target.

M21 CHARACTERISTICS

Main Chg	Dia	Ht	Wt	No Mines Per Box	Wt Per Box
Comp H6 (11 lb)	9"	4.5"	17.25 lb.	4	91 lb

- **Can be used with a tilt-rod assembly requiring 3.75 pounds of pressure on the extension rod to cause a 20-degree deflection.**
- **Requires a minimum of 290 pounds of pressure to detonate.**
- **Only conventional US AT mine with a direct-energy warhead.**

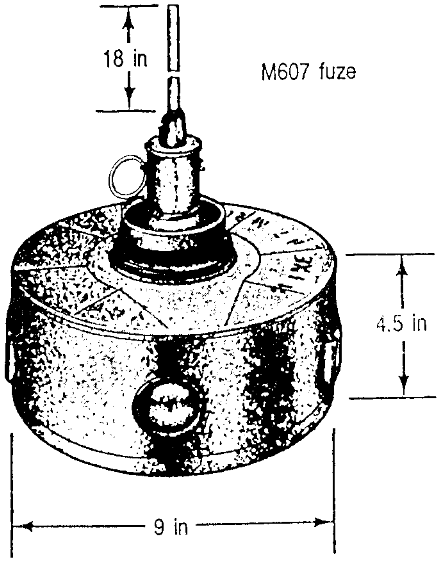


Figure A-38. M21 antitank mine

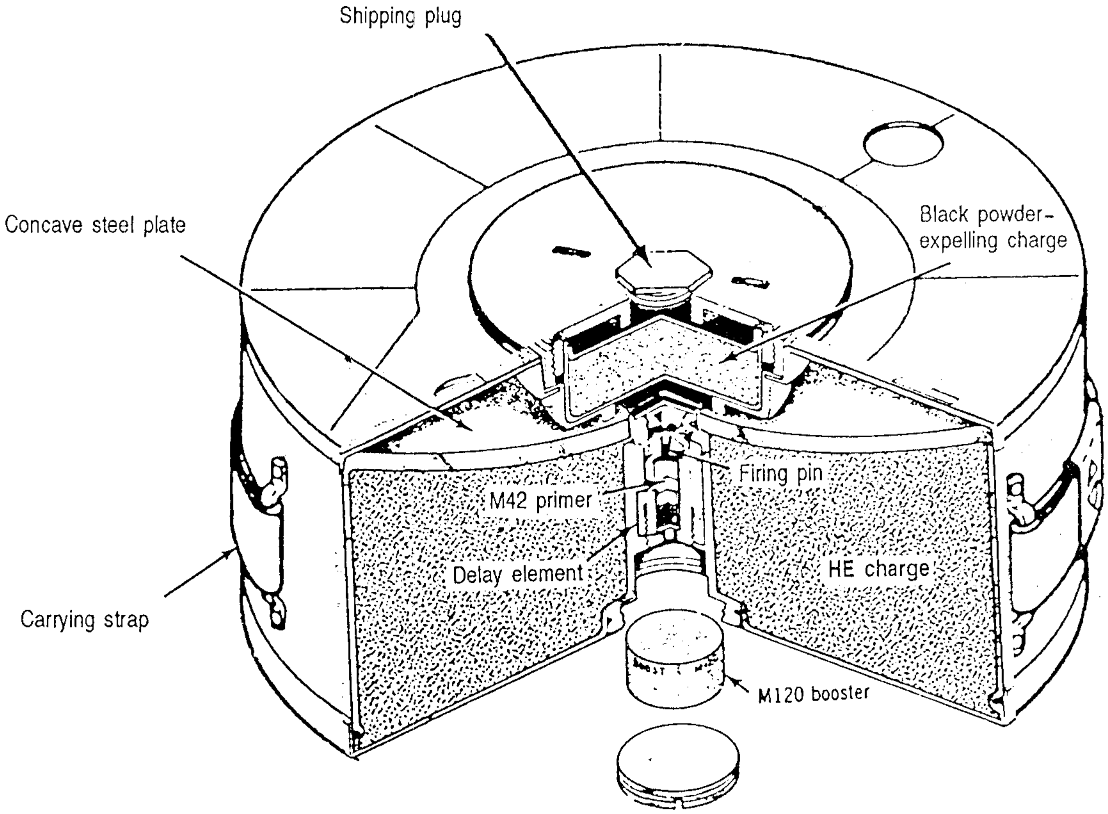


Figure A-39. M21 antitank mine

INSTALLATION

1. Inspect the mine.

a. If the mine is dented, cracked, or damaged, DO NOT USE IT.

b. Ensure the cotter pin of the fuze pull ring assembly and the fuze closure assembly are securely in place (Figure A-40).

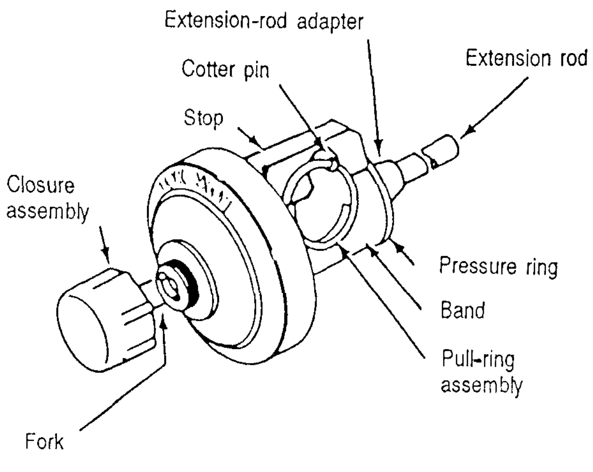


Figure A-40. M607 fuze

c. Inspect the fuze to ensure the neck portion behind the collar is not cracked.

2. Insert the booster.

a. Use a screwdriver end of an M26 wrench to remove the closing plug from the bottom of the mine (Figure A-41).

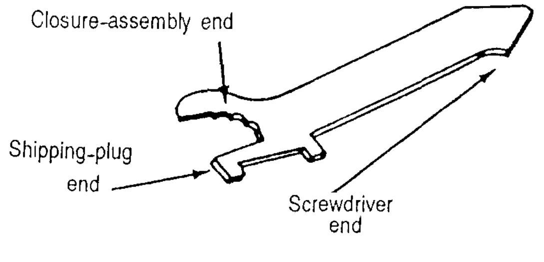


Figure A-41. M26 arming wrench

b. Examine the booster well for foreign material. If foreign material is present, gently tap the top of the mine with your hand to dislodge it. If it cannot be removed, replace the closing plug. DO NOT USE IT (Figure A-42).

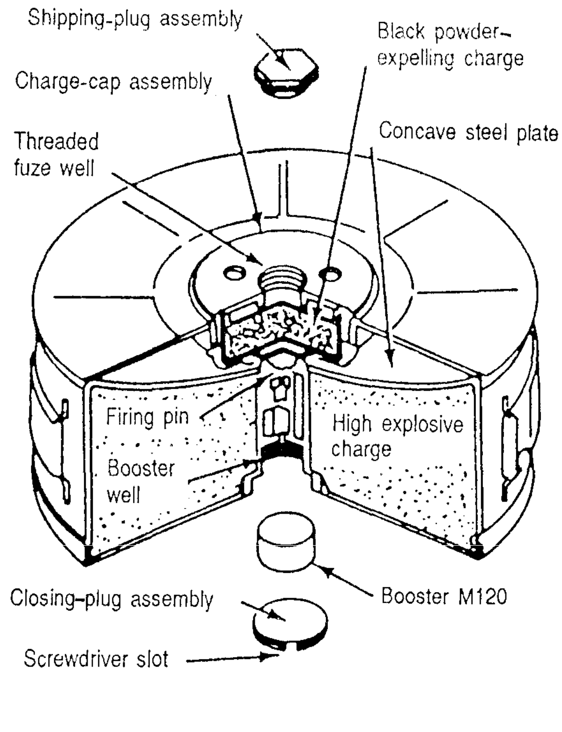


Figure A-42. Cutaway view of the M21 mine

c. Insert the M 120 booster, with the washer side toward the fuze, into the booster well.

d. Use the M26 wrench to replace the closing plug.

3. Fuze the mine.

a. Use the M26 wrench to remove the shipping plug from the fuze well on top of the mine.

b. Examine the fuze well for foreign material. If foreign material is present, gently shake the mine to dislodge it.

NOTE: If black powder falls out of the fuze well or foreign material cannot be removed, DO NOT use the mine.

c. Use the M26 wrench to remove the closure assembly from the M607 fuze. Ensure the gasket remains in place on the fuze.

d. Screw the fuze hand-tight into the fuze well.

4. Dig a hole to fit the mine.

a. Dig a hole deep enough so the top of the mine will be at ground level (Figure A-43).

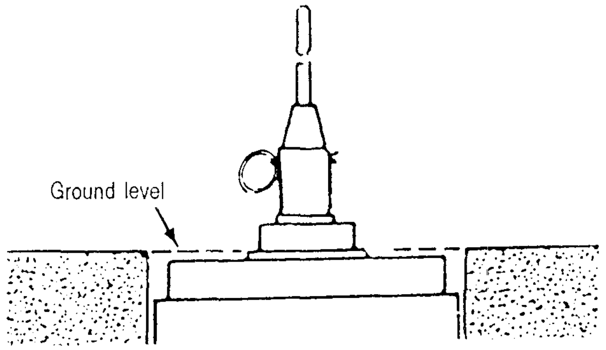


Figure A-43. Buried M21 with extension rod

b. Check the bottom of the hole to ensure the ground is solid enough to support the mine. If necessary, place a flat object under the mine to provide a firm foundation. Allow additional depth for the object.

5. Emplace the mine.

a. Place the mine in the hole.

b. Cover the mine with soil until it is level with the top of the mine.

c. Firmly press the soil around the sides of the mine.

NOTE: Ensure no soil falls around or under the plastic collar. For pressure operation, do not use the extension rod assembly.

6. Assemble the extension rod.

a. Screw the extension rod onto the M607 fuze.

b. Ensure the extension rod is pointing straight up.

7. Arm the mine.

a. On the pull ring, squeeze the end of the cotter pin together.

b. Remove the cotter pin by holding the fuze firmly in one hand and pulling the pull ring with the other hand.

c. Slowly and carefully remove the band and stop assembly from the neck of the fuze (Figure A-44).

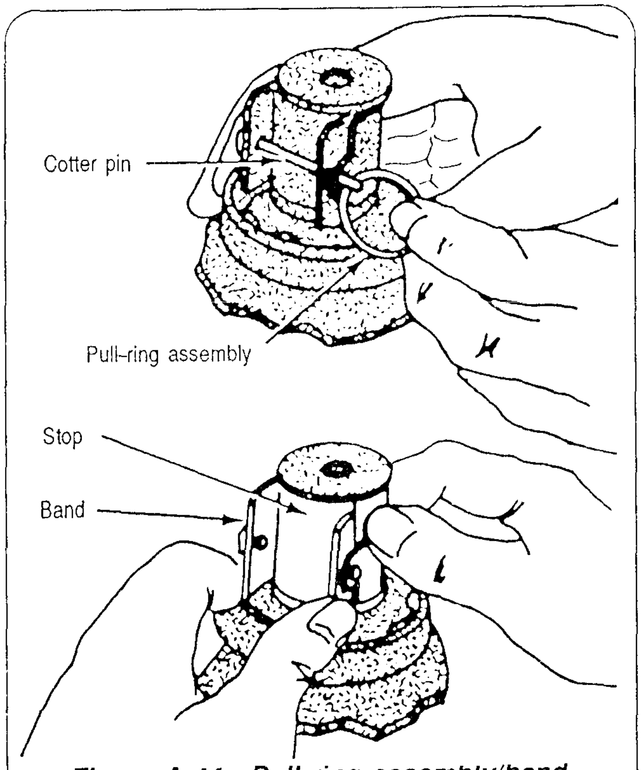


Figure A-44. Pull-ring assembly/band and stop assembly

8. Camouflage the mine.

a. Add twigs, grass, or other material natural to the area. Ensure no pressure is applied to the tilt rod or the fuze.

b. Place the excess soil in sandbags, Remove them from the area.

NOTE: Mines with extension rods are placed in tall grass, if possible.

c. Give the band, stop, pull ring assembly, shipping plugs, and closure assemblies to the NCOIC.

REMOVAL

9. Disarm the mine.

a. Carefully clear camouflage away from the mine.

b. Attach the band and stop to the fuze.

c. Insert the cotter pin into the band and stop. Spread the ends of the cotter pin.

d. Unscrew and remove the extension rod.

10. Check for AHDs.

a. Without putting pressure on the fuze, hold the mine firmly in place with one hand.

b. With the other hand, feel for AHDs by digging around the sides and underneath the mine.

11. Remove the mine.

a. Remove the mine from the hole.

b. Remove the fuze from the mine.

c. Install the closure assembly on the fuze.

d. Install the shipping plug into the fuze well of the mine.

e. Remove the closing plug from the bottom of the mine.

f. Remove the booster from the mine.

g. Install the closing plug into the booster well.

Section III. Firing Devices

An FD performs the function of a mine fuze by providing an alternative means to detonate the mine. An FD is normally used in conjunction with a standard fuze so a mine will have two separate explosive chains. The purpose of the second firing chain is to prevent the enemy from disarming or removing mines after emplacement. When used for this purpose, the FD is called an AHD. It is designed to function by detonating the attached mine or another explosive charge nearby, if unauthorized personnel attempt to remove or tamper with the mine. Both the M19 and the M15 have two secondary fuze wells for attaching an FD and an activator.

There are five standard US FDs:

- M1 pull.
- M3 pull/tension-release.
- M5 pressure-release.
- M1A1 pressure.
- M142 multipurpose.

These FDs utilize a spring-loaded striker and standard base and are designed to function in one or more of the following modes:

- Pressure.
- Pressure-release.
- Pull-tension.
- Tension-release.

When FDs are employed with M 15 and M 19 AT mines, they require the use of an M1 or M2 activator.

ACTIVATOR, ANTITANK MINE, Ml AND M2

Activators are essentially detonator boosters designed to magnify the explosive force generated by an FD with a standard base and transfer it to the main charge. Activators can be used with any one of several types of FDs to supply an AT mine with a secondary fuze for antihandling purposes. The M 1 activator is used with the M 15 AT mine, and the M2 activator is used with the M 19 nonmetallic AT mine. The activator also performs the function of an adapter for attaching the FD to the mine. One end of the activator is threaded externally for insertion in the secondary well of the mine. The other end is threaded internally to receive the standard base coupling of the FD.

The Ml activator (Figure A-45) is 2.1 inches long and is made of olive-drab plastic. It has a threaded closing plug and gasket. It contains a detonator and has a cylindrical, unthreaded cap which is cemented to the opposite end of the body and contains a tetryl booster charge. The thread, which screws into the mine, is 0.75 inch in diameter. The M2 activator is similar to the M 1, but it contains an HE pellet and its overall length is 1.9 inches. It is also made of olive-drab plastic.

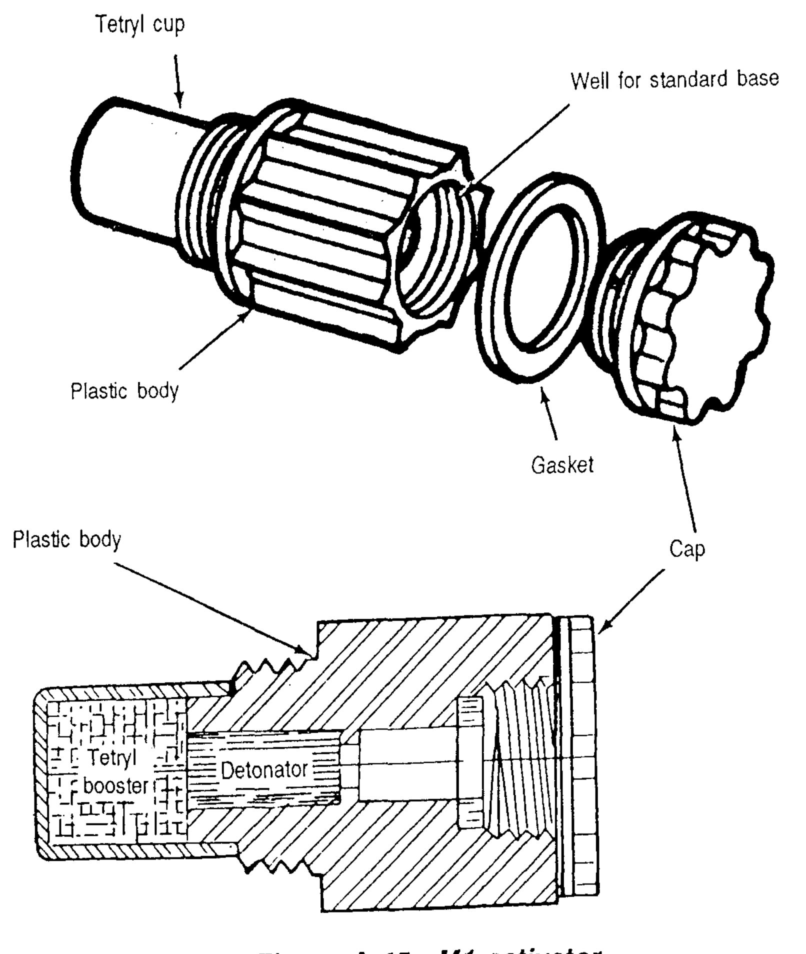


Figure A-45. M1 activator

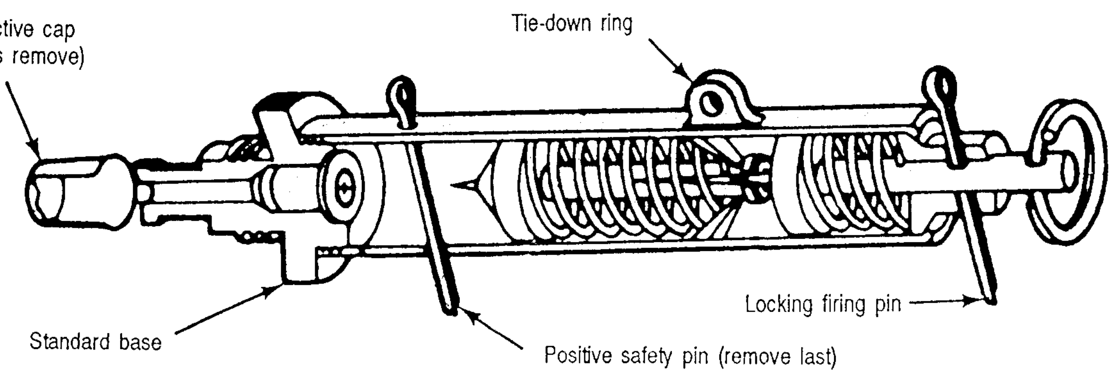


Figure A-46. M1 pull firing device

Ml PULL FIRING DEVICE

The M1 pull FD (Figure A-46) has the following characteristics:

- **Case: Metal.**
- **Color: Olive-drab.**
- **Diameter: 0.56 inch.**
- **Length: 3.31 inches.**
- **Internal action: Mechanical with split striker-head release.**
- **Initiating action: Pull of 3 to 5 pounds on trip wire.**
- **Safeties: Locking and positive safety pins.**
- **Packaging: Five units with standard base and two 80-foot spools of trip wire are packed in a fiberboard container; 30 fiberboard containers are packed in a wooden box.**
- **Activated only by pull or tension.**
- **Pull of 3 to 5 pounds on a trip wire attached to the pull ring and a suitable anchor withdraws the tapered end of the release pin from the split head of the striker. This frees the striker to fire the percussion cap.**

INSTALLATION

1. Inspect the FD for damage.

2. Ensure the positive safety and locking safety pins are in place.

3. Remove the protective cap from the standard base. Screw the standard base to the FD and the activator onto the standard base (Figure A-46).

4. Install the M 1 pull FD assembly into the secondary fuze/activator well (Figure A-47).

5. Place the mine with the FD in the hole. Ensure the safety pins remain in place.

a. Attach the wire to the stake.

b. Attach the wire to the pull ring. Leave slack in the wire (Figure A-47).

6. Arm the mine.

7. Cover and camouflage the mine. Leave a hole (trench) at the side of the mine to remove the safety pins (Figure A-47).

8. Carefully remove the locking safety first (Figure A-48).

9. Remove the positive safety pin.

10. Complete camouflaging the mine. Give safety pins to the NCOIC.

REMOVAL

11. Uncover the mine and carefully check surrounding area for booby traps, trip wires, and signs of tampering.

12. Replace the positive safety pin. Replace the locking safety pin. Cut all trip wires.

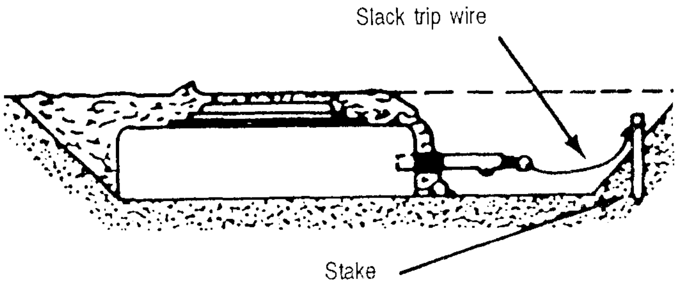


Figure A-47. M1 in the side fuze well

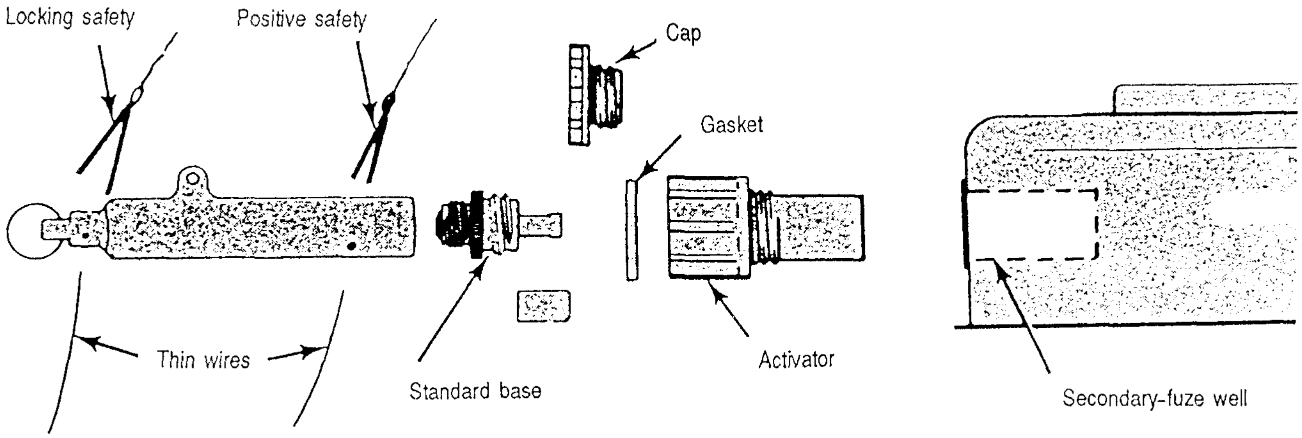


Figure A-48. Safety pin

M3 PULL/TENSION-RELEASE FD

The M3 pull/tension release FD (Figure A-49, page A-26) has the following characteristics:

- **Case: Metal.**
- **Color: Olive-drab.**
- **Diameter: 0.56 inch.**
- **Length: 4 inches.**
- **Internal action: Mechanical with spreading striker-head release.**
- **Initiating action: Direct pull of 6 to 10 pounds or tension-release.**
- **Safeties: Locking and positive safety pins.**
- **Packaging: Five units with two 80-foot spools of trip wire packed in a carton; five cartons packed in a wooden box.**
- **M3 pull/tension-release FD is a dual-function device.**
- **In the pull mode, pull of 6 to 10 pounds of pull on a trip wire detonates the mine.**
- **Tension-release mode, cutting or breaking of a taut trip wire permits detonation.**

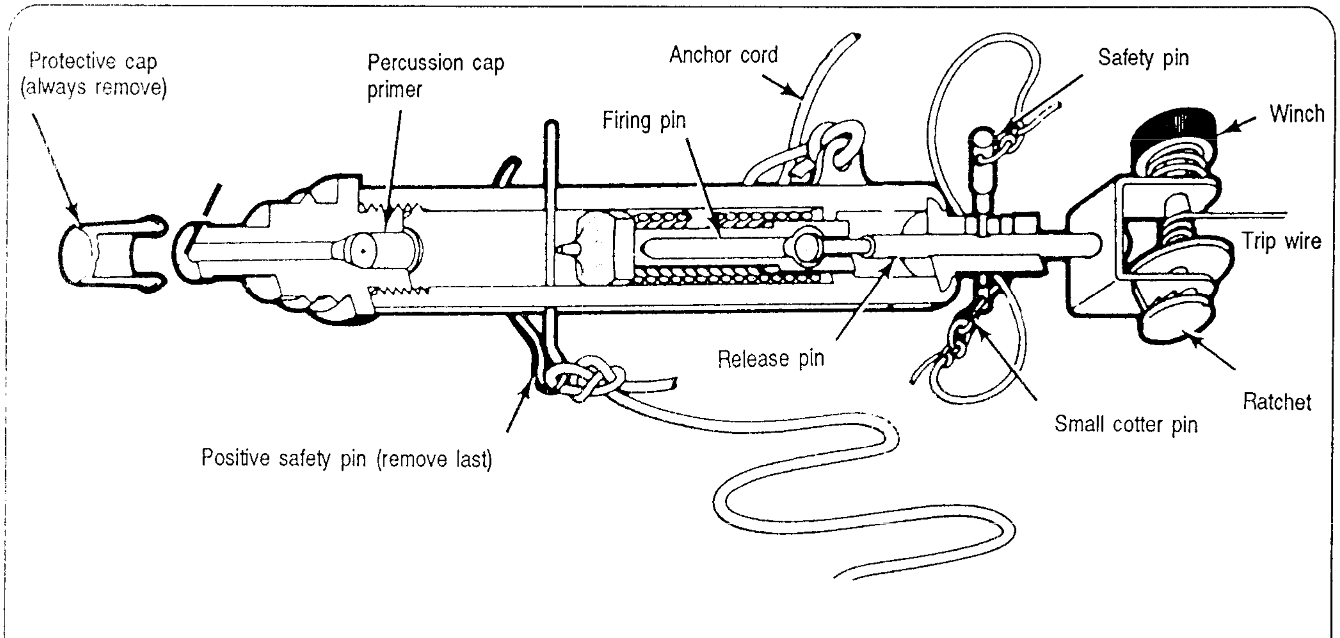


Figure A-49. M3 pull/tension-release firing device

> **WARNING**
> **Either cutting the trip wire or applying sufficient tension to the trip wire can activate this device.**

INSTALLATION

1. Dig a hole deep enough to bury the mine on a firm foundation.

2. Remove the protective cap from the standard base, and attach it to the M3 and activator.

3. Attach the device to the mine.

4. Place the mine in the hole. Leave a small trench for the FD.

5. Anchor the mine enough to withstand a pull of at least 10 pounds.

6. Attach one end of the trip wire to the anchor and the other end to the FD winch.

7. Arm the mine.

8. Use the knurled knob to draw the trip wire taut until the locking pin is pulled into the wide portion of the safety-pin hole (Figure A-50).

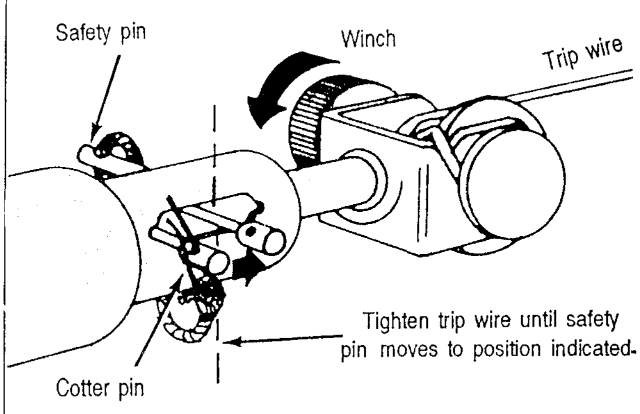


Figure A-50. Arming the M3

9. Remove the small cotter pin. Remove the locking safety pin.

NOTE: If a metallic click is heard, DO NOT remove the positive safety pin. Remove the device from the mine.

10. Remove the positive safety pin. Camouflage the area

REMOVAL

NOTE: Mines fitted with the M3 FD should be destroyed in place or removed by an EOD team.

