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School of Infantry
Training Command
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MM1311
12 Mar 04

STUDENT OUTLINE

60MM MORTAR AMMUNITION

TERMINAL LEARNING OBJECTIVE

(1) Given a fire command, mortar ammunition, and a fuse wrench, prepare mortar ammunition for firing by preparing the round in accordance with the fire command. (41TR.03.01)

ENABLING LEARNING OBJECTIVES

(1) Given a list of choices, identify the characteristics of a 60mm mortar round in accordance with TM 08206A-10/1A (41TR.03.01a)

(2) Given a list of choices and a diagram of a 60mm mortar round, identify the nomenclature of a 60mm mortar round in accordance with TM 08206A-10/1A. (41TR.03.01b)

(3) Given a list of choices and a mission, select a mortar round by choosing the round most appropriate for the mission. (41TR.03.01c)

(4) Given a 60mm mortar round, inspect a 60mm mortar round in accordance with FM 23-90. (41TR.03.01d)

(5) Given a 60mm mortar round, a fire command, and required tools, set a 60mm mortar round fuse in accordance with the fire command. (41TR.03.01e)

(6) Given a mortar round, a fire command, and required tools, set a 60mm mortar round charge in accordance with the fire command. (41TR.03.01f)

1. **Mortar Ammunition**. You will discover, as we progress through this period of instruction, that the 60mm mortar ammunition is almost identical to the 81mm mortar ammunition except for its size. The common factors and components are listed below.

a. Color code/Markings. (Figure 1.)

(1) Color code. The color code is the body color of the cartridge; it indicates what type of filler is contained in the body. Each type of round can be identified by its color and markings.

(2) Markings. The markings on the body of the cartridge indicate the **caliber** (81mm or 60mm), the **filler** (High Explosive/Smoke, RP/Illumination), **cartridge model** (M889, M888…etc.), and the **lot Number**.

COLOR	MARKINGS	TYPE	USE
Olive Drab	Yellow Markings	High Explosive	Fragmentation and Blast.
Light Green	Red Markings	White Phosphorous	Screening, signaling, incendiary
Light Green with a brown band. 81mm only.	Black Markings	Red Phosphorous	Screening, signaling, incendiary. Does not prevent the use of thermal.
White	Black Markings	Illumination	Battlefield illumination, Marking targets, and signaling.
Blue	White Markings	Training Practice	Training

FIGURE 1. Color code/Markings

b. Components (the only exception is the M69 training cartridge, which does not have a fuze. It has a solid body)

(1) **Fuze.** The fuze activates the filler and causes the cartridge to function at the desired time or on impact.

(2) **Body.** The body acts as a container for the filler. In the case of the high explosive cartridge it is also designed to break up into fragments when the cartridge detonates.

(3) **Fin Assembly.** The fin assembly acts as a stabilizer, much the same as the fletching on the back of an arrow. The fin assembly also provides a housing for the primer, the ignition cartridge (Charge zero), and the external propellants.

(a) Primer and ignition cartridge. The primer and ignition cartridge provide the initial flash that will either propel the cartridge out of the cannon or ignite the propellant charges on the fin assembly to fire the cartridge farther.

c. Gas check system. The gas check system allows a rapid build up of pressure in the breach area of the cannon to propel the cartridge out of the barrel. Since the round is slightly smaller than the barrel, there must be a means of preventing the gas from escaping around the cartridge.

(1) Gas check rings are a series of raised rings and grooves in the side of the body that will slow the expanding gasses as they escape from around the cartridge. This causes the breach pressure to increase and forces the cartridge out of the cannon.

(2) **Obturating band.** The obturating band functions like a piston ring in a combustion engine. As the heat and gasses make contact with the crimped obturating band the crimp is melted. The force of the round being pushed forward forces the obturating band towards the tail fin until it makes contact with the inside of the barrel and forms a seal. This seal causes the pressure to build behind the obturating band and forces the cartridge out of the barrel.

2. **60mm Ammunition**.

a. Classification/types of ammunition. There are four classifications of 60mm ammunition, high explosive, smoke, illumination and training practice. Based upon use, the principal classifications of training and service ammunition for the M224 mortar are as follows:

(1) High explosive (HE). Used against personnel and light material targets.

(a) M49A4 Cartridge (Figure 2.)

