

ENGINEER FIELD MANUAL

VOLUME 10

MINES AND BOOBY TRAPS, PART 1, ALL ARMS

(BILINGUAL)

(This publication replaces B-GW-320-010/FP-001 dated 1979-03-30 complete with Change 1 dated 1979-11-01)

WARNING

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Issued on Authority of the Chief of the Defence Staff Publiée avec l'autorisation du Chef d'état-major de la Défense

OPI: Director of Army Doctrine 8 (Protection)

1997-05-15

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National Défense Defence nationale

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FOREWORD

1. B-GL-320-010/FP-001, Field Engineer Manual, Volume 10, Mines and Booby Traps, Part 1, is issued on the authority of the Chief of the Defence Staff.

2. Suggestions for amendments shall be forwarded through normal channels to Chief of Land Staff, Attention: Director of Army Doctrine 8 (Protection).

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CHAPTER 1

INTRODUCTION

SECTION 1

GENERAL

PURPOSE

1. This manual states mine warfare and booby trap doctrine and techniques. It is designed to provide guidance to all arms soldiers, non-commissioned members and officers in the planning, preparation, training and operational use of mines and booby traps.

2. The information contained in this manual is applicable to operations at all levels of conflict.

RESPONSIBILITIES

3. All individuals, regardless of arm or branch, must possess the basic battlefield survival skill known as **MINE AWARENESS** and must be capable of laying and lifting protective minefields under supervision. Selected officers and NCMs of all arms must also be capable of recording protective minefields. Engineers and assault pioneers are responsible for booby traps and large scale mining, breaching and clearing operations. These are described in B-GL-320-010/FT-002, Mines and Booby Traps, Part 2, Engineers and Assault Pioneers.

AIM

4. The aim of this manual is to provide a handbook on mine awareness, protective minefield laying and hasty countermine operations. It contains sufficient detail to be used both as an instructional reference and as a field manual.

SCOPE

- 5. This manual covers the following aspects of mine warfare:
 - a. responsibilities;
 - b. the mine and booby trap threat;
 - c. characteristics and functioning of mines;
 - d. employment of mines;
 - e. booby traps;
 - f. countermine operations;
 - g. training; and
 - h. safety.

TERMINOLOGY

6. The terminology used in this manual is consistent with that of B-GL-303-002/JX-Z03 Army Glossary, B-GL-303-007/JX-Z07, Volume 2, Supplement 7, Engineer Vocabulary, AAP-6 NATO Glossary of Terms and Definitions and AAP-19 NATO Combat Engineer Glossary. A glossary of relevant terms is also available at the end of this publication.

REFERENCES

7. A list of references and standardization agreements as well as relevant Canadian Forces publications incorporated in this manual are at Annex A.

INTERNATIONAL LAW

8. Canada has agreed to abide by the following international agreements:

- a. Geneva conventions; and
- b. CUSHIE (Causing Unnecessary Suffering or Having Indiscriminate Effects) Convention - Protocol on Prohibitions or Restrictions on the Use of Mines, Booby-Traps and Other Devices (Protocol II) - Geneva, 10 October 1980, a copy of which is at Annex B.

9. It is the responsibility of anyone who orders or effects the emplacement of mines, booby traps and other devices to understand the legal restrictions governing their use, specifically the manner in which those restrictions apply to the protection of civilians and their property.

SECTION 2

DEVELOPMENT

HISTORY OF MINE WARFARE

1. Mine warfare, as we know it today, had its origin on the battle fields of World War I, with the introduction of the tank. To overcome this new threat, land mines were constructed using artillery shells. The Germans devised an electrically fired mechanism which was remotely controlled from hidden observation posts. The Allies improved on this with the development of a charge which was detonated when the tank drove over it. This was the forerunner of the modern antitank mine. By the end of World War I, delay action mines and booby traps had been used extensively.

2. Between the two world wars, the major European powers continued the development and the manufacture of land mines with Germany making the most progress. Mines were used at the beginning of World War II, how ever their true value was not shown until the British held off German forces in North Africa by using large placed antitank minefields. In Italy, there was increased use of antipersonnel mines. During World War II, more than 20 percent of all tank losses in all theatres were caused by mines, with losses in specific battles ranging as high as 40 percent.

3. North Korea made extensive use of mines during United Nations (UN) operations in Korea. Nearly 70 percent of all UN tank losses and 10 percent of personnel casualties were caused by mines.

4. When U.S. Marines first arrived in Vietnam, almost 65 percent of Marine casualties were due to mines and booby traps. With training and awareness this figure was drastically reduced, however extensive use still accounted for overall losses of 70 percent of all vehicle casualties and 33 percent of all personnel casualties.

5. Extensive use of mines continued through the 1973

Arab-Israeli War. Egyptian minefields were well covered by fire and were highly effective. Israeli minefields however were not well covered by fire and were thus less effective. Both Egyptian and Syrian forces breached the minefields using Soviet mine rollers.

6. During the Soviet occupation of Afghanistan from 1979 to 1988, the Afghan freedom fighters conducted widespread, intensive mining operations. They were successful in hindering the Soviet advance as well as demoralizing Soviet troops and forcing the commitment of engineer time and resources to countermine operations. The Soviets also conducted their own mining campaign in an attempt to cut off Afghan supply routes.

7. After eight years of war with Iran, the Iraqi army was acutely aware of the importance of mine warfare. During the Persian Gulf War of 1990-91 the Iraqis laid extensive minefields throughout Kuwait. These minefields were well sited, but were laid by poorly trained troops and the minefields were often not covered by fire or observation. Some lanes and gaps were not even closed. During the Allied offensive the minefields were not a hindrance to movement and did not become a factor in the battle.

8. During the first two years of peace support operations in the Former Yugoslavia (April 1992 to April 1994) mines and explosive accounted for 32 percent of war related casualties (direct fire, mines and explosives, and indirect fire).

9. The mines of the 1990s are far more sophisticated than the first mines (artillery shells) of World War I. However, the principles that govern the effective employment of mines remain unchanged.

EFFECTIVENESS OF MINES

10. The history of mine warfare has seen extensive use of mines in all major wars, yet they have rarely played the decisive role in the outcome of a battle. Measuring the real value of a minefield remains very difficult both qualitatively and quantitatively.

11. In later sections of this manual, terminology will be

introduced to describe the relative effectiveness (stopping power) of a particular minefield against a particular target. This effectiveness can only be achieved when mines are used to enhance the defender's weapons systems, not replace them.

12. A mine is a weapon which can produce personnel and vehicle casualties, but its effectiveness shall be measured in terms of the resulting reduction of mobility and not just the number of casualties caused. The opposing force may be aware of a particular minefield and divert his advance elsewhere, avoiding the minefield. How is the value of this minefield measured?

13. When a single mine is detected, it can be easily destroyed or avoided. The use of several, even thousands of mines will delay the opposing force, but mines alone cannot stop an opposing force. To be effective they must be covered by fire. The time delay described above will add to the effectiveness of the weapon systems covering the mines by lengthening the period of engagement.

FUTURE DEVELOPMENTS

14. The introduction of scatterable mine systems has, in many ways, revolutionized land mine warfare. Delivered by a variety of systems, including ground dispensers, artillery gun and rocket systems, helicopters and fixed wing aircraft, scatterable mines can be remotely delivered on targets at the forward edge of the battle area and in depth.

15. The technology of placed mines has also increased dramatically. The development of "smart" mines and area defence weapons has broadened the scope of employment for mines. The incorporation of shaped charges in mines and improved design have made all such mines more lethal and simpler to deploy.

16. Countermine operations have also received more attention in recent years. Development of stand-off detection systems, signature simulators, and improvements in mechanical and explosive breaching devices will provide more alternatives to countering mines. Experience has shown though, that no single method or device will B-GL-320-010/FP-001

counter all types of mines, in all terrain and all weather conditions. Therefore development in countermine equipment will continue to lag behind to some degree.

17. In view of the foregoing, it is essential that all troops have an understanding of the importance of mine warfare on the modern battlefield.

ANNEX A

REFERENCES AND STANDARDIZATION AGREEMENTS

1. The following CF publications are related to and may be used in conjunction with this manual:

- a. B-GL-319-001/FT-001 Engineer in Battle
- b. B-CE-320-002/PT-001 Engineer and Assault Pioneer Field Pocket Book
- c. B-GL-320-007/PT-001 Field Defences and Obstacles
- d. B-GL-320-009/FP-001 Demolitions Part 1 All Arms
- e. B-GL-320-009/FP-002 Demolitions Part 2 Engineers and Assault Pioneers
- f. B-GL-320-010/FT-002 Mines and Booby Traps Part 2 -Engineers and Assault Pioneers
- g. B-GL-303-002/JX-Z03 Army Glossary
- h. B-GL-303-002/JX-Z07 Engineer Vocabulary
- j. B-GL-304-003/TS-001 Operational Training Part 1 -Training Safety

2. The following international standardization agreements have been wholly or partially incorporated into this manual:

STANAG	QSTAG	TITLE
2036 Ed 4 Amdt 2	518	Land Minefield Laying, Recording, Reporting and Marking Procedures
2366		Effectiveness of Land Minefields
2394		ATP52(A) NATO Combat Engineer Doctrine
2889 Ed 3 Amdt 3	742	Marking of Hazardous Areas and Routes Through Them
2989 Ed 1 Amdt 3	862	Transfer of Barriers
2990	820	ATP50 Principles and Procedures for the Employment in Land Warfare of Scatterable Mines with a Limited Laid Life
2991	943	AAP19(B) NATO Combat Engineer Glossary

ANNEX B

GENEVA, CUSHIE WEAPONS PROTOCOL II

ARTICLE 1: Material scope of application

This protocol relates to the use on land of the mines, booby traps and other devices defined herein, including mines laid to interdict beaches, waterway crossings or river crossings, but does not apply to the use of antiship mines at sea or in inland waterways.

ARTICLE 2: Definitions

For the purpose of this Protocol:

18. "Mine" means any munition placed under, on or near the ground or other surface area and designed to be detonated or exploded by the presence, proximity or contact of a person or vehicle, and "remotely delivered mine" means any mine so defined delivered by artillery, rocket, mortar or similar means or dropped from an aircraft.

19. "Booby trap" means any device or material which is designed, constructed or adapted to kill or injure and which functions unexpectedly when a person disturbs or approaches an apparently harmless object or performs an apparently safe act.

20. "Other devices" means manually-emplaced munitions and devices designed to kill, injure or damage and which are actuated by remote control or automatically after a lapse of time.

21. "Military objective" means, so far as objects are concerned, any object which by its nature, location, purpose or use make an effective contribution to military action and whose total or partial destruction, capture or neutralization, in the circumstances ruling at the time, offers a definite military advantage.

22. "Civilian objects" are all objects which are not military

objectives as defined in paragraph 4.

23. "Recording" means a physical, administrative and technical operation designed to obtain, for the purpose of registration in the official records, all available information facilitating the locations of minefields, mines and booby traps.

ARTICLE 3: General restrictions on the use of mines, booby traps and other devices

- 1. This Article applies to:
 - a. mines;
 - b. booby traps; and
 - c. other devices.

2. It is prohibited in all circumstances to direct weapons to which this Article applies, either in the offence, defence or by way of reprisals, against the civilian population as such against individual civilians.

3. The indiscriminate use of weapons to which this Article applies is prohibited. Indiscriminate use is any placement of such weapons:

- a. which is not on, or directed at, a military objective; or
- b. which employs a method or means of delivery which cannot be directed at a specific military objective; or
- c. which may be expected to cause incidental loss of civilian life, injury to civilians, damage to civilian objects, or a combination thereof, which would be excessive in relation to the concrete and direct military advantage anticipated.

4. All feasible precautions shall be taken to protect civilians from the effects of weapons to which this Article applies. Feasible

precautions are those precautions which are practicable or practically possible taking into account all circumstances ruling at the time, including humanitarian and military considerations.

ARTICLE 4: Restrictions on the use of mines other than remotely delivered mines, booby traps and other devices in populated areas

- 1. This Article applies to:
 - a. mines other than remotely delivered mines;
 - b. booby traps; and
 - c. other devices.

2. It is prohibited to use weapons to which this Article applies in any city, town, village or other area containing a similar concentration of civilians in which combat between ground forces is not taking place or does not appear to be imminent, unless either:

- a. they are placed on or in the close vicinity of a military objective belonging to or under the control of an adverse party; or
- b. measures are taken to protect civilians from their effects, for example, the posting of warning signs, the posting of sentries, the issue of warnings or the provision of fences.

ARTICLE 5: Restrictions on the use of remotely delivered mines

1. The use of remotely delivered mines is prohibited unless such mines are used within an area which is itself a military objective or which contains military objectives, and unless:

- a. their location can be accurately recorded in accordance with Article 7 3. a.; or
- b. an effective neutralizing mechanism is used on each such mine, that is to say, a self-actuating mechanism which is designed to render a mine harmless or cause it to destroy

itself when it is anticipated that the mine will no longer serve the military purpose for which it was placed in position, or a remotely-controlled mechanism which is designed to render harmless or destroy a mine when the mine no longer serves the military purpose for which it was placed in position.

2. Effective advance warning shall be given of any delivery or dropping of remotely delivered mines which may effect the civilian population, unless circumstances do not permit.

ARTICLE 6: Prohibition on the use of certain booby traps

1. Without prejudice to the rules of international law applicable in armed conflict relating to treachery and perfidy. It is prohibited in all circumstances to use:

- any booby trap in the form of an apparently harmless portable object which is specifically designed and constructed to contain explosive material and to detonate when it is disturbed or approached, or
- b. booby traps which are in any way attached to or associated with:
 - intentionally recognized protective emblems, signs or signals;
 - (2) sick, wounded or dead persons;
 - (3) burial or cremation sites or graves;
 - (4) medical facilities, medical equipment, medical supplies or medical transportation;
 - (5) children's toys or other portable objects or products specially designed for feeding, health, hygiene, clothing or education of children;
 - (6) food or drink;

- (7) kitchen utensils or appliances except in military establishments, military locations or military supply depots;
- (8) objects clearly of a religious nature;
- (9) historic monuments, works of art or places of worship which constitute the cultural or spiritual heritage of peoples; and
- (10) animals or their carcasses.

2. It is prohibited in all circumstances to use any booby trap which is designed to cause superfluous injury or unnecessary suffering.

ARTICLE 7: Recording and publication of the location of minefields, mines and booby traps

- 1. The Parties to a conflict shall record the location of:
 - a. all pre-planned minefields laid by them; and
 - b. all areas in which they have made large-scale and preplanned use of booby traps.

2. The Parties shall endeavour to ensure the recording of the location of all other minefields, mines and booby traps which they have laid or placed in position.

- 3. All such records shall be retained by the Parties who shall:
 - a. immediately after the cessation of active hostilities:
 - take all the necessary and appropriate measures, including the use of such records, to protect civilians from the effects of minefields, mines and booby traps; and either
 - (2) in cases where the forces of neither Party are in the

territory of the adverse Party, make available to each other and to the Secretary-General of the United Nations all information in their possession concerning the location of minefields, mines and booby traps in the territory of the adverse Party; or

- (3) once complete withdrawal of the forces of the Parties from the territory of the adverse Party has taken place, make available to the adverse Party and to the Secretary-General of the United Nations all information in their possession concerning the location of minefields, mines and booby traps in the territory of the adverse Party;
- when a United Nations force or mission performs the functions in any area, make available to the authority mentioned in Article 8 such information as is required by that Article;
- c. whenever possible, by the mutual agreement, provide for the release of information concerning the location of minefields, mines and booby traps, particularly in agreements governing the cessation of hostilities.

ARTICLE 8: Protection of United Nations forces and missions from the effects of minefields, mines and booby traps

1. When a United Nation force or mission performs the functions of peace-keeping, observation or similar functions in any area, each Party to the conflict shall, if requested by the head of the United Nations force or mission in that area, as far as it is able:

- a. remove or render harmless all mines or booby traps in that area;
- b. take such measures as may be necessary to protect the force or mission from the effects of minefield, mines and booby traps while carrying out its duties; and

c. make available to the head of the United Nations force or mission in that area, all information in the Party's possession concerning the location of minefields, mines and booby traps in that area.

2. When a United Nations fact-finding mission performs functions in any area, any Party to the conflict concerned shall provide protection to the mission except where, because of the size of such mission, it cannot adequately provide such protection. In that case it shall make available to the head of the mission the information in its possession concerning the location of minefield, mines and booby traps in that area.

ARTICLE 9: International cooperation in the removal of minefields, mines and booby traps

1. After the cessation of active hostilities, the Parties shall endeavour to reach agreement, both among themselves and, where appropriate, with other States and with international organizations, on the provision of information and technical and material assistance - including, in appropriate circumstances, joint operations - necessary to remove or otherwise render ineffective minefields, mines and booby traps placed in position during the conflict.

APPENDIX 1

GENEVA CUSHIE WEAPONS PROTOCOL II -GUIDELINES ON RECORDING

1. Whenever an obligation for the recording of the location of minefields, mines and booby traps arises under the Protocol, the following guidelines shall be taken into account.

2. With regard to pre-planned minefields and large-scale and pre-planned use of booby traps:

- maps, diagrams or other records should be made in such a way as to indicate the extent of the minefield or booby trapped areas; and
- b. the location of the minefield or booby trapped area should be specified by relation to the co-ordinates of a single reference point and by the estimated dimensions of the area containing mines and booby traps in relation to that single reference point.

3. With regard to other minefields, mines and booby traps laid or placed in position.

4. In so far as possible, the relevant information specified in paragraph 1 above should be recorded so as to enable the areas containing minefields, mines and booby traps to be identified.

CHAPTER 2

THREAT AWARENESS

SECTION 1

GENERAL

INTRODUCTION

1. Between 1950 to 1990 the world's political situation was such that the threat to Canada and NATO was very clear. The Soviet dominated Warsaw Pact was the threat upon which all military doctrine was based and Soviet equipment, doctrine and organizations were studied in great detail. The present world climate does not present a clearly defined threat for Canada or NATO. It is therefore important for soldiers to be aware of the various types of mines and booby traps that exist throughout the world.

EMPLOYMENT OF MINES

2. Mines are employed as a major defensive and harassing weapon; the nuisance value of mines is considered to be almost equal to their destructive value. Mines are considered as a combat weapon and are employed in both the offence and defence.

- 3. Mines may be used in the offence as follows:
 - a. for flank protection of advancing units, assembly and attack positions, intermediate objectives, artillery and anti-tank gun positions, and approaches to bridges and river crossing sites;
 - b. to hold captured positions against counter-attacks; and
 - c. to block or contain withdrawing forces during a pursuit.

- 4. Mines may be used in the defence as follows:
 - a. to cause casualties;
 - b. to delay or modify movement to present more vulnerable targets for other weapons systems;
 - c. to block routes and canalize movement;
 - d. to restrict flexibility;
 - e. to strengthen existing defensive positions in response to the actual situation;
 - f. to protect the flanks of friendly forces at short notice;
 - g. to contain penetrations;
 - h. to interdict reinforcements; and
 - j. to restrain movement of headquarters and logistics support units.

5. In a conventional conflict there may be deliberate and hasty minefields which present different problems and require different techniques and equipment for breaching:

- a. Deliberate. Deliberate minefields consist of one or more belts, each laid in a regular pattern. These minefields may be buried and are usually covered by fire and tied into natural and artificial obstacles. Bypassing is difficult or impossible and a coordinated brigade or divisional effort is required to overcome resistance and breach the minefield; and
- b. Hasty. Hasty minefields may have no particular pattern or density. These may be laid mechanically or by hand and may be buried or surface laid. Scatterable mines may also be laid by artillery or aircraft. They are found in defiles,

along high-speed avenues, and in some cases scattered randomly about the countryside. Bypassing may be possible and the minefields may or may not be covered by fire. Their purpose is to cause delay, canalize, or deflect opposing forces.

6. Mines may also be used by unconventional forces. Their use of mines may not follow international law as stated in Chapter 1. Unconventional forces use mines as weapons of terror against both military and civilian targets.

SECTION 2

CHARACTERISTICS AND FUNCTIONING OF MINES

COMPONENTS

- 1. Mines generally consist of six parts (Fig 2-2-1):
 - c. a fuze or firing device, which actuates the detonator or igniter;
 - d. a detonator or igniter which actuates the booster;
 - c. a booster, which may be attached to the fuze or be a part of the main charge;
 - d. a main charge in a container, which usually forms the body of the mine;
 - e. a safety and arming mechanism, which prevents the unintentional or premature firing of the fuze; and
 - f. the outer casing or body, which contains all of the parts listed above.

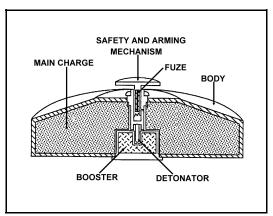


Fig 2-2-1 Mine Components

2. **Fuze**. A fuze is a device which initiates the explosive train. Fuzes come in a variety of types including mechanical, chemical, friction and electrical. Specific types of fuzes are discussed later in this chapter.