11. Carefully uncover the mine. Locate all AHDs attached to it.

12. Replace the positive safety pin (Figure A-51).

13. Replace the locking safety pin.

14. Check both ends of the trip wire before cutting it.

15. Place the mine in the SAFE (S) position, and diassemble the device.

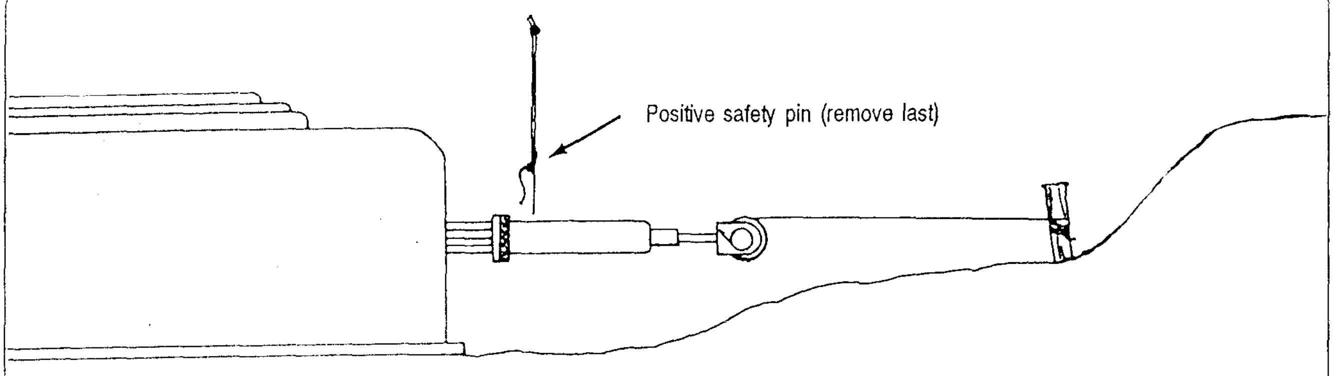


Figure A-51. Positive safety pin

M5 PRESSURE-RELEASE FIRING DEVICE (MOUSETRAP]

The M5 (Figures A-52 and A-53, page A-28) is activated by the release of pressure. Lifting or removing a restraining weight releases the striker to fire the cap. It has the following characteristics:

- **Case: Metal.**
- **Color: Olive-drab.**
- **Length: 1.75 inches.**
- **Width: 0.94 inch.**
- **Height: 0.69 inch.**
- **Internal action: Mechanical with a hinged striker release.**
- **Initiating action: Removal of restraining weight, 5 pounds or more.**
- **Accessories: Pressure board.**
- **Safeties: Safety pin and hole for interceptor pin.**
- **Packaging: Four complete FDs and four plywood pressure boards are packaged in a paper carton; five cartons are packed in a fiberboard box; and 10 fiberboard boxes are shipped in a wooden box.**

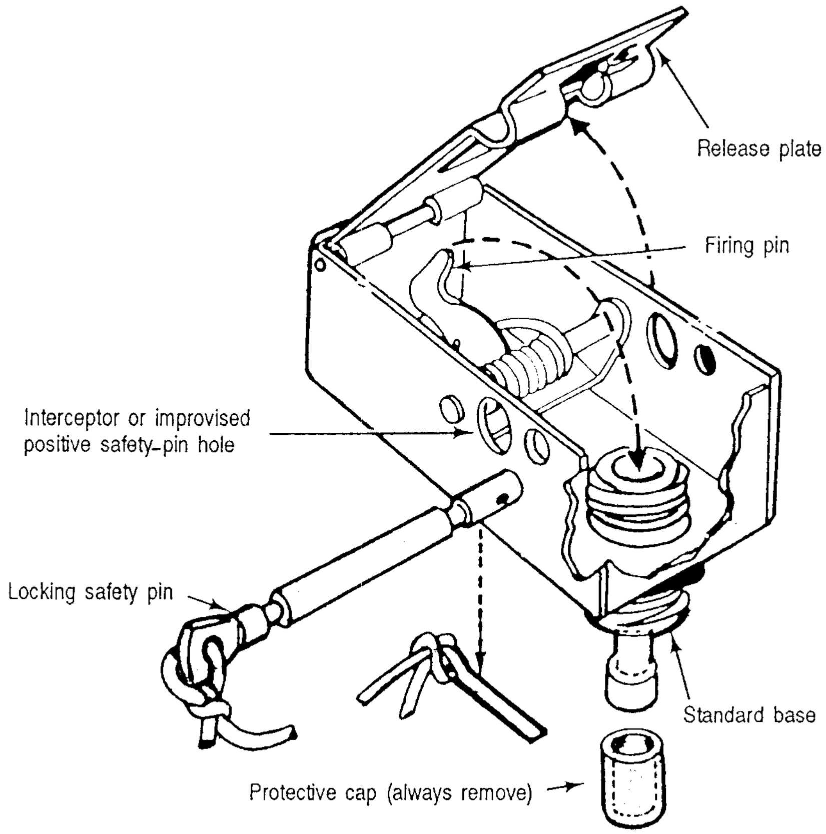


Figure A-52. M5 pressure-release firing device (mousetrap)

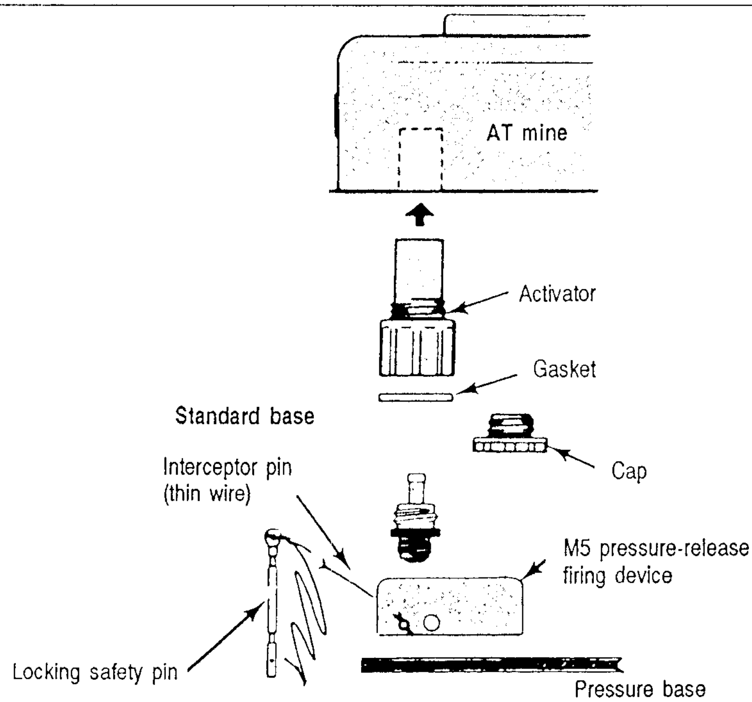


Figure A-53. M5 pressure-release firing device (mousetrap) (continued)

INSTALLATION

1. Dig a hole deep enough to bury the mine on a firm foundation. The pressure plate should be slightly above ground level.

2. Remove the protective cap from the standard base. Assemble the FD.

3. Use a coat hanger as a positive safety pin. Place the mine in the hole. Leave enough room to remove the pins.

> **WARNING**
> **Ensure the mine and the FD are resting on a firm foundation before removing the pins.**

4. Bury and camouflage the mine.

5. Arm the mine.

6. Remove locking safety pin (Figure A-54).

NOTE: If the positive safety pin is difficult to remove or if you hear a click when removing the locking safety, carefully remove the mine and replace the FD.

7. Remove the positive safety pin (interceptor pin).

REMOVAL

8. Carefully uncover the mine and inspect it for tampering. Locate and carefully uncover the FD.

> **WARNING**
> **Do not release the pressure being applied to the device.**

9. Insert the positive safety pin into the interceptor hole, and then insert the locking safety pin into the safety-pin hole.

10. Place the mine in the SAFE (S) position. Remove the mine and recover the FD.

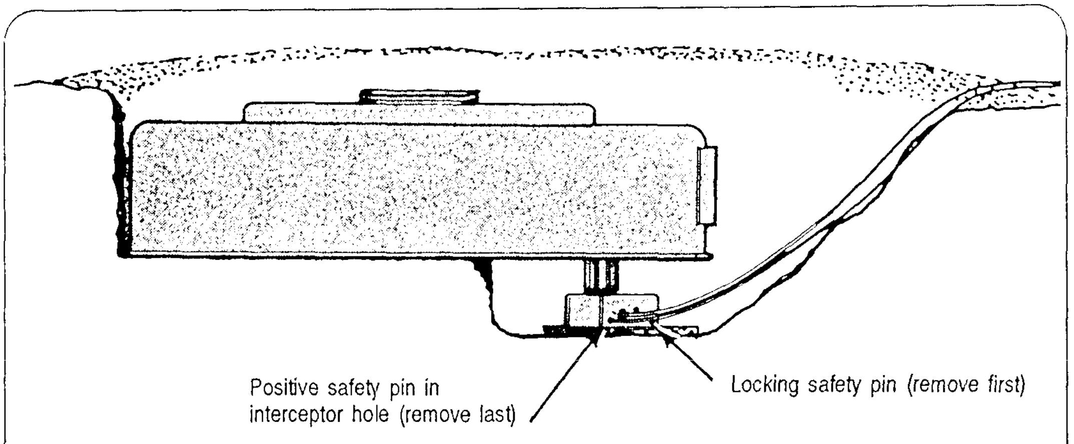


Figure A-54. Arming the M5

M1A1 PRESSURE FIRING DEVICE

The M1A1 (Figure A-55 and A-56) is pressure-actuated. Pressure is applied directly to the trigger head or can be transmitted via the three-pronged pressure head. A press of 20 pounds applied to the head compresses the striker release-pin spring and pushes the release-pin inward. The spring-loaded firing pin then fires the primer and standard base. It has the following characteristics:

- **Case: Metal.**
- **Color: Olive-drab.**
- **Length: 2.75 inches.**
- **Width: 0.63 inch.**
- **Internal action: Spring-driven striker with keyhole slot release.**
- **Initiating action: Pressure of 20 pounds or more.**
- **Accessories: Three-pronged pressure head and extension rod.**
- **Safeties: Safety fork and positive safety pin.**
- **Packaging: Five units with standard base are packed in a cardboard carton; 30 cartons are shipped in a wooden box.**

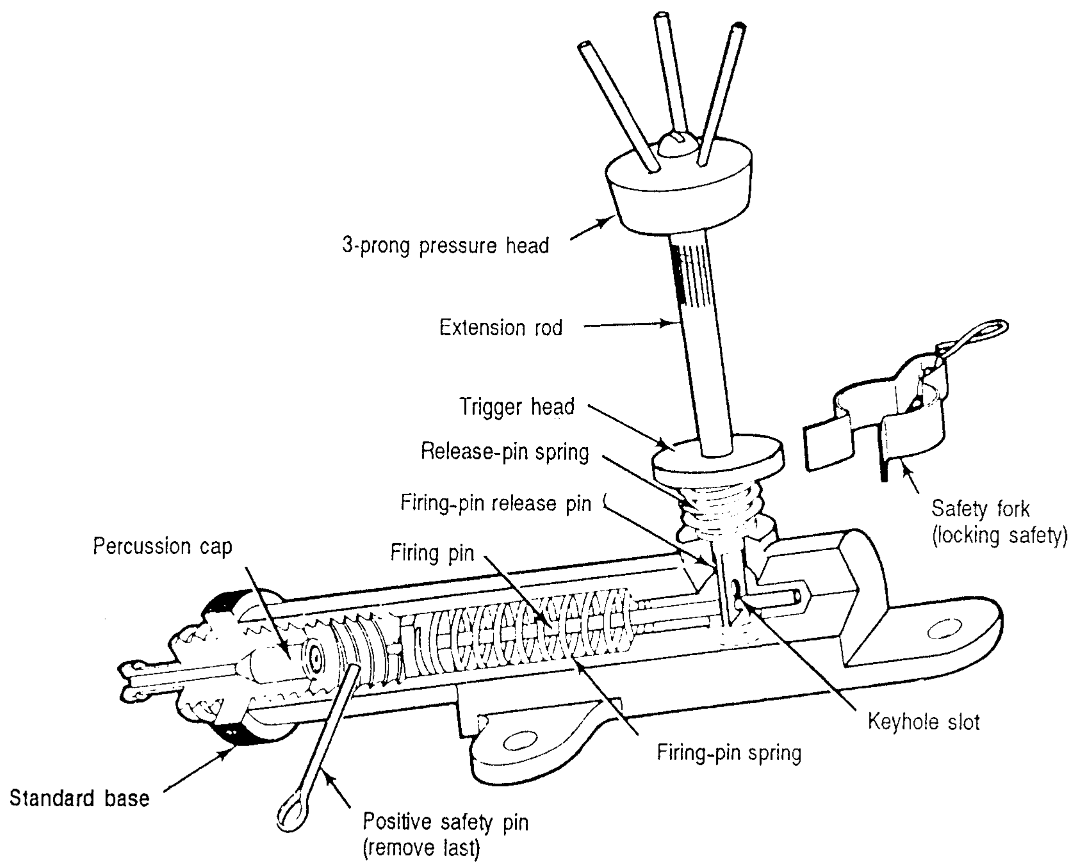


Figure A-55. M1A1 pressure firing device

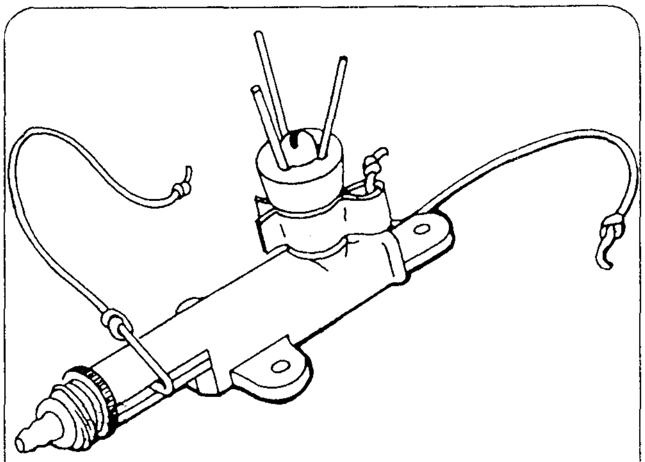


Figure A-56. M1A1 pressure firing device

INSTALLATION

1. Dig a hole deep enough to bury the mine on a firm foundation. The top of the pressure plate should be slightly above ground level with an open trench to accommodate the device.

2. Remove the protective cap from the standard base and mate it to the FD. Assemble the proper activator on to standard base.

3. Install the FD, and place the mine in the hole.

4. Arm the mine.

5. Screw the three-pronged pressure head into the top of the trigger head (use an extension rod, if necessary).

6. Remove the safety fork.

7. Remove the positive safety pin (Figure A-57). Camouflage the mine and FD. Leave the three-pronged head above ground level.

REMOVAL

8. Carefully uncover the mine. Locate all AHDs.

9. Replace positive safety pin. Replace safety fork.

10. Place the mine in the SAFE (S) position

11. Disassemble the FD.

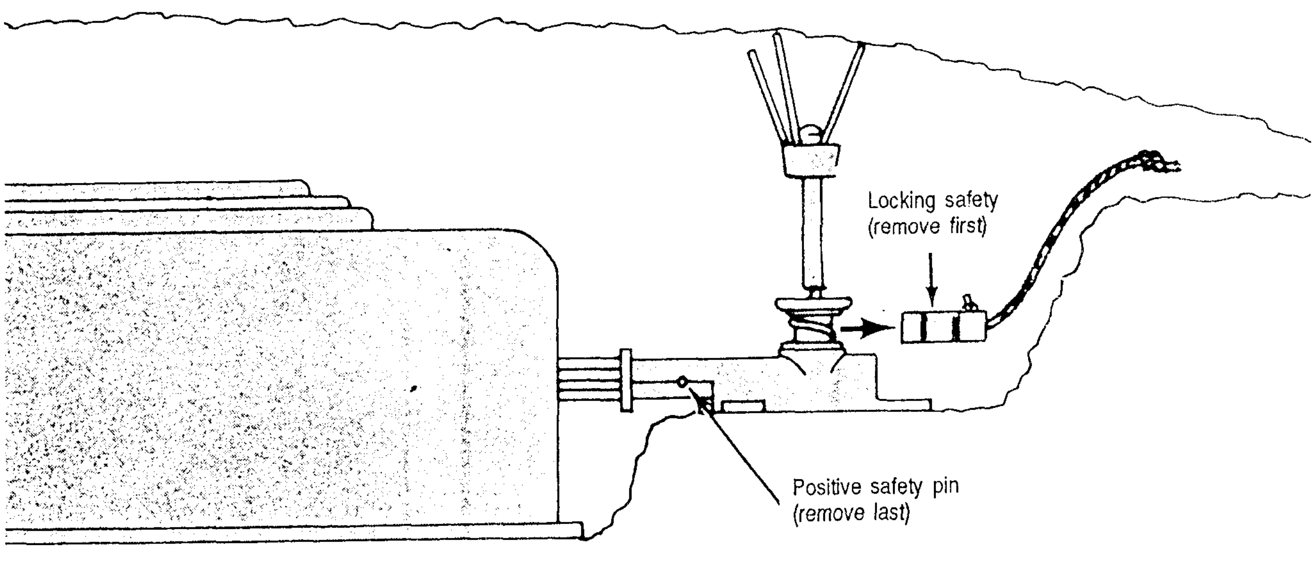


Figure A-57. Arming the M1A1

Ml42 MULTIPURPOSE FIRING DEVICE

The M 142 (Figure A-58) can be set up in any one of four modes:

- Pressure (25 pounds or more) (Figure A-59).
- Pressure-release (between 2 and 150 pounds) (Figure A-60).
- Pull (7 pounds or more) (Figure A-61).
- Tension-release (Figure A-62).

Although primarily intended for booby-trap applications, the M 142 is readily adapted as an AHD for mines. The device comes with a coupling device/primer that accepts a standard nonelectric blasting cap. The initiating action sets off an explosive chain that is passed from the FD and primer to the blasting cap, and then via the detonating cord to the main charge. However, the coupling device with primer will not initiate the detonating cord alone without a blasting cap attached. It is not adaptable to any activator or secondary fuze well. Therefore, when the M 142 is used as an AHD, replace the coupling device with a standard base. It has the following characteristics:

- **Case: Plastic.**
- **Color: Olive-drab.**
- **Diameter: 0.75 inch.**
- **Length: 2.25 inches.**
- **Internal action: Spring-driven striker.**
- **Safeties: Positive safety pin, square-head pivot pin, round-head pivot pin, and alternative safety-pin hole.**
- **Accessories: Nail and screw fasteners, coupling body assembly (F4), tension-release attachment, 50-foot spool of trip wire, and vinyl instruction sheet.**
- **Packaging: Round metal can that contains an FD and accessories.**

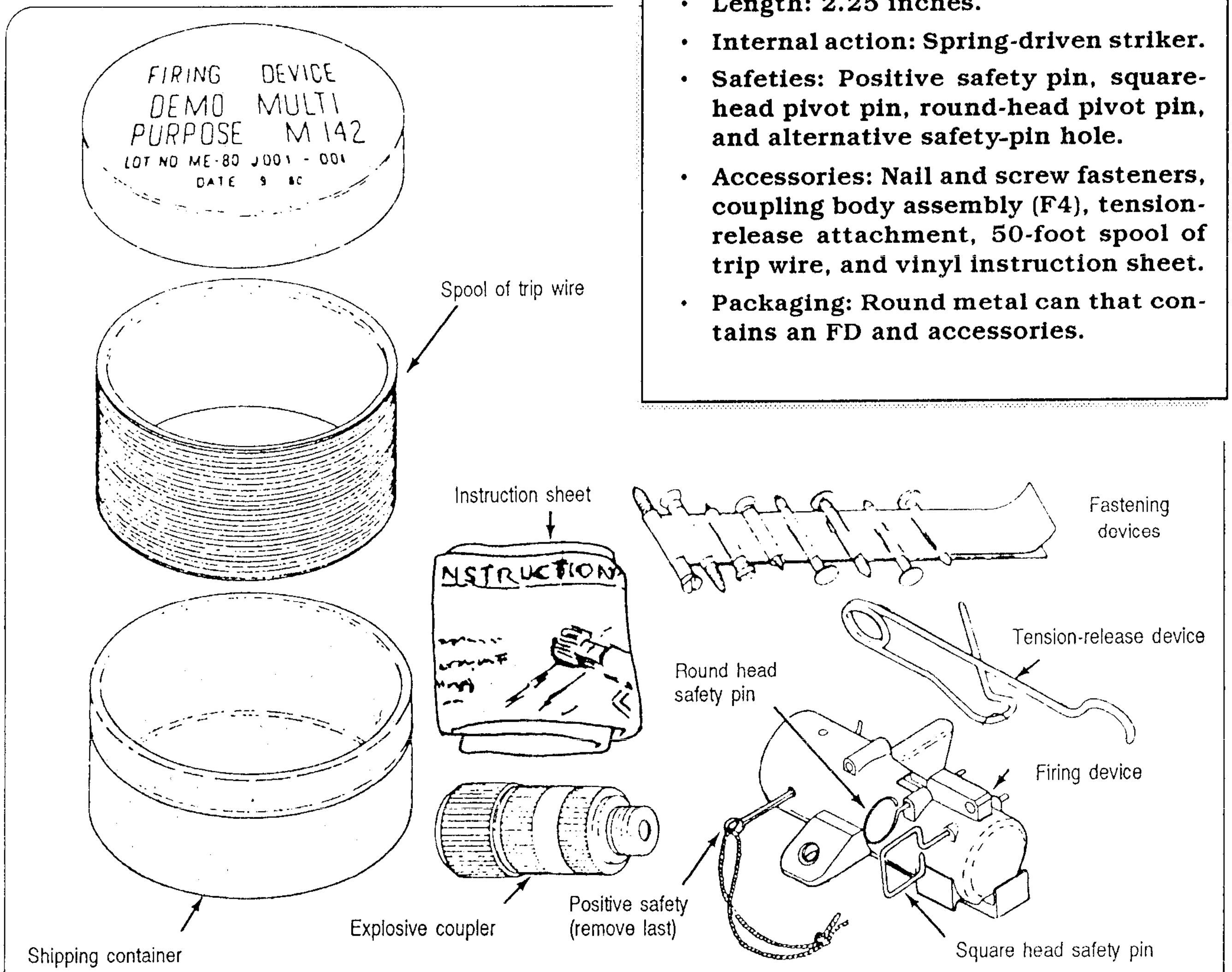


Figure A-58. M142 FD and accessory items

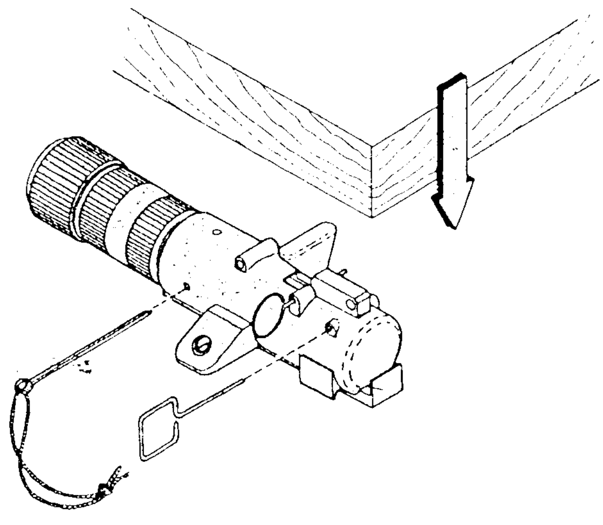


Figure A-59. M142 (pressure mode)

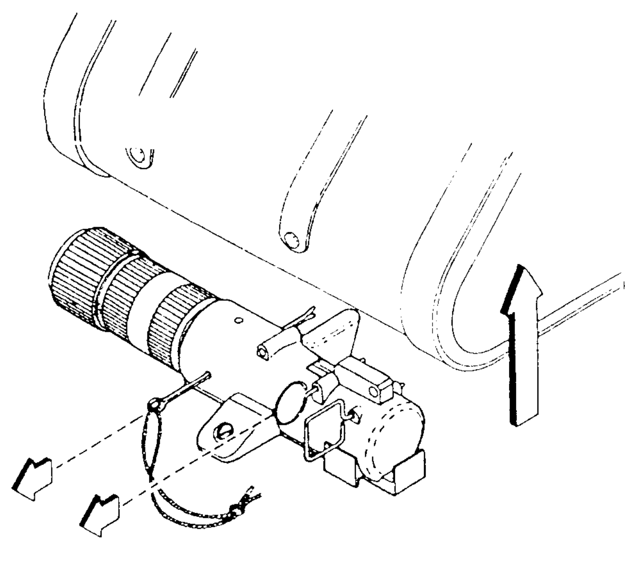


Figure A-60. M142 (pressure-release mode)

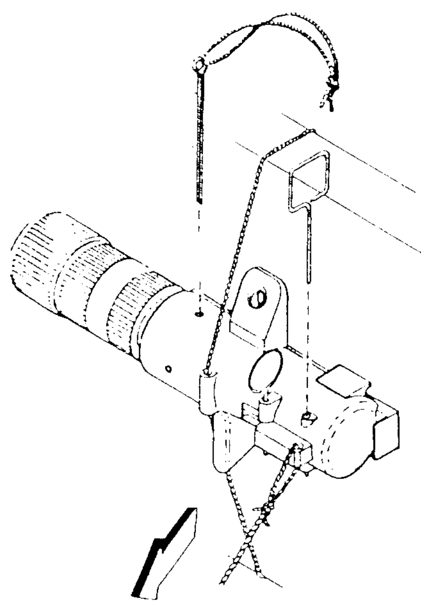


Figure A-61. M142 (pull mode)

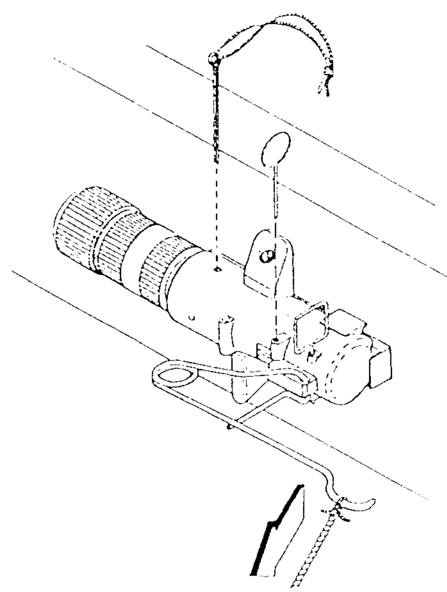


Figure A-62. M142 (tension-release mode)

INSTALLATION/REMOVAL

Arming and disarming procedures vary based on the activation mode. Detailed instructions are printed on a weatherproof, vinyl sheet included in each FD package.

APPENDIX B

THREAT MINEFIELD RECONNAISSANCE

Successful combined arms reconnaissance requires extensive training. Engineers train alone to hone their individual and collective skills, and they also train with scouts. This training fosters habitual integration of engineers with maneuvers for reconnaissance missions. The information gained from minefield reconnaissance assists the commander in refining the scheme of maneuver, in planning, and in task-organizing for breaching operations. Engineers are trained to evaluate the technical aspects of a minefield, and they collect the information during combined arms reconnaissance. Engineers in support of heavy forces reconnoiter enemy tactical minefield, and light engineers infiltrate to reconnoiter protective minefield. Scouts concentrate on other intelligence requirements.

The staff engineer integrates engineers into the maneuver R&S plan. He coordinates the plan with other R&S plans, artillery fires, infiltration lanes. and follow-on missions.

Engineer company and platoon R&S plans include—

- Issuing a warning order to subordinates that contains tentative minefield locations and specific requirements for information, equipment, and coordination.
- Moving early to allow connection with scouts.
- Affording leaders maximum time to prepare for the mission.

Early connection of engineers, scouts, and maneuver personnel is critical for planning and preparation. Engineers participate in planning passage of lines, routes, R&S mission / objective, reports, consolidation, and and exfiltration. At a minimum, rehearsals are conducted for actions on contact, at unexpected obstacles, and at the reconnaissance objective.

During movement, the R&S patrol uses concealed routes and limited visibility. It avoids enemy contact at all costs. The patrol establishes an objective rally point (ORP) short of the minefield. The R&S leader issues a contingency plan prior to R&S teams leaving the ORP. Engineer R&S teams then move to the R&S locations and establish security.

SECURITY

R&S teams ensure abnormal patrolling activity does not compromise selected breaching locations. The amount of patrolling should be similar at all possible points of attack. They do not leave behind evidence of their activities.

TECHNICAL INFORMATION

R&S teams gather the following information from the reconnaissance:

- Minefield location. Plot the perimeter location on a large-scale map and refer to recognizable landmarks.

- Perimeter description. Describe how the perimeter is fenced. If it is unfenced, describe how it is marked. If it is unmarked, show how it was recognized.
- Nuisance mines. If you discover a nuisance mine forward of the minefield's outer edge, remember, there may be others. Assembly areas might also be mined.
- Types of mines. Indicate whether mines are AT, AP, or have unknown fuzes (self-neutralized or self-destruct). Recover specimens of unknown or new mines and note the details.
- Details of any other devices. Describe booby traps, trip wires, flares, and antidisturbance devices.
- Laying method. Indicate whether mines are buried or surface-laid.
- Density and pattern. Include the mine spacing and the number of mine rows. Mine density is estimated using this information.
- Minefield depth. Provide the distance between strips/rows and describe markers.
- Safe lanes and gaps. Plot the location of suspected safe lanes and describe their marking.
- Ground conditions. Include information on general ground conditions.
- Other obstacles. Plot the location and construction of other obstacles.
- Enemy defenses. Describe the enemy's location and size. Include the location of enemy direct fire weapons.

NOTE: Engineers engaged in reconnaissance for OBSTINTEL should rarely, if ever, be used to reduce obstacles during the reconnaissance (although they make ideal leaders for subsequent breaching operations).

RECONNAISSANCE REPORT

Each R&S team commander submits a detailed intelligence report to the next higher headquarters when the reconnaissance is complete. A sample minefield report is shown in Figure B-1.

RECONNAISSANCE TECHNIQUE

A minefield R&S team normally consists of a commander and two men. When reconnaissance of several collocated sites is required, several teams might be formed into a reconnaissance group. When possible, teams are drawn from one platoon. There is no established reconnaissance drill, but the following technique is recommended for convenience and to ensure the results of each team are consistent and accurate.

- The R&S team consists of a prober, detector operator (relief man), and commander. It removes all equipment except flak vests, kevlar helmets, and weapons. The team uses stealth and available cover/concealment during movement to the reconnaissance site. (The reconnaissance is normally conducted at night.) Depending on the type of mines likely to be encountered, the prober or the detector operator enter the minefield first.
- The leading man (soldier 1) enters the mined area and dispenses a cord or tape. He feels for trip wires and feels/probes for mines and other devices in a path approximately 1 meter wide. He marks located mines and reports their location to the commander. The commander stays 1 to 5 meters behind soldier 1 and ensures soldier 1 stays on the correct azimuth.

Letter Designation	Explanation
A	Map sheet(s).
B	Date and time the information was collected.
C	Type of minefield (AT, AP, or mixed).
D	Grid references of minefield extremities, if known.
E	Depth of minefield.
F	Estimated time required to clear the minefield.
H	Estimated material and equipment required to clear the minefield.
I	Routes for bypassing the minefield, if any.
J-Y	Grid reference of lanes (entry and exit) and width of lanes, in meters.
Z	Additional information such as types of mines used, unknown mines, or types of booby traps.

Figure B-1. Sample minefield report

- Distances from the start point can be recorded in several ways. EXAMPLE: Once the mines are located, the commander uses a knot or loop code tied on the cord being dispensed by soldier 1. When necessary, the commander rotates soldier 1 and soldier 2. The relief man (soldier 2) stays approximately 5 meters behind the commander and uses a mine detector to search for deeply buried AT mines. The rate of travel (depending on terrain and soil conditions) is approximately 80 meters per hour. When all the information has been gathered, the R&S team returns along the cord/tape and removes evidence of its activities.
- The R&S team moves back to the ORP. The reconnaissance patrol conducts a debrief to eliminate redundant information. The patrol uses established procedures to report the information.
- During exfiltration back to friendly lines, the patrol again avoids enemy contact at all costs. It communicates with the friendly passage point unit, exchanges far and near recognition signals, and conducts a passage of lines.
- The engineer staff officer and the S2 debrief R&S units.

APPENDIX C

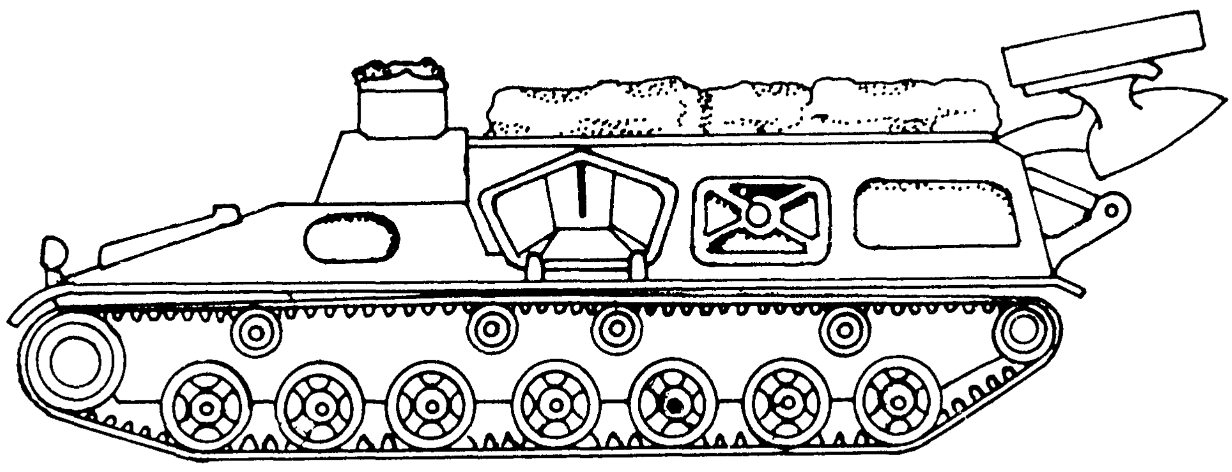
SOVIET MINE/COUNTERMINE OPERATIONS

This appendix is intended to complement the information presented in other field manuals on Soviet tactics obstacle warfare. It applies to most Soviet-style armies and their surrogates. Commanders should use the information to give added realism to unclassified staff and combined arms team training, although obstacle employment norms can change with METT-T factors for a given area of operation. Therefore, preoperational training on templating, intelligence, reconnaissance, and reduction procedures must be based on the best information available before deployment.