1. Type/use: High explosive/fragmentation and blast.

2. Identification: Olive drab w/Yellow markings

3. Components: Fuze-PD, M525 Series Propelling Charge-M181

4. Max. Range: 1930 Meters

5. Limitations: Short rounds may occur when fired in temperatures below 0 degrees Fahrenheit.

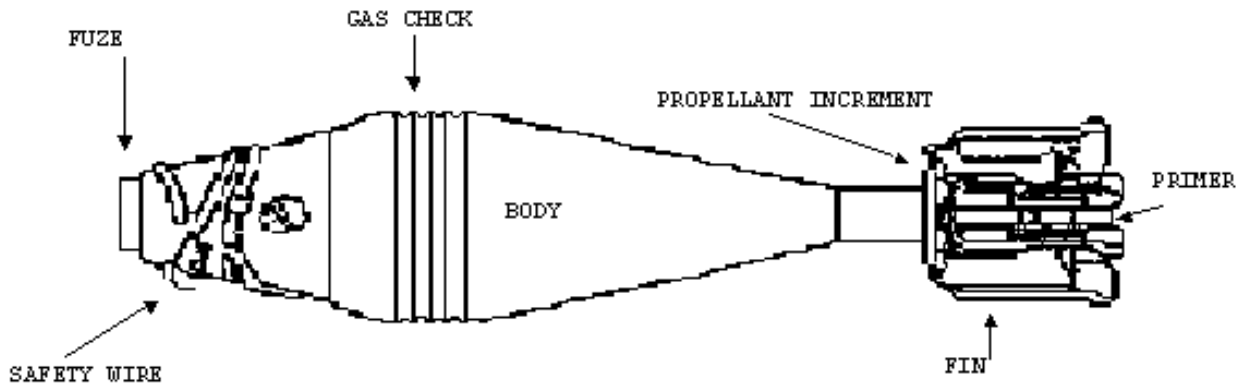

FIGURE 2. M49A4

(b) M888 Cartridge (Figure 3.)

1. Type/Use: High explosive/fragmentation and blast

2. Identification: Olive drab w/yellow markings

3. Components: Fuze-Point Detonating (PD), M935 Propelling Charge-M204

4. Max. Range: 3490 Meters

5. Limitations: Cartridge cannot be fired above charge 1 in hand-held mode. Cartridge must be fired a minimum distance of 300 meters during training.

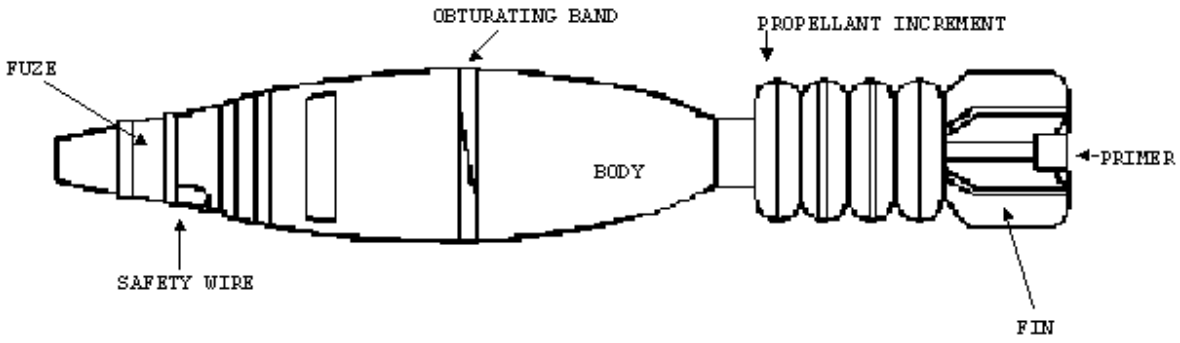

FIGURE 3. M888

(c) M720 Cartridge (Figure 4.)

1. Type/Use: High explosive/fragmentation and blast.

2. Identification: Olive drab w/yellow markings

3. Components: Fuze-Multi-option, M734 Propelling Charge- 204.

4. Max. Range: 3490 Meters

5. Limitations: Cartridge cannot be fired above charge 1 in hand-held mode. Cartridge must be fired a minimum distance of 300 meters during training.