3. **Detonator**. A detonator is a sensitive explosive that is actuated by the action of the fuze and fires the booster or the main charge.

4. **Booster**. A booster is less sensitive but more powerful than the detonator. It is not always required, but when used, is ignited by the detonator and provides a more powerful explosion to actuate the main charge.

5. **Main Charge**. Upon detonation, the main charge accomplishes the purpose of the mine by attacking the target with blast, fragments, projected metal slugs or flame. Some mines may also have a propelling charge to expel the main charge.

6. **Body or Case**. The body or case serves to hold the fuze holder and main charge. Depending on the desired degree of resistance to detonation and the purpose of the mine, which may be designed to cause damage by blast or fragmentation, the body may be made of metal, plastic, wood or other materials.

7. **Safety and Arming Mechanism**. Most mines have built in safety devices to prevent unintentional functioning of the fuze. Depending on the type of mine the safety device is usually of the safety fork and arming dial type, or a safety pin or clip. Additional safety may be provided by the removal of components such as the fuze or detonator.

CLASSIFICATION OF FUZES

- 8. The three classifications of fuzes are:
 - a. Contact A target must come in contact (direct or indirect) with the fuze to provide the required functioning;

- b. Controlled The mine is remotely controlled either electrically or non-electrically; and
- c. Influence A fuze actuated by the effect of a target on some physical condition in the vicinity of the fuze or radiation emanating from the fuze. Some influence fuzes have the ability to discriminate and count targets.
- 9. Contact fuzes can be actuated by the following actions:
 - a. pressure;
 - b. pressure release;
 - c. pressure/pull (dual action);
 - d. pressure/tilt (dual action);
 - e. pull;
 - f. pull/tension release (dual action);
 - g. tension release; and
 - h. tilt.
- 10. Controlled fuzes can be actuated by the following actions:
 - a. non-electric;
 - b. electric; and
 - c. radio frequency.
- 11. Influence fuzes can be actuated by the following actions:
 - a. magnetic;
 - b. acoustic;
 - c. vibration;

- c. friction (static electricity); and
- d. electro-magnetic signature.

FIRING SEQUENCE

12. **General.** The detonation of a mine is accomplished by a particular firing sequence called an **explosive train**. This sequence is shown in Fig 2-2-2. If the sequence is broken or a component removed the mine may not function. This is the basis for the arming, neutralizing and disarming of mines.

13. **Actuation**. Once a mine has been armed, the types of actions that cause it to actuate (Fig 2-2-3) are:

- a. **Pressure**. The downward force of a foot or the wheel or track of a vehicle;
- b. Pull. A pull on a trip-wire attached to the mine;
- c. Tension-release. Releasing tension e.g., cutting a trip-wire;
- d. **Pressure-release**. Removing a restraining weight;
- e. **Timer**. A delay period is set by a timer (including a timed chemical reaction);
- f. Electrical. The closing or opening of an electric circuit;
- g. Vibration;
- h. **Magnetic Induction**. A vehicle passing over or near the mine;

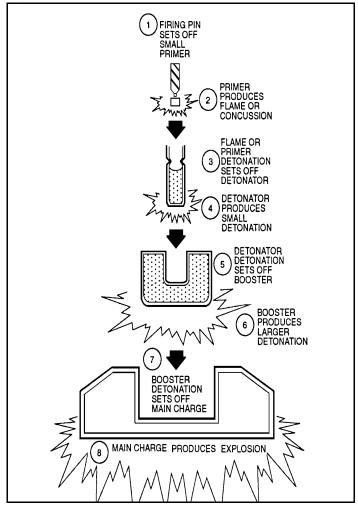


Fig 2-2-2 Explosive Train Of A Typical Mine

- j. **Frequency Induction**. A controlling signal is received from a distant transmitter; and
- k. **Frequency**. Audio (sound) waves from a target act on a microphone.

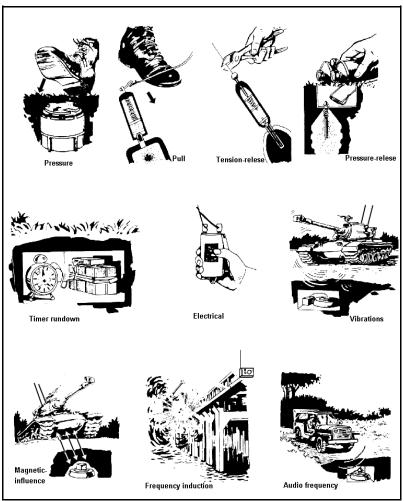


Fig 2-2-3 Methods of Actuating Mines

ANTIDISTURBANCE DEVICES AND BOOBY TRAPS

14. **Antidisturbance Devices**. Some mines are manufactured with integral antidisturbance devices which will actuate the mine when an attempt is made to remove it. They may be fitted to the mine or they may be a separate charge causing it detonate when the mine is disturbed.

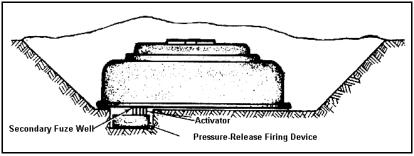


Fig 2-2-4 Antidisturbance Device Connected to the Mine

15. **Booby traps**. Booby traps may be connected to mines in such a way that they are actuated when an attempt is made to clear the mine. They will not necessarily explode the mine, but may take the form of an antipersonnel device separate from the mine. Similarly booby-traps may be set in minefields connected to pickets, wire, mine crates, etc, and designed to impede the clearance of the minefield by causing casualties.

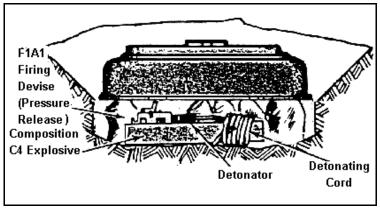


Fig 2-2-5 Antidisturbance Device Using Mechanisms Separate from the Mine

16. The use of antidisturbance devices and booby traps, if authorized, is an engineer and assault pioneer responsibility.

SECTION 3

CLASSIFICATION OF MINES

DEFINITIONS

1. **Mine**. A mine is an encased explosive or other material, designed to destroy or damage ground, boats or aircraft, designed to wound, kill or otherwise incapacitate personnel. It may be detonated by the action of its victim, by the passage of time, or by controlled means.

2. **Placed Mines**. Placed mines are designed for laying by hand or mechanical means usually in a pattern. They may be buried or surface laid, in a pattern or randomly, as the situation dictates.

3. **Scatterable Mines.** Scatterable mines are those mines that are laid without regard to classical pattern and are designed to be delivered by aircraft, artillery, missile, ground dispenser or hand. Once laid, they will normally have a limited laid life.

4. **Antitank Mines**. An antitank mine is a mine designed to immobilize or destroy a tank. It normally damages the vehicle tracks or wheels or penetrates the vehicle body. Antitank mines normally contain a large explosive charge weighing from 5 to 14 kg.

5. **Antipersonnel Mines**. A mine designed to wound, kill or otherwise incapacitate personnel. It may be detonated by the action of its victim.

SCATTERABLE MINES

6. Although mine warfare has existed for a long time, the concept of scatterable mines is relatively new. For the most part, mines have been laid by hand or by mechanically placing them on the ground in a pattern or randomly. Laying a placed minefield requires considerable time, manpower, expense and logistic support, with even more time required to record and report

minefield locations. The infantry company normally requires several hours to lay a protective minefield. A system loaded with antipersonnel or antitank mines can accomplish the same task. Scatterable mines can accomplish the same task in a mater of minutes using a wide variety of delivery means. They are laid without regard to pattern and usually have a limited life.

CLASSIFICATION OF MINES BY EFFECT

7. Land mines can also be classified according to the effects they cause:

- a. **Blast**. Produces casualties through shock/concussion, how ever, some secondary fragmentation will be present.
- b. **Fragmentation**. Detonation of the mine results in fragmented components being propelled in all directions at a high velocity to cause casualties.
- c. **Bounding Fragmentation**. Once actuated, the mine or its internal projectile is propelled into the air to a height of up to 2.0 m. After a brief time delay the mine/projectile explodes, sending fragmentation in all directions.
- d. **Directional Fragmentation**. Normally these mines are concave in shape with the fragmentation material placed only on one side of the explosive charge. Some blast mines have an optional fragmentation sleeve or collar which is placed around the mine to give a directional effect. When fired, the mine propels its fragmentation in the designated area.
- e. **Penetration**. There are two types of penetration:
 - Explosively Formed Projectile (EFP) The acceleration of a solid endplate (usually metal) from the face of an exploded charge such that the endplate remains in a solid state and functions as a projectile; and

(2) Shaped Charge (Jet) - An explosive charge so shaped and designed as to concentrate an explosive "jet" in a desired direction.

OFF-ROUTE MINES

8. Off-route mines, as their name indicates are placed beside a likely route to attack opposing force vehicles. A sensing device (pull, pressure, vibration, etc.) actuates the mine which fires a projectile. The projectile is usually an anti-armour rocket of some sort, but as it is normally actuated by an action of its target, it is defined as a mine.

UNDETECTABLE MINES

9. Mines which do not contain any metal are undetectable by in-service mine detectors. However proper prodding and feeling techniques and the use of search dogs will disclose a large percentage of mines of this type.

SECTION 4

MINE INDICATORS

RESPONSIBILITIES

1. All military personnel must be constantly on the alert for mines and booby traps. They must know their likely locations and the various indications that mines are present. Because of the large variety and number of mines found throughout the world, it is prudent to conduct pre-deployment and in-theatre Mine Aw areness Training for troops. This can help ensure that troops are prepared for the mines and mining techniques employed in the theatre.

MINE IDENTIFICATION

2. It is imperative that all personnel involved in operations be prepared to encounter mines. Each theatre of operations will have its own particular set of mines and these mines will change over time as existing mines are modified or replaced and new mines are introduced. Countries throughout the world produce mines of all sizes, shapes and effects. These mines can be factory made or improvised and can be made of a variety of materials such as metal, plastic or wood. Identification of these mines and knowledge of their characteristics and of their employment is the key to successsful mine counter measures.

MARKED MINEFIELDS

3. **NATO Standard System**. The NATO minefield marking system is described in Chapter 4. All troops must be familiar with this marking system. Although all minefields must be recorded, the information may not be available at the low er echelons. When such a minefield is encountered, a minefield report shall be sent in accordance with procedures described in Chapter 5. If the area has been in opposing force hands, extreme caution shall be used in approaching the perimeter fence since additional mines and booby traps may have been laid both inside and outside the marked area.

4. **Enemy Marking System**. Local intelligence shall also be used to prepare troops for the type of minefield markings that may be found. Upon encountering such a minefield, an unknown minefield report shall be submitted.

5. **Perimeter Fences Vary Widely in Type**. The standard perimeter marker, used with all types of fence, is a board in the shape of a triangle with the "MINES" written on it in the language of the force laying the minefield. Signs are placed in intervals along the fence, mounted at about eye level on posts driven into the ground. The method of marking minefields varies with their location. Fig 2-4-1 shows examples of perimeter fences employed throughout the world.

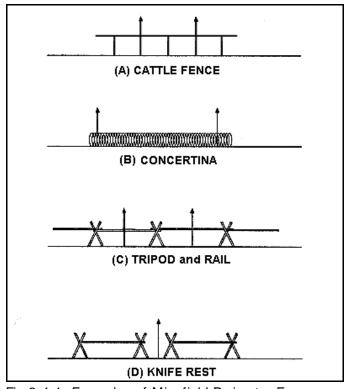


Fig 2-4-1 Examples of Minefield Perimeter Fences

UNMARKED MINEFIELDS

6. **General.** The first indication of the presence of mines and booby traps may often be a casualty. Such casualties are sometimes inevitable but much can be done to prevent them. Training and experience develops "**MINE AWARENESS**" which enables personnel to instinctively suspect the presence of mines. Our own intelligence will provide considerable information on the type and location of mines and minefields from air photos, interrogation, maps, etc. It is important that all personnel be familiar with the most current information and that this information be disseminated as widely and as quickly as possible.

7. **Indicators of Mines**. The complete concealment of mines requires more time and effort than can normally be afforded. Some of the original traces of minelaying will gradually disappear over time, but usually many of the following indicators remain:

- a. disturbance of the ground surface particularly on roads and grass, or loose sand scattered over grass;
- b. trampled earth or vegetation, footmarks or marks of wheeled or tracked vehicles in a pattern suggesting a minefield;
- c. improvised methods of marking minefields, such as piles of stones, spray painted trees, crossed sticks or other items on a path, bent tree branches or grass, gasoline cans or other containers (marking varies by theatre of operations and should be taught as part of the in-theatre mine aw areness brief);
- d. high and low trip wires;
- e. partial blockage of a road by a seemingly harmless obstacle which forces traffic onto the verge;
- empty containers of mines and components or explosive packaging, wrapping and seals which may have been left deliberately and booby trapped;
- g. human and livestock corpses; and
- h. damaged vehicles on the road or on the verge of the road.

8. **Training**. Experience has shown that most mines and minefields are found by a visual search by the individual soldier. Visual alertness must never be relaxed because of the use of mine detectors. A knowledge of the opposing force's habits, personal alertness and observation form the basis of training. All arms must

be trained to recognize the signs that indicate the presence of mines and help locate their positions.

9. **Likely Locations**. The following are some of the locations where mines are likely to be found:

- a. in bottlenecks and defiles where vehicles damaged by mines will block routes. This is particularly effective where the recovery or clearance of damaged vehicles is difficult;
- b. in places suitable for ambushing either vehicles or foot patrols;
- c. on verges of roads and tracks. Mines laid in paved roads are likely to be obvious except in verges and where overgrown grass and debris may provide concealment. Mines may be expected anywhere in loose surfaced tracks where concealment is easier;
- d. in and around demolitions (craters, demolished bridges, road blocks). Antipersonnel mines are likely to be used in quantity in such places;
- e. in diversions around obstacles, where concealment is usually easy;
- f. in likely waiting areas and exits from roads;
- g. in ditches, buildings and other places where troops are likely to stop for cover or rest (i.e. dead ground around a defensive position, shade trees, etc;
- h. in places likely to be used as assembly areas or observation posts;
- j. around abandoned equipment to hamper its recovery and to injure souvenir hunters;
- k. around defensive positions on approaches or locations

which might be used;

- m. on roads, railways, airfields, ports and installations to deny their use and delay repairs; and
- n. in likely helicopter landing sites, drop zones and landing zones.

SECTION 5

BOOBY TRAPS

POLICY

1. General policy on the use of booby traps, antidisturbance devices, booby trapped mines and tripwires in minefields is issued at the theatre level. The general theme of such a policy is to restrict the unauthorized use of these devices because of the danger to friendly troops. Within the terms of the theatre policy, formation commanders may further restrict the use of booby traps and other devices within their area for reasons such as the safety of the local population and of their troops.

EMPLOYMENT

2. The aim of using booby traps is to create an attitude of uncertainty and suspicion in the opponent's mind, thereby lowering morale and inducing a degree of caution which slows movement. The casualties and damage inflicted are merely means towards this end.

- 3. Booby traps are used in the following situations:
 - a. In the withdrawal. They are used to delay the enemy's advance in much the same way as nuisance mining. Buildings which the enemy may need for shelter, approaches to attractive harbour areas, and diversions around obstacles are all suitable locations;
 - b. In the defence. Booby traps may be laid in front of or among tactical obstacles, e.g. minefields, wire fences and road blocks, to impede enemy infantry and to prevent detailed reconnaissance and attempted neutralization. They may also be used to give warning of opposing force patrols and to deter them from using ground not otherwise covered by observation or fire; and

c. In the offensive. During raids in enemy occupied territory, charges with delay mechanisms may be used to cause damage, casualties and to create confusion. Normal booby traps may also be left behind to damage and delay the enemy when he counter-attacks to reoccupy the area.

RESPONSIBILITIES

4. **Setting**. Booby traps are used only on the orders of the divisional commander within the terms of the theatre policy. As indiscriminate use is liable to cause many casualties to our own troops, the plan must be carefully coordinated by the formation staff. Booby traps are set only by engineers and assault pioneers. The setting and clearance of booby traps is covered in B-GL-320-010/FP-002, Engineer Field Manual, Volume 10, Mines and Booby Traps, Part 2, Engineers and Assault Pioneers.

5. **Detection and Marking**. The systematic detection and clearance of booby traps is a task for engineers and assault pioneers. Every soldier shall how ever learn to look for signs which indicate the presence of booby traps. They shall learn to avoid performing many of the normal actions of life without first taking the necessary precautions. Field units are required to maintain personnel trained to search for booby traps and mark their presence.

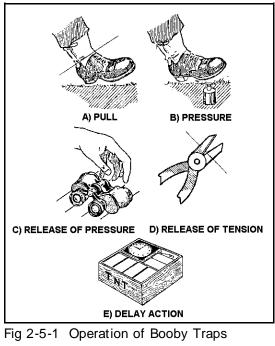
DETECTION

6. The detection of booby traps and the prevention of casualties is largely a matter of personal discipline and training. Knowledge of the subject is combined with keen eyesight and a suspicious mind. An understanding of the method of operation of booby traps and the principles used in siting booby traps assists in their detection.

ACTUATING BOOBY TRAPS

7. In almost every case booby traps operate by one of the following actions:

- a. Pull. By the movement of some concealed object, such as a thin trip wire, connected to the device (Fig 2-5-1(a));
- b. Pressure. By the direct pressure of a foot, wheel or track on a concealed mechanism (Fig 2-5-1(b));
- c. Pressure Release. By the lifting of some apparently harmless object from the concealed mechanism (see Fig 2-5-1(c));
- d. **Tension Release**. By the release of tension in a taut wire (Fig 2-5-1(d)); and
- e. Delay. By some form of automatic delay mechanism designed to function independently of any human agency. The delay may be from a few hours to many days (Fig 2-5-1(e)).



2-5-3

8. In the first four types of booby traps, the mechanism may actuate the charge immediately or with a delay-action from a few seconds to a few minutes.

PRINCIPLES OF SITING BOOBY TRAPS

9. The essence of a booby trap is cunning and variety. It usually takes one of the following forms:

- a. the baited trap;
- b. the trip-wire or equivalent;
- c. the double bluff; or
- d. a combination of all three.

10. The principles described below are normally observed when siting booby traps. Since the enemy also works on these principles, an understanding of them is important in the detection of booby traps.

- a. Concealment. The charges and mechanisms are concealed or made to resemble some harmless object. The surroundings will be disturbed as little as possible and all signs of preparation are concealed or removed;
- b. Constricted localities. The more constricted the site in which a booby trap is laid, the more chance there is of it being actuated, and the greater the difficulty of detection and clearance. Any form of defile is therefore a suitable site for booby traps;
- c. Concentration of booby traps. Booby traps are laid whenever possible in concentrations to reduce the chances of detecting them all without actuating some. Dummies are used freely;

- d. **Double bluff**. An obvious booby traps may be used to mask a nearby well-concealed booby trap;
- e. **Inconvenience**. Booby traps may be operated by the removal of obstacles such as road blocks and demolitions, or of furniture or litter in dugouts or buildings, particularly if these structures are suitable for headquarters use;
- f. Curiosity. The handling of souvenirs, pictures, food and drink containers, musical instruments, weapons, etc., may operate a booby trap;
- g. Everyday operations. Booby traps may be operated by opening or closing doors or windows, using telephones or electric light switches, etc;
- h. Attraction. Delay-action or incendiary bombs may attract personnel to a booby trapped site;
- i. Alternative methods of firing. A booby trap may be provided with two or more methods of firing; and
- j. **Variety**. As many different types as possible will be employed in any one location.

WHAT TO LOOK FOR AND WHERE

11. **General**. Booby traps are deliberately made difficult to recognize. Care and observation are essential and the following points must be borne in mind at all times:

- a. the presence of one booby trap indicates the probable presence of other traps;
- b. a study of the opponent's habits often indicates where booby traps might be expected;

- c. the presence of objects in unusual, often obvious, positions might indicate the presence of a booby trap; and
- d. a thorough understanding of the ways booby traps can be actuated assists in locating them.

12. **Vigilance.** There is no guarantee that any particular square metre of ground, any single room or any piece of jettisoned equipment in territory recently abandoned by the enemy is free of booby traps. Even international conventions for the conduct of war may be disregarded by an unscrupulous and desperate opponent, and instances have been recorded of booby trapped dead and wounded personnel. Continual vigilance is vital and shall become second nature.

13. **Likely Locations.** Since there is a limit to the resources of time, labour and material that the enemy can devote to booby trapping, it is probable that his main effort will be made in places where the greatest number of casualties is likely to result. The principles governing the selection of sites were detailed in paragraphs 10 and 11.

- a. **Recently occupied areas**. When following a retreating opponent, the following are suspect:
 - (1) **Roads and railways.** Embankments, blind turns, bridges, culverts, obstacles and the area around them, wooded stretches, junctions, cross roads,
 - (2) **Open country**. Woods, trees, posts, gates, paths, hedges, obstacles, stores, dumps, fire trenches, shelters and other field defences, and
 - (3) **Buildings and dugouts**. Steps, floors, doors, windows, cupboards, passages, furniture, fireplaces, water taps, toilets, supplies, light switches, floor coverings, pictures, documents.