MINE OPERATIONS

Soviet formations contain considerable organic minefield emplacement capability. Soviet rapid-mining capability presents a serious challenge to friendly maneuver. Figure C-1 summarizes mechanical minelayer assets organic to Soviet regiments and divisions.

To rapidly lay mines and place obstacles during offensive operations, the Soviets form a special



GMZ

Allocation

3 per Soviet division
3 per motorized rifle and tank regiment
15 GMZs total per Soviet division

Figure C-1. Soviet armored tracked minelayer (GMZ) team from regimental and division assets. This Soviet mobile obstacle detachment team is called a Podvizhnyy Otryad Zagrazhdeniya (POZ). POZs place AT mines on the most likely avenues for armored attacks or counterattacks. They are positioned on the flanks of a march formation for rapid deployment and are normally in close proximity to AT reserves. During the march, POZs reconnoiter avenues into the flanks and identify the most likely avenues for tank movement. At secured objectives, POZs reinforce existing obstacles and place new obstacles to help defeat counterattacks.

The combined arms commander orders the organization of a POZ and determines its composition based on the combat situation and available troops. The engineer elements in a division POZ come from the divisional engineer battalion and consist of three armored, tracked minelayers known as Gusenichnyy Mino-Zagraditeli (GMZs). This platoon-size element has two or three trucks that carry mines for immediate resupply. For the regimental POZ, the regimental engineer company provides a platoon-size unit equipped with two or three GMZs. The platoon travels in BTR-50/60s and has 600 AT mines.

The GMZ dispenses mines at intervals of 4 to 6 meters. Mine-laying helicopters also support the POZ. The HIP and HIND-D helicopters carry two or three dispenser pods of AP or AT mines. Artillery-fired scatterable mines can also support the POZ. Three GMZs can lay a 1,200-meter, three-row minefield containing 624 mines in 26 minutes (doctrinally, this minefield is broken into several minefields that are 200 to 300 meters long).

The Soviets use obstacles extensively throughout the depth of their defense, and their tactics are chosen well. Shallow obstacles can be breached quickly and easily.

Table C-1. Normal parameters for Soviet minefields

Antitank Minefield	
Front (situation-dependent)	200 to 300 meters
Depth	60 to 120 meters
Distance Between Rows	20 to 40 meters
Number of Rows	3 to 4 rows
Distance Between Mines	4 to 6 meters for antitrack mines; 9 to 12 meters for antihull mines
Outlay, Normal	550 to 750 antitrack mines/kilometer; 300 to 400 antihull mines/kilometer
Outlay, Increased Effect	1,000+ antitrack mines/kilometer; 500+ antihull mines/kilometer
Probability of Destruction	0.57 for antitrack mines (750/kilometer); 0.85 for antihull mines (400/kilometer)
Antipersonnel Minefield	
Front	30 to 300 meters
Depth	10 to 150 meters
Distance Between Rows	5+ meters for blast mines; 25 to 50 meters for fragmentation mines
Number of Rows	2 to 4 rows
Distance Between Mines	1 meter for blast mines; 50 meters or twice the lethal radius of fragmentation for fragmentation mines
Outlay, Normal	2,000 to 3,000 for HE/blast mines (2,000/kilometer); 100 to 300 for fragmentation mines
Outlay, Increased Effect	2 to 3 times normal outlay
Probability of Destruction	0.15 to 0.2 for HE/blast mines (2,000/kilometer); 0.1 to 0.15 for fragmentation mines (100/kilometer)

For example, a shallow, one-row minefield is essentially breached by blowing one or two mines in the row. The Soviets' rapidly placed minefield consists of three or four 200- to 300-meter -long rows, spaced 20 to 40 meters apart, with mines spaced 4 to 6 meters apart. As a rule, the minefield covers the depth of a football field. Table C-1 gives more detailed information on standard Soviet AT and AP minefields, although terrain and tactical situations dictate actual dimensions and distances of minefields. Figure C-2 shows a rapidly placed minefield. The Soviets typically use such a minefield when in a hasty defense (offense is temporarily stalled). Figures C-3 and C-4, page C-4, show standard *antitrack* and *antihull* minefields, respectively. Figure C-5, page C-5, shows a standard AP minefield.

The Soviets also emplace mixed minefields. They are not the same as US mixed minefields. Soviets normally emplace three rows of AT mines, then several rows of AP mines. AT and AP mines are not mixed in the same row.

Soviet engineers use two fundamental drills to emplace mines:

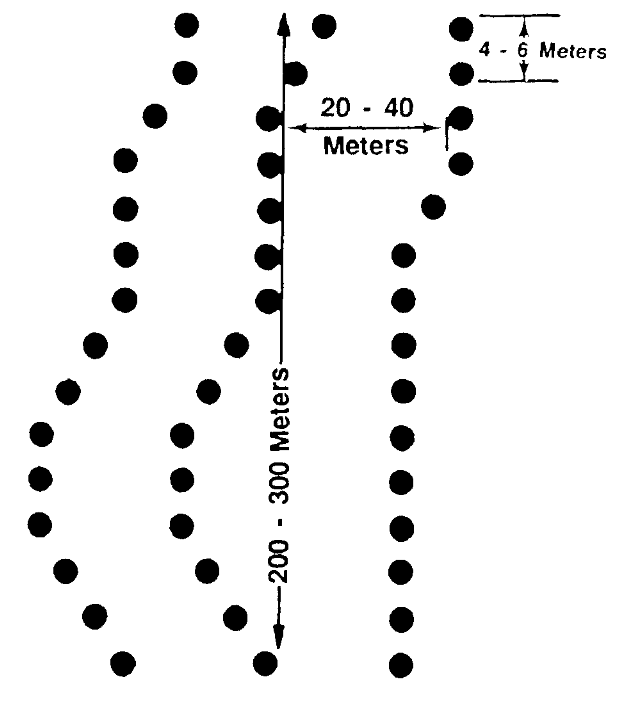


Figure C-2. Soviet rapid minefield

- When emplacing armed mines, the drill uses a crew of five sappers. The first crew member (the senior man and operator) is in the minelayer seat and monitors the operation of the minelayer and the motion of the mines in the guide chute. He also sets the mine spacing and controls the actions of the GMZ. The second and third members remove mines from containers and place them in the intake chute at intervals between the guide tray's drive chain. The GMZ driver steers the vehicle along the indicated route at the established speed.
- When emplacing unarmed mines, two or three additional sappers are assigned to arm the mines. After emplacing the mines, one sapper trails the minelayer, marks emplaced mines with pennants, and partially camouflages the mines. The remaining sapper(s) then arm the mines.

AP minefield emplacement is similar to AT minefield emplacement, but special precautions are taken. Soviet doctrine only allows PMN mines to be surface-laid from minelayers. POMZ-2M mines are emplaced with a truck-and-tray technique (PPMP). Extra effort is required to assemble, emplace, and camouflage the POMZ-2M mine. Extra effort is also required to deploy the POMZ-2M's trip wire.

Using three GMZs, a Soviet POZ can emplace 1,200 meters of a three-row, AT, surface-laid minefield, containing 900 AT mines, in 15 minutes. This does not include the 12- to 15-minute reload or the travel time. Both travel and reload times increase during limited visibility.

The type and complexity of an obstacle depends on the installing unit. Maneuver and artillery soldiers install simple, single-system minefields that are usually protective in nature. Engineer soldiers install complex obstacles that can include AHDs. Engineer obstacle placement is usually equipment-intensive. Soviet engineer effort generally concentrates on tactical obstacles unless maneuver soldiers are unable to employ necessary protective obstacles. The Soviets continue to improve obstacles supporting their positions by marking obstacles on the friendly side, burying mines, and adding AHDs.

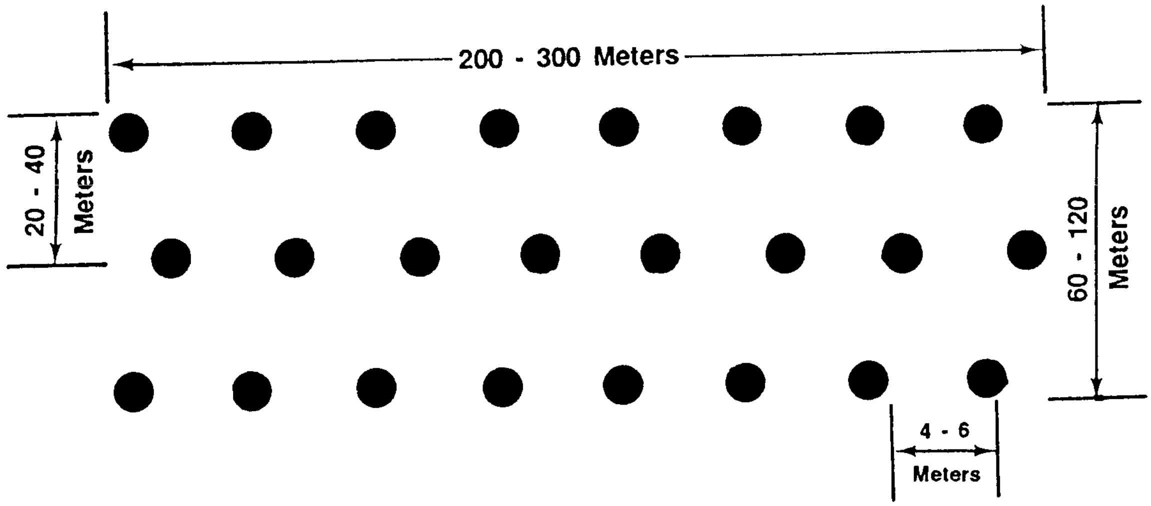


Figure C-3. Soviet antitrack minefield

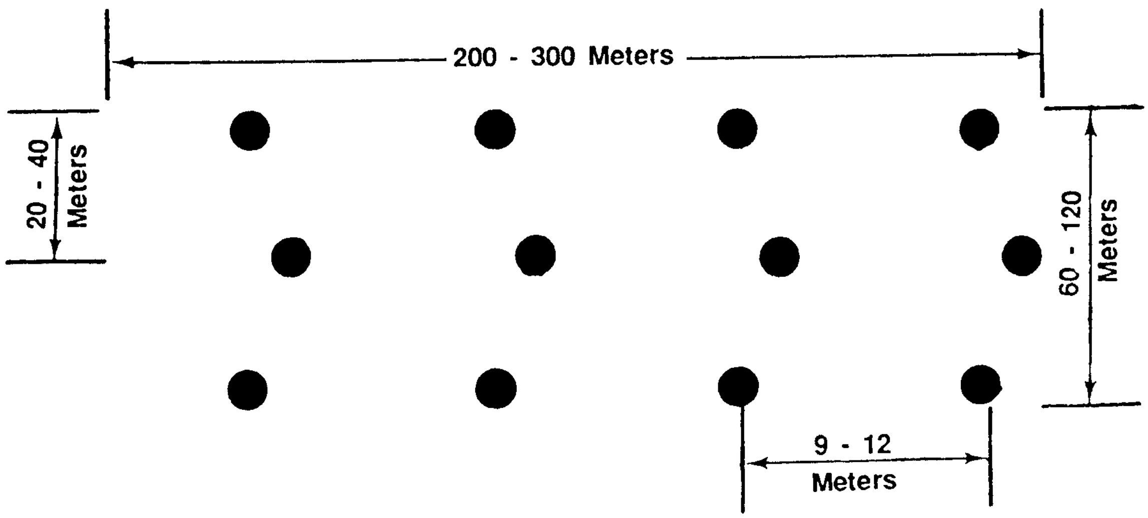


Figure C-4. Soviet antihull minefield

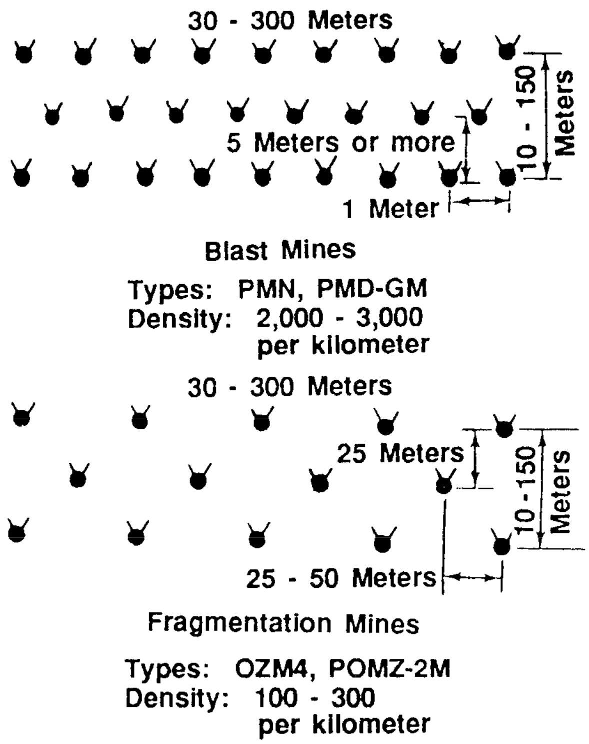


Figure C-5. Soviet antipersonnel minefield

COUNTERMINE OPERATIONS

In offensive operations, Soviet engineers clear passages through obstacles whenever they cannot be bypassed. Although clearing obstacles applies to the march and defense, the most critical performance of this task occurs during the attack. Engineers can be required to clear mines delivered by air, artillery, and rockets well ahead of NATO's forward edge. They must also breach obstacles contained within NATO strongpoints. The Soviets must also clear their own minefields when making the transition from defense to offense. In the offense, Soviet forces breach or bypass remotely delivered minefields in their form-up areas or routes of movement to the attack line. They also breach obstacles along the forward edge of the battle area (FEBA) and deep within NATO defenses.

Although clearing passages through obstacles is a primary task for Soviet engineers, any maneuver element can encounter mines delivered by air, artillery, or rockets. Engineers cannot respond to every encounter, so maneuver troops are also required to breach remotely emplaced obstacles.

Organization

A movement support detachment (Otryad Obespecheniya Dvizheniya (OOD)) supports the movement of maneuver forces. It is task organized from division or regimental engineer assets, the OOD can be from platoon- to company-size. The OOD is equipped with route and mine-clearing vehicles and devices. Depending on the mission, which comes directly from the combined arms commander or the NIS (chief of engineer services), an OOD is capable of filling craters, clearing minefields, preparing bypasses around major obstructions, and identifying NBC-contaminated areas.

The division engineer battalion can form two or three OODS. During marches, OODs travel in advance of the main body and clear obstructions reported by division reconnaissance elements. When they are deployed on main routes, they are under the protection of an advance guard or forward security element. When deployed on other routes, leading regiments provide OODS from organic engineer assets. An OOD at this level might consist of an engineer platoon with one or two dozers and up to three tanks fitted with dozer blades. OODs can be protected by a platoon of infantry or tanks and are usually accompanied by chemical reconnaissance personnel. They can detect, mark, and breach hasty minefields that are not properly covered by fire. If OODs encounter properly defended minefields, their clearing capabilities are limited.

Each battalion forms an obstacle-clearing group to create gaps in explosive and nonexplosive obstacles. Normally a part of a battalion-level OOD, the group follows first-echelon companies in APCs and creates gaps for those forces. These units can be equipped with BAT vehicles that have BTU bulldozer blades (Figure C-6) or with KMT-series mine plows (Figure C-7).

An obstacle-clearing detachment is created when more resources are needed to clear obstacles and debris. This usually occurs in urban environments and under conditions of massive destruction. An obstacle-clearing detachment is similar to an OOD, but its sole mission is to clear debris. Like an OOD, its composition depends on the mission scope and objective and on the tempo of the offensive.

The divisional engineer battalion of a motorized rifle or tank division has a sapper company to clear obstacles. The company commander receives a mission to clear minefield from the combined arms commander or the NIS. He then determines the exact location of the obstacle, ascertains the assets to devote to the task, and plans the methodology for success. Teams can be created to manually breach lanes using probes, hand-held mine detectors (Figure C-8), and shovels. Larger tasks may necessitate the use of vehicle-mounted DIM mine detectors (Figure C-9, page C-8), armored vehicle mine plows and rollers (Figure C-10, page C-8), and explosive line charges. When necessary or more practical, mines are explosively destroyed in place.

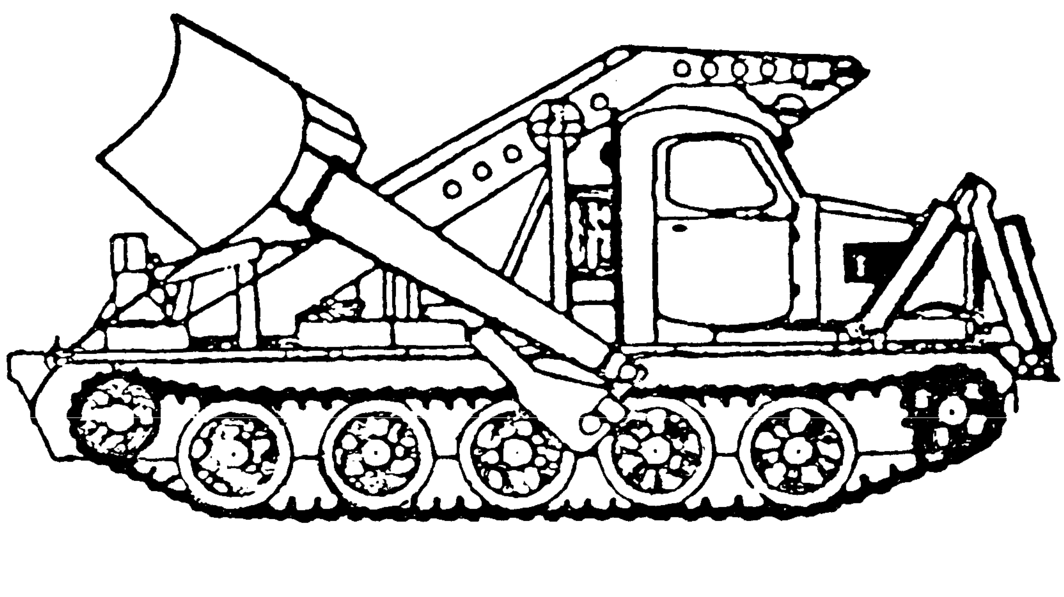


Figure C-6. BAT-M

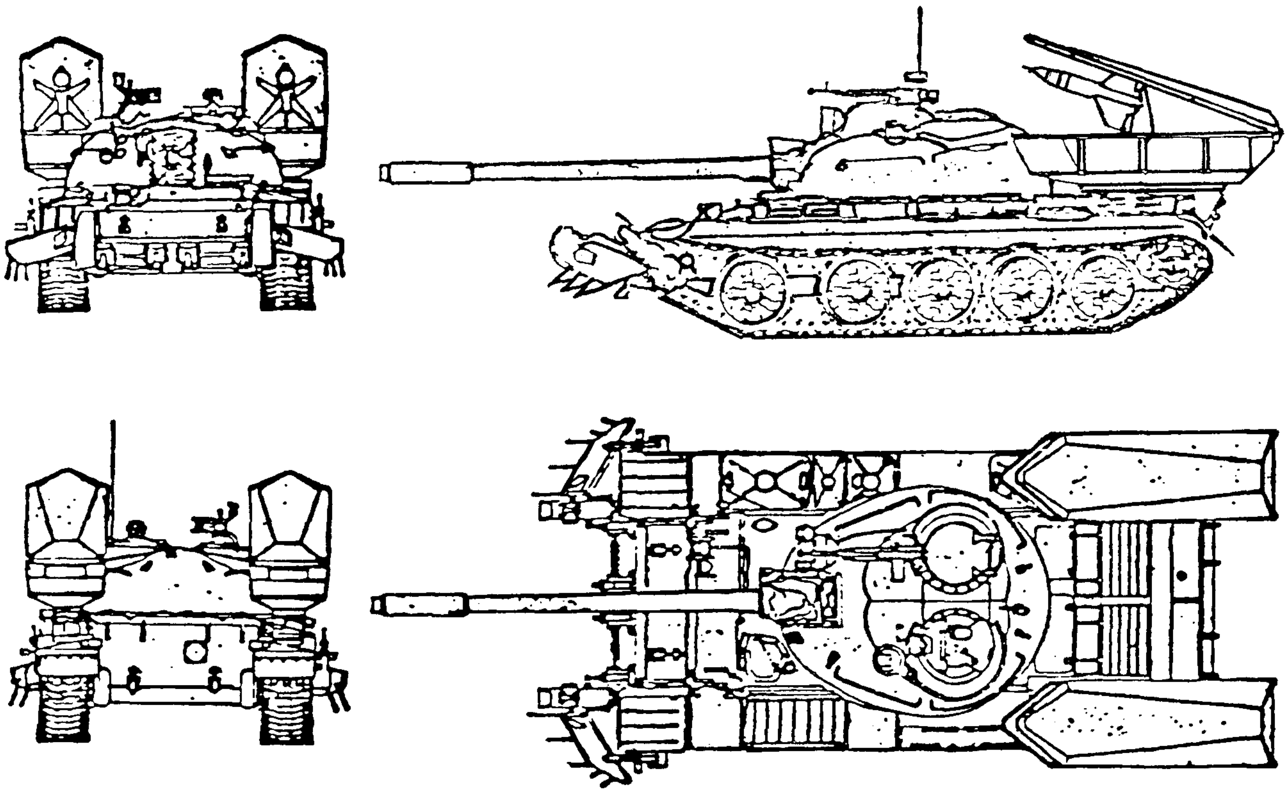


Figure C-7. KMT-4/6

Figure C-8. IMP (portable mine detector)

The engineer company of the motorized rifle or tank regiment has breaching equipment such as the KMT-series mine plows and rollers and the BTU dozer blades located in its technical platoon. Because of limited assets in the technical platoon, coupled with the responsibility of forming its own OOD, the regiment can receive a sapper section from the divisional sapper company. An additional IMR (Figure C-11, page C-9), BTR-50/60, and M1979 (Figure C-12, page C-10), as well as manual breaching equipment, come with the sapper section.

Maneuver units usually breach remotely emplaced obstacles by themselves using attached, built-in breaching equipment (BTUs and KMTs). In order to successfully carry out this task, all subunit commanders organize constant reconnaissance, notify subordinates about mined areas in a timely manner, train personnel on the means and methods for handling remotely emplaced mines, and clear terrain in a timely manner. They must also train

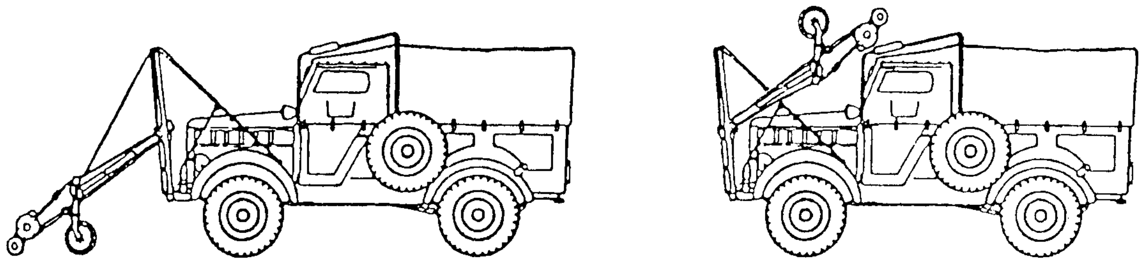


Figure C-9. DIM vehicle-mounted mine detector

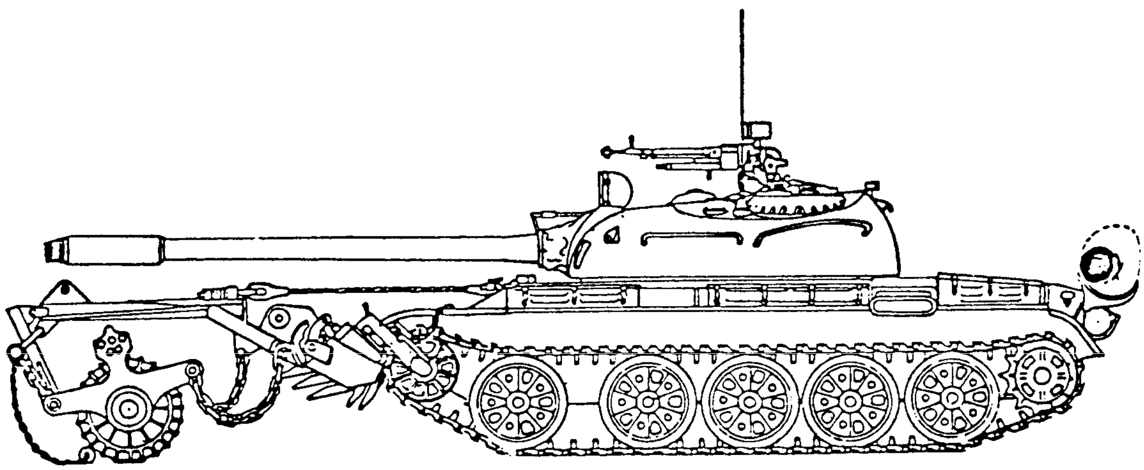


Figure C-10. KMT-5 plow-roller combination

their own teams for independent actions when removing combat equipment from mined areas. Soviet plows are considered maneuver-force assets, and one plow is assigned to each tank platoon. Recently, the BMP has been equipped with track-width mine plows, but the allocation has not been determined.

Equipment

The following items of equipment are used by the Soviet Army to detect and clear mines:

- BAT-M. The BAT-M dozer is a modified artillery tractor with a hydraulically operated

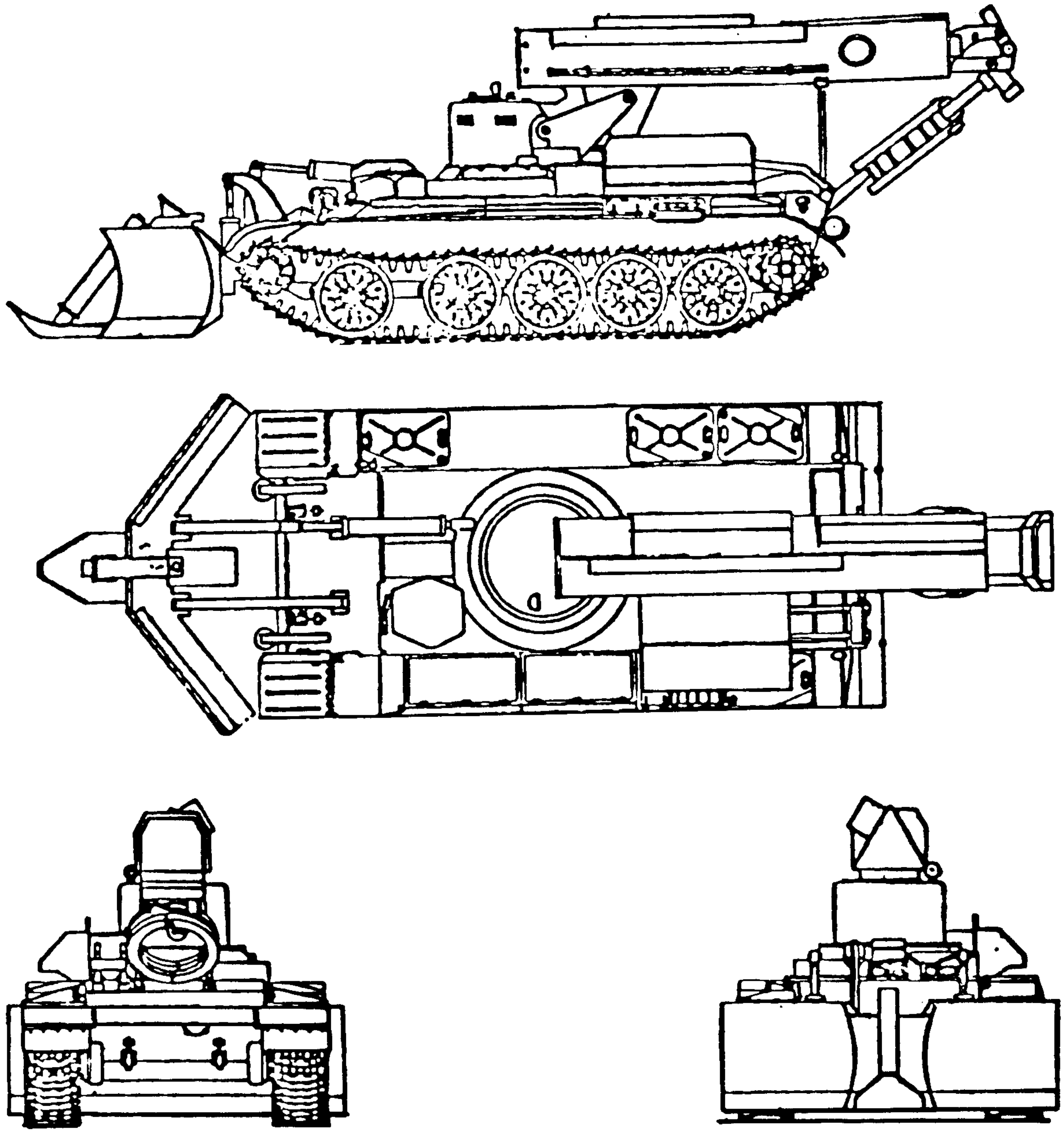


Figure C-11. IMR armored engineer tractor

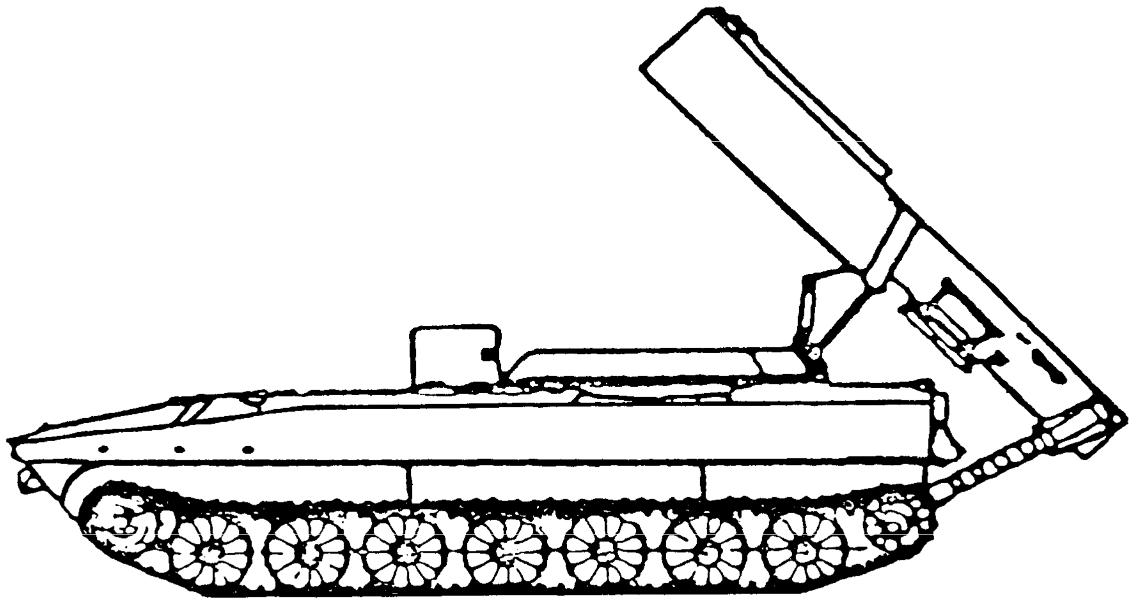


Figure C-12. M1979 armored mine clearer

bulldozer blade and crane. Sometimes called *roaders* by the Soviets, BAT-M dozers clear obstacles, fill craters, prepare bridge approaches, and do other heavy pioneer tasks. They can also be configured for snowplowing. The second generation BAT-M is the BAT-2. The BAT-2 can carry an 8-man engineer squad and operate in an NBC environment. The BAT-2 is replacing the BAT-M.