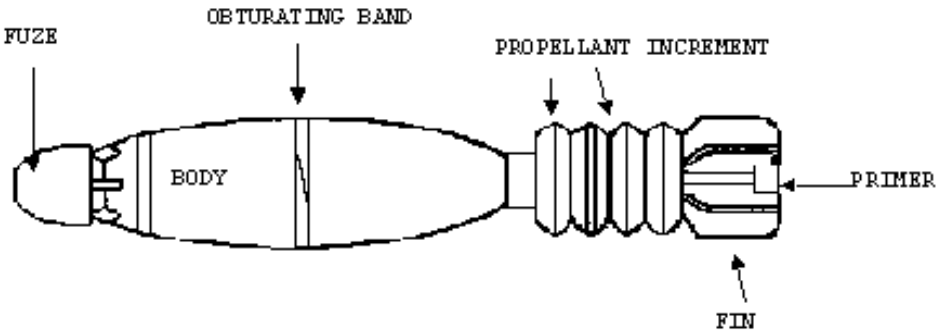

FIGURE 4. M720

(2) White phosphorus (WP). Used as a screening, signaling, casualty producing, or incendiary.

(a) M302A1 Cartridge (Figure 5.)

1. Type/use: Smoke (white phosphorus)/ screening and spotting.

2. Identification: Light green with light red markings.

3. Components: Fuze-PD, M527 Series Propelling Charge-M181.

4. Max. Range: 1630 Meters.

5. Limitations: Short rounds may occur when fired in below 0 degrees Fahrenheit temperatures. White phosphorous should always be stored nose up.

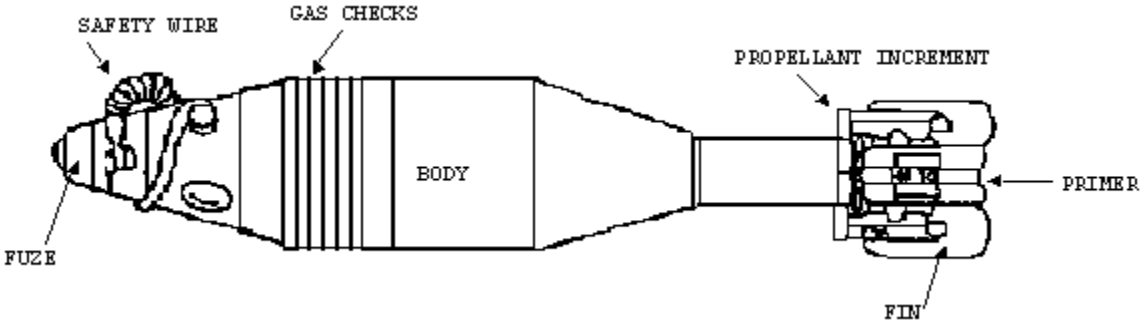

FIGURE 5. M302A1

(b) M722 Cartridge (Figure 6.)

1. Type/use: Smoke (WP)/signaling and screening.

2. Identification: Light green with red markings.

3. Components: Fuze-PD, M745 Propelling Charge-M204.

4. Max. Range: 3490 Meters.

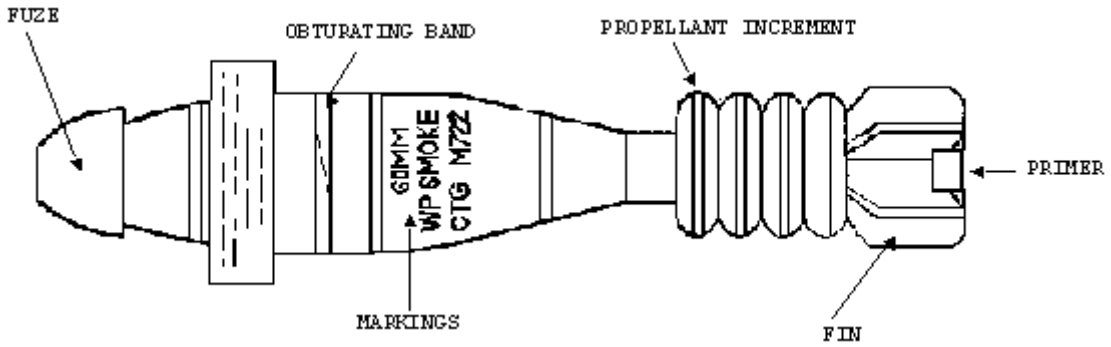

FIGURE 6. M722

(3) Illumination (ILLUM). Used in night missions requiring illumination for assistance in observation. Illumination may also be used to mark targets or to signal friendly forces.

(a) M83 Series Cartridge (Figure 7.)

1. Type/use: Illumination/battlefield illum, and marking targets.

2. Identification: White w/ black markings

3. Components: Fuze-Time, M65 Series Propelling charge-M182

4. Max. Range: 931 Meters

5. Limitations: Cartridge cannot be fired below charge 2.

6. Remarks: Cartridge contains an illuminating candle/parachute assembly. Candles provide about 250,000 candlepower illumination for at least 30 seconds.