- b. Rear or occupied areas. In rear areas or in occupied territories where there is unrest, the following places are often mined or trapped:
 - (1) **Railways**. The track may be mined with a pressure switch, or destroyed by a charge fired electrically by guerrillas when a train passes. The most likely places are in woods or other defiles or on bridges,
 - (2) **Sites of incidents.** After serious incidents such as explosions in buildings or vulnerable points, or after raids on camps and installation, all approaches to the scene may be mined or booby trapped. In addition, anything left behind after the raid will be suspect, and
 - (3) **Illegal arms caches**. Arms caches and other illegal stores may be booby trapped to cause casualties to searchers.

14. **Clues**. Many clues can be given which might indicate the presence of booby traps. The list is endless. Soldiers shall, by training and experience, learn "mine awareness". This awareness will also warn them of booby traps more surely than any list. Nevertheless, the following may indicate the presence of a booby trap:

- a. movable and apparently undamaged equipment and vehicles, food and drink and their containers, kitchen utensils, anything likely to make a souvenir;
- b. disturbed ground and small puddles, especially after rain;
- c. spoil, explosive wrappings, sawdust and nose caps from shells;
- d. footprints in soil, foreign to the nature of the ground, e.g., clay marks, where no clay exists on the surface;

- e. traces of camouflage, withered vegetation, etc., indicating some attempt at concealment;
- f. breaks in the continuity of vegetation, dust, paint-work, timbering, etc.;
- g. the presence of pegs, nails, electric leads, pieces of wire or cord for no apparent reason;
- marks on trees, on paths, on the ground or on walls of buildings without an obvious reason. Such marks may have been used by opposing force reconnaissance parties to indicate sites selected for booby traps;
- j. minor obstructions of all kinds on roads, in trench systems and in buildings, heaps of dead leaves, litter etc;
- k. irregular foot or wheeled traffic tracks for whose presence there is no apparent reason; and
- m. loose floor boards, signs of digging, recently replaced brickwork in cellars, or hollow sounding walls should all be suspected. These may well be the only clues to the presence of deeply buried delay-action charges.

15. **Particular Problems**.

a. **Concentration**. The following extract from a report on German booby traps in Florence in 1944 illustrates the problem of concentration of booby traps:

"Rubble from the demolitions was trapped with shrapnel and anti-tank mines, some being set as anti-personnel booby-traps with pull switches and trip wires. The presence of other metal in the rubble added to the difficulty of detection with either mine detectors or prodders.....". "Booby-traps were skilfully laid, many types of explosives and mines being used. Trip wires were cleverly concealed by leaves and the use of coloured wire out of doors, and by scattered clothing, documents, etc., indoors. Many shutters, door handles, floors and pieces of furniture were efficiently trapped...";

- b. Bluff. Large numbers of dummies may often be found. Provided that only one or two booby traps are put amongst them, caution is imposed on our troops and the enemy's aim is achieved. At the same time troops become careless after finding large numbers of dummies; when this happens they are more likely to be caught by the cleverly placed live booby trap; and
- c. Alternative methods of firing. Charges may be actuated by more than one device, or a device may operate on more than one action, e.g.:
 - (1) Pressure mechanisms may be concealed under a trip wire in order to catch a soldier tracing along it to find its end,
 - (2) A mechanism may work on the pull-release system. This type is usually attached to a taut trip wire. It actuates when the wire is pulled, but if the wire is cut the release of tension also actuates it, and
 - (3) A pressure-release mechanism is a pressure mechanism that actuates when the pressure is released. If one is placed under a floor board or railway line it actuates when pulled out by a searcher, unless it is first made safe.

CHAPTER 3

EMPLOYMENT OF MINES

SECTION 1

MINES IN OPERATIONS OF WAR

GENERAL

1. Mines can be employed against an enemy anywhere on the battlefield. Traditionally they have been used in defensive and withdrawal operations, but developments have greatly improved our ability to use mines in all operations of war. Placed and scatterable mines can be employed independently or in conjunction with other mines or weapon systems.

MINE WARFARE POLICY

2. Planning of minefields is done in accordance with the policies established by the highest operational commander. The policy at each level of command must be consistent with the overall concept of operations, probable future tasks, and available resources. Consequently, the emplacement of certain types of minefields and mines is controlled at various levels of command.

3. Subject to restrictions imposed by higher commanders, subordinate commanders are normally permitted to use mines and minefields within their available resources for their own local protection, to strengthen defensive positions and to disrupt or delay enemy movement.

- 4. The highest operational commander will set policies for:
 - a. types of mine and fuses permitted;
 - b. use of antidisturbance devices;

- c. minefield marking methods;
- d. use of phoney minefields; and
- e. booby traps.

5. In conjunction with the policies stated above, tactical commanders will:

- a. decide on the general siting of minefields;
- b. decide on the effect they wish to achieve from a minefield;
- c. set priorities for emplacing barrier; and
- d. allocate resources based on the advice of staffs and their engineer advisor.

OFFENSIVE OPERATIONS

6. The introduction of scatterable mines and mechanical minelayers permits greater use of mines during offensive operations. Mines can be used for:

- a. flank protection, reducing the number of troops committed to such security tasks;
- b. blocking enemy withdrawal routes and preventing reinforcement;
- c. blocking enemy counter-attack routes;
- d. disrupting enemy headquarters and logistic installations;
- e. isolating an objective;
- f. reducing enemy mobility within an objective area;
- g. disrupting enemy helicopter forward operating areas;

- h. fixing targets of opportunity for engagement with direct and indirect fire; and
- j. harassing and inflicting injuries, thereby affecting morale.

7. The use of mines with limited laid life will permit friendly forces to use the mined areas when required.

DEFENSIVE OPERATIONS

8. The time available to prepare obstacles during defensive operations will have considerable influence on the size of minefields and mines employed. Whether the mines are emplaced before or on contact with enemy forces will depend on the tactical situation and the degree of mobility the commander requires for his plan.

9. Both placed and scatterable mines will be employed extensively and used:

- a. as an economy of force measure;
- b. to cause personnel and vehicle casualties;
- c. to provide early warning of approaching enemy forces;
- d. to enhance the effectiveness of friendly direct and indirect fire weapons;
- e. to delay or canalize enemy forces;
- f. to hinder the enemy's use of key areas, including air landing or drop zones in rear areas;
- g. to separate dismounted enemy troops from their vehicles;
- h. to provide close in protection for defending units;
- j. to reinforce existing obstacles; and

k. to adversely affect enemy morale.

10. In addition to the uses described above, scatterable mines can be used in defensive operations to:

- assist troops fighting in the covering force area by attacking enemy formations and slowing down and delaying their advance;
- b. complement existing obstacles, including conventional minefields as part of the barrier plan;
- c. thicken existing obstacles where breaching is been attempted;
- d. close successful breaches;
- e. close a minefield lane or gap;
- f. prevent or delay enemy reinforcement; and
- g. interdict and disrupt enemy headquarters, artillery positions and logistic sites in depth.

11. The aim will be considered with respect to factors discussed earlier to ensure the most effective use of various mine types and delivery systems.

WITHDRAWAL AND DELAYING OPERATIONS

12. Mines are used in both withdrawal and delaying operations to impose delay and harass the enemy. Scatterable mines, used in the nuisance mining role, are particularly effective.

13. Scatterable mines are useful in closing lanes and gaps left in tactical minefields, once the defending forces are withdrawn.

SECTION 2

GENERAL CONSIDERATIONS

PLANNING FACTORS

1. **General.** Time, labour, transportation and material required to lay minefields are available only if advance planning is thorough. The planning will always consider the mission, own capabilities, terrain, weather and enemy capabilities.

2. **Tactical Objectives**. The tactical objective of the minefield will determine its type and size. For example, if the objective is to delay the enemy then a small minefield located in a defile may be just as effective in imposing delay as a larger minefield elsewhere.

3. **Enemy Capabilities**. Enemy capabilities influence the size, composition, type and method of mining. Some factors to be considered are:

- a. the tactics of enemy combat units;
- b. the quantity and quality of enemy breaching equipment and techniques;
- c. the capability of the enemy to harass or otherwise interfere with the progress of the laying force; and
- d. the capability of enemy intelligence and reconnaissance to locate friendly minefields.

4. **Capabilities of Laying Units.** Consideration shall be given to the number and the experience of the troops who will be doing the mining. Minefield planning includes an estimated time of completion to determine if the minefield presents an effective obstacle at the time required. If antidisturbance devices or booby traps are to be included, the availability of engineers and assault pioneers to lay these will be considered.

5. **Availability of Mines.** The development of extensive minefields in forward areas can be limited by the availability of mines. The basic load of mines provides only for small protective minefields. Larger minefields require advance planning to supply and transport the quantity of mines and stores required.

6. **Accessibility of Minefield Sites**. In difficult terrain the forward movement of mines and stores may be restricted and the laying rate reduced. In some cases, this difficulty can be overcome by the use of helicopters.

7. **Soil Conditions**. Soil conditions will determine the degree of difficulty in burying mines and surface laying may be required.

COORDINATION OF PLANS

8. The coordination of minefield planning is essential not only to ensure effective use of resources, but also to maximize the capabilities of all resources and weapon systems on the battlefield. Any interference with planned friendly forces mobility and manoeuvre is to be avoided. Coordination of minefields during all stages of planning and execution will include:

- a. Anti-Armour Plan. To ensure the minefield is covered by anti-armour fire, the depth of the minefield and distance from defensive positions shall permit those weapons to engage the enemy at the forward edges and beyond;
- Indirect Fire Plan. As with the anti-armour plan, coordination shall ensure minefields are sufficiently covered by observation. Planned scatterable mine targets shall be coordinated;
- c. **Patrol Plan**. Provisions are made for the inconspicuous marking of patrol lanes in forward minefields;
- d. Manoeuvre Plan. To ensure any minefield does not interfere with the planned manoeuvre of friendly forces all minefields shall be sited to complement the manoeuvre plan;

- e. **Countermoves Plan**. Provision for marking and closing these gaps shall be included in the planning, to permit the passage of countermove forces in tactical formation. Additional minefields may be necessary to protect exposed flanks of forces during their countermoves;
- f. **Withdrawal Plan**. Gaps and lanes through minefields will be available and marked and the lane and gaps must be closed when no longer required;
- g. **Deception Plan**. Lanes and gaps shall be sited such that their use does not give away the locations of friendly positions. The marking of the minefield shall not disrupt the deception plan;
- h. Administrative Plan. Mines, stores, transportation and personnel shall be available in sufficient quantities and appropriate locations. Priority demand and movement of ammunition and defence stores shall be considered; and
- j. **Plans of Adjacent Unit**. Coordination is required to ensure that:
 - (1) minefields are tied-in and anchored along common boundaries;
 - (2) there is mutual fire coverage and surveillance of minefields along unit boundaries; and
 - (3) adjacent units can execute operational support plans including patrolling and countermoves.

SITING FACTORS

9. The location of minefields will be dictated by the tactical plan, the terrain and other obstacles. Minefields will be sited to complement the tactical plan by canalizing, turning and delaying the enemy so that he becomes more vulnerable to friendly fire.

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10. The haphazard siting of minefields will result in an ineffective obstacle and the waste of considerable resources. Regardless of the design, type of mine or method of laying, minefields are most effective when they are:

- a. sited where they can be covered by direct fire and observed indirect fire;
- b. sited in conjunction with other obstacles (rivers, wooded areas, natural or man-made ditches, etc);
- c. laid in such a way as to reduce the chance of being detected visually or by electronic means before direct contact is made (along existing fences or on reverse slopes);
- d. extremely difficult or time consuming to bypass (linking of wooded or marshy areas); and
- e. used in locations and at times not expected by the enemy, to cause surprise, confusion and casualties.

11. Chapter 4, Section 4 discusses minefield gaps and lanes in detail. Generally lanes are sited to follow terrain features through the minefield. Gaps are sited where they are hidden from enemy observation and where they are not easily blocked by the enemy. The method of marking and closing gaps shall be considered when they are sited.

MINEFIELD RECONNAISSANCE

12. The level of control and degree of coordination required for minefield planning from corps to company level makes it necessary for the staff to determine in general, the defensive preparation requirements required in the various barrier zones so that mines and other stores can be estimated for operational and logistic planning.

13. Details of the minefield shall be confirmed and adjustments made to make the most effective obstacle. Ground reconnaissance

and liaison will permit accurate reports to be produced. This ground reconnaissance report will include:

- a. the exact extent of the minefield site;
- b. possible landmarks;
- c. accessibility of the site;
- d. the enemy threat to the mining operations and probable enemy approaches;
- e. terrain, soil and vegetation types;
- f. location of roads, trails and significant natural and artificial features, including obstacles; and
- g. for beach and ford sites, the water depth, current, bottom conditions and nature of banks.

CHAPTER 4

MINEFIELDS

SECTION 1

GENERAL

DETAILS REQUIRED WHEN A MINEFIELD IS ORDERED

1. The following details shall be included when a minefield is ordered laid:

- a. the tactical objective to be achieved;
- b. the type of minefield;
- c. minefield details (surface or buried) and types of mines (antitank, antipersonnel or mixed);
- d. the area to be mined, including lanes required;
- e. the requirement for fencing and marking;
- f. the time by which the minefield must be effective;
- g. the use of antidisturbance devices (laid only by engineers or assault pioneers); and
- h. other information or data as required.

2. The general area in which the minefield is to be laid shall be specified. The detailed siting is the responsibility of the officer in charge of laying the minefield in consultation with the tactical commander.

SPECIAL TACTICAL REQUIREMENTS

3. When mines are being laid, under threat of enemy interference, efficient organization and control are essential if the operation is to be completed successfully with a minimum of casualties. Two important points to be observed are:

- a. **Reconnaissance**. Thorough reconnaissance is essential; and
- b. **Command and Control**. Some noise is inevitable and therefore the chances of laying the mines without enemy interference are slim. Protection troops shall be provided so that the troops who are laying the mines will have to fight only as a last resort. The command and control of the protection troops and those laying the mines shall be established prior to the commencement of mine laying to ensure a controlled and coordinated response in the event of an enemy attack.

SECTION 2

CLASSIFICATION OF MINEFIELDS

GENERAL

1. Minefields are composed of antitank mines, antipersonnel mines or a mixture of the two. They can be laid where no natural obstacle exists or to reinforce other obstacles. In the latter case they can increase the delaying effect of the existing obstacle, or in conjunction with demolitions, hinder repair work. They are sited in accordance with the tactical plan.

TYPES OF MINEFIELDS

- 2. The four types of minefields are:
 - a. Protective: a minefield employed to assist the unit in its local, close-in protection. Protective minefields consist of mines without antidisturbance devices. Placed mines are usually surface-laid but may be buried if time permits. Protective minefields shall be removed when the unit leaves the position. If this is not possible, the unit commander must ensure it is reported, recorded and marked;
 - b. Tactical: a minefield which is part of a formation barrier plan and which is laid to delay, channel, or break up an enemy advance. All types of mines and antidisturbance devices may be used. Most tactical minefields are pattern-laid, either by hand or mechanically and may be surface laid or buried. Sensors, trip flares and other warning devices may be incorporated into the minefield. The recommended minimum depth of a tactical minefield is 400 m;
 - c. **Nuisance**: a minefield laid to delay and disorganize the enemy and to hinder enemy use of an area or route. All types of mines may be employed. Nuisance minefields are

seldom covered by observation or fire; therefore, if authorized, maximum use shall be made of antidisturbance devices and booby traps. Because surprise enhances the effects of nuisance minefields, good camouflage and concealment is required and consequently they are usually randomly laid to take full advantage of the concealment offered by a selected site; and

d. **Phoney**: an area free of live mines used to simulate a minefield, or section of a minefield with the object of deceiving the enemy. A phoney minefield resembles, as closely as possible, an actual minefield. The earth may be disturbed to simulate buried mines but care must be taken to ensure that the minefield is not too obvious. No live mines may be used, however mines similar in all other respects to the live mine may be emplaced, e.g. drill or practice mines. The minefield will be covered by the same degree of fire as that provided for the minefield simulated. It is the practice of some countries to include at least one live mine in a phoney minefield.

RESPONSIBILITIES

3. The responsibilities for ordering, siting and laying minefields are shown in the table at Fig 4-2-1. However, laying and siting authorization may be delegated down to the tactical commander who must cover the obstacle.

4. It is also important to note that detailed siting of tactical minefields is an engineer responsibility in accordance with the direction given by the tactical commander.

Minefield Responsibilities				
Ser	Type of Mine- field	Laying Authorized and General Area Decided by (1)	Detailed Siting	Laid by
(a)	(b)	(c)	(d)	(e)
1	Protec- tive	Unit commander (subject to restrictions by formation commander)	Unit	All arms assisted if necessary by engineer or assault pioneers
2	Tacti- cal	Divisional commander or higher	Engineers (2)	Engineers assisted as necessary by other arms
3	Nui- sance	Laying authorization IAW the general policy of divisional commander or higher. Siting authority rests with tactical commander within whose boundaries mining will be conducted.	Engineers	Engineers assisted as necessary by assault pioneers
4	Phoney	As for the type of minefield that it simulates.		

Fig 4-2-1 Minefield Responsibilities

TECHNICAL CLASSIFICATION OF MINEFIELDS

5. Minefields may also be classified according to the types of mines used. That is:

a. an antipersonnel minefield, which contains only antipersonnel (A pers) mines;

- b. an antitank minefield, which contains only antitank (AT) mines; or
- c. a mixed minefield, which contains both A pers and AT mines.

6. Tactical minefields may also be classified according to stopping power. The stopping power of a minefield is a measure of its effectiveness in stopping enemy vehicles, expressed as a percentage. The stopping power is determined by a number of factors including the types of mines employed, minefield density and the presence of breaching equipment on the enemy vehicles. Stopping power is fully explained in B-GL-320-010/FP-002, Engineer Field Manual, Volume 10, Mines and Booby Traps, Part 2, Engineers and Assault Pioneers.

SITING

7. The tactical commander plans the detailed siting of the minefield. The liaison between units in order to integrate the minefield is the responsibility of the officer in charge of laying the minefield.

REPORTING AND RECORDING

8. Any unit laying mines is responsible for the reporting, recording and marking the minefield unless circumstances preclude it. A detailed description of the various reports and records is found in Chapter 5.

INSPECTION

9. Units are responsible for the periodic inspection of minefields in their area to determine if there has been any enemy interference with the minefield. These inspections, which need only be visual, are independent of technical inspections which are an engineer responsibility. Minefields, as well as their perimeter marking fences, may be damaged by shell-fire, enemy action,

animals or weather. Units shall report any enemy activity and any damage to minefields and will repair perimeter marking and fencing in their area.

HANDOVER

10. When one unit takes over responsibility of an area from another unit, it is important, in order to avoid casualties to our own troops, that minefields of all types be handed over properly. The location of the minefields, perimeter fences and lanes is to be made well known to the incoming unit. In static conditions, when time is available, a proper handover can be best done by representatives of both units visiting every minefield in the area to which access can be obtained. Handovers will normally be effected between incoming and outgoing formations with engineer assistance.

11. A complete handover checklist is at Annex A. Minefield records will be transferred when the relief is effected.

COMPOSITION OF MINEFIELDS

GENERAL

1. The composition of a minefield is dependent upon the terrain, the time available for work and the types and quantities of mines that have been allocated.

2. In terms of laying technique, minefields may be pattern laid or random laid.

3. Minefield composition may vary depending on the laying nation. It is important to be aware of CF minefield patterns and also those of other nations which may be encountered in the handover of obstacles.

RANDOM LAYING

4. Random laying may be used for protective or nuisance minefields. Random laying is suitable only for mining small areas with a limited number of mines.

5. Mines are sited on likely enemy foot and vehicle approaches, keeping in mind normal siting principles (concealment, cover by fire and observation, etc). Mines can be surface-laid, or buried if time and ground permit.

6. The laying unit will always remember they may have to lift the mines, or pass on complete details to a receiving unit. Accurate recording is therefore essential.

PATTERN LAYING

7. Pattern laying drills, by hand or mechanically, are used for tactical minefields and occasionally protective minefields, if time and resources permit. For protective minefields, the laying is done

by the unit in place with advice and supervision from engineers or assault pioneers.

8. Minefields are laid in a pattern to produce a better obstacle (ie greater stopping power) than random laying, and to be located and lifted quicker. This method is best suited to mining large areas.

MEASUREMENTS

9. Metres are used to measure distances in a minefield. Canadian practice for manual laying is to use paces which are converted to metres.

OTHER OBSTACLES

10. Antitank ditches, wire obstacles, log and post obstacles, etc, shall be included when time permits in a minefield. These obstacles will dramatically increase the effectiveness of a minefield.

MINE ROWS AND STRIPS

11. A mine row is a row of mines laid in a straight line or in a series of straight line segments. The mines are spaced according to the design of the minefield. Spacing between mines may vary from row to row, but must be the same within a particular row.