- KMT-Series.
  - The KMT-4 mine-clearing plow was developed in the 1960s to fit on a T-54/55 tank. It actually consists of two plows, and each plow has five attached teeth. One plow is mounted in front of each tank track. When the plow is lowered, the teeth dig into the ground and remove mines from the path of the tank. (Mine rollers simply detonate mines.) The plow is lighter than the roller and permits tanks to retain their cross-country mobility. Estimated clearing speed is 10 kph and the depth of clearance is 10 centimeters. Three plows are issued to each tank company (one per platoon). However, these assets are normally held in the engineer company of a tank or motorized rifle regiment.
  - The KMT-5 plow/roller combination consists of two plows and two rollers attached to the front of a tank hull. The plows or the rollers can be used, depending on terrain features, type of soil, and the mine fuze. Plows and rollers cannot be used simultaneously. The rollers function against pressure-fuze mines. The system can survive 5 or 6 kilograms of explosives five or six times. The KMT-5 also includes a luminous lane-marking device for night operations.
  - The KMT-6 mine-clearing plow was introduced along with the T-64 and T-72 tanks in the early 1970s. It has operating characteristics similar to those of the KMT-4.

   - The KMT - 10 mine-clearing plow is fitted to the BMP-2 infantry combat vehicle.

- IMP Portable Mine Detector. The IMP portable mine detector has a tubular search head (containing one transmitting and two receiving coils encased in plastic) and a four- section handle. Power is furnished by four flashlight batteries that permit 20 hours of continuous operation. Two tuning controls are mounted on the handle. The coils in the search head compromise an induction bridge and are initially balanced for zero coupling. When the head passes over a metallic object, the induction bridge becomes unbalanced. This produces an audible signal in the headset. This 7.0-kilogram unit can detect mines buried to a depth of 45 centimeters.

- DIM Vehicle-Mounted Mine Detector. The DIM truck-mounted mine detector is primarily used to clear roads during convoys and road marches. It sweeps at a speed of 10 kph with a 2.2-meter width. It can detect metallic mines at a depth of 25 centimeters. The brakes on the DIM automatically engage when a mine is detected. Cross-country use of the DIM is limited.

- IMR Armored Engineer Tractor. This vehicle is mounted on a modified T-54/55 chassis. The turret is removed and a hydraulic crane, which can be fitted with either a grab or an excavator bucket, is emplaced. An adjustable, hydraulically operated blade is mounted on the front. The crane operator is provided with an armored cupola. The IMR can operate in an NBC environment.

- M1979 Armored Mine Clearer. This vehicle is mounted on the chassis of an amphibious 122-millimeter, 2S1 self-propelled howitzer. It has a turret-like superstructure that contains three rockets on launch ramps. These, together with the upper part of the superstructure, are hydraulically elevated for firing. The rocket range is estimated at 200 to 400 meters. Each rocket is connected to 170 meters of mine-clearing hose via a towing line. The hose is folded and stowed in the uncovered base of the turret and connected to the vehicle with a cable. The cable allows the vehicle crew to reposition the hose after launching.

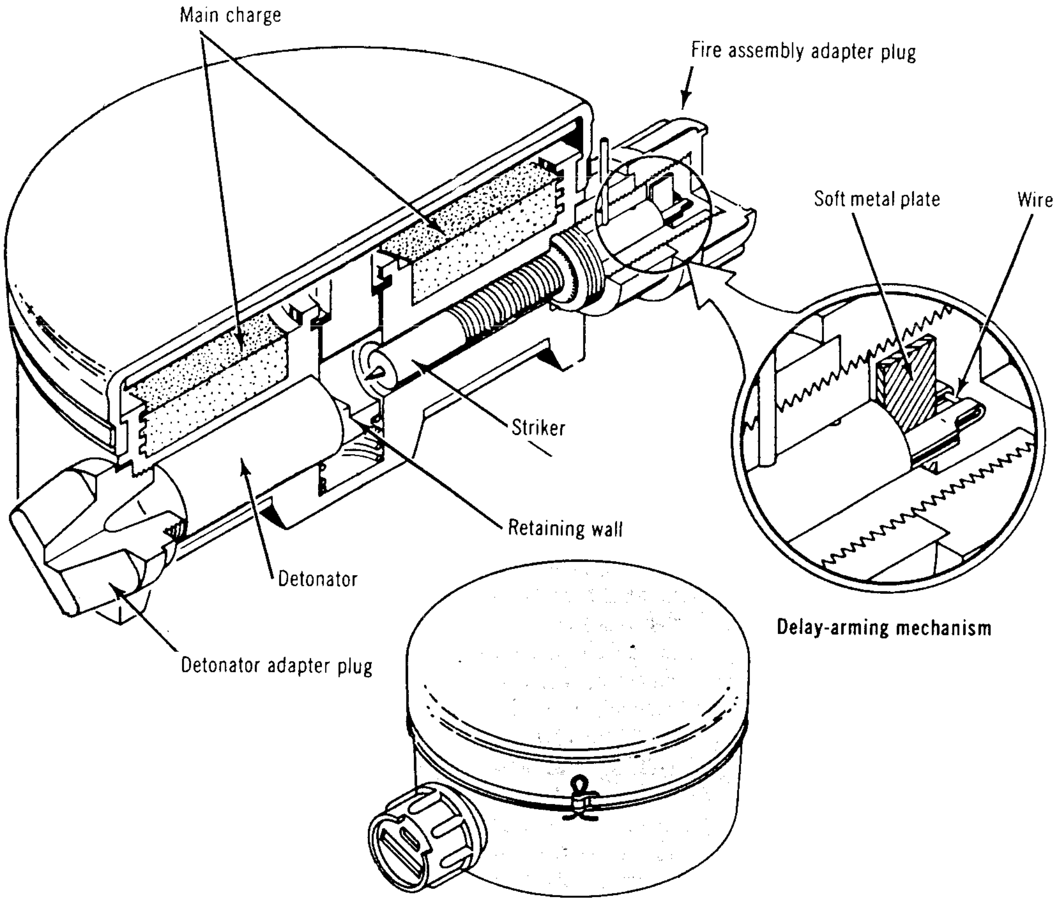
APPENDIX D

FOREIGN MINES

This appendix contains information on mines in use by some communist and free-world countries. The scope of this appendix is limited due to the amount of mine types available throughout the world (obsolete, current, and prototype mines in excess of 2,000 types).

The technical information presented here is primarily for identification purposes and is not intended to provide detailed guidance for disarming the mines. Mines and fuzes can be set up in a number of different configurations, and disarming procedures which may work for a particular mine may not necessarily work for the same mine when armed with a different fuze or antihandling device. Threat mines should be neutralized by destroying them in place using the procedures contained within this manual.

Section I. Antipersonnel Mines



PMN antipersonnel mine (Soviet)

PMN ANTIPERSONNEL MINE (SOVIET)

Characteristics

Height: 56 mm (2.2 in).

Diameter: 112 mm (4.4 in).

Mine Weight: 550 grams (1 lb 3.4 oz).

Explosive Weight: 200 grams (7. 1 oz).

Color: Sand or black rubber cover, Bakelite body.

Description

Fuze Type: Delay-armed, pressure-initiated.

Sensitivity: 5 to 8 kg (1 1.0 to 17.6 lb) pressure.

Detectability: With hand-held metallic detector; fair amount of metal in fuze assembly and cover retainer.

Capability

Type Kill: Blast effect.

Antihandling: None.

Vulnerabilities

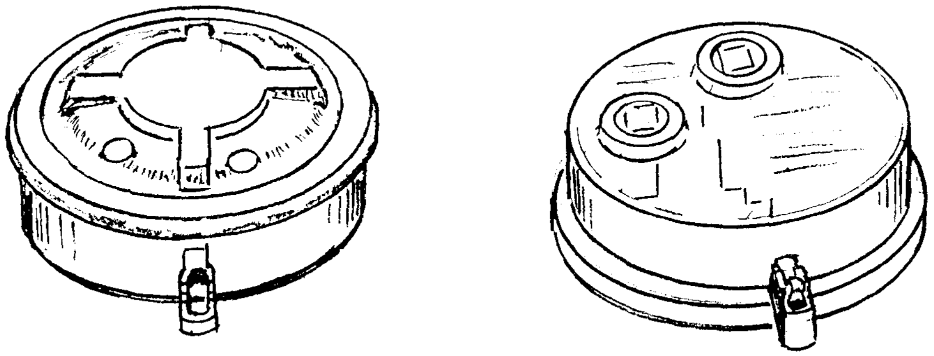
None.

Breach Guidance

Mine Plow: Removes armed mines from plowed area; some will detonate.

MICLIC: Blast overpressure readily defeats this simple pressure fuze.

Charge Placement: Adjacent to the PMN.



PMN-2 antipersonnel mine (Soviet)

PMN-2 ANTIPERSONNEL MINE (SOVIET)

Characteristics

Height: 54 mm (2.1 in).

Diameter: 125 mm (4.9 in).

Mine Weight: 450 grams (15.9 oz).

Explosive Weight: 115 grams (4.1 oz).

Color: Black rubber cover, green body.

Description

Fuze Type: Delay-armed, blast-resistant, pressure-initiated.

Sensitivity: 5 kg (11.0 lb) pressure.

Detectability: With hand-held metallic detector; fair amount of metal in fuze assembly.

Capability

Type Kill: Blast effect.

Antihandling: None.

Vulnerabilities

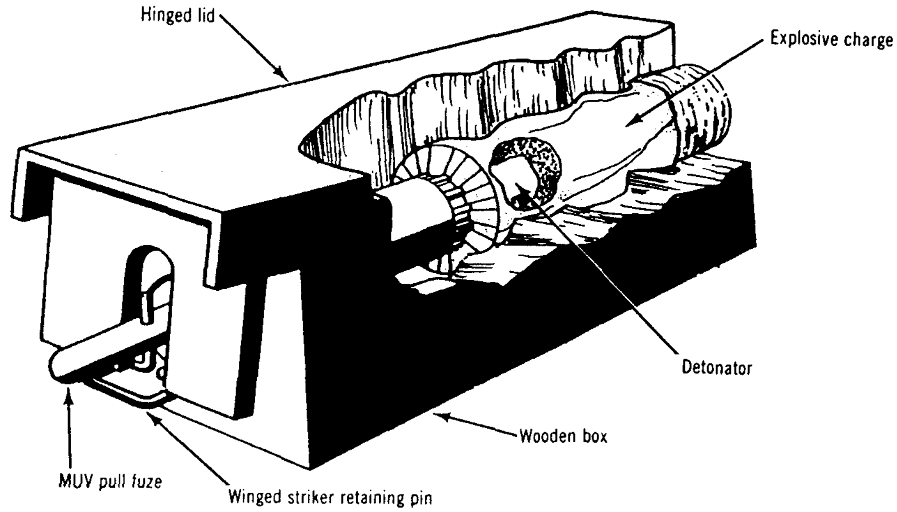
None.

Breach Guidance

Mine Plow: Removes armed mines from plowed area; some will detonate.

MICLIC: Drastic reduction in effectiveness against PMN-2 (blast-resistant).

Charge Placement: Adjacent to the PMN-2.



PMD-6, PMD-6M antipersonnel mines (Soviet)

PMD-6, PMD-6M ANTIPERSONNEL MINES (SOVIET)

Characteristics

Length: 196 mm (7.7 in).

Width: 87 mm (3.4 in).

Height: 50 mm (2.0 in).

Mine Weight: 400 grams (14. 1 oz).

Explosive Weight: 200 grams (7. 1 oz).

Color: Natural wood.

Description

Fuze Type: Pressure-initiated.

Sensitivity: 1 to 10 kg (2.2 to 22.0 lb) (depends upon condition of release pin in MUV fuze).

Detectability: With hand-held detector; fair amount of metal in MUV-type fuze and detonator assembly.

Capability

Type Kill: Blast effect.

Antihandling: None.

Vulnerabilities

None.

Breach Guidance

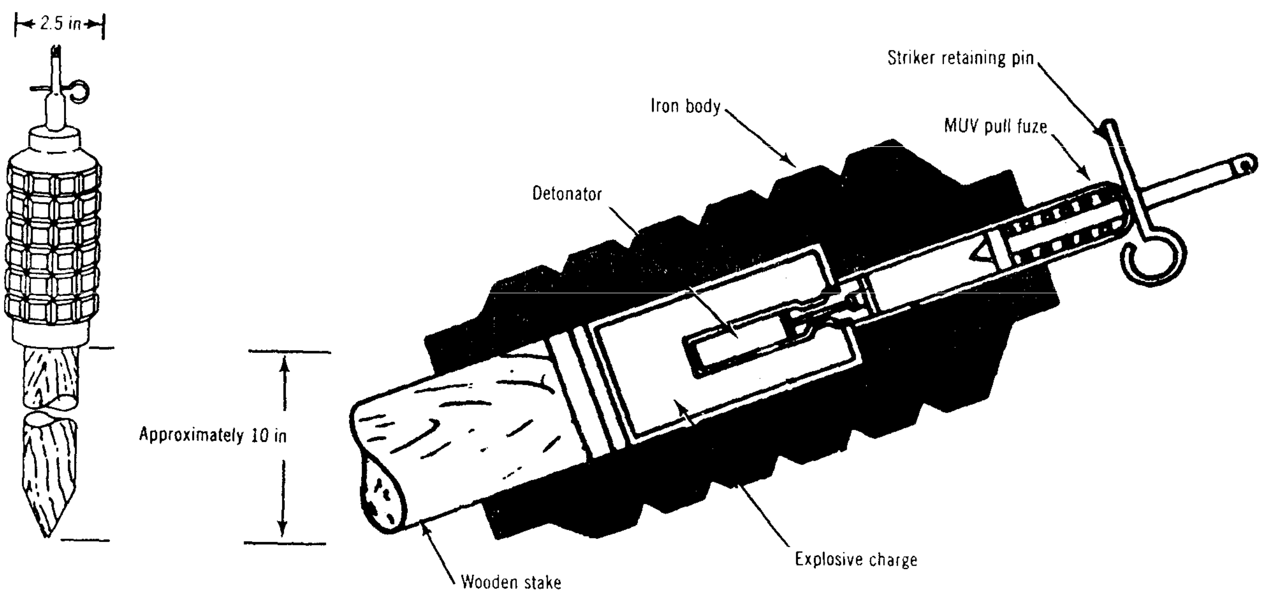
Mine Plow: Removes armed mines from plowed area; some will detonate.

MICLIC: Blast overpressure readily defeats a "SHU" type mine.

Charge Placement: Adjacent to the PMD-6 or PMD-6M.

Remarks

Delay-armed if MUV-2, MUV-3, or MUV-4 fuzes used. Probing for small "SHU"-type mines with low pressure thresholds is a very hazardous operation.



POMZ-2, POMZ-2M antipersonnel mines (Soviet)

POMZ-2, POMZ-2M ANTIPERSONNEL MINES (SOVIET)

Characteristics

Height: 107 mm (4.2 in) (without fuze).

Diameter: 60 mm (approx.) (2.4 in).

Mine Weight: 1,770 grams (3.9 lb) (POMZ-2M).
2,300 grams (5. 1 lb) (POMZ-2).

Explosive Weight: 75 grams (2.6 oz).

Color: Olive drab.

Description

Fuze Type: Trip-wire-initiated,

Sensitivity: 2 to 5 kg (4,4 to 11.0 lb) (depends upon condition of release pin in MUV fuze).

Detectability: Visual, stake mounted.

Capability

Type Kill: Fragmentation effect.

Kill Radius: 4 meters.

Antihandling: None.

Vulnerabilities

None.

Breach Guidance

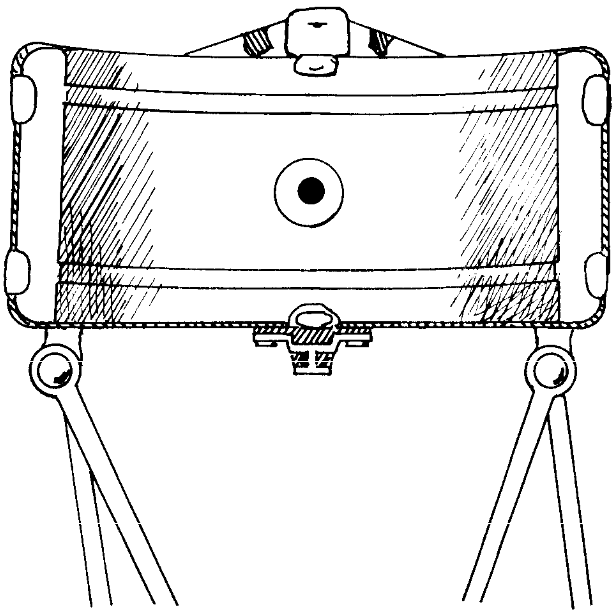
Mine Plow: Removes armed mines from plowed area; some will detonate.

MICLIC: Heavy line charges readily defeat trip-wire-initiated mines.

Charge Placement: Adjacent to the POMZ-2 or POMZ-2M.

Remarks

Weathered/rotten mounting stakes (wood) present a hazard to clearance teams (falling POMZ type bodies are heavy enough to initiate MUV fuzes).



MON-50 antipersonnel mine (Soviet)

MON-50 ANTIPERSONNEL MINE (SOVIET)

Characteristics

Width: 220 mm (8.7 in).

Depth: 45 mm (1.8 in).

Height: 105 mm (4.1 in) (without legs).

Mine Weight: 1,960 grams (4.3 lb).

Explosive Weight: 715 grams (1.6 lb).

Color: Green.

Description

Fuze Type: Trip-wire /command-initiated.

Sensitivity: 2 to 5 kg (4.4 to 11.0 lb) (depends upon condition of release pin in MUV fuze).

Detectability: Visual; stands on own steel legs.

Capability

Type Kill: Directed fragmentation effect.

Kill Radius: 50 meters, 60-degree area of coverage (fragmentation - 455 steel cylinders).

Antihandling: None.

Vulnerabilities

None.

Breach Guidance

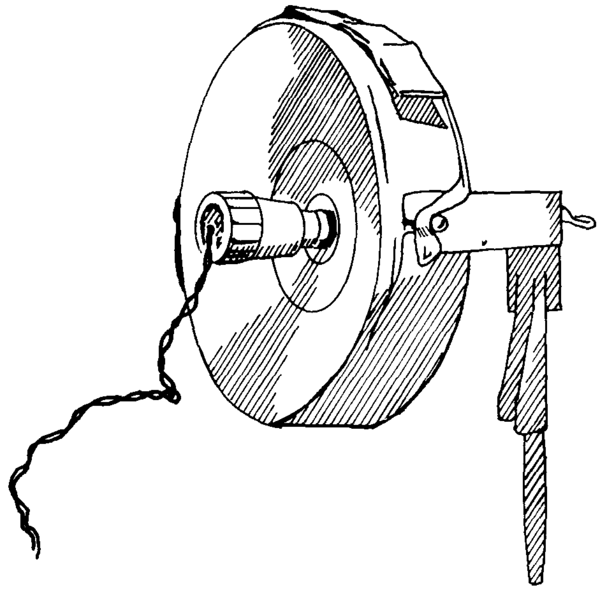
Mine Plow: Removes armed mines from plowed area; some will detonate.

MICLIC: Heavy line charges readily defeat trip-wire/command-initiated mines.

Charge Placement: Adjacent to the MON-50.

Remarks

Two fuze wells provide opportunity for multiple trip lines or the use of detonating cord for series connection to adjacent mines. A threaded steel well located at the base of the mine is used in conjunction with a heavy mounting spike for attachment to trees and buildings.



MON-100 antipersonnel mine (Soviet)

MON-100 ANTIPERSONNEL MINE (SOVIET)

Characteristics

Diameter: 240 mm (9.4 in).

Depth: 80 mm (3.1 in).

Mine Weight: 5,400 grams (11.9 lb) (without bracket).

Explosive Weight: 2,000 grams (4.4 lb).

Color: Olive drab.

Description

Fuze Type: Trip-wire/command-initiated.

Sensitivity: 2 to 5 kg (4.4 to 11.0 lb) (depends upon condition of release pin in MUV fuze.

Detectability: Visual; stands on heavy steel spike.

Capability

Type Kill: Directed fragmentation effect.

Kill Radius: 100 meters, 15-degree area of coverage (fragmentation - 405 steel cylinders, 10 mm x 10 mm).

Antihandling: None.

Vulnerabilities

None.

Breach Guidance

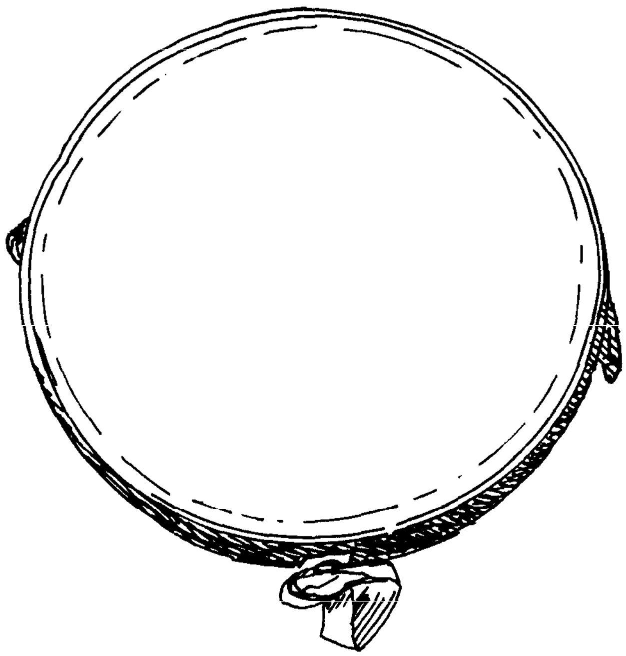
Mine Plow: Removes armed mines from plowed area; some will detonate.

MICLIC: Heavy line charges readily defeat trip-wire/command-initiated mines.

Charge Placement: Adjacent to the MON-100.

Remarks

A heavy steel mounting spike is used for attachment to trees and buildings.



MON-200 antipersonnel mine (Soviet)

MON-200 ANTIPERSONNEL MINE (SOVIET)

Characteristics

Diameter: 450 mm (17.7 in).

Depth: 130 mm (5.1 in).

Mine Weight: 25,000 grams (55.1 lb) (without bracket).

Explosive Weight: 12,000 grams (26.5 lb).

Color: Olive drab.

Description

Fuze Type: Trip-wire/command-initiated.

Sensitivity: 2 to 5 kg (4.4 to 11.0 lb) (depends upon condition of release pin in MUV fuze).

Detectability: Visual; stands on heavy steel spike.

Capability

Type Kill: Directed fragmentation effect.

Kill Radius: 200 meters, 15-degree area of coverage (fragmentation - 910 steel cylinders, 12 mm x 12 mm).

Antihandling: None.

Vulnerabilities

None.

Breach Guidance

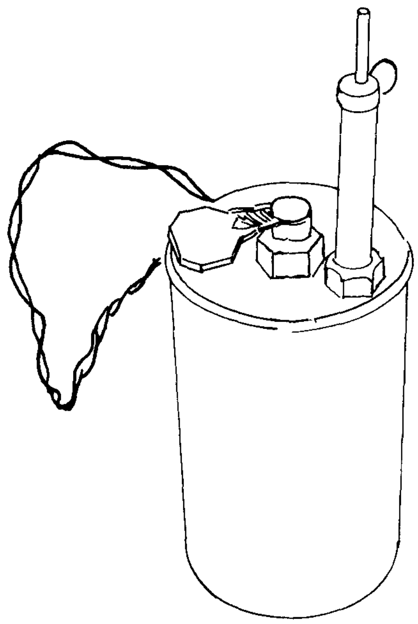
Mine Plow: Removes armed mines from plowed area; some will detonate.

MICLIC: Heavy line charges readily defeat trip-wire/command-initiated mines.

Charge Placement: Adjacent to the MON-200.

Remarks

A heavy steel mounting stand is available.



OZM-3 antipersonnel mine (Soviet)

OZM-3 ANTIPERSONNEL MINE (SOVIET)

Characteristics

Height: 120 mm (4.7 in) (without fuze).

Diameter: 75 mm (3.0 in).

Mine Weight: 3,000 grams (6.6 lb).

Explosive Weight: 75 grams (2.6 oz).

Color: Olive drab.

Description

Fuze Type: Trip-wire/command-initiated.

Sensitivity: 2 to 5 kg (4.4 to 11.0 lb) (depends upon condition of release pin in MUV fuze).

Detectability: Visual by identification of trip/command wire; significant metallic mass helps when using hand-held detectors.

Capability

Type Kill: Bounding fragmentation effect.

Kill Radius: 10 meters, 360-degree area of coverage.

Antihandling: None.

Vulnerabilities

None.

Breach Guidance

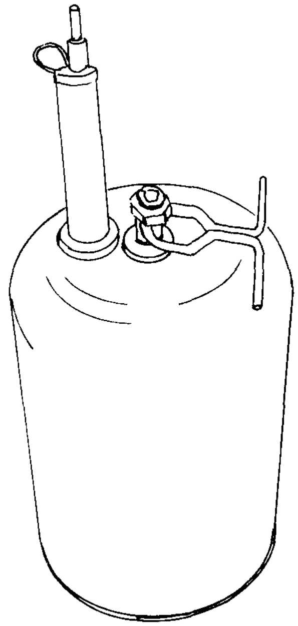
Mine Plow: Removes armed mines from plowed area; some will detonate.

MICLIC: Heavy line charges readily defeat trip-wire/command-initiated mines.

Charge Placement: Adjacent to the OZM-3.

Remarks

Delay-armed if MUV-2, MUV-3, or MUV-4 fuzes used.



OZM-4 antipersonnel mine (Soviet)

OZM-4 ANTIPERSONNEL MINE (SOVIET)

Characteristics

Height: 140 mm (5.5 in) (without fuze).

Diameter: 91 mm (3.6 in).

Mine Weight: 5,000 grams (11.0 lb).

Explosive Weight: 185 grams (6.5 oz).

Color: Olive drab.

Description

Fuze Type: Trip-wire/command-initiated.

Sensitivity: 2 to 5 kg (4.4 to 11.0 lb) (depends upon condition of release pin in MUV fuze).

Detectability: Visual by identification of trip/command wire; significant metallic mass helps when using hand-held detectors.

Capability

Type Kill: Bounding fragmentation effect.

Kill Radius: 15 meters, 360-degree area of coverage.

Antihandling: None.

Vulnerabilities

None.

Breach Guidance

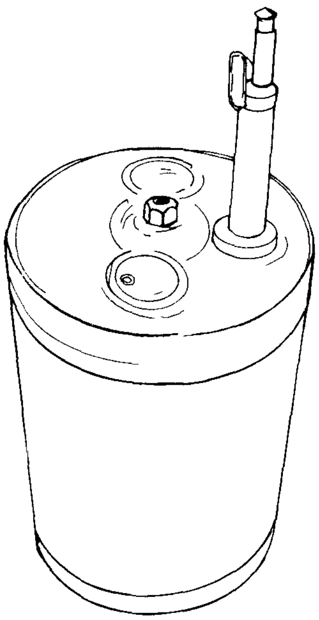
Mine Plow: Removes armed mines from plowed area; some will detonate.

MICLIC: Heavy line charges readily defeat trip-wire/command-initiated mines.

Charge Placement: Adjacent to the OZM-4.

Remarks

Delay-armed if MUV-2, MUV-3, or MUV-4 fuzes used.



OZM-72 antipersonnel mine (Soviet)

OZM-72 ANTIPERSONNEL MINE (SOVIET)

Characteristics

Height: 150 mm (5.9 in) (without fuze).

Diameter: 107 mm (4.2 in).

Mine Weight: 5,000 grams (11.0 lb).

Explosive Weight: 700 grams (1.5 lb).

Color: Olive drab.

Description

Fuze Type: Trip-wire/command-initiated.

Sensitivity: 2 to 5 kg (4.4 to 11.0 lb) (depends upon condition of release pin in MUV fuze).

Detectability: Visual by identification of trip/command wire; significant metallic mass helps when using hand-held detectors.

Capability

Type Kill: Bounding fragmentation effect.

Kill Radius: 30 meters, 360-degree area of coverage (fragmentation - 2,300 steel cylinders, 5 mm x 5 mm).

Antihandling: None.

Vulnerabilities

None.

Breach Guidance

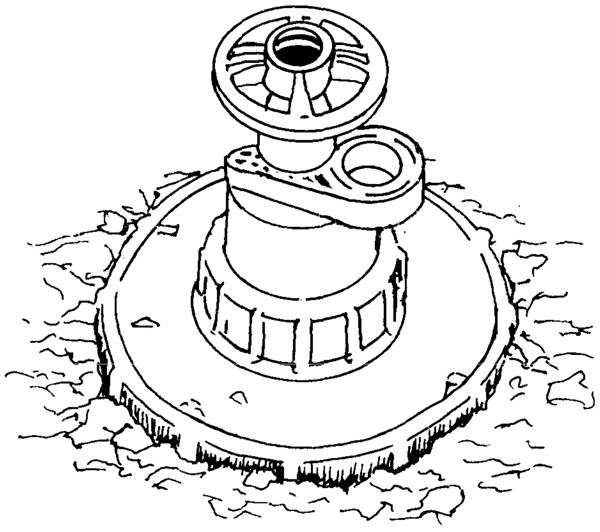
Mine Plow: Removes armed mines from plowed area; some will detonate.

MICLIC: Heavy line charges readily defeat trip-wire/command-initiated mines.

Charge Placement: Adjacent to the OZM-72.

Remarks

Delay-armed if MUV-2, MUV-3, or MUV-4 fuzes used.



P-40 antipersonnel mine (Italian)

P-40 ANTIPERSONNEL MINE (ITALIAN)

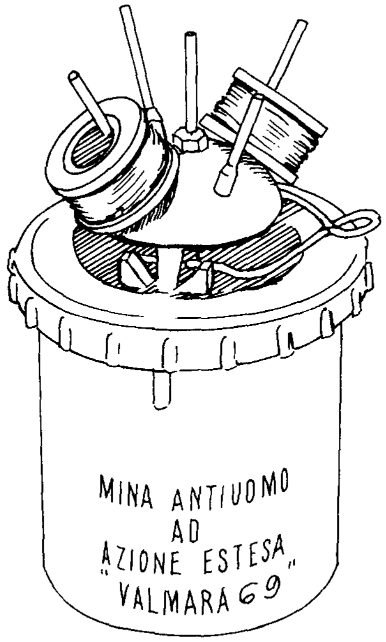
Characteristics
Height: 200 mm (7.9 in) (with fuze).
Diameter: 90 mm (3.5 in).
Mine Weight: 1,500 grams (3.3 lb).
Explosive Weight: 480 grams (1.1 lb).
Color: Green, sand brown.