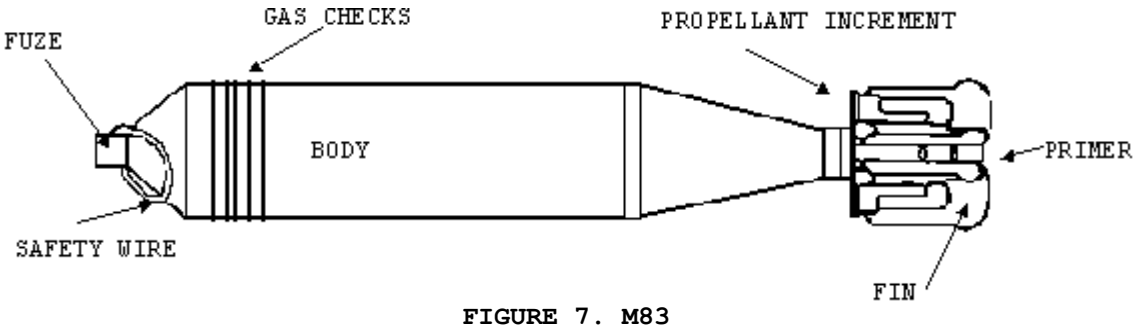

FIGURE 7. M83

(b) M721 Cartridge (Figure 8.)

1. Type/use: Illumination/ battlefield illum, and marking targets.

2. Identification: White w/ black markings

3. Components: Fuze-Mechanical Time Super quick (MTSQ): M776 Propelling charge: M204.

4. Max. Range: 3490 Meters

5. Limitations: Cartridge cannot be fired below charge 2.

6. Remarks: Cartridge provides about 325,000 candlepower illumination for at least 40 seconds.

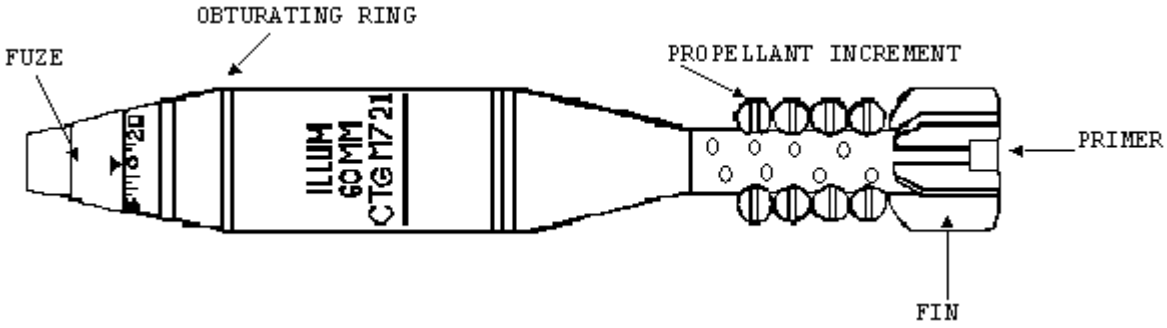

FIGURE 8. M721

(4) Training Practice (TP). Used for training in limited areas.

(a) M69 Cartridge (Figure 9.)

1. Type/use: Training

2. Identification: Black, blue or bronze w/ white markings

3. Components: Fuze-none Propelling charge-Ignition cartridge only.

4. Remarks: Cartridge has an inert body and can be reused. Replacement of the ignition cartridge is required for reuse.

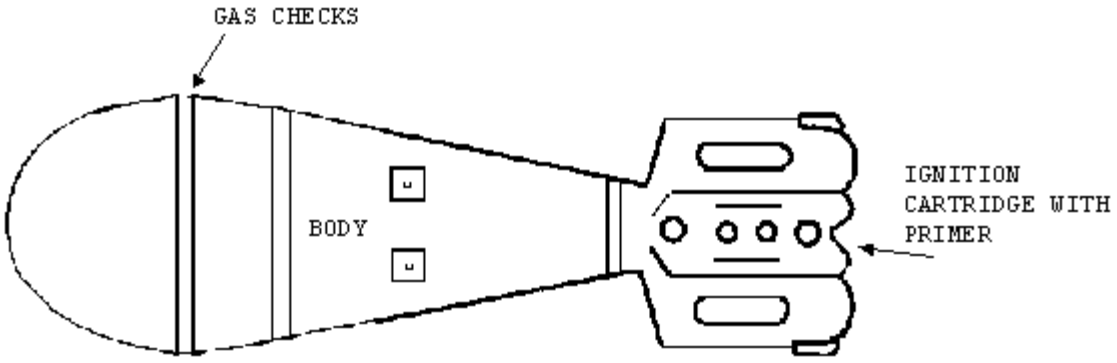

FIGURE 9. M69

(b) M50A3 Cartridge (Figure 10.)