12. A mine strip consists of two parallel mine rows laid three metres to each side of the strip centre-line. The mines in the two rows are staggered and the distance between individual mines is dependent on the type of mines laid. Spacing between mines may vary from strip to strip, but must be the same within a particular strip.

13. One or more rows and/or strips are used to make a minefield. Individual mine rows or strips are not usually laid entirely straight nor parallel to each other. They change direction to produce an effective minefield in depth.

MINE CLUSTERS

14. A mine cluster is a small group of mines consisting of one central mine (AT or A pers) and up to four A pers mines placed within a semi-circle of two metres from the central mine.

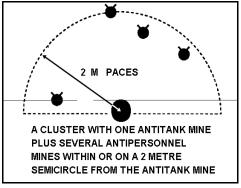


Fig 4-3-1 Mine Cluster

15. Clusters may be used instead of individual mines to form strips.

16. Mine clusters are not used by the Canadian Forces.

LANDMARKS

17. A landmark is a natural, artificial feature that can be accurately determined on the ground from a grid reference. Landmarks are used in siting and recording minefields and are identified by three two foot pickets driven flush to the ground in a triangular pattern.

TURNING POINTS AND END POINTS

18. A turning point is a point on the centre-line of a mine row or strip where the row or strip changes direction and are indicated by a turning point marker (identified by a two foot picket driven flush to the ground). B-GL-320-010/FP-001

19. End points markers are located at the beginning and end of a mine strip or mine row. They are indicated by an end point marker (identified by a two foot picket driven flush to the ground).

IRREGULAR OUTER EDGE

20. An irregular outer edge is a short mine row or strip laid in an irregular manner in front of the first row of the minefield, within the fence, in order to deceive the enemy as to the type or extent of the minefield. Generally, the irregular outer edge will only be used in minefields with buried mines.

21. The Canadian Forces do not use irregular outer edges.

MINEFIELD LANES AND GAPS

GENERAL

1. **General**. Unmined lanes and gaps are left or breached through a minefield to provide safe passage for patrols or other troops either on foot or with vehicles or so that movement can be conducted safely.

2. **Planning**. Minefield lanes and gaps are sited before mine laying begins. There will always be sufficient of each to ensure that, if some of them become known to the enemy and have to be closed, an adequate number remain.

3. **Control**. The siting of minefield lanes and gaps is controlled at the highest practicable level. Minefield gaps particularly must be sited so that they conform to any possible withdrawal route of forward friendly units and to the formation counter-attack plan.

MINEFIELD PATROL LANES

4. **Layout**. A minefield patrol lane is normally 1 m wide. It is not straight throughout its length, but zigzags through the minefield. The centre-line is marked out with tape, cable or cord before mining begins. Mines are not laid within 1 m of the centre-line of the patrol lane. The centre-line is marked as described in paragraph 5 below, before the white tape is laid out and the placing of mines starts.

5. **Marking**. Minefield patrol lanes will always be marked. In forward minefields it is important to give no indication to the enemy that a lane exists. The standard marking is a length of signal cable or cord along the centre-line, fastened to spikes driven flush with the ground. The ends of the centre-line are marked by lane markers in the rear perimeter fences.

6. **Concealment**. A minefield patrol lane itself requires no concealment. It becomes known to the enemy only through continued use. There is an advantage in having many lanes so that no one patrol lane is put to excessive use. Also, with many lanes, it does not matter if one is discovered by the enemy and has to be closed. The unit responsible for the minefield patrol lane shall be prepared to close it by removing the marking and adding the mines.

MINEFIELD LANES

7. **Layout**. A minefield lane is normally 8 m wide. It is as straight as possible and runs from the rear perimeter fence to the forward fence. It is marked as described in paragraph 8 below, before the laying of mines starts. Mines are not laid within 2 m of the lane. Only lanes that are required will be used. Lanes that are not required, are marked for future use but will not be signed until opened.

8. **Marking**. Minefield lanes will always be marked, but the method of marking varies according to the tactical situation. The marking is constructed in sequence, from initial marking, to immediate marking and finally to full marking as operations develop, in accordance with STANAG 2889 or QSTAG 742, Marking of Hazardous Areas and Routes Through Them. The marking itself is described as follows:

- a. a fence similar to the perimeter fence; and
- b. red and white pointed markers are fixed to alternate pickets in the fence, with the white point toward the lane;
- c. green and white lights are fixed to the markers at night as follows:
 - (1) at the entrance and exit, two green lights fixed in the centre of the markers, and
 - (2) in the lane, one white light fixed on the top of the marker.

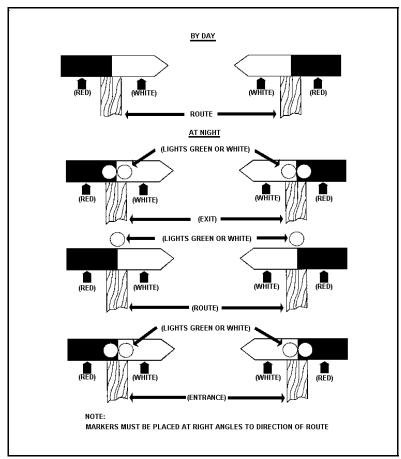


Fig 4-4-1 Lane and Gap Markers

9. **Concealment.** Like the patrol lane, the minefield lane itself requires no concealment. It becomes known to the enemy only through continued use. There is therefore an advantage in having many lanes so that no one lane is put to excessive use. Also, with plenty of lanes, it does not matter if one is discovered by the enemy and has to be sealed. The unit responsible for the minefield must always hold a stock of mines and be prepared to seal any lane on short notice by completing the mine rows.

MINEFIELD GAPS

10. **Layout**. The layout is similar to lanes, however gaps are normally a minimum of 100 metres wide.

11. **Marking**. Until such time as a minefield gap is to be used for tactical movement, marking is needed only for recording purposes. When a gap is required for tactical movement, it must be fully marked throughout its length. This is done by engineers using lane marking stores. Sometimes it may be desirable to move forces through a gap before it has been fully marked, however reconnaissance elements or engineers will mark the corner points of the gap.

12. **Concealment**. It is important that the location of gaps not be discovered by the enemy, and that the gaps closely resemble the rest of the minefield. For this reason gaps are not fully marked until required. The enclosed ground should be disturbed to the same extent, with tracks to represent the passage of mine carrying vehicles, and occasional signs of diggings or scattered spoil, mine crates and other suitable evidence. decoys may be emplaced so that enemy sensors cannot locate the gap by a lack of signature.

RECORDING

13. Minefield lanes or gaps shall be recorded. It is very important that full particulars are entered and that lanes and gaps are recorded accurately. See Chapter 5 for more detail on recording.

METHODS OF LANE AND GAP CLOSURE

14. If a minefield lane is ordered by a tactical commander, the unit responsible for closing the lane and the means to be used will be designated. Lanes and gaps can be closed for a number of reasons, for example:

- a. when a lane has been discovered by the enemy and must be closed to prevent infiltration;
- b. when friendly troops forward of the minefield have been

withdrawn and the obstacle is to be closed; and

c. prior to withdrawal from the position.

15. Lanes and gaps are normally closed by one of the methods given below:

- a. **Completion of Mine Rows**. This applies particularly to lanes and gaps. The location for the mines required to complete the mine rows across the lanes are marked. The mines necessary to complete a row are positioned on the left of the lane or gap;
- b. **Cratering**. Cratering, may be required to close roads through a minefield. This task is performed by engineers or assault pioneers only; and
- c. Scatterable Mines. Use of scatterable mines are the preferred method of closing minefield gaps. Their use to close lanes will be limited by the accuracy of the delivery means.
- 16. After closure the minefield record will be updated.

MARKING A MINEFIELD

GENERAL PRINCIPLES

1. Minefields are usually marked to avoid casualties to friendly troops. Marking will not be allowed to benefit the enemy when they attack, and the beginning of the minefield, from the enemy point of view, will therefore be concealed in order to deceive them.

- 2. The principles to be observed in marking minefields are:
 - Minefields will be marked with a perimeter fence unless otherwise ordered. Existing fences may be used where suitable;
 - b. The fence will not conform to the shape of the minefield nor give away its extent. It will always enclose some unmined ground;
 - c. The fence (on the enemy side) will not be obvious but must be visible to those who know its approximate position; and
 - d. All fences, existing or emplaced, are to be marked with signs to show their nature.

STANDARD PERIMETER MARKING FENCE

3. **Siting.** The perimeter fence is not sited at a constant distance from the nearest mines, and it does not run on the same bearing as the outer mine rows. Rather, it is placed at varying angles to the mine rows, thus making it more difficult for the enemy to locate the actual minefield. The rules for the standard forms of fences are given below.

4. **Construction**. The fence consists of a single strand of wire approximately waist-high suspended on pickets about 15 m apart

and a minimum of 15 m from the nearest mine. Later on it may be desirable to increase the number of pickets, signs and wires to improve the fence.

5. **Marking**. Fences on all sides are marked with red triangular mine signs hung on the wire between fence pickets with the word "MINES" written in white and displayed on the out side of the fence. The mine signs shall be spaced at intervals not exceeding 50 m. Other signs, such as boards marked "Danger - Mines", may also be erected on the perimeter fence for greater safety of our own troops and civilian population. Such additional notices are not compulsory and their absence does not mean the ground is unmined. As discussed in chapter 4, Section 4, Paragraph 8, lanes and gaps through minefields are fenced and marked as per the perimeter of a minefield. Additional "safe" lane markers identify the lane or gap to traffic.

ERECTION OF FENCES

6. For a protective minefield, the fence is erected in a clockwise manner starting on the near left hand corner leaving a gap in the near side fence until the mining is completed. It is important that the fencing party keep ahead of the leading mining party, and that no one attempts to move back through any part of the minefield where mines have been laid. If for any reason the laying party is withdrawn during the laying of a minefield, the perimeter fence will be completed and then re-opened when mine laying restarts.

INSPECTION AND MAINTENANCE

REQUIREMENT

1. The requirement for periodic inspections of minefields was introduced in Section 2. These inspections are required to ensure that the minefields and the perimeter marking fences have not been altered or damaged.

RESPONSIBILITY

2. Units are responsible for the inspection and maintenance of protective minefields in their defended area. Other minefields are inspected as ordered by formation HQ. Technical inspections are done by an engineer officer or NCM.

MINEFIELDS

3. Units shall carry out visual inspections of minefields in their area to ensure that the enemy has not been picking-up or neutralizing the mines. The frequency of these inspections will depend on the proximity of the enemy and his activities.

FENCES

4. Perimeter fences will be inspected for damage by shellfire, enemy action, animals or weather, so that repairs can be carried out immediately. Additional fence pickets are often required since only the minimum number were used in the first instance. These inspections shall be carried out daily where damage is likely, or once every three days in more remote areas.

LANES AND GAPS

5. Minefield lanes and gaps shall be inspected frequently, care being taken not to disclose them to the opposing force through frequent use.

6. In cases where a lane or gap is to support movement of a large number of vehicles, maintenance of the track or road will be included in the planning.

TECHNICAL INSPECTIONS

7. Technical inspections are necessary to ensure a minefield is still effective. The functioning of buried mines can be affected by:

- a. moisture entering into the fuze or body of the mine, where it can reduce the explosive power, corrode metal parts or freeze. This action can be further aggravated by local factors such as soil acidity or climatic conditions;
- b. frost action, following flooding can cause the mine to subside or be pushed up; and
- c. mechanical obstructions caused by insects or vegetation.

7. Technical inspections are conducted regularly on minefields to assess their effectiveness. These inspections will be conducted at least every three months, and more frequently when weather conditions are severe (e.g. flooding or alternating periods of freezing and thawing). The minefield record shall be available to the inspecting party.

8. When a minefield falls below the required effectiveness, a decision will be required regarding the laying of additional mines.

ANNEX A

HANDOVER/TAKEOVER CHECKLIST

1. When handing over a minefield, the passage of information in conjunction with the completed mine record is essential. The following list of points shall be covered:

- a. Tactical Situation:
 - (1) briefing on the terrain,
 - (2) information on the enemy,
 - (3) information on our own troops, including:
 - (a) adjacent units,
 - (b) local security of the obstacle, and
 - (c) information on the last of our own forces that will pass through the obstacle.
- b. Details of the Minefield:
 - (1) type of minefield,
 - (2) boundaries,
 - (3) number of strips and rows,
 - (4) landmarks/intermediate markers,
 - (5) type and number of mines laid,
 - (6) width and marking of lanes,
 - (7) type of fencing,

- (8) location of mines and fuzes required to close the lanes,
- (9) location of packing material/safety pins etc,
- (10) procedure required to close the obstacle,
- (11) traffic control,
- (12) maintenance of the driving surface on lanes,
- (13) estimate of the time required to close the lanes, and
- (14) estimate of the time required to remove the minefield marking.

2. The transfer of a minefield is actioned by the signing of the minefield record (CF947 Protective Minefield Record or CF1275 Minefield Record). The party assuming responsibility for the minefield will sign in the transfer block and include name, rank, unit and date-time group.

CHAPTER 5

LAYING PROTECTIVE MINEFIELDS

SECTION 1

PLANNING

GENERAL

1. A protective minefield is employed by units or sub-units to assist in its close-in protection. The laying, reporting and lifting of protective minefields is a responsibility of all arms units.

PLANNING CONSIDERATIONS

2. The main points to be considered when planning and laying a protective minefield are summarized in the following table.

Protective Minefield Planning Considerations			
Ser	Factor	Points for Consideration	
(a)	(b)	(c)	
1	Siting	 a. Probable enemy foot and vehicle approaches. b. Need to cover minefield with fire. c. Freedom of movement for own troops, eg, counter-attack and patrol routes. d. Concealment. e. Access for mine carrying vehicles or personnel. f. Out of grenade range of enemy breaching parties. g. Coordination with flanking units as required. 	

Protective Minefield Planning Considerations			
Ser	Factor	Points for Consideration	
(a)	(b)	(c)	
2	Design	a. May be AT, A pers, or mixed.b. Pattern or random laid.c. Buried or surface laid.	
3	Supply of Mines	a. Number and types required.b. Unpacking and preparation for laying.c. Method of delivery and timing at site.	
4	Method of Laying	 a. Time and labour available. b. Nature and condition of ground. c. Expected length of occupation of position. d. Tactical Situation. 	
5	Marking and Fencing	a. Perimeter marking always necessary to protect own troops.b. Extent of fencing dependent on the situation.c. Patrol lanes must be clearly marked.	
6	Reporting	 a. Intention to lay. b. Start of laying. c. Completion of laying. d. Any changes to the timings or minefield composition. 	
7	Recording	Recorded on CF947 Protective Minefield Record.	
8 Fig. 5-1-	Recovery	As recovery of the minefield is likely to be required later, the time available for recovery may affect the design and method of laying selected.	

Fig 5-1-1 Summary of Points for Consideration when Laying a Protective Minefield

LAYING RATES

3. **Laying Mines.** It is impossible to quote firm times for laying protective minefields as they vary widely with the circumstances of each case. The estimates below give some idea of the times likely to be required for pattern laying in average conditions. Random laying requires more time to site each mine.

4. **Buried Mines**. A platoon sized element, working by day without interference will lay an average of:

- a. 150 A pers blast mines per hour (C3A1/A2);
- b. 40 A pers fragmentation mines per hour (M16A1); and
- c. 40 AT mines per hour (M21 or DM21).

These laying rates assume the mines are ready for emplacement and they are hand-carried no more than 200 m. Rates for mining at night will normally be half the daylight laying rate.

5. **Surface Laid Mines**. A similar element, under the same circumstances will be able to lay on the surface:

- a. 80 A pers fragmentation mines per hour (M16A1);
- b. 40 A pers fragmentation mines per hour (M18A1);
- c. 40 off-route AT mines per hour (C14); and
- d. 80 AT mines per hour (M21 or DM21).

EMPLACING INDIVIDUAL MINES

GENERAL

- 1. Mines shall be laid so that:
 - a. the target that they are designed to stop can exert the necessary pressure to actuate the mine;
 - b. the mine is not readily discovered by the opposing force. This is usually done by concealing the mine but care is required to ensure that the concealment allows the mine to function properly; and
 - c. the individual mines are adequately spaced from adjacent mines to prevent sympathetic detonation.
- 2. Mines may be laid on the surface or buried.

SURFACE LAID MINES

3. Many trip-wire actuated mines are surface-laid, while some pressure-actuated mines may be either surface-laid or buried. Mines are generally surface-laid when there is insufficient time available to bury them or, in the case of protective minefields, when the mines are to be recovered by the unit laying them. To be effective, surface-laid mines will be well camouflaged to prevent easy detection and lifting. Dense ground cover is therefore preferable. The arming procedures are the same for mines buried or laid on the surface.

LAYING BURIED MINES

4. In order to determine the correct depth and method of burying a mine, it is necessary to consider the way in which the firing mechanism is actuated. Some mines use a small device on

top of the mine in the form of prongs; this is a common method used for A pers mines. Other mines are actuated by forcing down the lid or pressure plate; many AT mines are of this type.

5. Mines with prongs are best sunk flush with the ground so that only the tips of the prongs are exposed to contact the target. This ensures that the mine is held firmly upright and that the contact exerts a direct downward pressure rather than a sideways

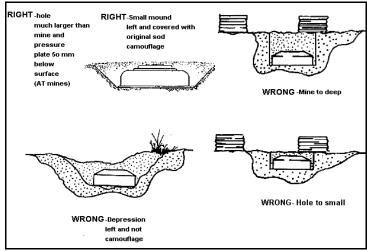


Fig 5-2-1 Burying AT Mines

thrust. A mine buried in this way is protected from damage and is very difficult to see. If it is buried more deeply it becomes unreliable as the covering of soil may prevent the mine from being actuated by the target.

6. Mines with pressure plates can still function when completely buried as long as the cushion of earth above them is not too thick. AT mines shall normally be buried with the top of the mine 50mm below ground level. If the hole is too small, the weight of the vehicle may be supported by a shoulder of the hole and thus fail to actuate the mine. This bridging action can be avoided by digging the hole wider than the mine.

7. Mines must be laid on a firm base so that the pressure of the wheel or track does not press the whole mine down without actuating it. The bottom of the hole will, if necessary, be made firm by tamping it down before the mine is placed.

8. To allow for the loose earth sinking (due to rain, etc), an additional covering of earth, normally sod, approximately 40mm thick is placed over the mine to form a slight mound with the sides of the hole well sloped. Care is to be taken that the mound blends with the surrounding ground and is as inconspicuous as possible. Fig 5-2-1 shows the principles described above applied to the laying of an antitank mine.

- 9. To prepare a hole for pressure-actuated antitank mines:
 - a. place the mine on the ground;
 - b. using a shovel, cut the ground approximately 0.30 m around the mine at a 45 degree angle to the depth of the blade;
 - c. set the mine aside;
 - roll the turf back as carefully as possible toward the likely direction of the approach for an opposing force, keeping the turf attached;
 - e. scrape the soil out of the hole to accept the mine, and dispose of excess soil by spreading it over a wide area;
 - f. if required, tamp the bottom of the hole or install a firm base as per paragraph 7 and Fig 5-2-1;
 - g. place the mine in the hole, and fill-in around it with spoil;
 - h. arm the mine as directed; and
 - j. replace the turf and camouflage.

UNFAVOURABLE GROUND CONDITIONS

10. On very soft ground such as deep mud or in marshy areas, the underside of the mine may not be large enough to support the pressure needed for actuation. Under these conditions a foundation for the mine will be constructed of rocks, planks, saplings or other materials. Packing crates for the mines also provide suitable material for this purpose.

11. Mine laying in snow covered areas is affected by the depth of snow. Mines shall be buried with the pressure plate at the surface when the depth of snow is less than 100mm. For snow depths of 100 to 300mm, the mines shall be laid on the surface. For deeper snow the mines shall be supported on sandbags or planks so that the tops of the mines are within 100mm of the snow surface.

12. If mines laid on frozen marshy ground are intended to remain during a thawing period, they shall be supported as for mines laid during the summer.

13. In wet weather or in snow covered terrain, mines can be placed in waterproofed bags to decrease the chance of water entering the mine and causing malfunctions due to rusting or freezing. Coating seams and joints on the mine body with grease prior to laying also helps.

CAMOUFLAGE

14. The purpose of minefield camouflage is to increase the effectiveness of the minefield. This is accomplished in the case of nuisance minefields by surprising the enemy and by hindering efforts to define and bypass the minefield. In all minefields, breaching is made more difficult by denying the enemy knowledge of the minefield pattern, the location of gaps or lanes, and most importantly, the location of individual mines. All mines, whether surface-laid or buried, shall be camouflaged to the greatest extent possible.

15. Burial provides the best camouflage. The turf shall be rolled back so that it can be replaced over the mine. Care must be taken that the hump created by the replaced turf is not too conspicuous. Excess soil from the hole is disposed by spreading over it a wide area. Additional grass and twigs may be added to complete the camouflage.