Description
Fuze Type: Trip-wire-initiated.
Sensitivity: 5 kg (11.0 lb) tension.
Detectability: Visual by identification of trip wire; significant metallic mass helps when using hand-held detectors.

Capability
Type Kill: Bounding fragmentation effect.
Kill Radius: 22 meters.
Antihandling: None.

Vulnerabilities
None.

Breach Guidance
Mine Plow: Removes armed mines from plowed area; some will detonate.
MICLIC: Heavy line charges readily defeat trip-wire-initiated mines.
Charge Placement: Adjacent to the P-40.



Valmara 69 antipersonnel mine (Italian)

VALMARA 69 ANTIPERSONNEL MINE (ITALIAN)

Characteristics

Height: 205 mm (8.1 in) (with fuze).

Diameter: 130 mm (5.1 in).

Mine Weight: 3,300 grams (7.3 lb).

Explosive Weight: 597 grams (1.3 lb).

Color: Green, sand brown.

Description

Fuze Type: Trip-wire / pressure-initiated.

Sensitivity: Pressure - 10 kg (22.0 lb).
Tension - 6 kg (13.2 lb).

Detectability: Visual by identification of trip wire; significant metallic mass helps when using hand-held detectors.

Capability

Type Kill: Bounding fragmentation effect.

Kill Radius: 27 meters, 360-degree area of coverage (fragmentation - 1,200 steel cubes at 5x5x5 mm).

Antihandling: None.

Vulnerabilities

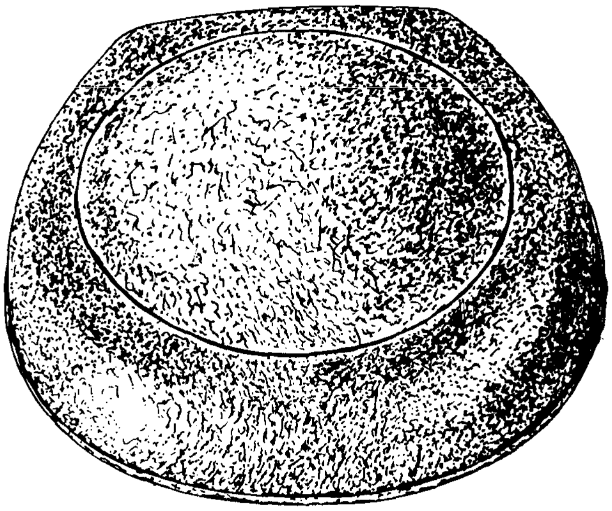
None.

Breach Guidance

Mine Plow: Removes armed mines from plowed area; some will detonate.

MICLIC: Heavy line charges readily defeat trip-wire-initiated mines.

Charge Placement: Adjacent to the VALMARA 69.



SB-33, SB-33/AR, EM20 scatterable antipersonnel mine (Italian, Greek)

SB-33, SB-33/AR, EM20 SCATTERABLE ANTIPERSONNEL MINE (ITALIAN, GREEK)

Characteristics

Height: 32 mm (1.3 in).

Diameter: 88 mm (3.5 in).

Mine Weight: 140 grams (4.9 oz).

Explosive Weight: 35 grams (1.2 oz).

Color: Sand brown, olive drab.

Description

Fuze Type: Blast-resistant, pressure-initiated.

Sensitivity: 5 to 20 kg (11.0 to 44.1 lb) pressure.

Detectability: Scattered- visual identification. Buried - difficult with hand-held metallic detector (approximately .86 gram metal, all nonmagnetic).

Capability

Type Kill: Blast effect.

Antihandling: Yes; the SB-33/AR version includes an electronic package with antiremoval features.

Vulnerabilities

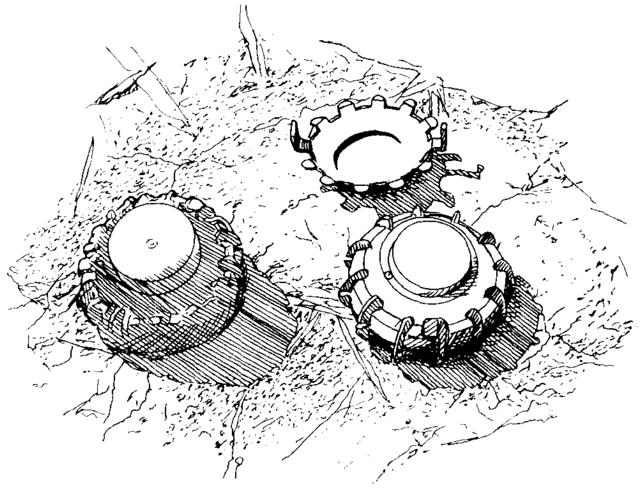
None.

Breach Guidance

Mine Plow: Removes armed mines from plowed area; some will detonate.

MICLIC: Drastic reduction in effectiveness against SB-33 (blast-resistant).

Charge Placement: Adjacent to the SB-33.



VS-50, TS-50, T/79 scatterable antipersonnel mines (Italian)

VS-50, TS-50, T/79 SCATTERABLE ANTIPERSONNEL MINES (ITALIAN)

Characteristics

Height: 45 mm (1.8 in).

Diameter: 90 mm (3.5 in).

Mine Weight: 186 grams (6.6 oz).

Explosive Weight: 50 grams (1.8 oz).

Color: Sand brown, olive drab.

Description

Fuze Type: Blast-resistant, pressure-initiated.

Sensitivity: 10 to 12 kg (22.0 to 26.4 lb) pressure.

Detectability: Scattered - visual identification. Buried - difficult with hand-held metallic detector (approximately .86 gram metal, all nonmagnetic).

Capability

Type Kill: Blast effect.

Antihandling: Yes; the VS-50-A version includes an electronic package with antiremoval features.

Vulnerabilities

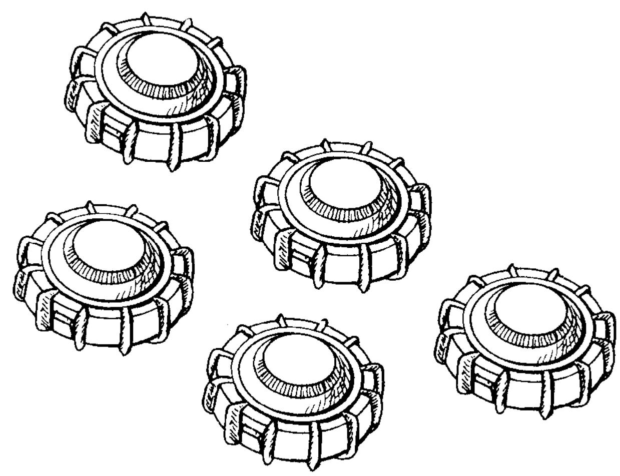
None.

Breach Guidance

Mine Plow: Removes armed mines from plowed area; some will detonate.

MICLIC: Drastic reduction in effectiveness (blast-resistant).

Charge Placement: Adjacent to the mine.



VS-MK2, VS-MK2-E scatterable antipersonnel mines (Italian)

VS-MK2, VS-MK2-E SCATTERABLE ANTIPERSONNEL MINES (ITALIAN)

Characteristics

Height: 32 mm (1.3 in).

Diameter: 90 mm (3.5 in).

Mine Weight: 135 grams (4.8 oz).

Explosive Weight: 34 grams (1.2 oz) (VS-MK2). 22 grams (0.8 oz) (VS-MK2-E).

Color: Sand brown, green, olive drab.

Description

Fuze Type: Blast-resistant, pressure-initiated.

Sensitivity: 10 kg (22.0 lb) pressure.

Detectability: Scattered - visual identification, Buried - difficult with hand-held metallic detector (approximately .86 gram metal, all nonmagnetic).

Capability

Type Kill: Blast effect.

Antihandling: Yes; the VS -MK2 -E version in-eludes an electronic package with antiremoval features.

Vulnerabilities

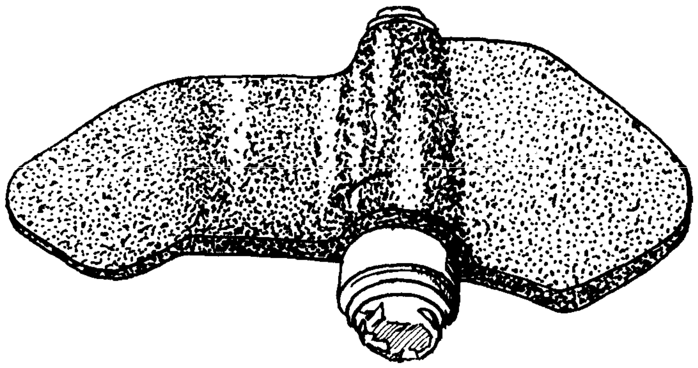
None.

Breach Guidance

Mine Plow: Removes armed mines from plowed area; some will detonate.

MICLIC: Drastic reduction in effectiveness (blast-resistant).

Charge Placement: Adjacent to the mine.



PFM-1 scatterable antipersonnel mine (Soviet)

PFM-1 SCATTERABLE ANTIPERSONNEL MINE (SOVIET)

Characteristics

Length: 120 mm (4.75 in).

Width: 60 mm (2.4 in).

Height: 20 mm (0.75 in).

Mine Weight: 74 grams (2.37 oz).

Explosive Weight: 40 grams (1.28 oz).

Color: Green, sand, or white.

Description

Fuze Type: Pressure-initiated (delay arming).

Sensitivity: 5 kg.

Detectability: Scattered - visual identification.

Capability

Type Kill: Blast effect.

Antihandling: None.

Vulnerabilities

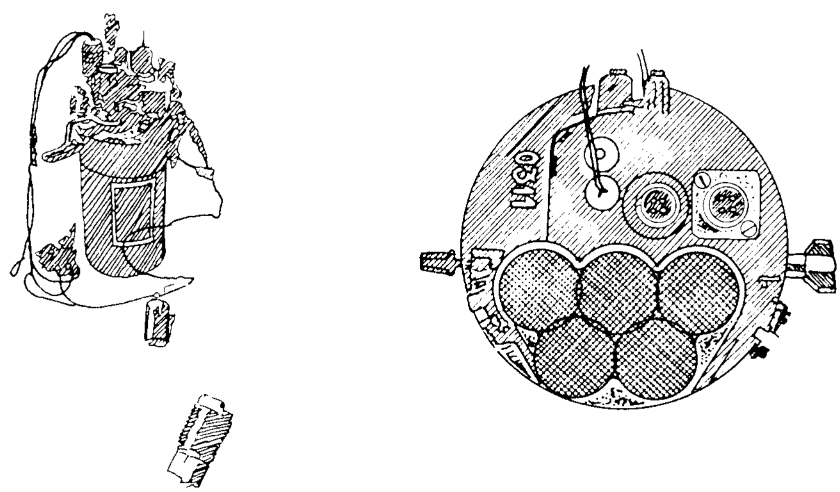
None.

Breach Guidance

Mine Plow: Removes armed mines from plowed area; some will detonate.

MICLIC: Blast overpressure will defeat this fuze.

Charge Placement: Adjacent to PFM-1.



VP 12/13 antipersonnel minefield control device (Soviet)

VP 12/13 ANTIPERSONNEL MINEFIELD CONTROL DEVICE (SOVIET)

Characteristics

Diameter: 110 mm (4.3 in).

Height: 250 mm (9.8 in).

Mine Weight: 2 kg (4.4 lb).

Power Source: 6 x 1.5V battery.

Fuze: MUV-2 or MUV-4.

Color: Olive drab, white markings.

Description

The VP systems are not mines, but are control and initiation devices for mines. Originally known as the UMK, the first model, the VP4, with its battery pack (VP5), has been succeeded by the VP 12 and VP 13. Both units are essentially similar and employ one or more geophones (seismic sensors) to detect personnel on foot up to 20 meters away. The unit is cylindrical in shape with a plain sheet steel body. The top surface is a complex series of sockets with wires protruding; it is attached to the main body by three steel clips. The geophone has a pointed probe on a cylinder with a wide cap and three attached wires.

Operation

The unit is positioned and the geophone(s) buried nearby. Up to five mines, normally directional or bounding, are connected to wires from sockets on the top surface; they may be up to 25 meters away from the unit. Once set up, a self-destruct charge is normally placed on the unit in a position marked by a white box stenciled on the body. Two wires are provided for this purpose. An MUV-2 or MUV-4 is screwed onto a socket housing a micro switch; this provides the delay to arming. When the micro switch is depressed by the striker, a red light-emitting diode (LED) indicates that the unit is active. The geophones will now register movement on foot, and the VP unit will fire some or all of the mines. When the battery runs down, the unit will automatically self-destruct. Battery life is thought to be up to one year.

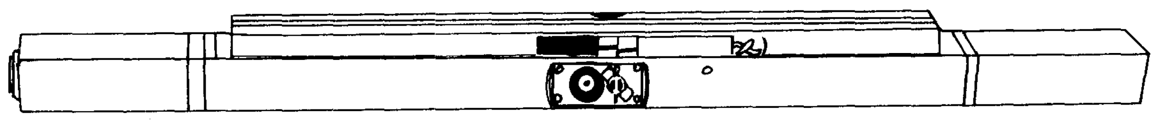
Neutralization

No attempt should be made to neutralize a VP 12 or 13.

Disarming

It is clearly undesirable to approach a VP system under any circumstances. Should clearance be absolutely necessary, all mines must be identified before any action is taken, bearing in mind the range of directional mines (up to 200 meters). The mines may be disarmed one at a time or a remote attack made on the control unit from a **safe** location: both options would be extremely dangerous if the unit were still active. Should an individual encounter a VP 12 or 13, his best option is to cut the copper-colored wires to the mine, one by one. This practice is not guaranteed to be safe, merely the best alternative

Section II. Antitank Mines



Barmine (UK)

BARMINE (UK)

Characteristics

Length: 1,200 mm (47.2 in).

Width: 81 mm (3.2 in).

Height: 102 mm (4.0 in).

Mine Weight: 10.4 kg (22.9 lb).

Explosive Weight: 8.4 kg (18.5 lb).

Color: Olive drab.

Description

Fuze Type: Both single- and double-impulse pressure fuzes available.

Detectability: Single-impulse fuze - transparent arming lever. Double-impulse fuze - black arming lever.

Capability

Type Kill: Blast effect.

Antihandling: None with above fuzes. However, an additional fuze does incorporate magnetic sensing and antidisturbance.

Vulnerabilities

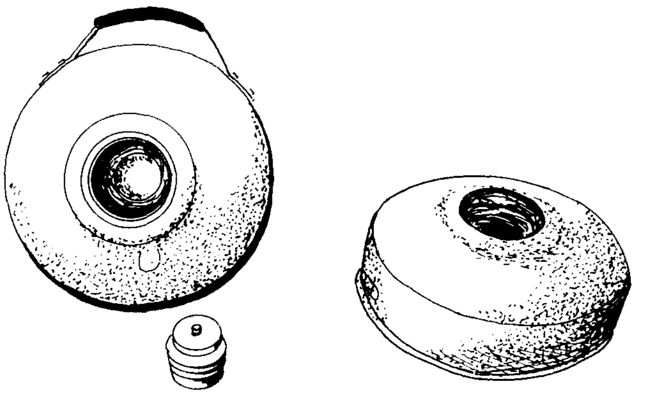
None.

Breach Guidance

Mine Plow: Removes armed mines from plowed area;

MICLIC: Single-impulse pressure fuze - none.
Double-impulse pressure fuze - none.

Charge Placement: Adjacent to the Barmine.
Minimum Safe Distance: For deliberate grappling - 50 meters.



MK-7 antitank mine (UK)

MK-7 ANTITANK MINE (UK)

Characteristics

Diameter: 325 mm (12.8 in).

Height: 130 mm (5.1 in).

Mine Weight: 13.6 kg (30.0 lb),

Explosive Weight: 8.89 kg (19.6 lb).

Color: Olive drab, brown.

Description

Fuze Type: Both single- and double-impulse pressure fuzes available as well as a tilt-rod fuze.

Sensitivity: Pressure - 150 kg (330.7 lb).
Tilt - 3 to 18 kg (6.1 to 39.7 lb).

Detectability: Visual for tilt rods; remaining by hand-held metallic detector (significant metallic content in mine body).

Capability

Type Kill: Blast effect.

Antihandling: Secondary fuze well available for booby-trap purposes (located on the bottom of the mine body).

Vulnerabilities

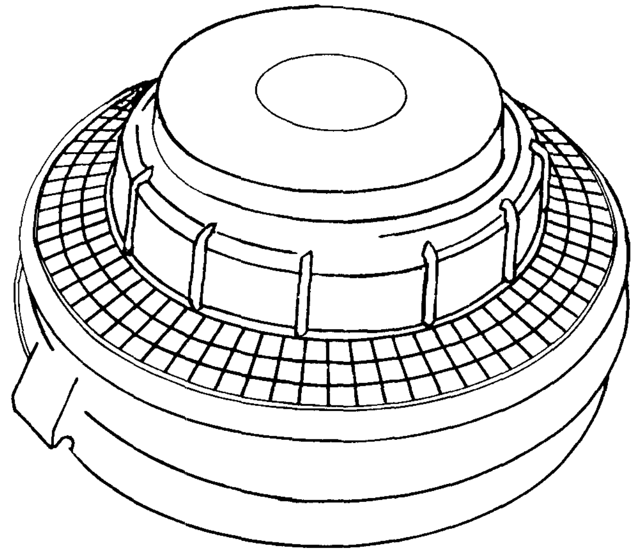
None.

Breach Guidance

Mine Plow: Removes armed mines from plowed area; detonates booby-trapped mines.

MICLIC: Single-impulse pressure fuze - none.
Double-impulse pressure fuze - none.
Tilt-rod fuze - none.

Charge Placement: Adjacent to the MK-7.



SH-55 antitank mine (Italian)

SH-55 ANTITANK MINE (ITALIAN)

Characteristics

Diameter: 280 mm (11.0 in).

Height: 122 mm (4.8 in).

Mine Weight: 7.3 kg (16. 1 lb).

Explosive Weight: 5.5 kg (12.1 lb).

Color: Sand brown.

Description

Fuze Type: Blast-resistant, pressure-initiated.

Sensitivity: 185 kg (407.8 lb).

Detectability: Difficult with hand-held detectors (metallic content approximately 5.0 grams; steel striker tip).

Capability

Type Kill: Blast effect.

Antihandling: Two secondary fuze wells available for booby-trap purposes (one each on the side and bottom of the mine case). Additionally, if the VSN/AR-AN fuze is present, then removal of the fuze itself will detonate the mine.

Vulnerabilities

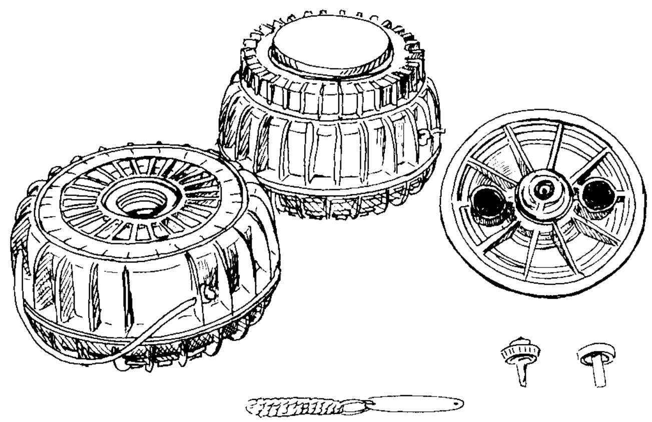
None.

Breach Guidance

Mine Plow: Removes armed mines from plowed area; detonates booby-trapped mines.

MICLIC: Drastic reduction in effectiveness (blast resistant).

Charge Placement: Adjacent to the SH-55.



TC-6, TCE-6, T.C. 6 antitank mines (Italian, Egyptian)

TC-6, TCE-6, T.C. 6 ANTITANK MINES (ITALIAN, EGYPTIAN)

Characteristics

Diameter: 270 mm (10.6 in).

Height: 185 mm (7.3 in).

Mine Weight: 9.6 kg (21.2 lb).

Explosive Weight: 6.0 kg (13.2 lb).

Color: Sand brown, olive drab.

Description

Fuze Type: Blast-resistant, pressure-initiated.

Sensitivity: 180 kg (396.8 lb).

Detectability: Difficult with hand-held detectors (metallic content approximately 2.86 grams; stainless steel striker tip and retaining spring). Much easier detection if the “E” version with its electronics package is employed.

Capability

Type Kill: Blast effect.

Antihandling: Secondary fuze well available for booby-trap purposes (on the bottom of the mine case).

Vulnerabilities

None.

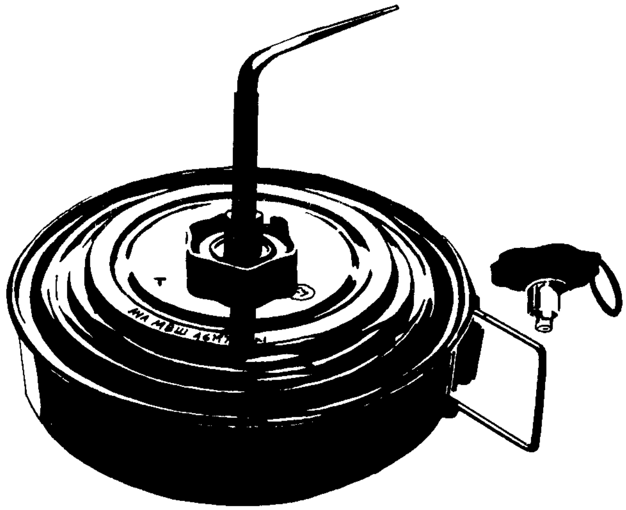
Breach Guidance

Mine Plow: Removes armed mines from plowed area; detonates booby-trapped mines.

Charge Placement: Adjacent to the TC-6, TCE-6, or T.C. 6 mines.

Remarks

The "E" version incorporates an electronics package primarily intended for remote activation/deactivation with a hand-held remote controller. Currently, this version does not include antilift/antidisturbance/self-destruct features. However, these are normal options in most Italian electronic fuzes.



TM-46, TMN-46, M/71 antitank mines (Soviet, Egyptian)

TM-46, TMN-46, M/71 ANTITANK MINES (SOVIET, EGYPTIAN)

Characteristics

Diameter: 305 mm (12.0 in).

Height: 108 mm (4.3 in).

Mine Weight: 8.6 kg (19.0 lb).

Explosive Weight: 5.7 kg (12.6 lb).

Color: Sand brown, olive drab.

Description

Fuze Type: pressure-initiated (no delay arming). Truncated tilt rod, contact-initiated.

Sensitivity: 180 kg (396.8 lb).

Detectability: Visually (truncated tilt rods) and hand-held detectors (significant metallic content in mine body).

Capability

Type Kill: Blast effect.

Antihandling: Secondary fuze well (TMN-46 only) available for booby-trap purposes (on the side of the mine body).

Vulnerabilities

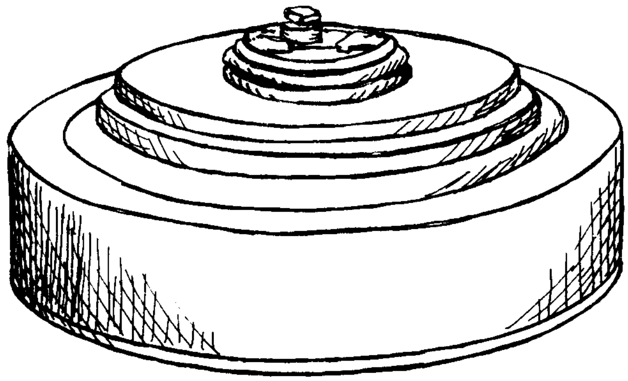
None.

Breach Guidance

Mine Plow: Removes armed mines from plowed area; detonates booby-trapped mines.

MICLIC: Detonates antitank mines with simple pressure fuzes.

Charge Placement: Adjacent to the mine.



TM-57 antitank mine (Soviet)

TM-57 ANTITANK MINE (SOVIET)

Characteristics

Diameter: 316 mm (12.4 in).

Height: 102 mm (4.0 in).

Mine Weight: 8.47 (18.7 lb).

Explosive Weight: 6.34 kg (14.0 lb).

Color: Olive drab.

Description

Fuze Type: Delay-armed, blast-resistant, pressure-initiated. Truncated tilt rod, contact-initiated.

Sensitivity: 200 kg (440.9 lb).

Detectability: Visually (truncated tilt rods) and hand-held detectors (significant metallic content in mine body).

Capability

Type Kill: Blast effect.

Antihandling: Secondary fuze well available for booby-trap purposes (located on the side of the mine body).

Vulnerabilities

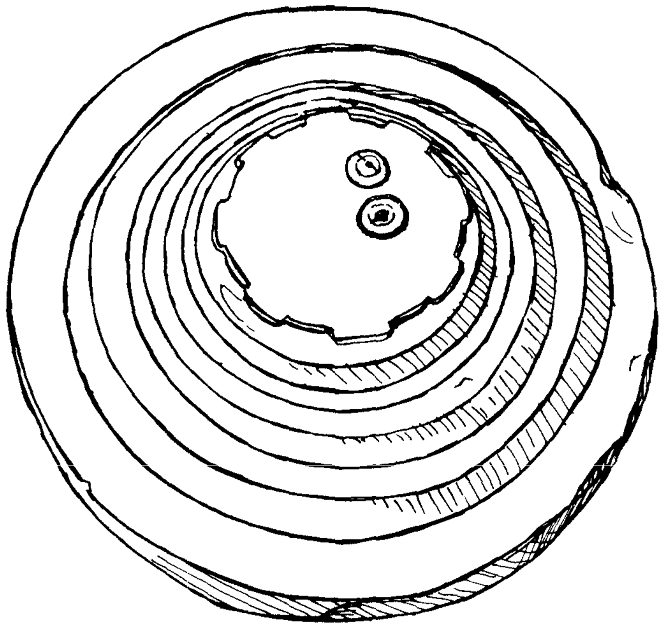
None.

Breach Guidance

Mine Plow: Removes armed mines from plowed area; detonates booby-trapped mines.

MICLIC: Drastic reduction in effectiveness (blast-resistant).

Charge Placement: Adjacent to the TM-57 mine.



TM-62M antitank mine (Soviet)

TM-62M ANTITANK MINE (SOVIET)

Characteristics

Diameter: 320 mm (12.6 in).

Height: 102 mm (4.0 in).

Mine Weight: 8.5 kg (18.7 lb).

Explosive Weight: 7.2 kg (15.9 lb).

Color: Olive drab.

Description

Fuze Type: Delay-armed, blast-resistant, pressure-initiated.
Delay-armed, magnetic-influence fuze type.
Seismic-influence fuze type.

Sensitivity: 200 kg (440.9 lb).

Detectability: With hand-held detectors; significant amount of metal in mine body.

Capability

Type Kill: Blast effect.

Antihandling: No secondary fuze wells. The magnetic and seismic fuze have inherent antidisturbance features. Additionally, antilift devices are associated with the TM-62 series mines.

Vulnerabilities

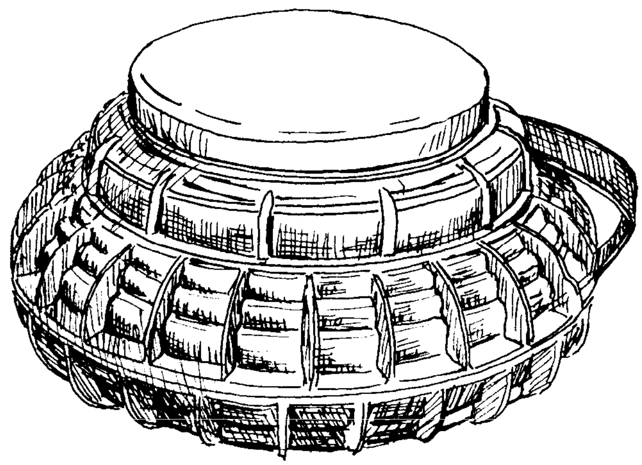
None.

Breach Guidance

Mine Plow: Removes armed mines from plowed area; detonates booby-trapped mines.

MICLIC: Drastic reduction in effectiveness (blast-resistant).

Charge Placement: Adjacent to the TM-62M mine.



VS-2.2 antitank mine (Italian)

VS-2.2 ANTITANK MINE (ITALIAN)

Characteristics

Diameter: 240 mm (9.4 in).

Height: 120 mm (4.7 in).

Mine Weight: 3.5 kg (7.7 lb).

Explosive Weight: 2.13 kg (4.7 lb).

Color: Sand brown, olive drab, green.

Description

Fuze Type: Blast-resistant, pressure-initiated.

Sensitivity: 180 to 220 kg (396.8 to 485.0 lb).

Detectability: Difficult with hand-held detectors (metallic content approximately 5.0 grams; steel striker tip).

Capability

Type Kill: Blast effect.

Antihandling: Bottom detonator well available for booby-trap devices. Additionally, if the VSN/AR-AN fuze is present, then removal of the fuze itself will detonate the mine.

Vulnerabilities

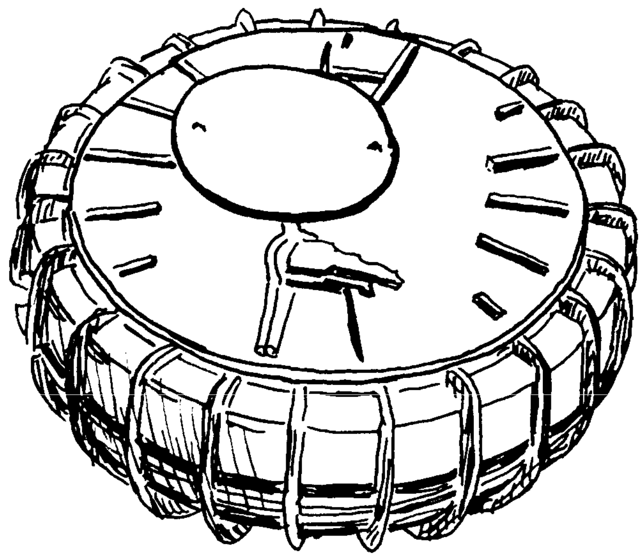
None.

Breach Guidance

Mine Plow: Removes armed mines from plowed area; detonates booby-trapped mines.

MICLIC: Drastic reduction in effectiveness (blast-resistant).

Charge Placement: Adjacent to the VS-2.2 mine.



SB-MV antitank mine (Italian)

B-MV ANTITANK MINE (ITALIAN)

Characteristics

Diameter: 236 mm (9.3 in).

Height: 101 mm (4.0 in) (with fuze)

Mine Weight: 5.0 kg (11.0 lb).

Explosive Weight: 2.6 kg (5.7 lb).

Color: Sand brown, olive drab.

Description

Fuze Type: Delay-armed, magnetic-influence initiated.

Sensitivity: Changing ambient magnetic fields.

Detectability: By probing and visual identification of camouflage efforts. Operating hand-held mine detectors may detonate this mine.

Capability

Type Kill: Shaped-charge effect.

Antihandling: Both antilift (tilt) and self-neutralization features.

Vulnerabilities

None.

Breach Guidance

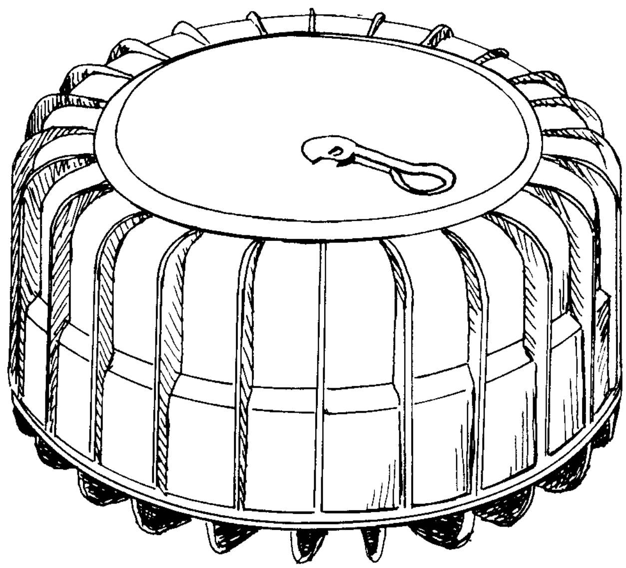
Mine Plow: Removes armed mines from plowed area; all fuzes will detonate, even those under the track area.

MICLIC: Little effectiveness against magnetic fuzes in buried conventional mines.

Charge Placement: Adjacent to the SB-MV mine.

Remarks

Self-neutralization settings are programmable.



VS-HCT antitank mine (Italian)

VS-HCT ANTITANK MINE (ITALIAN)

Characteristics

Diameter: 290 mm (11.4 in).

Height: 108 mm (4.3 in).

Mine Weight: 7.0 kg (15.4 lb).

Explosive Weight: 5.0 kg (11.0 lb).

Color: Sand brown, olive drab.

Description

Fuze Type: Delay-armed, magnetic-influence initiated.

Sensitivity: Changing ambient magnetic fields.

Detectability: By probing and visual identification of camouflage efforts. Operating hand-held mine detectors may detonate this mine.

Capability

Type Kill: Shaped-charge effect.

Antihandling: Both antilift (tilt) and self-neutralization features.

Vulnerabilities

None.

Breach Guidance

Mine Plow: Removes armed mines from plowed area; all fuzes will detonate, even those under the track area.

MICLIC: Little effectiveness against magnetic fuzes in buried conventional mines.

Charge Placement: Adjacent to the VS-HCT mine.

Remarks

Ten self-neutralization settings ranging from 1 to 128 days.

MIACAH F1, L14A1 antitank mines (French, UK)

MIACAH F1, L14A1 ANTITANK MINES (FRENCH, UK)

Characteristics

Length: 260 mm (10.2 in).

Diameter: 200 mm (7.9 in).

Height: 350 mm (13.8 in).

Mine Weight: 12.0 kg (26.5 lb).

Explosive Weight: 5.0 kg (11.0 lb).

Color: Olive drab,

Description

Fuze Type: Break wire, infrared sensor, command detonation initiation.

Sensitivity: Vehicle passage to 80 meters range.

Detectability: Visual identification of break and command wires.
Visual identification of off-route mine location.

Capability

Type Kill: Shaped-charge (horizontal effect).

Antihandling: None; however, command control must be neutralized.

Vulnerabilities

None.

Breach Guidance

Mine Plow: Initiates off-route mines, destroys host vehicle.

MICLIC: Heavy explosive line charge will neutralize break and command wires, as well as overturning those mines fairly close to the line charge. Not effective against infrared sensor unit.

Charge Placement: Adjacent to the MIACAH F1 or L14A1 mines.

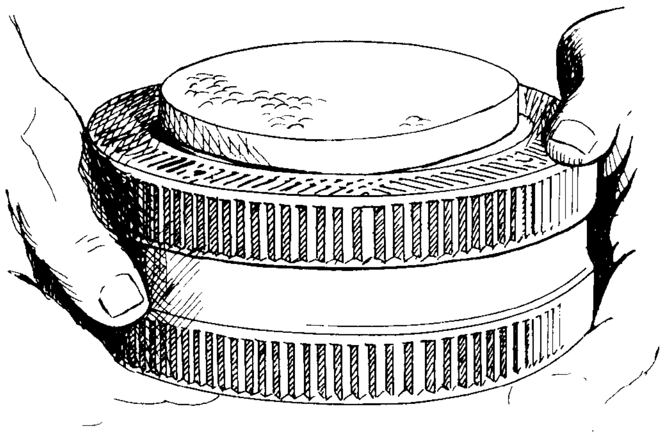


Figure D-29. TC/2.4, M/80 scatterable antitank mines (Italian, Egyptian)

TC/2.4, M/80 SCATTERABLE ANTITANK MINES (ITALIAN, EGYPTIAN)

Characteristics

Diameter: 204 mm (8.0 in).

Height: 108 mm (4.3 in).

Mine Weight: 3.3 kg (7.3 lb).

Explosive Weight: 2.4 kg (5.3 lb).

Color: Sand brown, olive drab.

Description

Fuze Type: Blast-resistant, pressure-activated.

Sensitivity: 180 kg (396.8 lb).

Detectability: Difficult with hand-held detectors (total metallic content is 2.46 grams).

Capability

Type Kill: Blast effect.

Antihandling: Yes; if MUV-type or VS-AR-4 antilift fuze is attached to bottom detonator well.

Vulnerabilities

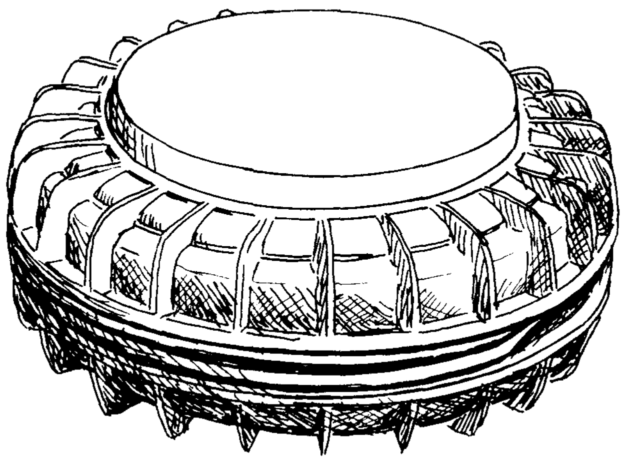
None.

Breach Guidance

Mine Plow: Removes armed mines from plowed area; detonates booby-trapped mines.

MICLIC: Drastic reduction in effectiveness (blast-resistant).

Charge Placement: Adjacent to the TC/2.4 or M/80 mine.



SB-81, SB-81/AR scatterable antitank mines (Italian)

SB-81, SB-81/AR SCATTERABLE ANTITANK MINES (ITALIAN)

Characteristics

Diameter: 232 mm (9. 1 in).

Height: 90 mm (3.5 in).

Mine Weight: 3.2 kg (7.1 lb).

Explosive Weight: 2.0 kg (4.4 lb).

Color: Sand brown, olive drab.

Description

Fuze Type: Blast-resistant, pressure-activated.

Sensitivity: 150 kg (330.7 lb).

Detectability: Scattered - visual identification. Buried - difficult with hand-held detectors (total metallic content of SB-81 is .91 grams).

Capability

Type Kill: Blast effect.

Antihandling:

- Scattered
  - SB-81: No built-in antihanldling/self-neutralization.
  - SB-81/AR: Has electronics package with options for both anti-handling and programmable self-neutralization.
- Buried
  - SB-81: Yes; if MUV-type or VS-AR-4 antilift fuze is attached to bottom detonator well.
  - SB-81/AR: Has built-in capability for optional antihandling and program-mable self-neutralization.

Vulnerabilities

None.

Breach Guidance

Mine Plow:

- Scattered
  - SB-81: Removes armed mines from plowed area.
  - SB-81/AR: Detonates armed mines when moved by plow.

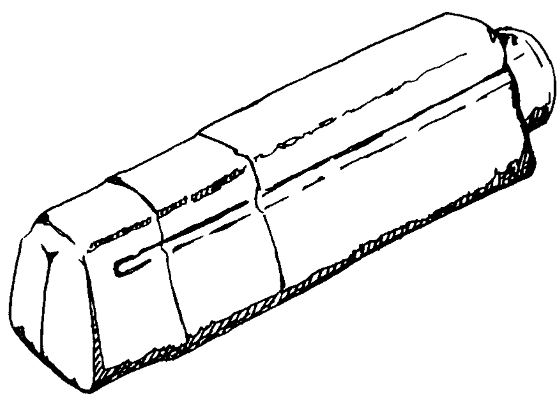
- Buried
  - SB-81: Removes armed mines from plowed area; detonates booby-trapped mines.
  - SB-81/AR: Detonates armed mines when moved by plow.

MICLIC: Drastic reduction in effectiveness (blast-resistant).

Charge Placement: Adjacent to the SB-81, SB-81/AR mine.

Remarks

Both the SB-81 and SB-81/AR antitank mines are helicopter-deliverable by the SY-AT system as well as other compatible Italian mine scattering systems.



PGMDM scatterable antitank mine (Soviet)

PGMDM SCATTERABLE ANTITANK MINE (SOVIET)

Characteristics

Length: 300 mm (11.8 in).

Height: 65 mm (2.5 in).

Mine Weight: 1.7 kg (approx) (3.7 lb).

Explosive Weight: 1.5 kg (approx.) (3.3 lb).

Color: Green, khaki, white.

Description

Fuze Type: Delay-armed, pressure-activated.

Sensitivity: Single pressure or accumulation of slight pressure - weight unknown.

Detectability: Scattered - visual identification.

Capability

Type Kill: Blast effect.

Antihandling: None; self-destruct 0 - 24 hours.

Vulnerabilities

None.

Breach Guidance

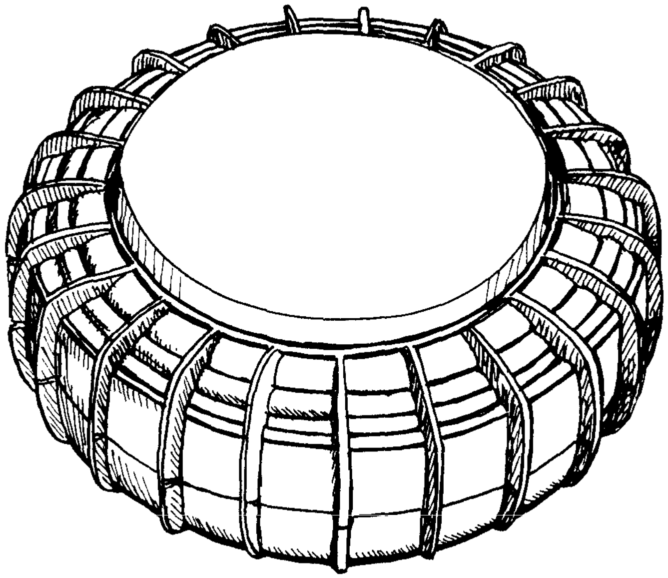
Mine Plow: Removes armed mines from plowed area; some will detonate.

MICLIC: Blast overpressure will defeat this fuze.

Charge Placement: Adjacent to PGMDM.

Remarks

This mine is thought to be extremely sensitive and cannot be disarmed. The mine, therefore, should never be touched and only approached if absolutely necessary after self-destruct period has elapsed.



VS-1.6, VS-1.6/AR, VS-1.6/AN scatterable antitank mines (Italian)

VS-1.6, VS-1.6/AR, VS-1.6/AN SCATTERABLE ANTITANK MINES (ITALIAN)

Characteristics

Diameter: 222 mm (8.7 in).

Height: 92 mm (3.6 in).

Mine Weight: 3.0 kg (6.6 lb).

Explosive Weight: 1.85 kg (4.1 lb).

Colors: Sand brown, olive drab with black rubber cover.

Description

Fuze Type: Blast-resistant, pressure-activated.

Sensitivity: 190 kg (418.9 lb).

Detectability: Scattered- visual identification. Buried- difficult with hand-held detectors (total metallic content of VS-1.6 is 2.46 grams).

Capability

Type Kill: Blast effect.

Antihandling:

- Scattered
  - VS-1.6: No built-in antihandling/self-neutralization,
  - VS-1.6/AR: Yes; electronics package with antiremoval.
  - VS-1.6/AN: No; electronics package has self-neutralization.
- Buried
  - VS-1.6: Yes; if MUV-type or VS-AR-4 antilift fuze is attached to bottom detonator well.
  - VS-1.6/AR: Yes; built-in capability for antihandling.
  - VS-1.6/AN: No; but does include self-neutralization.

Vulnerabilities

None.

Breach Guidance:

Mine Plow:

- Scattered
  - VS-1.6: Removes armed mines from plowed area.
  - VS-1.6/AR: Detonates armed mines when moved by plow.
- Buried
  - VS-1.6: Removes armed mines from plowed area; detonates booby-trapped mines.
  - VS-1.6/AR: Detonates armed mines when moved by plow.
  - VS-1.6/AN: Removes armed mines from plowed area; still subject to self-neutralization.

MICLIC: Drastic reduction in effectiveness (blast-resistant).

Charge Placement: Adjacent to the VS-1.6, VS- 1.6/AR, VS-1.6/AN mine.

Remarks

All the VS-1.6 antitank mines are helicopter-deliverable by the VS-MD-H system as well as other compatible Italian mine scattering systems.

APPENDIX E

SAFETY AND TRAINING

Conduct mine training as if the mines were live. This is the only way soldiers form a habit of handling mines correctly and safely and gain a true appreciation of the requirements and the time it takes to perform an actual mine warfare mission. Live mine training gives soldiers the confidence needed to handle mines and their components. Accidents can usually be traced to ignorance, negligence, deliberate mishandling, overconfidence, mechanical failure, or fright. The first four can be overcome by training and proper supervision. Mechanical failure rarely happens; but if it does, it can be controlled by training and proper supervision. The last item, fright, is mastered through well-controlled, live mine training.

Mine training is inherently dangerous. Between FY85 and FY88, there were eight accidents in the active Army during mine warfare training (US Army Safety Center, Fort Rucker, Alabama). These accidents resulted in the deaths of three soldiers. In FY90, there were two mine accidents, resulting in eleven casualties. Live mine training is dangerous, in part, because several different types of mines and fuze systems are used throughout the world.

Detailed safety instructions for each type of mine are provided throughout this manual. This appendix merely points out the safety aspects of live mine training that are common to all types of mines.

STORAGE

There are three types of mines used in mine training—

Inert. Does not contain explosives.

Practice. Contains a low explosive (LE) charge or a smoke producing increment to simulate detonation.

HE. Actual mines used in combat.

Conventional mines are painted to enhance concealment, to retard rusting of exposed metal parts, and to help identify the type of mine and filler (HE, LE, or chemical agent). Older manufactured mines are painted according to the Five-Element Marking System; newer manufactured mines are painted according to the Standard Ammunition Color Coding System (see Table E-1, page E-2).

Note: Mines that are color-coded and marked according to the old system have been on hand for several years. Ensure all ammunition, whether color-coded according to the old or new system, is properly and fully identified.

Always handle mines with care. The explosive elements in fuzes, primers, detonators, and boosters are particularly sensitive to mechanical shock, friction, static electricity, and high temperatures. Boxes and crates containing mines should not be dropped, dragged, tumbled, walked on, or struck. Do not smoke within 50 meters of a mine or its components.

When it is necessary to leave mines in the open, set them on dunnage at least 2 inches above the ground. Place a waterproof cover (such as canvas) over them, and leave enough space for air circulation. Dig drainage trenches around the stacks to prevent water from collecting under the mines. Protect mines and their components against moisture by waterproofing them with grease coatings, tar

Table E-1. Mine color-coding system

Type of Ammunition	Five-Element Marking System (old)	*Standard Ammunition Color-Coding System (new)
Persistent casualty chemical agent	Gray with green markings and two green bands	Gray with green markings and two 1/2-inch green bands
Nerve agent	Gray with green markings and either two or three green bands	Gray with green markings and three 1/2-inch green bands
Incendiary	Gray with violet markings and one violet band	Light red with black markings and one yellow band
HE	Olive drab with yellow markings	Olive drab with yellow markings
Practice mine	Blue with white markings	Blue with white markings
Inert mine	Black with the word *INERT* in white	Blue with the word *INERT* in white

*Chemical ammunition containing HE has one 1/4-inch yellow band in addition to other markings.

paper, or tarpaulins. Additional maintenance procedures include—

- Do not open mine boxes in a magazine, at an ammunition dump, or within 30 meters of an explosive store. If available, use copper or wooden safety tools to unpack and repack mines.
- Do not fuze mines within 30 meters of an explosive or ammunition holding area. Mines can be fuzed at the mine dump.
- Use specifics authorized by the US Army Materiel Command and applicable technical manuals to disassemble mines and their components.
- Safety pins, safety forks (clips), and other safety devices prevent accidental initiation of the mine while it is handled. Remove them as the last step when arming the mine, and replace them before the mine is moved again.
- Place tape over firing device wells, cap wells, activator wells, and fuze cavities. Ensure they are clear of obstruction and free of foreign matter before attempting to install the fuze, detonator, or firing device.
- Mines usually function satisfactorily at temperatures from 40 degrees Fahrenheit (F) to 160 degrees F. Most mines are not appreciably affected by temperature changes. If the temperature fluctuates around freezing, take steps to prevent moisture or water from accumulating around the mine and subsequently freezing. Mines can become neutralized by the ice formations (see Chapter 12).
- Mines can be recovered (taken up and relaid) if proper procedures are observed and components do not show evidence of damage or deterioration.

- Practice or inert mines, or their components, are not present when live mines, or their components, are being used.
- Never mix inert mines with live mines.
- Do not display live mines or their components in museums, demonstrations, models, or similar layouts. Only inert equipment can be used for displays.
- Always handle explosive materials with appropriate care. The explosive elements in primers, blasting caps, and fuzes are particularly sensitive to shock and high temperatures.
- Assemble activators, standard bases, and firing devices before installing them. Do not carry them in pockets of your clothing.
- Do not point firing devices at anyone.
- When possible, complete camouflaging before removing the positive safety pin.

NOTE: Additional storage and safety precautions are outlined in TM 9-1300-206.

LIVE MINE TRAINING

Live mine training is the preparing, laying, arming, neutralizing, and disarming of live mines using live fuzes and components in a training environment.

Supervisors must adhere to the following safety considerations when conducting live mine training:

- Only personnel who are qualified and certified according to the local range SOP are allowed to supervise activities or training in which live mines or their components are used.
- Minimum personnel requirements to conduct live mine training are—
  - Range officer (OIC).
  - Range safety officer (RSO).
  - One NCO supervisor for each arming bay.
  - Mine explosive breakdown NCO.
  - One medic per four arming bays.
  - Guards, as required by the range SOP.
- A sound organization is a must before live mine training can begin. The OIC and supervising NCOs conduct a demonstration/briefing to ensure the practice runs smoothly.
- The training officer must foresee hazards that can occur through personnel nervousness or material failure. The commander conducts a risk assessment according to AR 385-10.
- The OIC takes his place at the control point or post. Once he is satisfied that all safety regulations have been observed, he orders the first detail to start training.
- Soldiers are trained on inert and practice mines before arming live mines according to guidelines established by the Standards in Training Commission (STRAC).
- Do not insert fuzes into mines until ordered to do so by the OIC.
- An NCO supervisor must be present when soldiers arm live mines. He ensures soldiers adhere to procedures and regulations.
- Only one soldier arms a mine at any given time.
- Disarm the mine before arming the next one.
- Never arm an M16 AP mine in the trip-wire mode during live mine training.
- Instructors inspect fuzes and mines for serviceability before starting practice.
- After each student has gone through the station, the instructor inspects mines and their components for damage and excessive wear. If damage or wear is found, replace the mine and the fuze.

- All personnel wear a helmet, with a serviceable chin strap fastened, and body armor when arming and disarming mines.
- Ear protection is not permitted in the arming bays. The student must be able to hear the NCO supervisor and certain distinct noises (such as a firing pin dropping).
- Post guards at all entrances to the range. They communicate by radio, wire, voice, or signal with the RSO. No one enters the range without permission from the RSO.
- Keep mine records and inventory sheets. Maintain accountability of all mines and fuzes, before and after each exercise.
- The instructor draws and returns supplies; checks equipment for issue; and ensures live mines are safe, serviceable, and unarmed. He ensures the requirements contained in AR 385-63, appropriate range regulations, and SOPS are observed. He also ensures that no one does anything to prejudice safety.
- Clearly mark the word *LIVE* on all live mines and their components used for live mine training. Maintain them separately from practice and inert mines.
- Do not use live AHDs with live mines during training. They can be used with practice and inert mines.
- Conduct all arming and disarming in the prone position according to TM 9-1345-203-12&P.
- Waiting personnel are located in a bunker, behind a suitable barricade, or a safe distance from mine training.
- Supervisors ensure live mine training is not rushed. There are no shortcuts. Allow the soldier ample time to arm and disarm the mine. Most soldiers are already in a high state of stress from dealing with live munitions. Rushing them only serves to heighten their stress level.

LIVE MINE DEMONSTRATION

Live mine firing demonstrations show mine characteristics and capabilities using M 14, M16, and M18 AP mines and M15, M19, and M21 AT mines. The appropriate authority must authorize the demonstration, and firing personnel must be fully conversant with all safety and technical aspects pertaining to live mine firing.

Rules

An OIC and RSO are appointed for each activity involving live mine firing. The amount of explosive contained in the mine cannot exceed the maximum amount allowed for the range. Only one mine is fired at a time.

Upon arriving at the range, the instructor and his assistants establish areas according to the following rules (areas are signposted for large demonstrations):

Firing point. Sited outside the danger area and near the OIC to facilitate coordination, commentaries, and firing.

Spectator area. Sited outside the danger area and within earshot of the commentator. It is large enough to provide a good view of the explosion.

Supply area. Any suitable area away from spectators.

Explosive area. Sited away from supplies and spectators.

Mine area. Mines are set out in full view of the OIC and spectators. Individual mines are a minimum of 25 meters apart.

Target area. Targets are positioned and inspected by spectators before the blasting cap is inserted into the mine.

M14 AP Mine

Safety distance: 100 meters.

Firing procedures:

1. Roll out 100 meters of electric firing cable and attach it to a stake or picket in the ground (leave at least 3 feet of free end). Test the firing cable for continuity.

2. Dig a hole in the ground deep enough so the top of the M 14 is flush with the ground surface. Ensure there is enough clearance under the mine for the electric blasting cap, which protrudes from the base of the mine. Do not remove the safety clip. The actuating dial remains on the SAFE (S) position.

3. Test an electric blasting cap (under a sandbag) with the demolition test set.

4. Attach the ends of the blasting cap leads to the end of the electric cable, and insulate the joints with tape. Place the blasting cap in the detonator well and secure it with a rubber band or adhesive tape. (See Figure E-1.)

5. If desired, place a target on top of the mine (a boot full of sand is suitable).

6. All personnel withdraw to the firing point.

7. Conduct normal prefire checks, then fire the mine.

NOTE: The mine explodes instantaneously. The demonstration clearly illustrates the sound of an M14 explosion, the size of the crater left by an M14, and the effect on a rubber-sole boot.

Misfires: If the mine misfires, the RSO disposes of the mine by placing a block of C4 as close to the mine as possible, without touching it. He destroys the mine by normal nonelectric means.

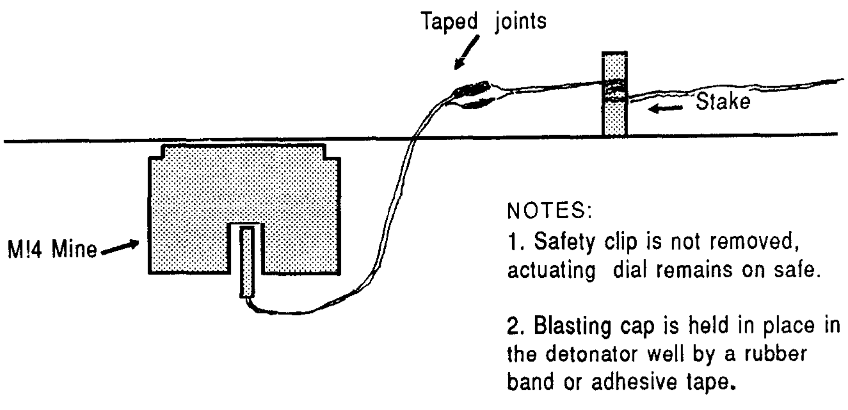


Figure E-1. M14 AP mine

M16 AP Mine

Safety distance: 300 meters.

Firing procedures:

1. Roll out 300 meters of firing cable and attach it to a stake or picket in the ground (leave at least 3 feet of free end). Test the firing cable for continuity.

2. Place the mine in the ground (dig in level with the surface). Remove the shipping plug.

3. Test a blasting cap (under a sandbag) with the demolition test set.

4. Attach the ends of the blasting cap leads to the end of the electric cable, and insulate the joints with tape. Place the blasting cap in the fuze well. (See Figure E-2.)

Suggested target: A circle of tar paper, 20 feet in diameter, supported by 6-foot pickets. Spectators can later view shrapnel effects.

NOTE: This method dispenses with the M605 igniter. The mine cannot be detonated by pull or pressure. The expulsion charge and millisecond delay fuzes are still operated, and the mine bounds out of its casing (which remains in the ground) before exploding in the air. Although the normal firing delay is removed, it does not detract from the demonstration. The blasting cap is suspended two-thirds of the way down the fuze well to initiate the expelling charge and delay elements.

Misfires: In the event of a misfire, the RSO disposes of the mine by placing a block of C4 as close to the mine as possible, without touching it. He destroys the mine by normal non-electric means.

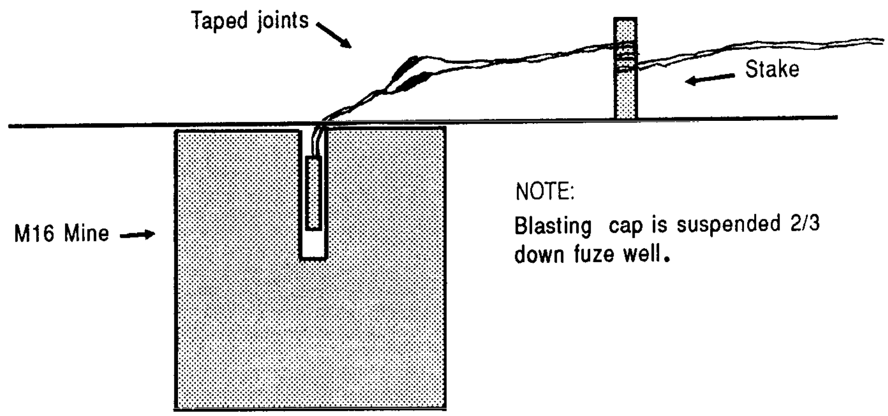


Figure E-2. M16 AP mine

M18A1 AP Mine

Safety distance: 300 meters.

Firing procedures:

1. Roll out 300 meters of firing cable and attach it to a stake or picket in the ground (leave at least 3 feet of free end). Test the firing cable for continuity.

2. Place the mine on the ground. (Ensure the front of the mine faces away from the firing point.) Remove the shipping plug.

3. Test an electric blasting cap (under a sandbag) with the demolition test set.

4. Attach the blasting cap to the firing cable and secure the splice with tape. Place the electric blasting cap in the detonator well. (See Figure E-3.)

Suggested target: Several E-type silhouette targets 15 to 100 meters from the mine.

NOTE: The procedure detailed here applies only to demonstration firings. Standard accessories are used on all other occasions. The mine explodes instantaneously and clearly illustrates the sound of an M18A1 explosion.

Misfires: In the event of a misfire, the RSO disposes of the mine by placing a block of C4 as close to the mine as possible, without touching it. He destroys the mine by normal non-electric means.

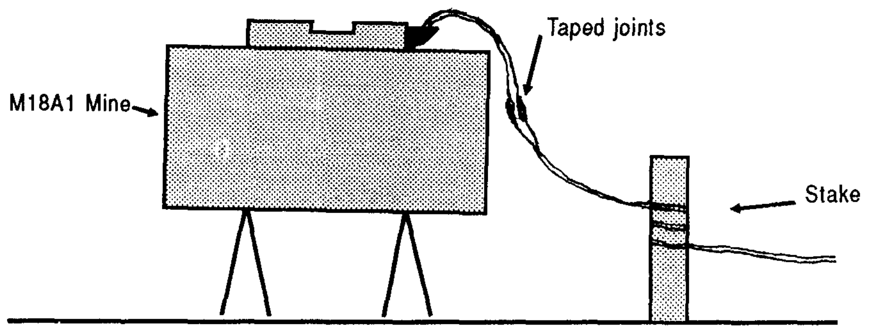


Figure E-3. M18A1 AP mine

M15, M19, and M21 AT Mines

Safety distance: 1,000 meters.

Firing procedures:

1. Roll out 1,000 meters of firing cable and attach it to a stake or picket in the ground (leave at least 3 feet of free end). Test the firing cable for continuity.

2. Place the mine in the ground; leave the top exposed. A target is used only when the mine can be placed without disturbing the target. A derelict vehicle is a suitable target.

3. To detonate M15 and M19 mines, place a block of C4 on top of them. (See Figure E-4.)

4. To detonate an M21 mine, remove the shipping plug from the booster well and pack the well with C4. Insert an electric blasting cap into the C4. (See Figure E-5.)

NOTE: Do not remove safety devices, and keep arming dials in the SAFE position. The mine explodes instantaneously and clearly demonstrates the blast /shaped charge effect.

Misfires: In the event of a misfire, the RSO disposes of the mine by placing a block of C4 as close to the mine as possible, without touching it. He destroys the mine by normal non-electric means.

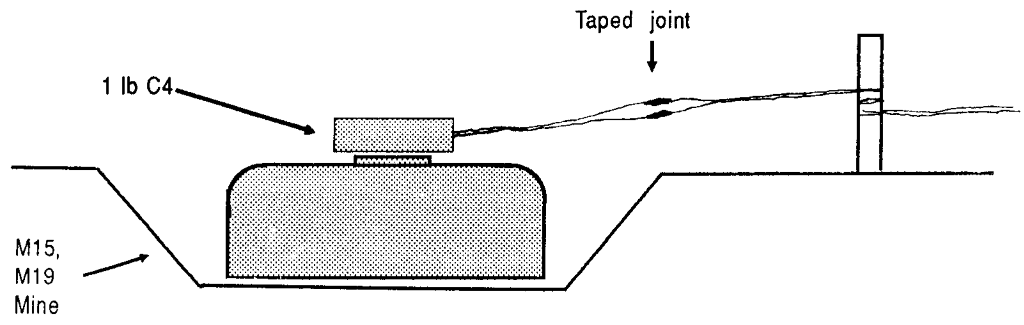


Figure E-4. M15 and M19 AT mines

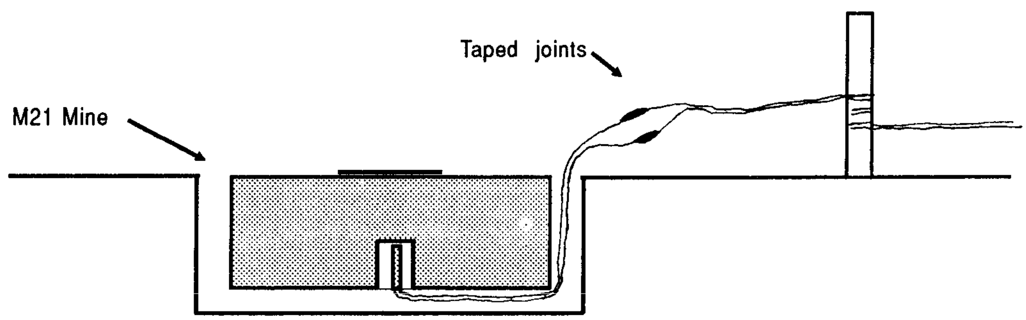


Figure E-5. M21 AT mine

RISK ASSESSMENT FOR LIVE MINE DEMONSTRATIONS

The following risk assessment is provided as a guideline for live mine demonstrations using M14 and M16 AP mines. It must be carefully reviewed before conducting a demonstration. Live mine demonstrations can be conducted in a safe manner. The risk of injury to personnel is significantly minimized if you adhere to established procedures.