16. Mines or fuzes on or above ground shall also be camouflaged. Only lightweight material shall be used to camouflage A pers mines in order not to reduce the effectiveness of the mine. Care must be taken that the camouflage material does not cause premature actuation or interfere with the functioning of the mine.

17. White coloured mines may be used on snow covered terrain, but are very conspicuous when the snow melts. In general, mines buried in the snow and camouflaged with vegetation are preferable.

18. The obliteration of tracks in snow covered or soft terrain is impossible. An area may be covered with tracks to hide the minefield or a track may be laid across the area prior to mining in an attempt to deceive the enemy into thinking the route is open.

PROTECTIVE MINEFIELD LAYING

CONDUCT

1. Like all obstacles, a thorough reconnaissance is required to maximize the effectiveness of a protective minefield and ensure the safety of the laying parties. No work will normally begin on a protective minefield until all trenches have been sited, coordination done with flanking units and areas of responsibility confirmed.

2. Random mine laying of protective minefields at night shall be restricted to command actuated mines because of sighting, recording and recovery difficulties. If other mines are to be laid at night, they shall be surface laid in ro pattern

DRILLS

3. **Random laying**. Protective minefields are laid randomly when time is of the essence, and the position is only going to be occupied for a short period of time. Mines are normally surface laid but they may be buried. There is no precise drill for random laying, but the following apply:

- a. personnel laying mines shall be fully instructed on the aim to be achieved in each case;
- b. the position and type of each mine on the ground is to be clearly marked before laying begins;
- c. personnel laying mines may work individually or in pairs;
- d. orders to each pair will specify clearly the route to be followed (normally out and back along the same route) and the order in which mines are to be laid. In cases where doubt may arise as to the route, or when laying is being carried out during darkness, it may be necessary before

laying starts to lay tapes to mark safe routes. The tapes are recovered by the laying party when finally leaving each site;

- e. the distance between each laying party, if possible, is never less than 20 m;
- f. no trip wire shall be emplaced within 2 m of any other trip wire or adjacent A pers mine;
- g. when antidisturbance devices or trip wires are employed and soldiers are working in pairs, one of the pair will withdraw out of the minefield before the mine is armed; and
- h. mines are not armed until the order to do so is given by the officer or NCO in charge.

4. **Row pattern**. The principle method of laying a protective minefield while in a defensive position is by a simple row pattern. The laying unit will use simple rows of mines spaced a minimum interval of 6 m between mines. The mine spacing within a row is the same for the entire row. There will be at least 8 m between rows of AT mines and 15 m between an AT mine row and an A pers mine row . No trip wire shall be emplaced within 2 m of any other trip wire or adjacent A pers mine. The procedure for row pattern protective mining is as follows:

- a. Prior to laying:
 - (1) select reference points (landmarks, bearings),
 - (2) select routes to and from the minefield,
 - (3) determine the number of rows and mine spacing (minimum 6 m) required,
 - (4) arrange for protection while laying the minefield,

- (5) set out the landmarks and end row markers, and mark the row(s) with signals cable, white tape or other suitable material,
- (6) prepare the mines in a safe location close to the minefield, and
- (7) brief the mine laying party and distribute the mines;
- b. Upon arrival at the minefield, mines are laid as follows:
 - (1) pace along the pre-selected row (s) and indicate to each soldier the location of his or her mine,
 - (2) bury the mines if required,
 - (3) arm and camouflage the mines individually, when ordered and under supervision, and
 - (4) return for additional mines if required (in which case, a guide will remain at the beginning of the row until it is completed);
- c. All perimeter fencing and marking is completed in accordance with Chapter 4; and
- d. The number of mines, bearings, distances and landmarks are recorded on the CF947 Protective Minefield Record as detailed in Section 5 of this chapter.

5. An alternative means of spacing the mines is to use a measured piece of cordage with the mine spacing indicated by knots or tape. This cordage is laid along the pre-selected bearing then the mines are placed at the indicated marks.

REPORTING

MINEFIELD REPORTS

1. **General.** Minefield reports are needed to avoid casualties to our own troops. While knowledge of the existence and position of mines will be denied to the enemy as far as possible, our own troops must have sufficient information to permit the safe movement of patrols and deployment of troops and vehicles.

2. The primary reasons for reporting minefields is to ensure a current, and accurate recording of minefield locations on the operational maps of all units and HQs concerned. For this purpose, simple tactical reports are sufficient. Normal staff procedures ensure that the information reaches everyone concerned. In particular, the Engineer HQ at each level will be informed of all mining undertaken by other arms units.

3. **Responsibilities**. Units requesting, ordering, laying and recording minefields are required to make reports at various stages. These reports are used for conventional and scatterable minefields. The detailed message formats and the reporting procedures are found in B-GL-303-002/FP-Z02, Operational Staff Procedures, Field Message Formats. Commanders authorized to order mine laying will report their intention to lay (Report of Intent) a minefield to their next higher headquarters by the fastest secure means available. A Report of Completion, usually oral, will be forwarded by the fastest means possible upon completion of the minefield. These reports will include the following information:

- a. tactical information;
- b. type of minefield (AT, A pers, mixed);
- c. method of emplacement;

- d. number and type of mines;
- e. location of minefield, including width of minefield lanes and gaps;
- f. whether mines are surface-laid or buried;
- g. length of time for which the minefield will remain effective (if applicable);
- h. estimated starting and completion times (for Report of Intent only); and
- j. actual completion time (for Report of Completion only).

RECORDING

MINEFIELD RECORDS

1. A minefield record is required for each minefield regardless of type. The record is an important document in that it is used to locate and lift minefields. There are two types of minefield records used by the Canadian Forces:

- a. CF 947, Protective Minefield Record; and
- b. CF 1275, Minefield Record.

2. The CF 947, Protective Minefield Record, is used by all arms when recording the location and composition of protective minefields. The CF 1275, Minefield Record, is used by engineers and assault pioneer when recording all minefields except protective minefields.

PROTECTIVE MINEFIELD RECORD (CF 947)

3. The officer in charge of the minefield laying unit is responsible for ensuring the protective minefield record is properly prepared. If the minefield is lifted by the laying unit on leaving the position, the record is destroyed. If the minefield is passed to another occupying unit, one copy of the record must be given to the commander of that unit during the hand-over, and further copies, as required by the unit SOPs, are submitted through the chain of command.

4. Fig 5-5-1 shows the instructions on the back of the Protective Minefield Record which are expanded in the remainder of this section. The record when completed resembles a range card as shown in Fig 5-5-2.

5. **Orientation.** Complete the Azimuth Block.

INSTRUCTIONS FOR COMPLETION PROTECTIVE MINEFIELD RECORD

1. Send Intention to Lay Report. When authority received, site allocated mines on likely enemy foot and vehicle approaches. Ensure locations are under friendly direct fire and if possible concealed from the enemy. Complete Azimuth Block.

2. Select centre point of record circle. It must be readily identified. Locate a permanent feature as a landmark (e.g. road junction) and tie into centre point The centre point and landmark(s) shall be marked with three two-foot pickets, driven flush to the ground in a triangular pattern..

3. Send Start to Lay Report. Lay mines in sequence commencing with those farthest from the centre marker and closest to the enemy.

4. As each mine is laid, number it, measure bearing in mills or degrees and distance in paces or metres and record it. Symbols to be used to describe the mines are:

- a. AT mine M
- b. A pers mine M
- c. Trip wire - t-
- d. Alignment of directional mine \ddot{U}

5. For mines not visible from the centre point, estimate the bearing and distance and *record as estimated (est)*. Select an intermediate landmark visible from both centre point and mine in question, measure bearings and distances and record.

6. When all mines are laid, complete Mine Data and Identification Blocks. Send Minefield Completion Report.

7. The protective minefield record must be updated immediately if any changes are made to the existing protective minefield.

8. If the minefield is to be handed over to a new unit, brief OIC of new unit on all details, pass record and have the officer sign in the Minefield Transfer block

9. If minefield is to be left in position after unit departs, ensure sufficient copies of record as required by unit SOPs are passed up the chain of command.

10. If a minefield is to picked up, use record to locate all mines and then destroy record.

Fig 5-5-1 Instructions for Completion of Protective Minefield Record

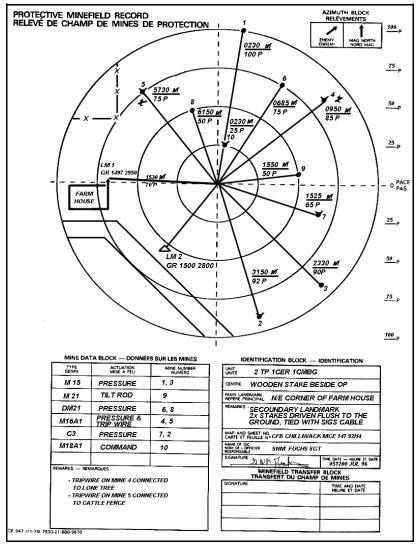


Fig 5-5-2 CF947 Protective Minefield Record - Example

6. **Centre**. The centre of the record circle is selected on the ground. It is essential that the centre can be easily identified on the ground, by either selection of an existing landmark (e.g. corner of

a building), or by tying the centre point to a landmark (e.g. a road junction) which is unlikely to be destroyed or removed. The centre point and landmark(s) shall be marked with three two foot pickets, which are driven flush to the ground in a triangular pattern.

7. **Mine Laying and Recording**. As each mine is laid, the record is completed by showing the appropriate symbol, the mine number (in sequence of laying) and its bearing and distance in paces (record the conversion of paces to metres under "Remarks" on the record) from the centre. Symbols to be used singly or in combination as appropriate and are shown in Fig 5-5-1.

8. **Mines Not Visible from Centre**. Some mines may not be visible or accessible in a straight line from the centre point. In these cases, the bearing and distance from the centre point to the mine are estimated and marked on the map, but are clearly indicated as estimates "*est*". A secondary landmark is selected which is visible to both the centre point and the mine in question, and tied in.

9. **Completion of Minefield Record**. When all mines are laid and recorded on the record circle, the Mine Data Block and Identification Block are completed. If the laying unit leaves and another unit occupies the position, the Minefield Transfer Block is signed by the incoming commander after a briefing by the outgoing commander.

10. **Changes**. Any changes to the minefield must be recorded on the CF 947 and reported.

11. **Departure**. If the minefield is to be left in a position after unit departs, sufficient copies of the record, as required by unit SOPs, are passed up the chain of command. If the minefield is to be lifted, use the record to locate all mines, and then destroy the record.

12. **Accuracy**. The requirement for accurate recording of mines is obviously essential if the safety of our own troops is to be guaranteed, and if minefields are to be lifted quickly and safely. A

high degree of accuracy is required in measuring the distances and bearings, and in completing the Mine Data and Identification Blocks. The recording of the bearings and distances on the form is not meant to be an exercise in draughtsmanship; the drawing need not be exact, but the data given shall be as accurate as possible.

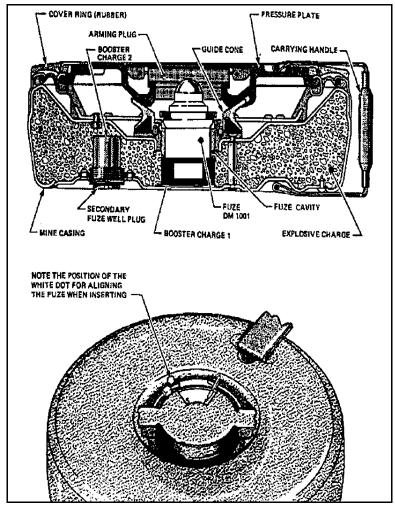
ANNEX A

CANADIAN FORCES ANTITANK MINES

This annex contains information on the following AT mines:

- a. Appendix 1 DM21 Antitank Mine (GE);
- b. Appendix 2 M21 Antitank Mine (US); and
- c. Appendix 3 C14 Antitank Off-Route Mine (CA).

APPENDIX 1



DM21 ANTITANK MINE (GE)

Fig 5A1-1 DM21 AT Mine - Sectional View and Top View

1. **General**. The DM21 is a blast effect AT mine that has a 5 minute arming delay device in its fuze. The DM21 can be deployed

in up to one metre of water for a period of three months. The arming plug has two indicators, F (armed) and S (safe).

 Data. Weight: 9.2 kg Explosive: 5.2 kg Fuze(s): DM1001 pressure with a 5 minute arming delay device. Secondary Fuze Cavities: Nil Functioning: 185 kg pressure

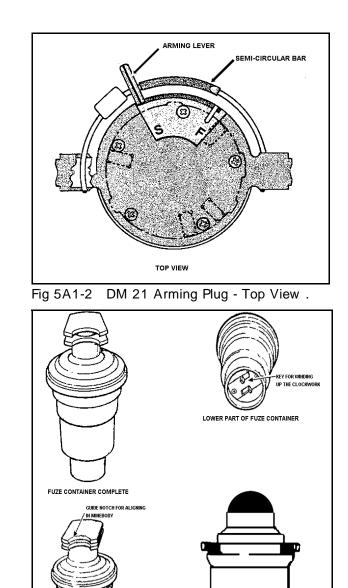
3. **Packing**. 4 DM21 mines and 4 DM1001 fuzes are stored in an ammo box DM60460. Total weight of a box of mines is 46.0 kg

4. **Training Mine**. The DM50 Antitank Mine, Dummy and the Dummy fuze DM20.

5. **Inspection.** Make sure the arming plug is indicating "S". Inspect the body of the mine for signs of damage such as dents, cracks or corrosion. Check fuze cavities for dirt or foreign objects and for signs of corrosion. Also inspect the fuze for dirt and corrosion or other damage. Dirt and foreign objects are removed but mines and fuzes showing signs of damage shall be put aside for eventual destruction.

6. **To arm.** Unscrew arming plug, ensuring the arming switch is set to **"S"**. Unscrew the fuze container and set aside the low er part. Ensure the fuze is not armed (ensure red arming indicators on the bottom of the upper part of the fuze are not aligned and the safety pin on the side of the fuze is not protruding). If either condition is encountered, the fuze is armed and must be set aside for disarming or disposal. If the fuze is safe :

- a. place fuze with upper part of the fuze container in the fuze cavity with the guide notch of the fuze container pointing to white dot on the pressure plate of the mine;
- b. push fuze in mine until it snaps home audibly;





с.

5A1-3

FUZE

GASKET

SAFETY PIN

pull-off upper part of fuze container and screw in the arming plug;

- d. press down on safety and arming mechanism (semi-circular bar) while simultaneously turning arming switch from "S" to "F" position. The five minute arming delay device will start ticking audibly. After 5 minutes the mine is armed, and
- e. retain upper and lower parts of the fuze container.
- 7. **To neutralize**. This mine cannot be neutralized.

8. **To disarm**. Carefully inspect the mine. If marks on the ground indicate the mine has been run over by a vehicle, the mine shall be considered a dud and will be destroyed where situated.

- a. Unscrew arming plug.
- b. Place upper part of fuze container on mine fuze and line up guide notch with white dot.
- c. Push upper part of fuze container onto fuze until it snaps in place.
- d. Turn upper part of fuze container 90 degrees (clockwise or counter-clockwise) and pull out upper part and fuze.
- e. Reset timer (See paragraph 8).
- f. Replace fuze in container.
- g. Turn arming switch to "S" (This is done by moving the switch as close to safe as possible before turning the arming plug over and using the lower part of the fuze container to depress the spring mechanism and simultaneously turn the arming lever to the "S" position.

j. Screw arming plug into mine.

RESETTING THE TIMER

9. When resetting the timer and clockwork mechanism, reset the arming lever from \mathbf{F} (armed) to \mathbf{S} (safe). The following procedure can be used if the fuze is found armed upon receipt or if the mine is disarmed for use in the future.

- a. Locate clockwork winding key on the bottom of the lower part of the fuze container.
- b. Insert the clockwork winding key into the slot on the base of the fuze and rotate it fully clockwise.
- c. Inspect to ensure the safety pin has retracted into the recess and red arming indicators on the fuze base are no longer aligned. If either condition is not met, the fuze must not be used and will be destroyed.
- d. If the safety pin has retracted into the recess and the red arming indicators on the fuze base are no longer aligned, the fuze is safe and can be reused.

APPENDIX 2

M21 HEAVY ANTITANK MINE (US)

1. **General.** The M21 is full width attack mine which can penetrate 76mm of armour plate at a distance of 533mm. The M21 is a penetration mine. A plate charge penetrates the belly of the tank, or damages the suspension or track of the vehicle, depending on the location of contact.

2. Data.

Weight: 7.95 kg Explosive: 4.9 kg Fuze: M607 tilt rod Secondary Fuze Cavities: None Safety Device: Safety pull ring assembly Functioning: 20 degree deflection of tilt rod

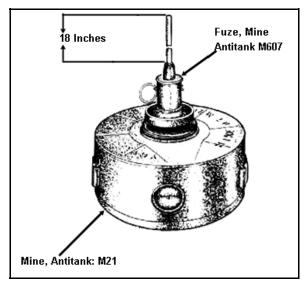


Fig 5A2-1 M21 AT Mine with M607 Fuze.

cking.

2 mines with 2 fuzes and 2 boosters in a moisture barrier bag

2 bags (4 mines) with 2 wrenches in wirebound box total weight of 1 box is 40.8 kg

4. **Training Mine**. Available in classroom training set. Designation TBD.

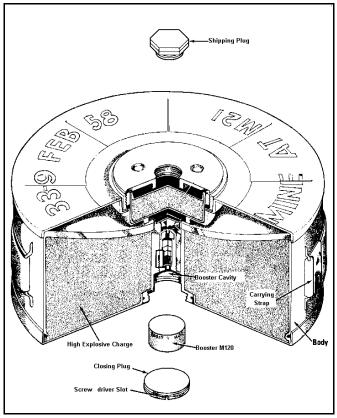


Fig 5A2-2 Sectional View of M21 AT Mine

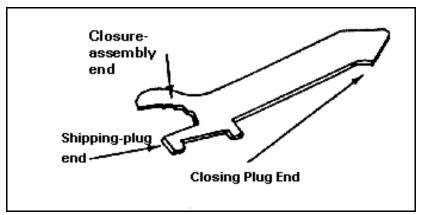


Fig 5A2-3 M26 Arming Wrench

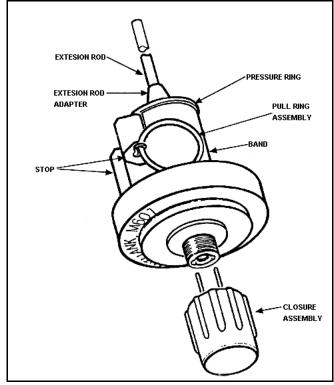


Fig 5A2-4 M607 Antitank Mine Fuze Prior to Assembling to M21 Mine

5. **Inspection**. Inspect the mine and fuze. If dented, cracked or damaged, do not use it. Ensure the cotter pin of the fuze pull ring assembly and the fuze closure assembly are securely in place.

Ensure the plastic collar beneath the pull ring assembly is not damaged or shattered and the tilt rod extension and pressure ring are not tilted. If damage or tilt is observed notify the officer or NCO in charge of the mining operation immediately.

6. **To arm**. Use the screwdriver end of the M26 wrench to remove the closing plug from the bottom of the mine. Examine the booster cavity for foreign material. Remove any foreign material by gently tapping on the bottom of the mine with your hand to dislodge it. If it cannot be removed, replace the closing plug. Do not use the mine, set it aside for disposal.

- a. Insert M120 booster, with the washer side toward the fuze, into the booster cavity, and replace the closing plug.
- b. Use the M26 wrench to remove the shipping plug from the fuze cavity.
- c. Use the M26 wrench to remove the closure assembly from the M607 fuze. Ensure the gasket remains in place on the fuze. Then screw the fuze (hand tight) into the fuze cavity.
- d. Dig a hole deep enough so that the top of the mine body will be at ground level.
- e. Place the mine in the hole and cover the mine with soil until it is level with the top of the mine (Ensure no soil falls around or under the plastic collar).
- f. For tilt rod actuation, screw the tilt rod extension into the M607 fuze. Ensure the extension rod is pointing straight up.
- g. Squeeze the ends of the cotter pin of the pull ring assembly together. Remove the cotter pin by holding the fuze firmly in one hand. Slowly and carefully remove the band and stop assembly from the neck of the fuze. The mine is now armed.
- h. Retain the band, stop, pull ring assembly, shipping plug and

closure assembly for future disarming of the mine.

j. Camouflage the mine. Ensure no pressure is applied to the tilt rod or the fuze.

7. **To neutralize**: Replace safety and arming mechanism (the band, stop, pull ring assembly) on the fuze.

- 8. **To disarm**. Neutralize the mine, then:
 - a. unscrew tilt rod extension.
 - b. check for antidisturbance devices.
 - c. remove mine from ground (if required).
 - d. unscrew the fuze and replace shipping plug in mine and closure assembly on the fuze.
 - e. remove M120 booster and replace plug.

APPENDIX 3

C14 OFF-ROUTE MINE (CA)

1. **General.** The C14 is a horizontal attack, off-route mine, based on a modified AT-4 launch tube fitted with a Carl Gustav 84mm, FFV 65 HEAT cartridge, which can penetrate up to 400mm of Rolled Homogeneous Steel Armour at a distance of 15-150 m.

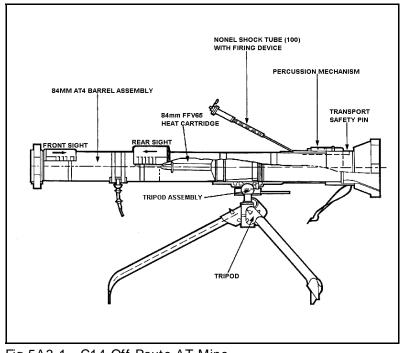


Fig 5A3-1 C14 Off-Route AT Mine

2. Technical Data.

Weight (system complete): 10.2 kg Warhead Charge: HEAT 500 g cast OCTOL 70/30 Fuzing System:

Nose and shoulder initiated piezo-electric base fuze (warhead)

Primary Means of Firing:

6-10 kg manual pull or trip wire pull on the M42/P firing device.

Secondary Means of Firing:

Remote controlled, expedient firing (engineers and assault pioneers only).

3. **Packing**. One launch tube assembly, one tripod assembly, M42/P firing device, trip wire (100 m), and cotton pull cord (10 m).

4. Training Mine. Nil.

5. **Inspection**. Make sure that the safety pins are secured in the launch tube percussion mechanism and in the M42/P firing device. Inspect the launch tube assembly for dirt, foreign objects and for signs of damage such as dents, cracks or corrosion. If a safety pin is missing, put the launch tube or the M42/P firing device aside and advise the officer or NCO in charge. Similarly, launch tubes showing signs of damage will be set aside for eventual destruction.

6. **Aiming.** The aiming criteria at Fig 5A3-2 provides the best kill probability for the T62, T64, T72 and BMP type targets. The aiming criteria (see Fig 5A3-3) for the C14 off-route mine is composed of:

- a. recommended trip wire lead distance(in front of or behind the aim point on approach);
- b. recommended gun aim elevation based on distance between gun position and the aim point; and
- c. anticipated target speed.

	Gun Position Range (m)				
	15	25	50	100	150
Lead Distance (m) Target Speed 10 km/hr	-1.79	-1.68	-1.41	-0.90	-0.42
Lead Distance (m) Target Speed 30 km/hr	-1.37	-1.05	-0.24	+ 1.2 9	+ 2.74
Lead Distance (m) Target Speed 50 km/hr	-0.95	-0.41	+ 0.9 3	+ 3.4 9	+ 5.91
Gun Elevation Aim Point (m above ground)	1.02	1.05	1.19	1.74	2.6

Fig 5A3-2 C14 Off-Route Mine Aiming Criteria

- 7. Sequence of aiming the C14 (paragraph c) is as follows:
 - a. determine gun position range.
 - b. determine estimated speed of approaching target.
 - c. from subparagraphs a and b select lead distance (+ /-) for best kill probability and position trip wire + or - of the aim point as determined by the table above. Where the mine is to be remote controlled (ie, trip wire not employed) some form of marking, visible from the firing point, should be employed to identify the lead distance(s) from the target.
 - d. aim the mine at the aim point (horizontal) and site at the elevation (vertical alignment) which corresponds to the target range determined in subparagraph a.

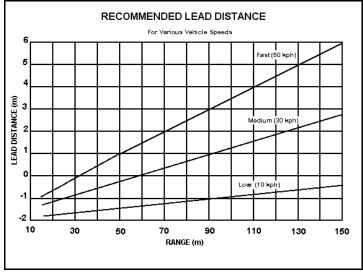


Fig 5A3-3 C14 Off-Route Mine Aiming Correction

8. **To Arm.** (See Fig 1 through 5) Locate the tripod in a suitable position (20 to 150 m along a line of sight) from the proposed target aiming point and sandbag tripod legs (when extended) or otherwise secure in place (i.e., strap tripod to vertical upright such as a tree).

- a. Attach launcher to tripod assembly.
- b. Open sight covers to expose pop-up sights and aim the launcher at the proposed aim point (adjusting for proper gun elevation, aim in accordance with Fig 5A3-3 and Fig 5A3-3).
- c. Tighten the handle on the tripod assembly to lock the launch tube in place.
- d. **Warning**. Observe back blast danger zone of 60 m to the rear of the launch tube and ensure all flammable material, equipment, friendly troops, etc are out of this area. See Chapter 7, Annex A, Appendix 1 for danger template.

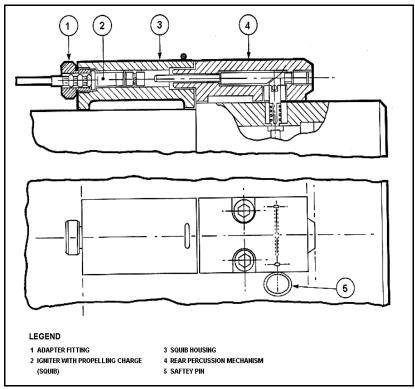


Fig 5A3-4 C14 Mine Launch Tube Percussion Mechanism

- e. Attach the squib end of the shock tube to the launch tube percussion firing mechanism by inserting the squib in the squib housing and secure it using the screw in adaptor fitting. Secure the non-electric (NONEL) shock tube to avoid any direct pull on the adapter fitting which may result in a misfire.
- f. Remove the launch tube percussion mechanism safety pin, but leave it attached to the elastic cord provided.

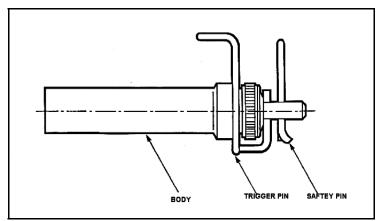


Fig 5A3-5 C14 Off-Route Mine - M42/P Firing Device

9. **Remote Controlled Actuation**. Unwind the NONEL shock tube, avoid causing kinks and sharp bends. Lead back to the firing point location and attach the M42/P firing device. Remove the safety pin from the M42/P firing device and retain it for future neutralization of the firing device, if necessary. The mine is now armed for remote firing by an operator.

10. **Trip Wire Actuation** If the mine is to be actuated by trip wire, the M42/P firing device must be securely attached to a solid object such as a tree or picket, which constitutes the firing point. Ensure that the M42/P firing device angle to the direction of the trip wire pull is approximately 90 degrees for most reliable functioning (i.e., the trigger pin is in line with the trip wire).

11. Attach the trip wire to the firing device trigger pin and check for proper tension (trip wire not exerting pull on trigger pin) and attach the shock tube assembly (having unwound the shock tube as described in paragraph 6).

12. Remove the safety pin from the M42/P firing device and retain it for future neutralization of the firing device, if necessary. The mine is now armed and ready for use.

13. **To Neutralize**. Insert the safety pin into the M42/P firing device. Remove the NONEL shock tube from the M42/P firing device.

- 14. **To Disarm**. Neutralize the mine and:
 - a. ensure the M42/P firing device is in safe custody before leaving the firing position to disarm the mine;
 - b. insert the safety pin in the launch tube percussion firing mechanism;
 - c. unscrew the adapter fitting from the percussion mechanism;
 - d. disconnect the squib end of the shock tube from the adaptor fitting,
 - e. replace the adaptor fitting, and
 - f. recoil the shock tube and repack the components in the shipping box.

ANNEX B

CANADIAN FORCES ANTIPERSONNEL MINES

This annex contains information on the following A pers mines:

- a. Appendix 1 C3A1/A2 (CA) A pers Mine;
- b. Appendix 2 M16A2 (US) A pers Mine; and
- c. Appendix 3 M18A1 (US) A pers Mine.

APPENDIX 1

C3A1/A2 (ELSIE) ANTIPERSONNEL MINE (CA)

1. **General**. The C3A1/A2 is a pressure operated mine designed to inflict injury on personnel. The mine is manufactured from non-metallic material with the exception of the firing pin, steel balls, detonator and detector ring. If the detector ring is removed prior to laying the mine, then the Elsie becomes very difficult to detect with metal detectors.

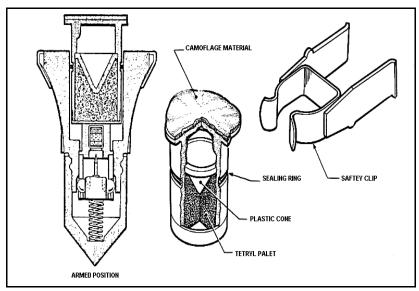


Fig 5B1-1 C3A1/A2 A pers Mine

2.

Data:Weight:85 gramsExplosive:9.45 gramsFuze(s):integral, ball releaseSafety Devices:safety clipFunctioning:7.25 - 13.6 kg pressure

3. Packing:

12 mines and 12 fuzes are in a carton 8 cartons (96 mines) are in a metal box total weight of metal box is 18.1 kg

4. **Training mine**. C4A1 Practice Mine, C7 Drill Mine.

5. **Inspection.** Verify to ensure that body and fuzes are indeed separate and that the shipping plug is in the body. Ensure that the arming clip is in place on the fuze. Check all components for dirt or foreign objects and for signs of damage, dents, cracks, or corrosion. Any damaged parts will be set aside for destruction.

6. **To Arm**. keeping the shipping plug in place, push the mine body into the ground using the hand, boot, or dibber. If the ground is hard, dig a hole with a bayonet. Then:

- a. remove the shipping plug, ensuring that no loose stones or dirt fall into the mine;
- b. insert the charge into the mine, ensuring that the safety/arming clip is in full contact with the mine, and
- c. remove the safety/arming clip. The mine is now armed.

7. **NOTE:** The detector ring may be removed (upon direction of the authorized commander) to render the mine more difficult to detect with a metal detector. The detector ring will be removed only by qualified engineer and assault-pioneer personnel. When so authorized, remove the aluminum ring before placing the mine in the ground.

8. **To Neutralize**. Replace the safety/arming clip.

9. **To Disarm**. Neutralize, and

- a. gently remove the fuze and replace it in its original shipping container.
- b. replace the shipping plug.

APPENDIX 2

M16A2 ANTIPERSONNEL MINE (US)

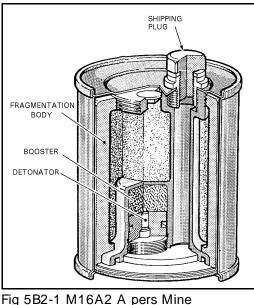
1. **General**. The M16A2 is a bounding fragmentation mine consisting of a mine body and a fuze. It detonates between 0.6 m and 1.2 m above the ground. It has a lethal radius of 32 m and a danger radius of 185 m. Because of its effective area coverage, the M16A2 is used in mixed mine fields to protect antitank mines against enemy breaching parties. However, it can be used by itself in ambushes and for protective or nuisance mining.

2. Technical Data.

Weight: 3.6 kg without fuze Explosive: 0.5 kg Fuze(s): M605 combination Safety Devices: Various safety clips Functioning:

(1) 3 - 33 kg pressure; or

(2) 1 - 6 kg pull on trip wire



5B2-1

3. Packing.

4 x M16A2, 4 x M605 fuzes, (both in metal containers) 4 x 14 m tripwire and 1 x wrench all in a wooden box, total weight of 20 kg

4. **Training mine**. C6 Drill Mine.

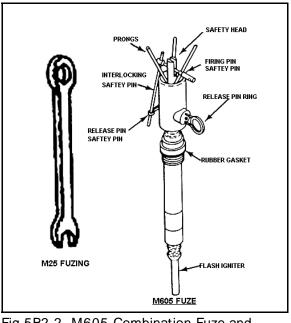


Fig 5B2-2 M605 Combination Fuze and M25 Fuzing Wrench

5. **Inspection.** Verify to ensure that body and fuze are indeed separate and the shipping plug is in the body of the mine. Ensure that the release pin and interlocking safety pin assembly are in place on the fuze safety head. Check all components for dirt or foreign matter and for signs of damage such as dents, cracks or corrosion. All damage parts will be set aside for destruction.

6. **To Arm**. Use the M25 fuzing wrench provided to remove shipping plug and screw in the M605 fuze ensuring that the fuze is tight and the rubber gasket is around the fuze base.

- a. For pressure actuation:
 - place the mine in the hole so that only the prong tips are above the ground level;
 - (2) pack earth around the mine to the bottom of the release pin ring;
 - (3) remove release pin safety pin first. The interlocking safety pin should fall free, and
 - (4) camouflage the mine up to the level of the firing pin safety pin.
- b. For tripwire actuation:
 - place the mine in hole so that release pin ring of fuze is barely exposed above ground surface and pack earth around the mine to ground level;
 - (2) attach two trip wires to anchoring objects (not the mine) approximately 10 m from the mine. The wires should form a wide "V" with the opening toward the opposing force;
 - (3) attach the trip wire to the release pin ring;
 - (4) install trip wires so that they do not exert pull on release pin ring;
 - (5) remove release pin safety pin first. The interlocking safety pin will fall free;
 - (6) camouflage the mine, and
- d. Remove the firing pin safety pin. The mine is now armed.

7. **To Neutralize**. Insert a safety pin, steel wire or nail in firing pin safety pin hole; then insert a release pin safety pin.

8. **To Disarm**. Neutralize. Re-insert the release pin safety pin (carefully clearing soil from the top of the fuze).

- a. If trip wire actuated, cut the slack trip wires attached to the release pin ring.
- b. Remove the fuze from the fuze cavity and replace the shipping plug.

APPENDIX 3

M18A1 CLAYMORE ANTIPERSONNEL MINE (US)

1. **General.** The M18A1 is a directional, fragmentation mine that is effective against both personnel and soft-skinned vehicles. Upon detonation, 700 steel fragments are delivered forward of the mine approximately 2 m in height to a distance of 50 m in a 60 degree (1060 mils) arc. Fragments are effective up to 50 m and can cause casualties up to 300 m. A danger template is shown at Chapter 7, Annex A, Appendix 2. The following accessories are provided for the operation of the mine:

- a. M57 Firing Device, hand held, 1 per mine;
- b. Electric Detonating Assembly, an M4 (30.5m firing cable) or M6 (4.5m firing cable) electric detonator;
- c. M40 Test set, 1 per 6 mines; and
- d. M7 Bandoleer, water resistant canvas bandoleer with instruction sheet sewn on inside flap.

2. Technical Data.

Weight: 1.6 kg Explosive: 0.7 kg Fuze(s): M4 or M6 Electric detonators (The detonator cavity is not compatible with other in-service detonators or detonating cord) Safety Devices: Safety catch on firing device Functioning:

- 1. Remote controlled, electrically.
- 2. Expedient electrical firing, engineers and assault pioneers only.

3. Packing.

- 1 M18A1 w/Accessories per Bandoleer
- 6 Bandoleers per wooden box

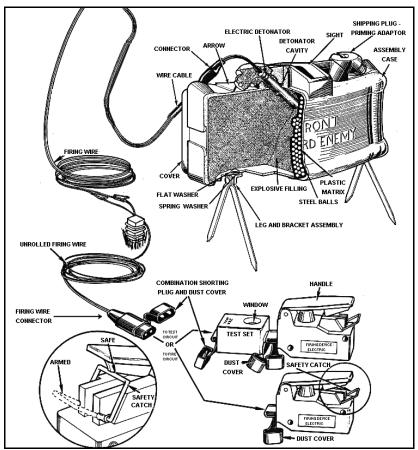


Fig 5B3-1 M18A1 Claymore A pers Mine and Accessories

5. **Inspection.** Inspect the Claymore and detonator for dirt and for cracks, dents, corrosion or other signs of damage. Check the detonator and the detonator cavity for foreign matter. Check the couplings for tightness and foreign matter. Check the cables for signs of deterioration. Dammaged components will be set aside for destruction. Prior to deployment, the M57 Firing Device and the firing circuit shall be tested.

6. **Testing the M57 Firing Device**. Remove the dust covers from the connector on the firing device and from the smaller connector on the test set. Plug the test set into the firing device. Do not remove the combination shorting plug and dust cover from the other end of the test set.

- a. Switch the safety catch on the firing device to the armed position.
- b. Hold the test set window close to the eye to reduce the risk of enemy observation at night and to make the flash easier to see in sunlight. Grip the firing device firmly and fully depress the handle as quickly as possible while observing the window in the test set.
- c. Proper functioning of the firing device is indicated by a flash in the test set window. If no flash is seen, remove the combination shorting plug and dust cover from the test set and ensure that the wire shorting bridge in the dust cover is intact.
- d. If the wire shorting bridge is broken or missing, a substitute bridge can be improvised by using a pin or short length of wire. If the wire shorting bridge is intact replace the firing device as it is likely non-serviceable.
- e. If several firing devices fail the test, the test set itself may be defective and should be replaced.

7. **Testing the Firing Circuit. WARNING**. Before proceeding with this test all personnel shall be in a protected position and the danger area for a detonator shall be cleared.

- a. Remove the insulation tape from the package containing the detonator and firing wire assembly. Retain for possible repair of the firing wire.
- b. Unroll the firing wire from the firing position to the mine, ensuring that the detonator is not handled roughly. The

firing position shall be at least 16 m to the rear and the sides of the mine.

- c. Ensure that the safety catch on the firing device is in the safe position. Plug the test set into the firing device.
- d. Remove the combination shorting plug and dust cover from the test set and firing wire connector. Insert the firing wire connector into the test set. Ensure that the danger area for the detonator is clear.
- e. Switch the safety catch to the ARMED position and fully depress the firing device handle.
- f. A flash in the test set window indicates that the firing circuit is functioning. If no flash occurs, the firing wire is broken or the detonator is defective:
 - (1) **Broken Firing Wire**. Splice the wires at the break and secure the splice with the insulating tape and retest.
 - (2) **Defective Detonator**. Replace the detonator and retest.
 - (3) If the test indicates a functioning circuit, return safety catch to SAFE position.
- g. Disconnect the firing wire connector from the test set and the firing device and replace the dust covers on all components.

8. **Setting Up**. Remove the mine and accessories from the bandoleer. Turn the folding legs downward and spread apart, then twist the legs so that they protrude to the front and rear of the mine. "FRONT TOWARD ENEMY" points in the direction of the enemy.

a. **Aiming**. When using the peep sight, aim the mine at the head of an individual who is standing 45 m in front of the mine, while pressing the folding legs firmly into the ground.

When using the knife edge sight, aim the mine at the feet of an individual who is standing 50 m from the mine. The bandoleer may be placed under the mine to support it if necessary.

- b. Unscrew either of the shipping plug priming adapters from the mine and slide the slotted end onto the section of firing wire above detonator. Pull any excess firing wire through until the detonator is fully home, in the adapter.
- c. Wind the firing wire two or three times around a stake positioned near the mine and on the same side into which the detonator will be inserted.
- d. Ensure that the combination shorting plug and dust cover is fitted to the other end of the firing wire and that the M57 Firing Device is in safe custody.
- e. Screw the adaptor holding the detonator into the detonator cavity (finger-tight only).
- f. Remove any artificial aiming marks.
- g. Bury the firing wire to protect it from damage. In some cases as disturbed earth is difficult to camouflage it may be desirable to leave firing wire lying on the ground.

9. **Firing**. Ensure that the safety catch on the firing device is in the safe position and that all friendly troops are clear of the danger area.

- a. Switch the safety catch to the armed position. The mine is now armed.
- b. Keeping your head down (in case the enemy has tampered with the siting of the mine), depress the handle of the firing device to fire the mine. Mines that are damaged or fail to fire are treated as duds.

10. **To Neutralize**. Switch the safety catch on the firing device to the SAFE position and remove the firing wire connector from the firing device and replace the dust covers on both components.

11. **To Disarm**. Neutralize and ensure that the firing device is in safe custody before leaving the firing position to disarm the mine.

- a. Unscrew the adaptor assembly from the mine.
- b. Disconnect the detonator from the adapter.
- c. Replace the adapter.
- d. Recoil the firing wire and return the components to the bandoleer.

CHAPTER 6

COUNTERMINE WARFARE

SECTION 1

GENERAL

RESPONSIBILITIES

1. Mines are used to such an extent on the modern battlefield that it is essential that all arms units take some responsibility for mine counter-measures. It is imperative that all personnel recognize likely locations and they be constantly on the look-out for mines and booby traps.

2. **Mines.** The main responsibility for minefield clearance rests with engineers and assault pioneers. Other arms units are required to have personnel specially trained for, and assigned to detecting, locating and clearing A pers and AT mines.

3. **Booby Traps**. Booby trap clearance will only be conducted by engineers and assault pioneers. However, all field unit personnel are required to be aware of the threat, and to know how booby traps are detected, marked and reported.

RECONNAISSANCE

4. The engineer commander requires as much information as possible about the mined area if he is to advise the commander and assist in planning a breaching operation. Manoeuvre units are responsible for finding a bypass around the obstacle and in the process will contribute to definition of the minefield.