During the demonstration, mines are not armed with standard fuzes. They are activated by electric blasting caps placed inside the fuze wells. The safety clip on the M14 mine is **not** removed.

A demonstration shows the effectiveness of M14 and M16 AP mines. Spectators do not handle the mines or explosives. To show the effectiveness of an M14 mine, a boot is filled with sand and placed over the mine; for an M16 mine, a sheet paper is placed in a semi-circle around the mine. Spectators remain in bunkers or at a safe distance while mines are primed with electric blasting caps and during the detonation. After the mines have been detonated and the RSO has cleared the area, spectators are allowed to view the results of each mine. Misfires are handled by the RSO.

Figure E-6, pages E-9 and E-10, is a risk assessment prepared by the Department of Transportation.

QUALITATIVE RISK ASSESSMENT.

Qualitative risk assessment techniques are used to place a value on the level of risks created by hazards in an operation. The principal qualitative technique is the Risk Assessment Code (RAC) described in MILSTD-882B. This method was established as a common way to set priorities for DOD-wide hazard abatement programs and uses a RAC matrix format to combine the concepts of frequency and severity into a single, numerical code. It is very useful in comparing different risks such as those from different programs or even differences such as health vs. safety risks.

RACs are implemented, for the Army, in AR 385-10. In that regulation, the two qualities of Hazard Severity and Hazard Probability are described as follows:

Category I - CATASTROPHIC. "May cause death or loss of a facility." In this case "loss" does not mean a period of interrupted service; it means destruction of the facility or operation.

Category II - CRITICAL. "May cause severe injury, severe occupational illness, or major property damage.

Category III - MARGINAL. "May cause minor injury, minor occupational illness, or minor property damage."

Category IV - NEGLIGIBLE. "Probably would not affect personnel safety or health, but nevertheless in violation of specific standards."

Figure E-6. Excerpt from Risk Assessment Techniques Manual, prepared by the Department of Transportation's Transportation Safety Institute, August 1986

Mishap Probability. This is "the probability that a hazard will result in a mishap, based on an assessment of such factors as location, exposure in terms of cycles or hours of operation and affected population." This expression combines the idea of the probability of an event and the exposure to the event. These probabilities are expressed as letters conforming to the following scaling system:

Subcategory A - "Likely to occur immediately."
Subcategory B - "Probably will occur in time."
Subcategory C - "May occur in time."
Subcategory D - "Unlikely to occur."

The two qualities are combined to yield a RAC by use of the following table:

AR 385-10 Risk Assessment Code Table

		Mishap Probability			
		A	B	C	D
Hazard Severity	I	1	1	2	3
	II	1	2	3	4
	III	2	3	4	5
	IV	-	-	-	-

Table 3

In using the AR 385-10 RAC system, it's important to note that the IA and IIA classifications are termed "imminent danger." Though their RAC codes of 1 are the same as that of the IB entry, their immediacy makes them more critical. The codes are useful in assessing an operation as it begins, but they must be updated as the operation continues, the facility ages, etc. to account for degrading condition or performance.

For risk managers there are some important organizational/management considerations to RAC codes. AR 40-10 (Health) also contains a RAC system, but due to a difference in definitions, the health RAC code may be a lower number indicating a higher degree of risk. This is important to managers that are comparing health risks to others ranks under AR 385-10; the health issue would always win if no compensation or consideration were factored into the codes. From the managerial standpoint it must be remembered that RACs are judgmental and not necessarily held to be the same by different managers or evaluators. When differences in perception occur, the differences are likely based in either the understanding of the operation's behavior or the criteria for selecting the probability and severity. You'll find it wise to listen for the basis of others' RAC choices and attempt to develop a common understanding.

QUANTITATIVE RISK ASSESSMENT.

Quantitative risk assessment techniques are used to prepare estimates of risk levels using performance data, when available, to improve the accuracy of risk estimates used in risk acceptance decision making. These assessments are numeric values representing the safety risk of an Army activity, system operation, or comparable endeavor, based on actuarial or derived numeric data. Though RACs are numerical, they are derived from judgments and are not demonstrable in records of performance. If it is desirable that performance be measured, it's necessary that quantified estimates of risk levels be established, that risk levels must be predictive so that future performance has a base of comparison, and that risk levels be assigned numeric values.

Figure E-6. Excerpt from Risk Assessment Techniques Manual, prepared by the Department of Transportation's Transportation Safety Institute, August 1986 (continued)

RISK ASSESSMENT FOR LIVE MINE TRAINING

The USAEC, Department of Instruction (DOI), obtained information for the following risk assessment from the Collective Training Branch, Department of Training and Doctrine (DOTD), and the Field Engineering Branch for Engineer Officer Basic Course (EOBC) demolitions training. Hazards are identified and analyzed on preliminary hazard analysis work sheets (see Figures E-7 through E-18, pages E-11 through E-24.) Risk assessment codes are assigned to each hazard based on severity and probability of occurrence.

References used in the risk analysis process include this manual and the following publications:

- DA Pam 350-38.
- AR 385-10.
- AR 385-16.
- AR 385-63.
- STP 5-12B1-SM.
- ★ TC 25-8.
- TM 9-1345-203-12&P.
- TM 43-0001-36.

PRELIMINARY HAZARDS ANALYSIS WORK SHEET

Operation Name: Arming the M14 AP Mine
Date Prepared: 11 October 1990
Sheet Number: 1 of 1

Hazards	System Effects	Causal Factors	RAC	Actions	Controlled RAC	Standards/Comments
(1) Damaged mine used	(1) None	(1) Lack of training/improper training (2) Improper supervision (3) Incomplete or no inspection	IV B (-)	(1) Train/inspect supervise (2) Do not use mine (3) Contact QASAS to investigate (4) Turn in the mine for disposal	IV D (-)	(1) Proper training (2) Soldiers proficient on training aid mines first (3) 1 instructor to 1 soldier (4) All training is conducted in the prone position (5) Mine training is done after identified by a unit's METL and only with select personnel
(2) Too much pressure on the pressure place (without detonator installed)	(1) Belleville spring snaps firing pin in extended position	(1) Improper handling procedures	II C (3)	(1) Ensure proper handling when the safety clip is removed (2) Do not use mine	IV C (-)	(6) Training is conducted in the proper environment (7) Soldiers are in the proper protective gear
(3) Screwing detonator into the mine with a firing pin in the extended position	(1) Mine detonates	(1) Lack of training/improper training (2) Improper supervision (3) Incomplete or no inspection	II C (3)	(1) Ensure proper inspection is conducted. (2) Contact QASAS	II D (4)	(8) No trip wires or AHDs are used with a live M14 mine
(4) Improper handling of detonator	(1) Detonator detonates	(1) Improper soldier handling (2) Lack of training/improper training (3) Improper supervision (4) Incomplete or no inspection	III C (4)	(1) Handle detonator properly	III D (5)	
(5) Weakened Belleville spring	(1) Mine detonates at pressure lower than designed pressure	(1) Belleville spring weakening	I C (2)	(1) Inform units of lower detonating pressure	I D (3)	

Figure E-7. Preliminary hazards analysis work sheet (arming M14)

PRELIMINARY HAZARDS ANALYSIS WORK SHEET

Operation Name: Disarming the M14 AP Mine
Date Prepared: 11 October 1990
Sheet Number: 1 of 1

Hazards	System Effects	Causal Factors	RAC	Actions	Controlled RAC	Standards/Comments
(1) Remove camouflage	(1) Mine detonates	(1) Pressure on pressure plate (2) Damage or malfunction (3) Lack of training/improper training (4) Improper supervision (5) Incomplete or no inspection	I B (1)	(1) Do not apply pressure (2) Remove camouflage slowly or do not camouflage mine at all	I D (3)	(1) See comments on arming an M14 AP mine
(2) Replace safety clip	(1) Mine detonates	(1) Pressure on pressure plate	I C (2)	(1) Ensure proper handling when installing safety clip	I D (3)	
(3) Turn pressure plate to SAFE	(1) Mine detonates	(1) Pressure on pressure plate (2) Weakened Belleville spring	I C (2)	(1) Do not apply pressure to pressure plate	I D (3)	
(4) Remove mine from hole	(1) Mine detonates	(1) Dropped mine	I C (2)	(1) Ensure proper handling	I D (3)	
(5) Remove detonator	(1) Detonator detonates	(1) Soldier improperly handles mine (2) Lack of training/improper training (3) Improper supervision	I C (2)	(1) Handle detonator properly	I D (3)	

Figure E-8. Preliminary hazards analysis work sheet (disarming M14)

PRELIMINARY HAZARDS ANALYSIS WORK SHEET

Operation Name: Arming the M15 AT Mine
Date Prepared: 11 October 1990
Sheet Number: 1 of 1

Hazards	System Effects	Causal Factors	RAC	Actions	Controlled RAC	Standards/Comments
(1) Damaged mine used	(1) None	(1) Lack of training/improper training (2) Improper supervision (3) Incomplete or no inspection	IV B (-)	(1) Do not use mine (2) Contact QASAS to investigate (3) Turn mine in for investigation/disposal	IV D (-)	(1) Proper training (2) Soldier proficient on inert mines first (3) 1 instructor to 1 soldier (4) All training is conducted in the prone position (5) Mine training is done after identified by a unit's METL and only with select personnel
(2) Too much force on extension rod/pressure ring (M624 fuze)	(1) Mine detonates	(1) Soldier bends/pushes on rod or fuze	I B (1)	(1) If the extension rod is used, the safety stop and band will not be removed **OR** (2) Remove the extension rod before removing safety stop and band	I D (3)	(6) Training is conducted in the proper environment (7) Soldiers are in the proper protective gear (8) No trip wires or AHDs are used with an M15 mine
(3) Too much pressure on pressure plate (M603 fuze)	(1) Mine detonates	(1) Soldier applies excessive pressure	I D (3)	(1) See comments	I D (3)	
(4) Fuze improperly seated in the fuze well (M603 fuze)	(1) Mine detonates	(1) Excessive debris/corrosion in well (2) Lack of training/improper training (3) Improper supervision (4) Incomplete or no inspection	I C (2)	(1) Perform depth check with wrench	I D (3)	(9) Using the cap to perform the fuze depth check is not authorized. Use wrench.
(5) Improper handling of fuze (M603 fuze)	(1) Fuze detonates	(1) Pressure applied to fuze with safety fork removed	II D (4)	(1) Handle fuze properly	II D (4)	

Figure E-9. Preliminary hazards analysis work sheet (arming M15)

PRELIMINARY HAZARDS ANALYSIS WORK SHEET

Operation Name: Disarming the M15 AT Mine
Date Prepared: 11 October 1990
Sheet Number: 1 of 1

Hazards	System Effects	Causal Factors	RAC	Actions	Controlled RAC	Standards/Comments
(1) Remove camouflage	(1) Mine detonates	(1) Too much pressure on pressure plate (2) Damage to the mine	I D (3)	(1) Do not apply pressure to pressure plate (2) See comments	I D (3)	(1) See comments under arming the M15 AT mine (2) See attached separate risk assessment for command detonating a mine in place with explosives
(2) Not being able to turn the mine to safe or reinstall safety ring, safety stop, or safety pin	(1) Mine detonates	(1) Too much resistance (M603 fuze) to turning indicator (2) Safety band (M624), safety stop or safety pin has become damaged (3) Foreign material has entered the fuze well	I C (2)	(1) Controlled detonation in place	None	
(3) Remove fuze/install safety fork	(1) Fuze detonates	(1) Pressure on the pressure plate of fuze (2) Fuze is not removed	II D (4)	(1) Follow proper procedures	II D (4)	

Figure E-10. Preliminary hazards analysis work sheet (disarming M15)

PRELIMINARY HAZARDS ANALYSIS WORK SHEET

Operation Name: Arming the M16 Series AP Mine
Date Prepared: 11 October 1990
Sheet Number: 1 of 1

Hazards	System Effects	Causal Factors	RAC	Actions	Controlled RAC	Standards/Comments
(1) Damaged mine used	(1) None	(1) Lack of training/improper training (2) Improper supervision (3) Incomplete or no inspection	IV C (-)	(1) Do not use mine (2) Contact QASAS to investigate (3) Turn in the mine for investigation/ disposal	None	(1) Proper training (2) Soldiers proficient on inert mines first (3) 1 instructor to 1 soldier (4) All training is conducted in the prone position (5) Mine training is done after the need is identified by a unit's METL and then only with select personnel
(2) Faulty fuze used (M605)	(1) Mine detonates	(1) Safety pins missing (2) Prongs bent (3) Fuze head does not turn freely (4) Pins installed incorrectly	IB (1)	(1) Do not use fuze (2) Contact QASAS to investigate (3) Turn mine in for investigation/disposal (4) Conduct quality control check before training	ID (3)	(6) Training is conducted in the proper environment (7) Soldiers are in the proper protective gear (8) No trip wires or live AHDs are used with an M16 mine (9) In the event of damage or loss of any safety pins, stop training with this particular mine and destroy it
(3) Pressure applied to prongs after the positive safety pin is removed	(1) Mine detonates	(1) Pressure is applied inadvertently	IB (1)	(1) Do not at any time remove the positive safety pin	ID (3)	
(4) Fuze improperly armed	(1) Mine detonates	(1) Individual pushes in on release pin while or after positive safety pin is removed (2) Wrong sequence for removing pins (3) Locking safety pin is removed; click is heard; soldier continues	IB (1)	(1) Do not at any time remove the positive safety pin	ID (3)	

Figure E-11. Preliminary hazards analysis work sheet (arming M16)

PRELIMINARY HAZARDS ANALYSIS WORK SHEET

Operation Name: Disarming the M16 Series AP Mine
Date Prepared: 11 October 1990
Sheet Number: 1 of 1

Hazards	System Effects	Causal Factors	RAC	Actions	Controlled RAC	Standards/Comments
(1) Remove camouflage	(1) Mine detonates	(1) Too much pressure on M605 fuze pressure prongs	I C (2)	(1) Close supervision (2) Procedure is not rushed (3) Do not camouflage mine	I D (3)	(1) It is highly recommended that this mine not be fully armed by leaving positive safety pin in the fuze at all times (2) See comments for arming the M16 AP mine
(2) Replace safety pins	(1) Mine detonates	(1) Pins not replaced (2) Pull on release pin ring (3) Pressure on fuze pressure prongs (4) Pins replaced in wrong order	I C (2)	(1) Close supervision (2) Procedure is not rushed	I D (3)	(3) See attached separate risk assessment for command detonating a mine in place with explosives
(3) Remove M605 fuze	(1) Mine detonates	(1) Safety pins not properly in place, thus allowing pressure to be applied to the fuze, pressure prongs, or release pin	I C (2)	(1) Close supervision (2) Assure pins are secure and replaced correctly	I D (3)	

Figure E-12. Preliminary hazards analysis work sheet (disarming M16)

PRELIMINARY HAZARDS ANALYSIS WORK SHEET

Operation Name: Arming the M19 AT Mine
Date Prepared: 11 October 1990
Sheet Number: 1 of 1

Hazards	System Effects	Causal Factors	RAC	Actions	Controlled RAC	Standards/Comments
(1) Damaged mine used	(1) None	(1) Lack of training/improper training (2) Improper supervision (3) Incomplete or no inspection	IVB (-)	(1) Do not use mine (2) Contact QASAS to investigate	IVB (-)	(1) Proper training (2) Soldiers proficient on inert mines first (3) 1 instructor to 1 soldier (4) All training is conducted in the prone position (5) Mine training is done after identified by a unit's METL and only with select personnel
(2) Improper handling of detonator	(1) Detonator detonates	(1) Soldier handles detonator improperly (2) Lack of training/improper training (3) Improper supervision (4) Incomplete or no inspection	IID (4)	(1) Handle detonator properly	IIID (5)	(6) Training is conducted in the proper environment (7) Soldiers are in the proper protective gear (8) No trip wires or AHDs are used with a live M19 mine
(3) Pressure on pressure plate	(1) Mine detonates	(1) Soldier applies too much pressure	ID (3)	(1) See comments	ID (3)	
(4) Weakened Belleville spring	(1) Mine detonates at pressure lower than designed pressure	(1) Belleville spring weakening	IC (2)	(1) Inform soldiers of less pressure required to detonate	ID (3)	

Figure E-13. Preliminary hazards analysis work sheet (arming M19)

PRELIMINARY HAZARDS ANALYSIS WORK SHEET

Operation Name: Disarming the M19 AT Mine
Date Prepared: 11 October 1990
Sheet Number: 1 of 1

Hazards	System Effects	Causal Factors	RAC	Actions	Controlled RAC	Standards/Comments
(1) Remove camouflage	(1) Mine detonates	(1) Too much pressure on pressure plate (2) Damage or malfunction	I D (3)	(1) Do not camouflage mine	I D (3)	(1) See comments under arming the M19 AT mine
(2) Not being able to turn the mine to safe	(1) Mine detonates	(1) Too much resistance turning the dial indicator (2) Foreign material has entered the fuze well	I C (2)	(1) Controlled mine detonation in place	I D (3)	(2) See attached separate risk assessment for command detonating a mine in place with explosives
(3) Remove fuze assembly and replace detonator with shipping plug	(1) Detonator detonates	(1) Dropping fuze assembly with detonator (2) Dropping the detonator	II C (3)	(1) Handle fuze assembly and detonator properly	II D (4)	

Figure E-14. Preliminary hazards analysis work sheet (disarming M19)

PRELIMINARY HAZARDS ANALYSIS WORK SHEET

Operation Name: Arming the M21 AT Mine
Date Prepared: 11 October 1990
Sheet Number: 1 of 1

Hazards	System Effects	Causal Factors	RAC	Actions	Controlled RAC	Standards/Comments
(1) Damaged mine used	(1) None	(1) Lack of training/improper training (2) Improper supervision (3) Incomplete or no inspection	IV B (-)	(1) Do not use mine (2) Contact QASAS to investigate (3) Turn mine in for investigation/disposal	IV B (-)	(1) Proper training (2) Soldiers proficient on inert mines first (3) 1 instructor to 1 soldier (4) All training is conducted in the prone position (5) Mine training is done after identified by a unit's METL and only with select personnel
(2) Too much force on extension rod/pressure ring (M607 fuze)	(1) Mine detonates	(1 Soldier bends/pushes on rod or fuze	IB (1)	(1) If the extension rod is used, the safety stop and band will NOT be removed **OR** (2) Remove the extension rod before removing the safety stop and band	ID (3)	(6) Training is conducted in the proper environment (7) Soldiers are in the proper protective gear (8) No trip wires or AHDs are used with an M21 mine
(3) Fuze improperly seated in the fuze well	(1) Mine detonates	(1) Excessive debris/corrosion in well (2) Lack of training/improper training (3) Improper supervision (4) Incomplete or no inspection	IC (2)	(1) See comments	ID (3)	
(4) Improper handling of fuze	(1) Fuze detonates	(1) Pressure applied to fuze while mine is armed	IID (4)	(1) Handle fuze properly	None	

Figure E-15. Preliminary hazards analysis work sheet (arming M21)

PRELIMINARY HAZARDS ANALYSIS WORK SHEET

Operation Name: Disarming the M21 AT Mine
Date Prepared: 11 October 1990
Sheet Number: 1 of 1

Hazards	System Effects	Causal Factors	RAC	Actions	Controlled RAC	Standards/Comments
(1) Remove camouflage	(1) Mine detonates	(1) Too much pressure (2) Tilt extension rod (3) Damage or malfunction	I B (1)	(1) DO NOT USE extension rod (2) Close supervision	I D (3)	(1) See comment for arming the M21 AT mine
(2) Replace band, stop, and cotter pin	(1) Mine detonates	(1) Too much pressure (2) Tilt extension rod (3) Damage to stop, band, or cotter pin	I B (1)	(1) DO NOT use extension rod (2) Close supervision	I C (2)	(2) In the event of damage or loss of stop, band, or cotter pin, stop training with this particular mine and destroy it
(3) Remove extension rod and/or fuze	(1) Mine detonates	(1) Too much pressure (2) Tilt extension rod	I C (2)	(1) DO NOT USE extension rod (2) Ensure proper placement of band, stop, and cotter pin	I D (3)	(3) See attached separate risk assessment for command detonating a mine in place with explosives.
(4) Remove booster	(1) Booster detonates	(1) Soldier improperly handles booster	II D (4)	(1) Handle booster properly	None	

Figure E-16. Preliminary hazards analysis work sheet (disarming M21)

PRELIMINARY HAZARDS ANALYSIS WORK SHEET

Operation Name: Preparing charges and priming explosives to be used for mine demolition (detonated in place)
Date Prepared: 11 October 1990
Sheet Number: 1 of 1

Hazards	System Effects	Causal Factors	RAC	Actions	Controlled RAC	Standards/Comments
(1) Defect wire or faulty test of wire	(1) No detonation	(1) Wire will not carry electrical charge to detonate explosive	IV D (-)	(1) Do not use wire (replace it)	None	(1) After testing, ensure wire ends are twisted together
(2) Electric blasting cap check done incorrectly or not done at all	(1) Blasting cap detonates	(1) Cap improperly handled (2) Cap not put under sandbag	III C (4)	(1) Handle cap properly (2) Place cap under sandbag	IV D (-)	
(3) Blasting cap attached incorrectly to firing wire	(1) Blasting cap detonates	(1) Cap/firing wire improperly handled (2) Firing wire end not shunted	III C (4)	(1) Ensure firing wire is shunted (2) Ensure proper handling of blasting cap	IV D (-)	
(4) Blasting cap inserted incorrectly/too forcefully into one-pound demolition charge	(1) Blasting cap and/or one-pound demolition charge detonates	(1) Too much pressure on blasting cap (2) Cap improperly handled	I D (3)	(1) Ensure proper handling of blasting cap	I D (3)	(2) Only 1 demolitions person and 1 safety person will be at the mine when the blasting cap is inserted into the demolitions
(5) Charge does not detonate	(1) No detonation	(1) Faulty blasting cap (2) Faulty blasting machine (3) Faulty firing wire	IV C (-)	(1) OIC declares a misfire (2) Follow RSO procedures for a misfire	IV C (-)	(3) RSO is responsible for clearing misfires (4) RSO keeps a "misfire kit" under his control

Figure E-17. Preliminary hazards analysis work sheet (preparing charges and priming explosives)

PRELIMINARY HAZARDS ANALYSIS WORK SHEET

Operation Name: Mine arming/disarming peripheral factors (not all-inclusive)
Date Prepared: 11 October 1990
Sheet Number: 1 of 1

Hazards	System Effects	Causal Factors	RAC	Actions	Controlled RAC	Standards/Comments
(1) Good weather	(1) None direct	(1) Temperature between 45 and 70 degrees Fahrenheit (2) Clear or partly cloudy (3) Wind less than 5 mph	IV A (-)	None	None	(1) This list is not conclusive and will depend on the particulars of the unit, the training, and the range facilities
(2) Minimal weather	(1) None direct	(1) Temperature between 32 to 44 or 71 to 80 degrees Fahrenheit (2) Drizzle (3) Winds between 5 and 15 mph	III A (2)	(1) Close supervision (2) Do not rush training to get in shelter (3) Postpone or cancel training	III C (4)	
(3) Bad weather	(1) Wet, miserable soldiers (2) Wet munitions	(1) Temperature less than 32 or greater than 80 degrees Fahrenheit (2) Moderate to heavy rain (3) Snow or ice (4) Winds greater than 15 mph	I C (2)	(1) Postpone or cancel training	I D (3)	
(4) Lack of references	(1) The sequential arming or disarming not done correctly, causing the fuze and/or mine to detonate	(1) Current doctrine not available (2) Questions or confirmation of techniques not quantified	I B (1)	(1) Stop training if unsure of a task (2) Have proper references available	I D (3)	
(5) Lack of support materials or components	(1) Improper procedures or practices introduced, causing the fuze and/or the mine to detonate	(1) Not enough or incorrect fuzes, wrenches and/or washers used	I C (2)	(1) Ensure proper support material is available (2) Stop training if the proper material is not available	I D (3)	

Figure E-18. Preliminary hazards analysis work sheet (mine arming/disarming)

PRELIMINARY HAZARDS ANALYSIS WORK SHEET

Operation Name: Mine arming/disarming peripheral factors (not all-inclusive)
Date Prepared: 8 June 1990
Sheet Number: 1 of 1

Hazards	System Effects	Causal Factors	RAC	Actions	Controlled RAC	Standards/Comments
(6) Condition of soldiers	(1) Improper procedures or practices introduced, causing the fuze and/or the mine to detonate	(1) Long amount of training with little or no sleep (2) Strenuous training conducted before or during live mine training	I D (3)	(1) Ensure soldiers have adequate sleep (2) Allow for breaks during training (3) Stop training if soldiers appear to be heavily fatigued	None	Additional peripheral factors a unit commander may wish to consider: level of proficiency, time of event (day or night), availability and extent to emergency response assets, train up (rehearsals and dry runs), terrain, and location of instructor in relation to soldier during the training
(7) Protective clothing	(1) Improper or lacking protective clothing, increasing the severity of an accident if it does occur	(1) Improper or lacking protective clothing	I C (2)	(1) All soldiers participating in mine training will have kevlar, flak vest, and boots	None	

Figure E-18. Preliminary hazards analysis work sheet (mine arming/disarming) (continued)

APPENDIX F

PLATOON LEADER'S PLANNING GUIDE FOR ROW MINEFIELDS

1. The platoon leader conducts troop-leading procedures.

2. The platoon leader *issues* a fragmentary order (FRAGO) to the platoon (includes the task, day/night, observation post (OP), times).

3. The platoon leader conducts a reconnaissance of the minefield location and coordinates with the maneuver force on the exact location.

- Ensures the maneuver force covers the minefield by observed direct or indirect fire.
- Ensures the final location is tied to existing or reinforcing obstacles.
- Determines the locations for mine rows, landmarks, fences, mine dumps, and approaches.
- Selects movement routes.
- Establishes local security and job site security.

4. The platoon leader calculates man-hours and logistical requirements and arranges for mines to be drawn. (See standard pattern minefield logistical calculations in Chapter 3, page 3-8.)

- Calculates the number of mines.
- Calculates the number of platoon hours to install the minefield.
- Calculates the amount of fencing and marking material.
- Calculates the number of trips to transport mines.

5. The platoon leader reports by secure means, to higher headquarters, the intention to lay mines. The report includes the tactical purpose, number and type of mines, location, whether mines are surface-laid or buried, where lanes and/or gaps are located, and the proposed start and completion times.

6. The platoon sergeant organizes the platoon to emplace the minefield.

- Siting party.
- Marking party.
- Recording party.
- Laying party.
  - Burial party (if necessary).
  - Arming party.

NOTE: The size of these parties is determined by METT-T.

7. The platoon sergeant assembles all equipment and material to emplace the minefield.

- Equipment and materials include a map, lensatic compass, minefield record forms, stakes or pickets, sledgehammers or picket pounders, engineer tape on reels, nails, barbwire on reels, concertina, marking signs, wire cutters, gauntlets, metric tape, picks, shovels, and sandbags.

  NOTE: **The quantity of equipment and material required varies depending on the size of the minefield and the number of soldiers working.**

- For night operations, equipment includes a HEMMS and/or them-lights to mark the lanes, turning points, intermediate row markers, and row markers. If possible, coordinate with higher headquarters for use of night observation devices.

NOTE: The platoon must assume they are being observed by the enemy and must maintain noise and light discipline.

8. The platoon leader reports the unit has initiated emplacement to higher headquarters. The report includes the time, location, and obstacle number.

9. The platoon establishes a mine dump on the friendly side of the minefield.

- Selects a reasonably level site with adequate access for vehicles.
- May elect to keep mines in trailers (mobile mine dumps).

10. The platoon emplaces the minefield.

Siting party operations.

- The platoon leader designates the start point and the azimuth of the first row of the minefield. This is the row closest to the enemy.
- The siting party installs pickets at the row marker, siting picket (at the end of the first row), and intermediate markers as necessary.
- The siting party then installs pickets for the IOE (if applicable), short strips (if applicable), and second and subsequent rows.
- The platoon leader/sergeant designates lanes.
- The siting party lays tape for the lanes.
- When finished with these tasks, the siting party augments other parties as directed by the platoon sergeant.

Marking party operations.

- Once the last (rear) row has been sited by the laying party, the marking party may install a concertina fence 10 meters on the friendly side from the last (rear) row. Forward minefields will be marked as necessary to protect friendly troops.
- Once lanes have been sited, the marking party installs a minefield fence.
- Upon completion, the marking party augments other parties as directed by the platoon sergeant.

Recording party operations.

- As the minefield is sited and marked, the platoon leader designates landmarks to the rear of the minefield.
- Beginning from one landmark, the recording NCO relates the minefield to the landmark by recording azimuths and distances.
- The NCO completes DA Form 1355.
- The platoon leader reviews DA Form 1355 for correctness and ensures the form is classified SECRET.
- The platoon leader signs DA Form 1355.
- The platoon leader submits one copy of DA Form 1355 to higher headquarters as soon as possible and retains one copy.

Laying party operations.

- Upon arrival, establishes mine dump.
- Uncrates and stacks AT mines.
- Leaves all other mines in their crates with the lids removed.
- Places fuzes and detonators in separate boxes; does not mix fuze types.
- Hauls the mines to the site.
- The APCs then load 20 to 30 mines (based on load plans). These mines are on edge and no more than three high.
- The APCs line up on the marked rows beginning with the first row (closest to

the enemy). The APCs will lay from right to left.

- Each carrier has three soldiers inside—one driving, one manning the .50 caliber machine gun (for security), and one inside handing the mines out the rear door (or inside the trailer handing out the back). Another soldier walks behind the carrier and places the mines on the ground (see Figure F-1).
- The driver drives along the marked row slowly so the soldier walking behind may lay the mines correctly.
- Each mine is laid 6 meters apart. This is measured by a rope that extends off the back of the carrier or the trailer that is 6 meters long. The rope is anchored to something heavy (for example, a partially filled sandbag). When the sandbag reaches the last laid mine, another unarmed mine is placed on the ground.
- Mines are emplaced in this manner until the carrier has no more mines and returns to the mine dump for a replenishment.
- The IOE short strips are emplaced at the same time the first (baseline) row is emplaced.
- Burial party operations (if required).
  - The burial party follows immediately behind the laying party. The depth of each hole is in accordance with the depth specified in the technical manual for that mine.
  - Burial party operations may be combined with arming party operations.