- 5. The following information is required:
 - a. positions of the forward edge and the extremities of the mined area;

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- b. details of the composition of the mined area:
 - (1) depth,
 - (2) density,
 - (3) types of mines, and
 - (4) use of trip wires;
- c. soil conditions (soil classification (sand, gravel, clay and silts) and bearing capacity);
- d. location of enemy lanes and gaps;
- e. location of enemy positions covering the mined area; and
- f. details of obstacles sited in conjunction with the mined area.

6. Minefields laid by allied forces that are subsequently occupied by the enemy may have been laid in a pattern familiar to us. This possibility does not exclude the requirement for a reconnaissance. The enemy can be expected to change the minefield to some extent.

7. Patrols can be initiated to determine or confirm information. They may be other arms, all engineer, or an engineer reconnaissance party with a protection party. The choice is based on the tactical situation, requirement for protection, and information to be obtained.

8. Complete reconnaissance details are in B-GL-320-010/FP-002, Engineer Field Manual, Volume 10, Mines and Booby Traps, Part 2, Engineers and Assault Pioneer.

SECTION 2

DETECTION

INTELLIGENCE

1. Successful offensive mine counter-measures are dependent on good intelligence. Over a period of time good intelligence will establish enemy mine warfare tactics, and preferences. Information judged against this intelligence forms the basis of selecting targets and approaches for offensive action.

2. Valuable information about minefields and booby trap sites can often be obtained from prisoners of war, particularly engineer prisoners. Local inhabitants may also have valuable information about enemy mining activity. All prisoners are evacuated to the rear, but formation staffs will be able to have certain enemy personnel interrogated about various operational activities including mining and booby traps.

3. Additional information can be determined from the following sources:

- a. personnel and vehicle casualties;
- b. patrols;
- c. air photographs;
- d. injuries to livestock, or lack of livestock in rural areas;
- e. friendly ground observations; and
- f. air reconnaissance.

CURRENT METHODS OF MINE DETECTION

4. There are five main methods which can be used for mine detection:

- a. visual identification;
- b. manual (feeling with the hands, followed by prodding);
- c. mechanical (really a method of mine breaching and clearance because mine detection is only verified by mine detonation. Rollers and ploughs are normally designed as combat systems suitable for getting combat vehicles which have specific design characteristics, i.e. low ground pressure, across obstacles to the objective and may not detect the presence of mines that would threaten vehicles with greater ground pressures, ie. logistic wheeled vehicles);
- d. electronic detectors; and
- e. animals.

5. **Visual Method**. Experience has shown that careful and intelligent observation by the individual soldier often discloses the location of a mine or booby trap. Visual alertness must never be relaxed because of the presence of equipment detectors or locators. It is imperative that all personnel know how to find A pers mines.

6. **Manual Method**. Prodding is a slow and labourious process but it is the only effective capable of locating all types of mines buried at normal depths in all climatic conditions. It is therefore the standard method of detecting AT mines. When the presence of A pers mines is suspected, care must be taken to ensure the prodder does not actuate them. First, A pers mines must be felt for with the hands and trip wire feelers. Trip wire feelers are made from a piece of medium gauge wire of about one metre long and stiff enough not to be bent readily, or from a thin stick cut from a hedge. Any mines found are either neutralized or marked and avoided.

7. **Mechanical Methods**. Rollers, ploughs and flails may be employed as mechanical detection systems.

8. **Electronic Detectors.** Most electronic detectors indicate the presence of metal objects in the ground. Their use as mine detectors enables ground to be searched more rapidly than by prodding. The use of metal is how ever becoming more limited with the introduction of non-metallic mines. Few mines are completely non-metallic, but many have only a small amount of metal in their fuzes. The mine detector does not easily distinguished metal in such small quantities from other small metallic objects likely to be present in the ground, particularly on a battlefield. The use of detectors is therefore confined to following prodders to search for metallic mines they may have missed. The current Canadian mine detector is covered in Annex B to this chapter.

9. **Animals.** Animals, particularly dogs, can be trained to operate with humans to detect mines buried at normal depths. They have their limitations, and are to be regarded as a subsidiary rather than a main method of detection. These limitations include:

a. Unavoidable limitations.

- tiredness of dog or handler. This can be minimized by resting the dogs at intervals during the task and ensuring that the team is not kept waiting before or after tasking. A dog can effectively search for periods of up to two hours;
- (2) sickness or injury of dog or handler;
- (3) inexplicable off day in a dog,
- (4) distractions, other dogs, other animals, food or people;

- (5) weather, excessive wet, heat or cold, and
- (6) darkness, the handler's reduced ability to read his dog even in artificial light.

b. Avoidable limitations.

- (1) excessive movement or disturbance in or a search area;
- (2) danger of setting off booby traps which can be minimized by a systematic use of dogs and the visual alertness of the handler;

10. The true value of animals is their ability to detect nonmetallic mines and therefore they can be employed as part of a mine clearance system (manual, mechanical, electronic and animals) to counter the mine threat in a theatre where the mine threat includes AT, A pers, metallic and non-metallic mines.

SECTION 3

MINEFIELD BREACHING AND CLEARANCE OF MINES

GENERAL

1. There are three basic methods of breaching minefields and clearing mines:

- a. manual;
- b. with explosives; and
- c. by mechanical means.

2. **Manual**. Manual breaching and clearance is done by visually and physically (with hands and prodders) searching the area. Manual techniques involve a greater degree of risk due to the possible existence of antidisturbance devices and lack of protection from enemy fire. Modern surveillance devices have made the silent hand breach a risky operation. Manual breaching and clearance is an engineer and assault pioneer responsibility, except in the lifting of protective minefields.

3. **Explosives.** Explosive clearance involves the destruction of mines in-situ with a small explosive charge, or in the case of a minefield breach, by the use of an explosive device like a Bangalore Torpedo or an explosive line charge.

4. **Mechanical Means**. There are different means of breaching and clearing minefields mechanically, including ploughs, rollers and flails. These equipments displace, neutralize or actuate the mine.

CHOICE OF METHOD

5. None of the above methods are guaranteed to clear 100% of the mines in a given area. The choice of method depends on:

- a. the degree of opposition;
- b. the nature of the ground;
- c. the presence of physical obstacles;
- d. the availability of equipment;
- e. the importance of the site;
- f. the tactical requirements of the situation;
- g. the types of mines and the presence of antidisturbance devices; and
- h. the state of training and experience of the breaching or clearance party.

6. Commanders ordering minefield breaching or clearance shall appreciate the local situation, and will clearly define the degree of damage that is acceptable and amount of risk that is justifiable, i.e. whether mines are to be pulled or blown in place, neutralized by hand or merely marked and left.

MANUAL BREACHING AND CLEARANCE

7. In a case where manoeuver units are required to conduct a manual breach or clearance of their own protective minefields, the task shall be conducted as follows:

a. neutralize the mines in accordance the procedures in Chapter 5 Annexes A and B; and b. disarm is the mines in accordance procedures in Chapter 5 Annexes A and B.

8. **Unknown Mines or Fuzes**. If an unknown type of mine or fuze is found during breaching or clearance operations, the options for manoeuver units are:

- a. if qualified, destroy it in place using a small explosive charge; or
- b. mark the mine, and report it immediately so that it can be investigated by engineers or assault pioneers.

EXPLOSIVE BREACHING AND CLEARANCE

9. **General.** Explosives can be used to explode individual mines or mechanisms in-situ or can be used to clear a lane through mined areas. The use of explosives to detonate individual mines or mechanisms is restricted to qualified personnel.

10. **Procedure**. A small charge is placed as close as possible to the mine without touching it and detonated from a safe distance, thus exploding the mine. These charges can be initiated individually or on a ring main, destroying more than one mine at a time.

MECHANICAL BREACHING AND CLEARANCE

11. **General**. Mechanical means of breaching include ploughs, rollers and flails which are employed in accordance with B-GL-320-010/FT-002, Engineer Field Manual, Volume 10, Mines and Booby Traps, Part 2, Engineers and Assault Pioneers and B-GL-305-001/FT-001 Armoured Regiment in Battle. The full details of these are beyond the scope of this chapter but are summarized below.

12. **Ploughs.** Tanks can be fitted with a plough attachment which ploughs through the ground in front of each track; it lifts any mines in its path and pushes them to one side clear of the tracks. If a tank is fitted with the plough attachment, its mobility is restricted when ploughing and crossing hard ground is slow which

lengthens the time the tank is exposed to enemy fire. The plough follows the terrain but it is unlikely to be effective in close country where there are roots and boulders or where there are numerous ditches. If the leading tank only is fitted with ploughs, the following tanks must keep in exactly the same track which is difficult under operational conditions. Otherwise the following tanks may actuate mines pushed to one side by the plough. As the plough covers only the line of the tracks, the tank could also be immobilized by full width attack mines.

13. **Rollers**. Tanks can also be fitted with heavy rollers which cover the ground in front of each track and actuate single pressure mines. These rollers can be defeated by mines with double impulse fuses or full width attack mines. If every tank were fitted with rollers, then an attack through minefield could be mounted on a broad front, but the mobility of the tank is restricted when fitted with rollers. If only a proportion of tanks have rollers, then the other tanks must cross the minefield by following exactly in the tracks of the leading tank. This is technically not difficult, but may be hazardous, particularly if under direct fire and attempting to cross as fast as possible. There is a good chance that a following tank will actuate a mine which has not been covered by the roller.

14. **Flails**. A proportion of tanks may be fitted with a flail, which is a high speed rotating drum, the width of the tank, with lengths of heavy chain attached. The flail poses similar restrictions to the mobility of the breaching tank described above, but has the advantage of being able to actuate all mines over the full tank width.

SECTION 4

MOVEMENT IN A MINEFIELD

GENERAL

1. Personnel may find themselves in a minefield under a variety of circumstances. Known minefields will be the subject of formal minefield breaching and mine clearance operations. However, troops may easily find themselves in hitherto unknown, neglected or scattered enemy (and friendly force) minefields. To make matters worse, forward minefields will very likely be covered by enemy fire. Survival and mission success will depend on individual, team and unit training.

TROOPS IN CONTACT

2. **Manoeuvre Forces.** Manoeuvre troops may encounter mines in the attack and in the defence. To attempt to "bull" out of a live minefield could be disastrous. To remain in place, even for a short time, might prevent mine casualties but it may well invite enemy fire. Unit mission and tasks, and enemy activity, particularly in the light of technical intelligence, will determine subsequent actions. Stopping in place, or withdrawal may not be an option. Unit SOPs will deal with these situations and unit training shall exercise personnel in the various minefield drills.

3. **Patrols.** Patrol preparation will include drills on encountering mines. A deciding factor will be if the patrol is under fire or not. Another important factor will be the element of surprise that may have been lost. Unit training and SOPs will cater to these situations.

TROOPS NOT IN CONTACT

4. **S.A.N.D.I.** Personnel on resupply, repair or recovery tasks may also find themselves in a minefield. For troops not in contact with the enemy, the prescribed drill is **S.A.N.D.I.**:

- Stop, - Assess, - Note, - Drawback, - and Inform

- 5. **Stop:**
 - a. **Dismounted Troops.** Immediately stand still and order **all** to halt and stand still. This is particularly important if a member of the group has just become a mine casualty because of the natural tendency to rush to the casualty.
 - b. **Mounted Troops**. Stop the vehicle or order the vehicle to halt. Initially, stay in the vehicle.

6 **Assess.** Visually search the area for trip wires, exposed mines or signs of mining. Assess the ground to determine what route will be followed to drawback or withdraw from the hazardous area.

7. **Note**. Record and if possible report by radio, (don't approach and don't touch!). For example, note the shape (square, round, circular, rectangular, cylindrical, domed, Claymore), the colour (light or dark green, brown, black, sandy, grey, metallic, natural wood, olive, blue, white, or disruptive pattern camouflage, including any identifying markings), the material (plastic, rubber, wood, sheet metal, cast iron, metal alloys, concrete, bakelite, cast explosive), and the size (length, width, height, and diameter) of any trip wire, mine or mine component.

8. Drawback.

a. **Dismounted**. If an engineer clearance team is not available, or circustances otherwise require an immediate withdrawal, this may involve prodding a path one metre wide to a safe area (where there is no obvious threat). The drawback procedure involves the repetition of the following drills until clear of the area:

- (1) Look. For trip wires, mines or indicators;
- (2) Check for trip wires. Using the C7 rifle cleaning rod as a trip wire feeler, held gently between thumb and first finger, slowly push the rod forward at ground level, supported by the other hand. Then slowly raise the rod to a level well above the head when standing. Repeat the procedure on the left side, centre and right side of the one metre path to be cleared. Then holding the rod vertically, slowly sweep the rod accross the one metre path to be cleared. This procedure will ensure the detection of any trip wires running either parallel to or across the path to be cleared. If a trip wire is encountered, do not attempt to clear it. Clear a path along the trip wire to one end or to a location where it can be safely crossed and then continue clearing a path to the desired destination. In certain cases, it may be necessary to select another drawback route if the hazard presented by a trip wire(s) is too great. Physically check for trip wires after looking. Some trip wires are so thin, they are virtually undetectable or may be hidden by vegetation.
- (3) **Feel.** In either a prone or kneeling position. Gently feel the ground across the one metre path for mine fuzes or tops of mines.
- (4) **Prod**. See Annex A to this chapter and **most important**, **don't rush**. It is not worth missing a mine for the sake of speed.
- (5) **Mark**. If resistance is met by the prodder. Mark the spot using anything at hand, and carefully by-pass the area to the left or right. Mark any suspected mines **and** the path to be followed.
- b. Mounted. If an engineer clearance team is not available, or

circumstances otherwise require an immediate withdrawal, exit the vehicle via the rear or over the roof to the rear (don't step down from the side of the vehicle). Step into the vehicle tracks created by the vehicle or others in the convoy and withdraw to safety in the vehicle tracks, using the dismounted drawback procedure described above. Any trip wires should have been tripped by the passage of vehicles, but visually search for them anyway. The dismounted drawback procedure is used because mines have been known not to function in spite of having been driven over by a vehicle(s). If there are no vehicle tracks because the road is hard packed, then withdraw on the hard packed surface avoiding any soft, disturbed, damaged or freshly repaired areas. Mark the withdrawal path as best as possible.

9. **Inform.** Once clear of the hazardous area, sign or mark the approach, record the location on the map, and report this information to headquarters. If a mounted approach, alert other vehicles by marking the distance to the halt point on the warning sign.

CASUALTY RECOVERY

10. Often, the first indicator of mines will be a personnel or vehicle casualty. Keep in mind that the first reaction is to run to the aid of a casualty. This urge must be overcome to avoid further casualties.

11. Don't panic! Control the situation.

- a. Immediate actions are S.A.N.D.I. as described above for all non-casualties in the area. Maintain at least a 20m distance between members in a group and stay close to the ground. Continually reassure the casualty that help is coming and to stay as still as possible.
- b. Clear a path to the casualty. If not in a known safe area, start clearing a path to the closest known safe area and then to the path being cleared to the casualty.
- c. Clear an area around the casualty to permit people to move safely around the casualty while administering first aid and to

verify that the casualty is not lying over top of another mine.

- d. Now that it is safe, provide first aid.
- e. Evacuate the casualty along the cleared path.
- f. Complete the reporting process if the casualty had the group's radio communications.

12. If the casualty is close when the mine strike occurs, e.g., the casualty is in the same vehicle, it is possible to administer first aid immediately because it is safe to approach the casualty.

13. Remember, when in this situation and not under direct or observed fire, take your time. Don't rush since it may cause further casualties. Whenever possible, call for combat engineer and medical help as soon as possible.

SECTION 5

COUNTERING SCATTERED MINES AND OTHER SUBMUNITIONS

GENERAL

1. Scatterable mines are a submunition, along with bomblets and grenades, that are spread by vehicle or aircraft dispensers, or dropped over a target by missiles, rockets or projectiles. They may be A pers, antimaterial or AT, dual purpose, chemical, incendiary or high explosive.

2. These submunitions are very small. Some function like bombs, exploding on impact; some operate like conventional land mines. Others, on hitting the ground, eject trip wires out to six metres from the mine. Dual purpose submunitions have a shaped charge for penetrating hard targets but may also be used against personnel. Some scatterable mines have magnetic fuzing and are actuated by a magnetic signature; others have antidisturbance and self destruct fuzing. These are area denial weapons and will invariably be used in combinations of A pers and AT or antimaterial.

3. Placed mines are buried or surface laid, and camouflaged where possible. Scatterable mines land on the surface and usually can be seen. However, bush, rubble and tall grass may hide scatterable mines as effectively as placed mines. Furthermore, these submuntions may appear attractive and innocent looking or may resemble the conventional "pronged can".

4. Rapid identification of the mine type and prior knowledge of its characteristics are important. The most effective tactic to counter the effects of mines delivered on top of a unit is directly related to knowledge of the mines themselves.

DELAYED ARMING

5. All scatterable mines are specifically designed to minimize the possibility of premature actuation either in or near the delivery system, or upon impact with the ground. The mechanisms to provide such a safety feature vary from one mine type to another and may incorporate clockwork mechanisms, chemical reaction with the atmosphere, electronics, and the like. Thus, many scattered mines are not armed for periods ranging to about five minutes after impact. This delay may offer an opportunity to redeploy if this is an option. It may also be the only occasion to physically remove the submuntions from the immediate area of vehicles, CPs, trenches, routes, supply stocks etc.

MINES ARMING UPON IMPACT

6. If the scattered mines arm on impact or within seconds, there will be no opportunity to react as described above. If the mines are identified as not equipped with antidisturbance devices, a path can be cleared by physically removing mines from the selected escape route. If the unit is equipped with a dozer tank or a bulldozer, and if influence fuzes are not used, such vehicles need only push the mines aside. Otherwise, long sticks or any non-ferrous material immediately at hand are used to push the mines aside.

UNKNOWN MINES

7. When mines of a type not previously identified are emplaced upon a unit, extreme caution is required. Rapid expedient tests can be conducted on the mines. Small arms fire and hand grenades are used to attempt to determine the existence of antidisturbance devices. If mines are not easily detonated, antidisturbance devices have probably not been used and it may be possible to remove the mines physically (manually or mechanically). If small arms fire or hand grenades easily actuate the mines, this method can be used to clear a lane out of the mined area.

SUBMUNITIONS USED BY ALLIED FORCES

8. The possibility of encountering mines and sub-munitions delivered by allied units cannot be ruled out, nor can the possibility of enemy use of captured stocks. Training must include appropriate drills in reactions to mines in our inventory.

SECTION 6

TRIP WIRES

DETECTION AND CLEARANCE

1. **General.** Trip wires may be used with almost any type of mine, but they are most commonly used with A pers mines and off-route AT mines. They are normally laid at about ankle height where they are well concealed by long grass or other vegetation. In wooded areas, trip wires may be used with A pers mines fastened to bushes or trees well above ground level where they are likely to have greater effect against passing troops or vehicles. When it is known or suspected that trip wires exist, they must be located and removed as the countermine operation proceeds.

2. **Detection**. Trip wires normally have a matt surface and are dark in colour so that they cannot be readily seen even in bright sunlight. If it is determined that trip wires exist in an area, personnel shall attempt to leave the invested area by withdrawing along their own tracks. If in doubt as to the safety of this escape route, a trip wire feeler shall be used to check for trip wires on the path out of the booby trapped area. A trip wire feeler is about one metre long made either from a thin branch or a piece of medium gauge wire stiff enough not to bend readily.

3. **Clearance**. If personnel are qualified to do so, the trip wire mechanism and the mine is to be neutralized. If the trip wire is slack or taut the individual traces the wire to both ends, having ensured there is no contact with ground not previously checked for other surface laid mines or the fuzes or trip wires of buried mines, neutralizes any mechanism found, then cuts the wire. Never pull a slack wire or cut any wire taut or slack. Attempt to examine both ends of any wire before touching it. In the case where the individual is not qualified or confident in the neutralization of the trip wire mechanism, it will be left alone, marked, and reported so that an expert can deal with it.

ANNEX A

MINE PRODDER AND DRILLS

1. **Prodder, Mine, Non Magnetic**. The current pattern mine prodder is the Prodder, Mine, Non Magnetic (NSN 6665-99-840-0116 EAC 59-817);

2. The prodder consists of a central body section of light hollow tubing to which can be screwed at one end a point section and at the other a pistol grip handle. The point is made of hard non magnetic iconel alloy to prevent detonating magnetically influenced mines. The shape is chosen to prevent blunting and corrosion, which would increase friction. The assembled prodder is 1 metre long and weighs 409 grams. When it is used kneeling or lying on the ground, the body section is omitted and the point is screwed directly onto the handle. When not in use, the prodder is dismantled and the point section is fitted inside the body section. The prodder is carried in a webbing frog which can be slung from the web belt.

3. **Improvised Prodder**. The prodder is the most efficient and least tiring implement to use. Occasions will arise when it is not available. Current policy on using a ferro-magnetic prodder such as an improvised steel prodder or the bayonet is laid out by the Director Military Engineering (D Mil E) as follows:

"Ferro-magnetic objects should not be used to prod for mines, except in an operational emergency where it is deemed that the risk of personal injury due to accidental detonation is less than the operational risk."