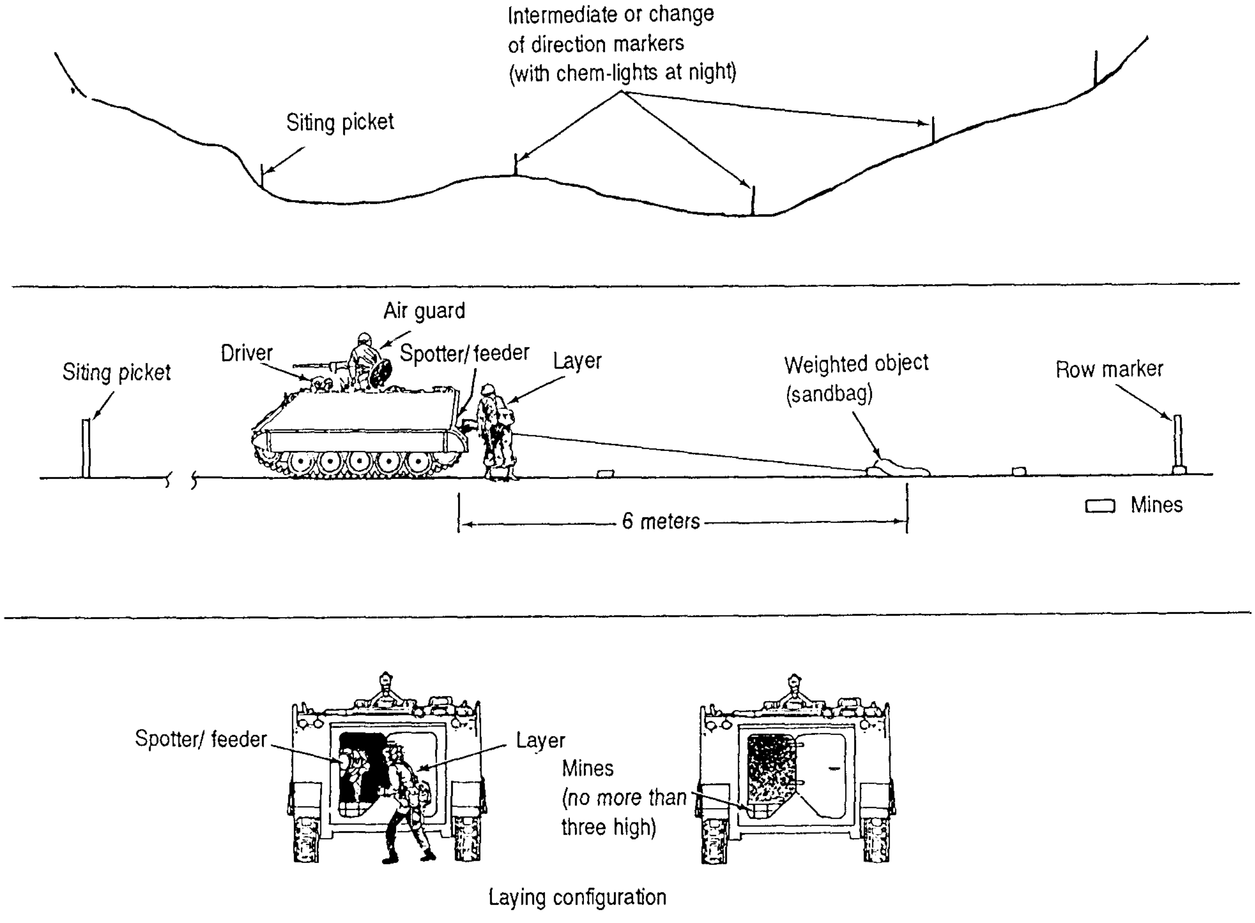


Figure F-1. Mine laying

GLOSSARY

1 LT	**first lieutenant**
2S1	A Soviet self-propelled howitzer.
A	**armed**
M	**avenue of approach**
abn	**airborne**
ACE	**armored combat earthmover (M9)** - A highly mobile armored, amphibious combat earthmover capable of dozing, excavating, rough grading, and ditching functions.
AD	**armor division**
ADA	**air defense artillery** - Weapons and equipment for actively combatting air targets from the ground.
ADAM	**area denial artillery munition** - An artillery round containing 36 mines (M731/M73lA1 with self-destruct time of 4 hours or M692/M692Al with self-destruct time of 48 hours). The ADAM contains only antipersonnel mines.
ADC	**area damage control** - Measures taken before, during, or after hostile action or natural or man-made disasters to reduce the probability of damage and to minimize its effects.
ADE	**Assistant Division Engineer**
AHD	**antihandling device** - A device arranged to detonate a mine when it is disturbed.
AI	**area of interest**
ALO	**aviation liaison officer** - An officer (aviator/pilot) attached to a ground unit who functions as primary advisor to the ground commander regarding air operations matters.
ammo	**ammunition**
AP	**antipersonnel mine** - A mine designed to kill or wound soldiers.
APB	**antipersonnel blast** - An antipersonnel mine designed to cripple the foot or leg of the soldier who steps on it. It can also burst the tire of a wheeled vehicle that passes over it.
APC	**armored personnel carrier** - A lightly armored, highly mobile, full-tracked vehicle, amphibious and air-droppable, used primarily

	for transporting personnel and their individual equipment during tactical operations.
APF	**antipersonnel fragmentation -** An antipersonnel mine that, when stepped on, throws a canister into the air. The canister bursts and scatters shrapnel throughout the immediate area. A directional aimed fragmentation mine is designed primarily for use against personnel.
APOBS	**Antipersonnel Obstacle Breaching System -** A man-portable, line-charge, obstacle-breaching system capable of clearing a footpath through antipersonnel minefield and wire entanglements.
approx	**approximate**
AR	**Army regulation**
★ **ARDEC**	**Armament Research Development Center**
ARNG	**Army National Guard**
arty	**artillery**
ASP	**ammunition supply point -** A place where ammunition is received from supporting supply points and broken down for distribution to subordinate units.
assault breach	A breach tactic used by small units (company teams and platoons) to penetrate an enemy's protective obstacles and seize a foothold within his defense.
AT	**antitank mine -** A mine designed to immobilize or destroy a tank
AVLB	**armored vehicle launched bridge**
AVLM	**armored vehicle launched MICLIC**
BAI	**battlefield air interdiction -** Air operations conducted to destroy, neutralize, or delay the enemy's military potential before it can be brought to bear effectively against friendly forces.
BAT-M	A Soviet tracked engineer dozer.
bde	**brigade**
block	A tactical obstacle intent used to integrate fire planning and obstacle effort to stop an attacker along a specific avenue of approach. Requires extensive obstacle effort and overwhelming direct and indirect fires. Obstacles must be tied into terrain and allow no bypass.
BMA	**battery minefield angle**
BMP	A Soviet tracked amphibious infantry combat vehicle.
bn	**battalion**

BOS	**Battlefield Operating System**
BP	**battle position**
BRDEC	**Belvoir Research Development and Engineering Center**
BTR-50/60	A Soviet wheeled amphibious armored personnel carrier.
BTU	A Soviet tank-mounted dozer blade.
CAS	**close air support**
cav	**cavalry**
cbt	**combat**
CBU	**cluster bomb unit** - An aircraft store composed of a dispenser and submunitions.
cdr	**commander**
CEV	**combat engineer vehicle** - An armored, tracked vehicle that provides engineer support to other combat elements. Vehicle is equipped with a heavy-duty boom, winch, dozer blade, and 165 mm demolition gun.
CG	**commanding general**
them	**chemical**
chg	**charge**
℄	**centerline**
cl	**class**
CLAMS	**Cleared-Lane Marking System** - Allows rapid remote marking of the breached lane, which can be seen at night. It can be mounted on the rear of any M1/M60 tank with the proper adapter assembly.
clearing operations	The total elimination of an obstacle or unexploded ordnance over a defined area. Normally, clearing is a sustainment engineer task conducted well after total elimination of all direct and indirect fires able to cover the obstacle. Clearing is an extremely resource-intensive, slow operation and is typically assigned to engineers (division or higher).
cm	**centimeter(s)**
co	**company**
collapsing circuit	Has a dual role of antihandling or delay action. When any part of the energizing circuit is out or the battery runs down, the contacts will close to complete a separate firing circuit.

cont	**continued**
countermine	A subcomponent of mobility that concentrates solely on the actions taken to counteract a mine or minefield through detecting, reducing, and/or bypassing.
CP	**command post**
CS	**combat support**
CSR	**controlled supply rate -** The rate of ammunition consumption that can be allocated, considering the supplies and facilities available, for a given period.
CSS	**combat service support**
CU	**cubic**
d	**deep**
DA	**Department of the Army**
DCU	**dispenser control unit**
deg	**degree**
demo	**demolition**
dev	**device**
dia	**diameter**
DIM	A Soviet vehicle-mounted mine detector.
disrupt	A tactical obstacle intent to focus fire planning and obstacle effort to break up an enemy's formation and assets, and to piecemeal his attack. May be used to separate combat echelons or combat forces from their logistical support.
div	**division**
DOD	**Department of Defense**
DOI	**Department of Instruction**
DOTD	**Department of Training and Doctrine**
DST	**decision support template**
DTG	**date-time group**
DZ	**drop zone -** A specific area upon which airborne troops, equipment, or supplies are airdropped.

E **executed**

ea **each**

EA **engagement area**

ECM **electronic countermeasures** - The division of electronic warfare that involves taking actions to prevent or reduce an enemy's effective use of the electromagnetic spectrum.

EDD **explosive detector dog**

EFSP **engineer forward supply point**

EM **enlisted member**

engr **engineer**

EOBC **Engineer Officer Basic Course**

EOD **explosive ordnance disposal** - Personnel with special training and equipment who render explosive ordnance (such as bombs, mines, projectiles, and booby traps) safe, make intelligence reports on ordnance, and supervise the safe removal of ordnance.

°F **degrees Fahrenheit**

FA **field artillery**

FASCAM **family of scatterable mines**

FD **firing device**

FEBA **forward edge of the battle area** - The foremost limits of a series of areas in which ground combat units are deployed.

FIST **fire support team**

fix A tactical obstacle intent to focus fire planning and obstacle effort to slow an attacker within a specified area.

FLOT **forward line of own troops** - A line which indicates the most forward positions of friendly forces in any kind of military operations at a specific time. The FLOT normally identifies the forward location of covering and screening forces.

FM **frequency modulated**

FM **field manual**

FO **forward observer**

FPF **final protective fires**

frag **fragmentation**

★ **fragment hazard zone** The area outside a scatterable minefield's safety zone that poses significant risk or hazard to friendly maneuver (personnel and vehicles) from shrapnel or an explosively formed penetrator when self-destruction occurs. This area can extend out to 640 meters for AT mines oriented on their sides. This is the maximum possible fragment hazard zone. The risk of being struck at this distance is negligible. Tests indicate that acceptable risk for maneuver is the distance over 235 meters from the outer edges of the minefield safety zone.

FRAGO **fragmentary order**

FSCOORD **fire support coordinator** - One who conducts the planning and executing of fire so that targets are adequately covered by a suitable weapon or group of weapons.

FSE **fire support element** - Used to enhance and speed fire support coordination.

ft **foot, feet**

G3 **Assistant Chief of Staff, G3 (Operations and Plans)**

gal **gallon(s)**

GDP **general defense plan**

GEMSS **Ground-Emplaced Mine Scattering System (M128)** - A trailer-mounted system that may be towed by a variety of tracked or wheeled vehicles.

GMZ **Gusenichnyy Mino-Zagraditel** - A Soviet armored, tracked minelayer.

GPBT **general purpose barbed tape**

gr **gram(s)**

H **mustard**

HCU **hand control unit**

HD **distilled mustard**

HE **high explosive** - Generally applied to the bursting charges for bombs, mines, projectiles, grenades, and demolition charges. Defined by Department of Transportation as materials susceptible to detonation by a blasting cap.

HEMMS **M133 hand-emplaced minefield marking set** - A set consisting of lights, signs, tape, wire, poles, pole driver, batteries, and a wooden storage chest. The set is used as a means of safely guiding forces through or around scatterable or conventional minefields.

HEMTT **heavy expanded mobility tactical truck**

HIND-D A Soviet attack helicopter.

HIP A Soviet medium-lift helicopter.

HMMWV **high-mobility multipurpose wheeled vehicle**

HQ	**headquarters**
hr	**hour(s)**
ht	**height**
ID	**infantry division**
IDA	**improved dog bone assembly**
IFF	**identification, friendly or foe (radar)**
IFV	**infantry fighting vehicle**
IMP	A Soviet portable mine detector.
IMR	A Soviet armored, engineer tractor.
in	**inch(es)**
inf	**infantry**
inst	**instructions**
IOE	**irregular outer edge -** In land mine warfare, short mine rows or strips laid in an irregular manner along the minefield front facing the enemy. Used to deceive the enemy as to the type or extent of the minefield. Generally, the IOE will only be used in minefield with buried mines.
I P	**initial point**
IPB	**intelligence preparation of the battlefield**
JAAT	**joint air attack team**
Jan	**January**
kg	**kilogram(s)**
K-Kill	**catastrophic kill -** Results when the weapon system and/or crew arc destroyed, and the vehicle can no longer perform its intended mission.
km	**kilometer(s)**
KMT	A Soviet mine plow and roller.
kph	**kilometers per hour**
lane	A route through an enemy or friendly obstacle that provides safe passage for a force. The route may be reduced and proofed as part of a breach operation or constructed as part of a friendly obstacle.

lb pound(s)

LD long duration

l d r leader

LE low explosive

LED light-emitting diode

LOC lines of communication

LOGPAC logistics package

LRP logistics release point

Lt lieutenant

LZ **landing zone -** Any specified zone used for the landing of aircraft.

m meter(s)

M1979 A Soviet armored mine clearer.

mag magnetic

MBA main battle area

MC mobility corridor

MCB mine-clearing blade

MCOO modified combined obstacles overlay

MCR mine-clearing roller

METT-T mission, enemy, terrain, troops, and time available

Met+VE meteorological data/ velocity error

MF minefield

MHE materials handling equipment

MICLIC **mine-clearing line charge (M58A4)-** A rocket propelled line charge that will breach a lane 14 meters wide by 100 meters long through minefield with single-impulse, pressure-activated, antitank mines and mechanically activated, antipersonnel mines.

MILSTD Military Standards

min minute(s)

min	**minimum**
M-Kill	**mobility kill** - Results when one or more of the vehicle's vital drive components is destroyed and the target is immobilized. With an M-Kill, the weapon system and crew are not destroyed, and the weapon system, though immobilized, continues to function.
m/1-m	**mine lethality per meter**
mm	**millimeter(s)**
MOPMS	**Modular Pack Mine System** - A suitcase-shaped mine dispenser that can be emplaced anytime before dispensing mines. The system contains 17 antitank and 4 antipersonnel mine.
MOUT	**military operations on urbanized terrain**
mph	**miles per hour**
MR	**molasses residuum**
MRB	**motorized rifle battalion**
MRC	**motorized rifle company**
MRL	**multiple rocket launch**
MRR	**motorized rifle regiment**
M-S	**Miznay-Schardin**
m/sq-m	**mines per square meter**
MSR	**main supply route**
MUV	A series of Soviet-style fuzes.
NA	**not applicable**
NAI	**named area of interest**
NATO	**North Atlantic Treaty Organization**
NBC	**nuclear, biological, chemical**
NCO	**noncommissioned officer**
NCOIC	**noncommissioned officer in charge**
NIS	Soviet chief of engineer services.
no	**number**

obst	**obstacle**
OBSTINTEL	**obstacles intelligence**
Ott	**October**
OIC	**officer in charge**
OOD	**Otryad Obespecheniya Dvizheniya** - A Soviet movement support detachment.
OP	**observation post**
OPLAN	**operation plan** - A plan for a single operation or a series of connected operations to be carried out simultaneously or in succession. It is usually based on stated assumptions and is the form of directive employed by higher authority that permits subordinate commanders to prepare supporting plans and orders. The designation *plan* is usually used instead of *order* in preparing for operations well in advance. An operation plan may be put into effect at a prescribed time or on signal; it then becomes an operation order.
OPORD	**operation order**
OPSEC	**operations security**
ORP	**objective rally point**
OZ	**ounce(s)**
P	**proposed**
PDM	**pursuit-deterrent munition**
PIR	**priority intelligence requirement**
PK	**probability of kill**
pl	**platoon**
PL	**phase line**
plt	**platoon**
PMN	A Soviet pressure-activated, antipersonnel blast mine.
POMZ-2M	A Soviet trip-wire-activated, antipersonnel fragmentation mine.
POZ	**Podvizhnyy Otryad Zagrazhdeniya**- A Soviet mobile obstacle detachment.
PPMP	A Soviet antipersonnel minefield pattern.

pt	**point**
QASAS	**Quality Assurance Specialist Ammunition Surveillance**
qty	**quantity**
RAAM	**remote antiarmor mine** - An artillerv round containing 9 mines (M741/M741A1 with a 4-hour self-destruct time or M718/M718Al with a 48-hour self-destruct time). The RAAM contains only antiarmor mines.
RAC	**risk assessment code**
RAOC	**rear area operations center**
RCU	**remote control unit (M71) - Used to dispense MOPMS mines on command.**
RDX	**cyclonite**
reduce	The creation of a lane through, over, or around an obstacle. In the case of minefield, refers to destroying, neutralizing, removing or bypassing mines. In a breach operation, one of the four breaching fundamentals.
ref	**reference**
rep	**representative**
req'd	**required**
RP	**reference point** - A prominent, easily located point in the terrain.
rpm	**revolutions per minute**
rpt	**report**
rqr	**requirement**
R&S	**reconnaissance and surveillance**
RS0	**range safety officer**
S	**safe**
S2	**Intelligence Officer (US Army)**
S3	**Operations and Training Officer (US Army)**
S4	**Supply Officer (US Army)**
★ **safety zone**	The area where no friendlv forces will enter during a scatterable minefield's life cycle. The dimensions of this area differ between the various delivery systems; however, all outlier mines will be contained. This area may be delineated/marked by a fence (with signs) depending on its relative position on the battlefield.
scat	**scatterable**

SCATMINWARN	**scatterable mine warning** - A report used to notify affected units that scatterable mines will be emplaced.
SD	**self-destruct**
sec	**second(s)**
SFC	**sergeant first class**
SFF	**self-forging fragmentation** - A direct-energy warhead designed to penetrate the armor on a vehicle's underside or side.
SHU	A rectangular, wooden, box-type, AP, pressure-blast mine similar in appearance and size to a shoe box.
SITREP	**situation report** - A report giving the situation in the area of a reporting unit or formation.
SM	**scatterable mine**
SOP	**standing operating procedure**- A set of instructions covering those features of operations that lend themselves to a definite or standardized procedure without loss of effectiveness. The procedure is applicable unless ordered otherwise.
SOSR	**suppression, obscuration, security, and reduction**
S&P	**stake and platform**
sqdn	**squadron**
SSAN	**social security account number**
STANAG	**Standardization Agreement** - The record of an agreement among several or all member nations to adopt similar military equipment, ammunition, supplies, and stores and procedural operations, logistics, and administration.
STRAC	**Standards in Training Commission**
strip feeder report	A report from the NCOIC to the OIC that indicates what type mines and how many of each type were placed in a strip. A working tool with no set format.
t	**ton(s)**
T-54, T-55 T-64, and T-72	Soviet main battle tanks.
TAC CP	**tactical command post**
TAHQ	**theater army headquarter**

TAI	**tactical area of interest**
TC	**track commander**
TCP	**traffic control post**
TF	**task force**
tgt	**target**
tm	**team**
TMD	**tactical munitions dispenser**
TO	**theater of operations**
TOC	**tactical operations center**
TRADOC	**United States Army Training and Doctrine Command**
trns	**trains**
TRP	**target-reference point**
turn	A tactical obstacle intent used to integrate fire planning and obstacle effort to direct an enemy formation off one avenue of approach to an adjacent avenue in support of the scheme of maneuver.
u	**under construction**
UBL	**unit basic load** - The quantity of supplies required to be on hand within and movable by a unit or formation. It is expressed according to the wartime organization of the unit or formation and maintained at the prescribed levels.
UHF	**ultrahigh frequency**
UK	**United Kingdom**
US	**United States**
USAEC	**United States Army Engineer Center**
USAR	**United States Army Reserves**
UTM	**universal transverse mercator (grid)**
VHF	**very high frequency**
VS	**versus**
VX	Persistent, highly toxic nerve agent developed in the mid-1950s and absorbed primarily through the skin. It is the US standard nerve agent.

w	**wide**
W/	**with**
WAM	**wide-area mine**
WP	**white phosphorous** - A yellow, waxy chemical that ignites spontaneously when exposed to air. It is used as a filling for various projectiles, as a smoke-producing agent, or as an incendiary effect.
wt	**weight**
z	**Zulu time**

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U

V

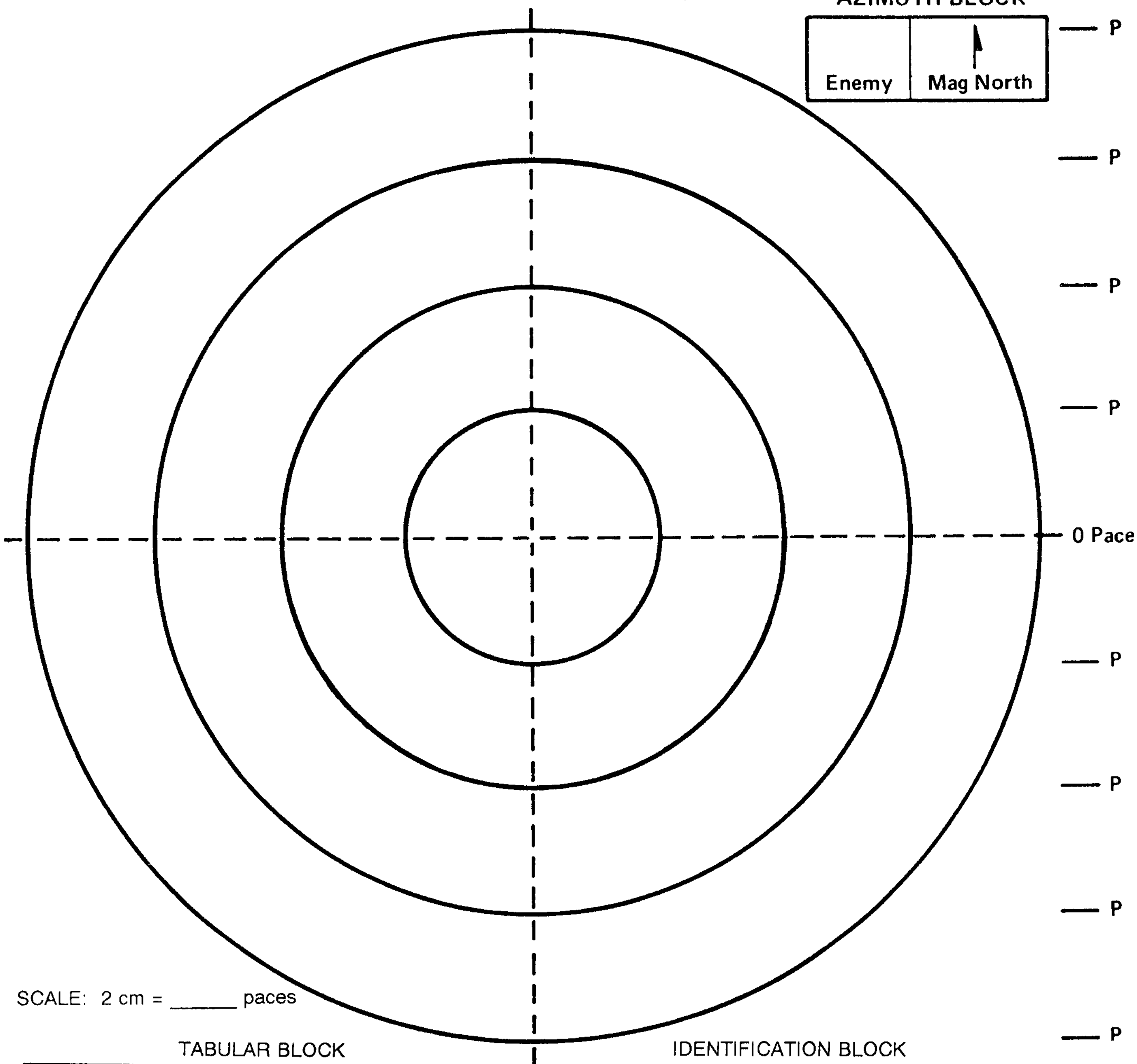
★ **W**

HASTY PROTECTIVE MINEFIELD RECORD

For use of this form, see FM 20-32; the proponent agency is TRADOC.

AZIMUTH BLOCK

Enemy	Mag North



SCALE: 2 cm = ______ paces

TABULAR BLOCK

Row	Type	Actuation	Mine Number
Remarks			

IDENTIFICATION BLOCK

Unit	
Ref Pt	
Remarks	
Map & Sheet No	
Name of OIC	
Signature	Time & Date
Mines Removed	
Mines Transferred	

DA Form 1355-1-R, Jul 75

HASTY PROTECTIVE MINEFIELD RECORD

For use of this form, see FM 20-32; the proponent agency is TRADOC.

INSTRUCTIONS

1. Designate an easily identifiable reference point on the ground (tree, stump, or stake). Orient the form (the blank form on the reverse) by tying in the center point of circles to the designated reference point on the ground.

2. Tie in reference point to a landmark (road junction or house corner) that can be found on a standard military map.

3. Complete the azimuth block.

4. Complete the following information in the identification block: unit, reference point, remarks, map, sheet number, OIC, name, and SSAN.

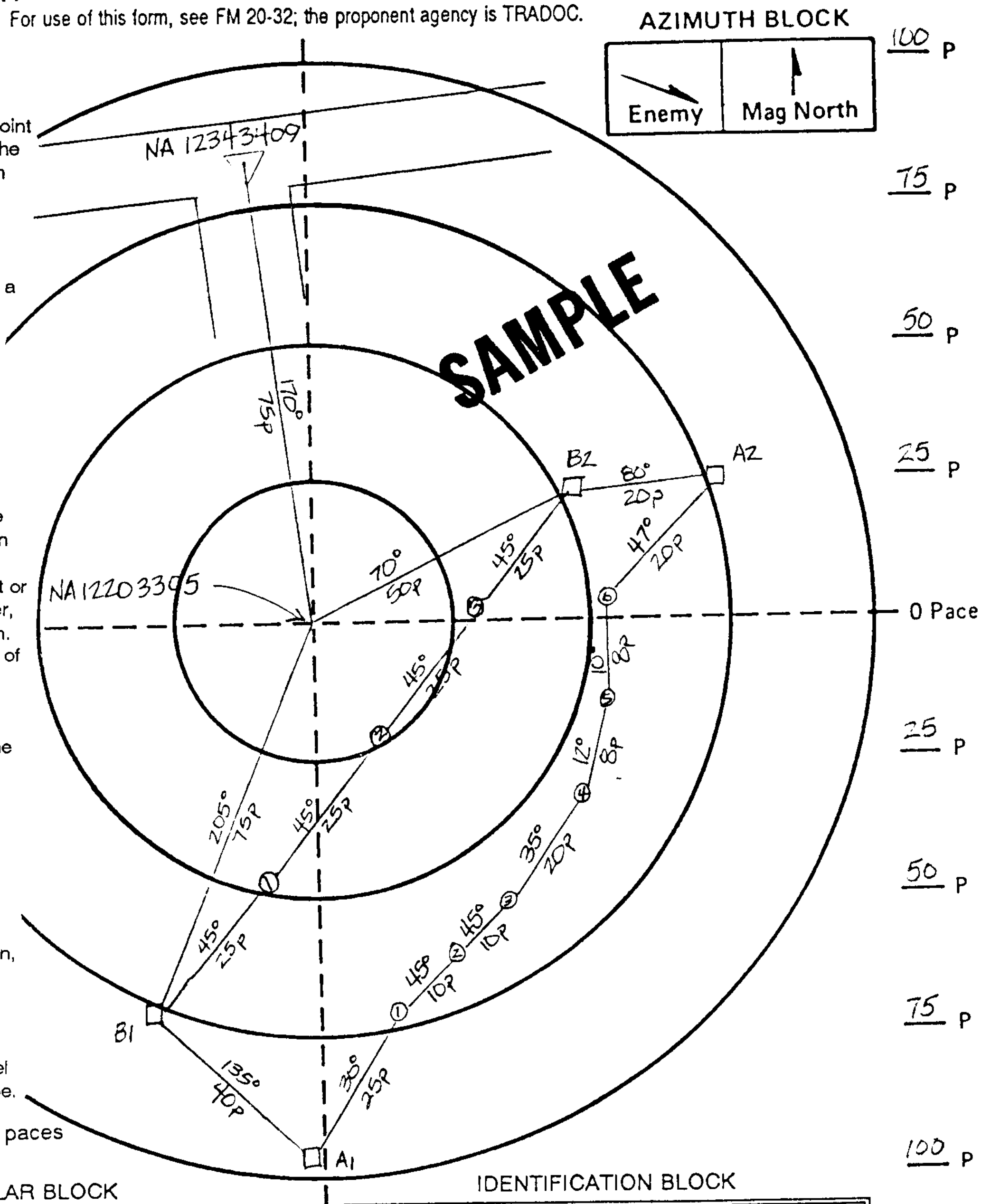
5. Starting from the reference point, record the magnetic azimuth in degrees (°) and distance in paces (P) of each leg from the friendly position toward the enemy position and from right to left or left to right across each row of mines. However, all rows must be recorded in the same direction. Whichever direction is used, the starting points of the rows must be marked A1, B1, and so forth, and the ending points marked A2, B2, and so forth, as shown in the example. Each mine in each row will be numbered sequentially from the starting point to the last mine in the row.

6. Fill in the tabular block (see sample).

7. Fill in the scale being used in the space provided. Fill in the pace readings in the right margin.

8. Make all minefield reports (intention, initiation, completion, transfer, and change) by some secure means.

9. Note what has been used to identify A1 and B1, such as 2 x 4 driven flush with ground, steel picket, or fence post wrapped with engineer tape.



SCALE: 2 cm = 25 paces

TABULAR BLOCK

Row	Type	Actuation	Mine Number
A	M16A1	Tripwire	1, 2, 6
A	M21	Pressure	3, 4, 5
B	M16A1	Tripwire	1, 3
B	M18A1	Controlled	2

Remarks: Points A1, A2, B1, B2 are marked with orange tent pegs flush with ground.

IDENTIFICATION BLOCK

Unit: 2nd Platoon, D Co, 16th Engr BN	
Ref Pt: Tree stump side of road with white engr tape at NA 12203305.	
Remarks: Landmark is road junction at NA 12343409.	
Map & Sheet No: TALBOT 5568	
Name of OIC: 2LT ALLAN, SSN: 123-45-6789	
Signature: A.G. Allan	Time & Date: 1700 / 29 Sept 93
Mines Removed	
Mines Transferred	

DA Form 1355-1-R, Jul 75

By Order of the Secretary of the Army:

GORDON R. SULLIVAN
General, United States Army
Chief of Staff

Official:

MILTON H. HAMILTON
Administrative Assistant to the
Secretary of the Army
02487

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