4. Effective prodders can easily be fabricated when necessary from wood or plastic rods. The essentials are a point at one end and a handle at the other. It can be made to suit the position it is to be used in.

5. **Method of Using the Prodder**. Prodding can be done either standing, kneeling or lying on the ground, but prodding in the kneeling or prone position is the most effective. The prodder is pushed gently but firmly into the ground at an angle to the horizontal of about 30E. A prodder must never be jabbed into the ground. If it is, there is a good chance of any mine which is encountered being detonated. If the prodder strikes a solid object, a mine is suspected. It shall be firmly impressed on all soldiers engaged in prodding that any relaxation in the method of prodding will lead to casualties.

- 6. The correct prodding drill is:
 - a. the soldier assumes the kneeling or lying position and visually inspects or, in darkness or obscurity, feels the ground by hand, as far forward as is possible to comfortably reach, to locate any small A pers mines, trip wires or prongs; marks and bypasses or neutralizes and removes any found;
 - b. to minimize casualties if a mine is actuated, not more than two soldiers will prod side by side. To ensure that no ground is missed between the pair of soldiers prodding together, the area that each searches will overlap. They start from a common boundary and work outwards. They keep pace with each other, starting a new line of prods together. If a width of more than two metres is to be searched, additional pairs may prod with a distance of 20 metres between each pair;
 - c. the first pair will mark the edges of their cleared area with mine tape. Mine tape dispensers can be attached onto the webbing but they are not usually included in the equipment of most arms, in which case a method of laying out a securing string, tape or cable is improvised;
 - d. when more than one prodding party is used, the soldier closest to the cleared area will reel in the marking tape as

they proceed, and the other soldier in the second party will lay out the new boundary;

- e. prodding is very tiring and efficiency drops rapidly; soldiers shall be relieved as often as possible;
- f. eye protection shall be worn by all soldiers engaged in prodding;
- g. unless only a lane for personnel is required, prodding will be followed by sweeping with a mine detector to locate deeply buried metallic mines; and
- h. when the required lane has been cleared, it will be marked properly and recorded.

ANNEXE B

AN-19/2 MINE DETECTOR

1. The main reference for this equipment is C-59-782-000/MB-001 Operating Instructions AN-19 Mine Detecting Set NSN 6665-21-906-1023.

2. **General**. The AN-19/2 Mine Detector is designed to detect mines electronically. It is capable of detecting mines having a very low metal content, which are scattered on the surface, buried, or are located in fresh or salt water.

3. The detector, complete with all accessories, is stored in a rucksack-type carry bag fitted with shoulder straps. Each detector is provided with a metal transport/storage box which holds the carry bag and detector components.

4. **Description**. The AN-19/2 Mine Detector consists of the following main components:

- a. search head and telescopic handle with hand grip, arm rest and cable and connector;
- b. electronics unit;
- c. headphone with cable and connector, and
- d. cable clamps.

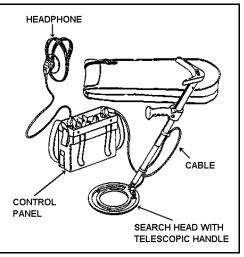


Fig 6B-1 AN-19-2 Main Components

5. The main components of the detector, and the accessories, are stowed in the carry bag as illustrated below. The accessories include:

- a. list of contents;
- b. operator's manual;
- c. spare search head securing bolt and nut;
- d. two spare cable clamps;
- e. test block; and
- f. spare batteries.

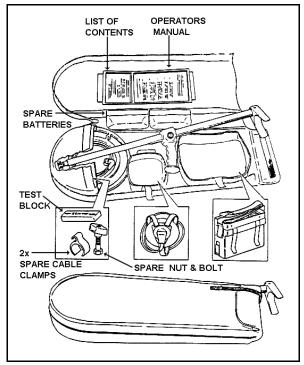


Fig 6B-2 AN-19/2 Carry Bag and Accessories

6. Main Data:

- a. batteries: 4 x 1.5V Standard D cell batteries
- b. operating Time (with 4 new batteries at 20EC): 70 hrs
- c. detection Range-
 - (1) mine with very small metal content: 10 cm
 - (2) typical antitank mine: 50 cm
- d. operating temperature: -35EC to + 55EC
- e. storage temperature: -55EC to + 85EC
- f. weight unit with bag and batteries: 4.2 kg
- g. dimensions -
 - (1) unit packed in bag: 77 x 28 x 10 cm approx.
 - (2) search head diameter: 27 cm
 - (3) telescopic pole fully extended: 612 cm
 - (4) telescopic pole folded: 77 cm

7. **Battery Check**. Prior to operation, batteries will be checked as follows:

- a. observe the lamp below the ON/OFF switch on the control panel, and turn the switch ON. The lamp will flash once to indicate the batteries are charged and inserted correctly; and
- b. if no flash is observed, check the battery installation. If the installation is correct and no flash is observed, change the

batteries. If the lamp flashes continuously, the batteries are low and are to be replaced.

8. **Sensitivity Calibration**. The sensitivity of the detector is calibrated as follows:

- a. turn the SENSITIVITY knob counter-clockwise all the way;
- b. position the search head approximately 50 cm above the ground and turn the SENSITIVITY knob clockwise until a continuous tone is heard;
- set the desired volume of the tone with the LOUDNESS knob;
- d. turn the SENSITIVITY knob slowly counter-clockwise until the tone ceases;
- e. sweep the search head back and forth over the ground at a height of approximately 5 cm and at a rate of one metre per second. If ground conditions produce a disturbing tone, turn the SENSITIVITY knob further counter-clockwise until the tone ceases;
- f. check the sensitivity setting with the 5 cm test piece. With the search head at a minimum of one metre above the ground, move the test piece toward the centre of the search head (ensure there are no rings, watches or other metal objects to interfere with the check); and

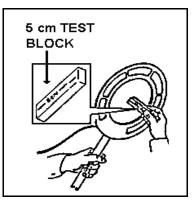


Fig 6B-3 Checking Sensitivity with the 5cm Test Piece

g. the AN-19/2 must emit a distinct tone for a distance of at least 5 cm between the metal pin in the test piece and the bottom of the search head, see Fig 6B-3.

9. **Operation**. Hold the search head approximately 5 cm above the ground and sweep it back and forth at a rate of one metre per second. Keep the cable taut and out of contact with the telescopic handle at all times.

10. The inner ring of the search head indicates the presence of metal objects by sounding a tone in the headphone. The quality and volume of the tone depends on the size, shape, position, and depth of the object in the ground or water. When an object has been detected, perform small sweeping motions over the object until it is exactly located. Normally, the tone will be loudest when the search head is directly centred above the object. If the object is very small, the tone will be louder when the object is closer to the inner ring than to the middle of the search head.

11. **Interference**. To prevent interference during searching, or while setting or adjusting sensitivity, ensure that the distance separating different search heads is not less than two metres. Also, using cable clamps ensure that the cable is not in contact with, nor wrapped around, the telescopic handle

12. **Operating in the Prone Position**. When the AN-19/2 is operated by someone lying on the ground, only the inner tube of the telescopic handle is used.

13. **Large Metal Objects**. When searching for large metal objects, detection and localizing can be accomplished faster if the sensitivity is lowered by turning the SENSITIVITY knob counter-clockwise.

14. **Care and Maintenance**. No preventive maintenance is required apart from cleaning and the simple function checks described above. All main components are interchangeable without recalibration.

- a. Clean all the AN-19/2 components with a clean, damp cloth and allow to dry.
- b. After use in salt water, rinse the search head, telescopic handle and search head cable assembly with fresh, clean water before cleaning.
- c. Do not use solvents or detergents. Do not lubricate the telescopic handle with anything but vaseline.

CHAPTER 7

SAFETY AND TRAINING

SECTION 1

GENERAL

REFERENCES

1. B-GL-304-003/TS-0A1, Operational Training, Volume 3, Part 1, Training Safety, covers all aspects of safety in training and shall be read in conjunction with this manual.

2. Safety requirements for the storage and the transportation of bulk explosives are in the following **CFTOs**:

- a. storage: C-09-153-001/TS-000; and
- b. transportation:
 - (1) A-LM-008-040/FP-000,
 - (2) A-LM-008-041/FP-001,
 - (3) A-LM-158-004/AG-000,
 - (4) A-LM-187-002/JS-001, and
 - (5) A-SJ-100-001/AS-000.

3. A check of Federal and Provincial regulations concerning the transportation of explosives shall also be completed prior to transporting explosives outside training areas.

4. Range Standing Orders will contain information pertaining to a specific range or training area.

7-1-1/7-1-2

SECTION 2

MINE AND BOOBY TRAP TRAINING

GENERAL

1. During mine and booby trap training, the safety precautions described in this chapter will be strictly observed. Minimum control measures are spelled out below.

2. All mine training will be supervised by a Engineer Officer 24, Senior NCO Fd Engr 041, Senior NCO Inf 031.14 (Adv Pnr) or by an instructor who has qualified on the Unit Land Mine Warfare Instructor Course (TSS CM/UF).

3. The instructor or the designated, qualified assistant will be responsible for supervising the drawing, accounting and returning of stores, and for checking equipment issued.

4. All items and components used in mine training will be placed under the strict control of a qualified instructor, who will maintain a control list detailing items and components issued and persons to whom they were issued.

5. The instructor or the qualified assistant will ensure that all mines, booby traps and components are safe for use.

6. Items and components will only be issued to other qualified instructors and all items will be returned and accounted for before the dismissal of the class or the end of training.

7. The principles stated in B-GL-304-003/TS-0A1 concerning the safe handling of grenades and other ammunition will be applied to the handling of mines and booby traps by the officer in charge of the exercise (OIC Exercise), by Range Safety Officers (RSO) and by instructors, in addition to the precautions detailed in this section. 8. For every exercise or demonstration with live mines, an adequate range area will be provided, marked and guarded as described in B-GL-304-003/TS-0A1.

9. The OIC Exercise will inspect all mines and accessories prior to use to ensure that live and inert items are not mixed together and that all fuzes have been removed.

10. For instruction in mining drills, inert or practice mines will be used. When laying or breaching drills are being taught, practice mines with audible or visible means of indicating actuation may not always be available. In such cases, if it is necessary to provide some form of indication of the mine itself or of an antidisturbance device, then this indication is to consist of a maximum of 200 mm of FBI, or a charge explosive training, C2, initiated by an adapter assembly beneath the mine. On no account are live detonators, detonating cord or other explosives to be used.

AUTHORIZED LIVE MINE EFFECTS DEMONSTRATIONS

11. Live mines, components or accessories may be used for demonstration only on an authorized range in the presence of an RSO.

- 12. The following safety precautions will be rigidly observed:
 - a. Live mines may be detonated to demonstrate their explosive force and the resulting effects. This must be authorized by Range Standing Orders, and
 - b. The standard mine fuze will not be used. The mine shall be initiated by the use of a priming charge for AT mines or a detonator for A pers mines.

AUTHORIZED LIVE MINE TRAINING

13. Live mines, components or accessories may be used for training only on an authorized range in the presence of an RSO.

Initiation devices will not be inserted into live mines during classroom style instructional periods.

14. Training with live mines is the culmination of a unit's mine warfare training cycle. It will only be undertaken when the Commanding Officer is satisfied with the level of individual, collective and supervisory skills achieved with inert/drill/practice mines. The following activities are authorized during live mine training: arming, laying, neutralizing and disarming live antitank mines in the Canadian inventory, subject to the procedures described in Chapter 5.

15. Live mine training will not be conducted with A pers mines.

16. During live mine training, the following safety precautions will be rigidly observed:

- a. An assistant RSO shall be in each area where live mines are being handled and/or with each party handling live mines.
- b. The ratio of safety staff to students for laying drills will be as per party commander to laying party for the various laying drills (i.e. 1 instructor per section for row pattern, protective minefields).
- c. The ratio of safety staff to students for the arming of live mines will be one instructor per student;
- d. Each live mine laid will be well marked so that there is no doubt as to its exact location;
- e. Live mines will be laid within a well defined, ie, fenced area. Live minefields will not be left unattended.
- f. All mines, components and accessories shall be accounted for following mine training.

- g. Mines, components and accessories shall be cleared and adequately packed for transport by the drawing unit prior to return to the ammunition officer's control;
- h. The laying of an extensive live AT minefield will not be undertaken. A maximum of thirty (30) live AT mines may be used in any given minefield;
- j. Mechanical laying of live mines shall not be undertaken; and
- k. Live mines will not be laid during hours of darkness.

17. The OPI for live land mine training is the Director Military Engineers (D Mil E).

18. Requests for exemptions from this policy are to be sent through the chain of command to D Mil E. D Mil E, assisted as required by supporting offices of concerned interest (OCIs), will be responsible for approving exemptions on a case-by-case basis.

19. **Reports**. Copies of pertinent portions of unit post exercise reports on exercises involving live mine training shall be forwarded to NDHQ/D Mil E.

INERT MINES

20. Inert mines and training items will not be placed or stored with live mines and accessories. All inert mines will be clearly marked as such. In addition:

- a. inert mines and training items will not be used where a live demonstration is being carried out; and
- b. for training in laying, detecting, lifting, breaching and clearing drills, only inert, drill or practice mines will be used.

BOOBY TRAP TRAINING

21. All booby trap training, including the drawing, inspection, use and return of stores will be supervised by a Engineer Officer 24, Senior NCO Fd Engr 041 or a Senior NCO Inf 031.14 (Adv Pnr).

22. Personnel qualified Unit Land Mine Warfare Instructor (TSS CM/UF) are qualified to set up simple "non-explosive" booby traps for the purpose of instructing searching and recording procedures only.

23. The training for setting out and clearing booby traps is conducted for engineer and assault pioneers only.

24. During training the following safety precautions shall be rigidly observed:

- a. Explosive charges or live detonators will not be used in booby trap training;
- b. Base couplings or snouts may be used with a 200mm length of Fuze, Blasting, Instantaneous, (FBI) or Charge, Explosive, Training C2, to simulate a charge. Strict control in size of fuse and placement of mechanism must be exercised to prevent accidents; and
- c. Training charges incorporating live explosives may be used for demonstration purposes by instructors provided that the procedure is closely controlled;
 - (1) charges shall not be attached to the booby trap, which may become a missile,
 - (2) sites of charges will be marked to permit neutralizing if required,
 - (3) danger areas will be marked or recorded and guarded to prohibit entry,

- (4) precautions will be taken to eliminate fire hazards,
- (5) charges shall be limited to the authorized quantity as specified in Range Standing Orders, and
- (6) a detailed record will be maintained of each charge, its location and size, and successful/unsuccessful detonation.

25. Electric bell or buzzer alarms may be substituted to represent the charge in electrical booby trap circuits.

26. The testing of firing devices, in particular, spring-loaded mechanisms, shall be carefully supervised to ensure that personnel are not injured or endangered by careless handling of devices.

SECTION 3

SAFETY IN OPERATIONS

GENERAL

1. Safety in operations is outlined in Chapters 2, 5 and 6. Observation of the following rules in dealing with minefields will prevent casualties. All ranks shall be familiar with the following:

- a. always be alert when moving about the country and treat with suspicion any object, natural or artificial, which appears out of place in its surroundings;
- expect constant changes in the opposing forces's mining techniques;
- c. if you suspect that an area may be mined don't move over the most obvious and easiest ground without searching it first;
- d. mark and report all mines and booby traps that are found;
- e. mark and report all lanes and areas which have been cleared;
- f. in the event of a casualty, follow the correct drill; and
- g. remember that any mistake made may kill your comrades as well as yourself.

MINING

2. The importance of command and control at all levels during any mining operation shall be continually stressed. All mines must be treated as dangerous, as they may be detonated in any of the following ways:

- a. by all vehicles including motorcycles;
- b. by animals;
- c. by personnel walking, running or riding a bicycle; or
- d. by careless handling of the mine.

3. Mines may detonate if dropped after they have been armed. They are therefore armed only after they have been placed in the ground except in mechanical mining drills.

- 4. The following precautions must be observed during mining:
 - a. personnel on vehicles are not to enter the completed part of the minefield. To ensure this, the various parties must work in echelon with the party nearest to the enemy being furthest ahead. Therefore the fencing party must always be ahead of the party laying the outermost row;
 - b. by night, if soldiers have to withdraw from the minefield before it is completed, they shall do so by moving forward along the pickets marking their row until they reach a safe lane or to the side perimeter fence. If they follow the perimeter fence they shall keep to the outside. Only in an emergency, such as an unexpected attack, can withdrawal directly to the rear be permitted;
 - c. no movement in the reverse direction to laying shall be permitted. If an officer or NCO needs to contact the tail of the laying party, the officer or NCO must wait until they reach his or her location;
 - d. special care is required to ensure that mine vehicles do not enter or leave across a completed part of the minefield;
 - e. to prevent possible casualties, parties laying mines shall be dispersed as far as possible without interfering with the efficiency of the operation;

- f. each mine and fuze shall be inspected before laying. Any showing signs of damage must be disposed of; and
- g. action to be taken when soldiers find themselves in a mined area is described in Chapter 6. Before laying a minefield, the OIC shall ensure all soldiers thoroughly understand the action to be taken in such circumstances.

5. The following special safety precautions are to be taken when laying A pers mines during operations:

- a. use the minimum number of personnel;
- b. one soldier alone is to be responsible for laying one mine;
- c. handle all mines, fuzes and firing devices with care at all times; and
- d. do not withdraw safety devices until ordered.

COLOUR CODING

6. Mines are painted to retard rusting of exposed metal parts, to aid in identification of type and to indicate type of filler, such as high or low explosive, or toxic:

- a. HE mines and related items are painted olive drab with yellow markings. Some items may also have yellow stripes or bands, or have their closing plugs painted yellow;
- b. practice mines are painted gold with black markings; and
- c. inert mines are painted gold with black markings, including the word "INERT" in black;
- d. **Caution.** Mines which have been colour-coded and marked according to the older system (white markings on light blue) will be on hand for several years. Therefore, special care

shall be taken to assure that all ammunition whether colour-coded according to the older or the newer system, is properly and fully identified.

CARE, HANDLING AND PRESERVATION OF MINES

7. Mines shall be handled with care at all times. The explosive elements in fuzes, primers, detonators and boosters are particularly sensitive to mechanical shock, friction, static electricity and high temperature. Boxes and crates containing mines will not be dropped, dragged, tumbled, walked on or struck. The boxes shalld be electrically grounded whenever practicable and protected from high temperature.

8. Mines are packed to withstand conditions ordinarily encountered in the field. Items that are not water-proofed are packed in moisture resistant containers. Care shall be taken to keep containers and packing boxes from becoming broken or damaged. All broken containers and packing boxes shall be repaired immediately and careful attention given to the transfer of all markings to the new parts. Such containers shall not be opened until the mines are about to be used or prepared for use. Items unpacked but not used shall be repacked and the containers sealed. Such items shall be used first in subsequent operations in order that stocks of opened containers and packing boxes may be kept to a minimum.

ANNEX A

MINIMUM DANGER AREAS FOR CANADIAN INVENTORY MINES

Mine	Туре	Danger Area Radius
C3A1/A2	A pers	100 metres
M16A2	A pers	500 metres
M18A1	A pers	See Template Appendix 2
C14	AT	See Template Appendix 1
M21	AT	1000 metres
DM21	AT	1000 metres
FFV 028 SN	AT	1000 metres

Fig 7A-1 Canadian Mines Safety Distances

Appendices:

- 1. Danger Template C14 Off-Route Mine
- 2. Danger Template M18A1 Claymore Mine

APPENDIX 1

DANGER TEMPLATE C14 OFF-ROUTE MINE

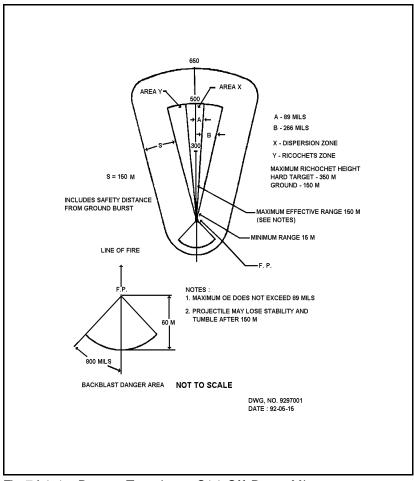
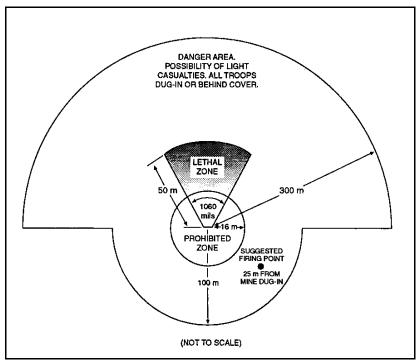


Fig 7A1-1 Danger Template - C14 Off-Route Mine

APPENDIX 2



DANGER TEMPLATE M18A1 CLAYMORE MINE

Fig 7A2-1 Danger Template - M18A1 Claymore Mine