1. Type/use: Training and practice (TP)

2. Identification: Blue w/ white markings.

3. Components: Fuze-PD, M525 Series Propelling Charge-M181.

4. Max. Range: 1930 Meters.

5. Limitations: Short rounds may occur when fired in below 0 degrees Fahrenheit temperatures.

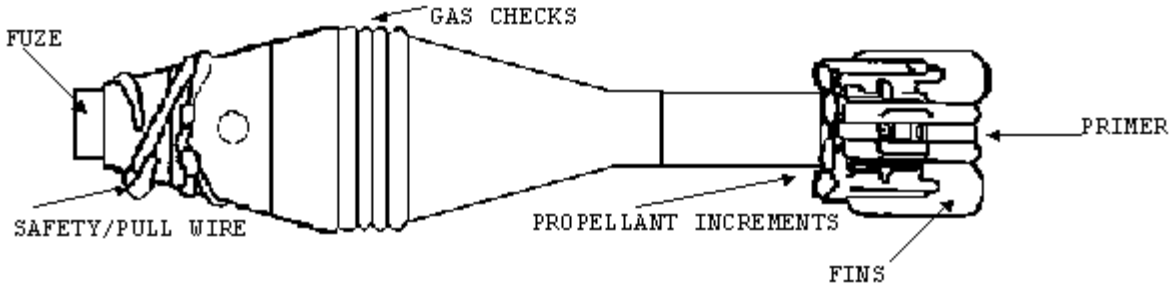

FIGURE 10. M50A3

(c) M766 Cartridge (Figure 11.)

1. Type/use: Training and practice (TP)

2. Identification: Blue w/ white markings and a brown band.

3. Components: Fuze, PD, Practice, and M779.

4. Max. Range: 538 meters.

5. Remarks: A pyrotechnic charge in the fuze produces a flash, an audible sound and a cloud of smoke. The body is hollow and may be recovered for rebuilding and reuse. The range can be reduced by removing the increment plugs from the body to allow gasses to vent through the body. Cartridge contains a spotting charge.

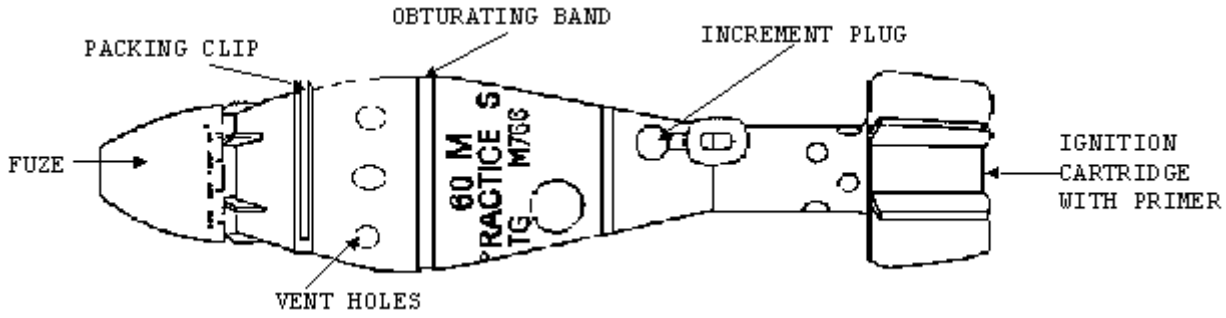

FIGURE 11. M766

3. **Mortar Fuzes**. The fuzes used on 60mm mortar ammunition are made to cause the fired round to function at the desired time or point. The fuzes used with 60mm mortar ammunition are classified as point detonating, time, and multi-option.

a. Point Detonating Fuzes

(1) Point Detonating, M525 and M527 (Figure 12.)

(a) Function: Impact

(b) Setting: None (super quick only)

(c) Remarks: Fuzes have bore-riding pins and safety wires. **DO NOT FIRE THE CARTRIDGE IF YOU HEAR A BUZZING SOUND AFTER REMOVING THE SAFETY PIN! DO NOT ATTEMPT TO FORCE THE SAFETY PIN INTO THE FUZE. PLACE THE ROUND IN A MISFIRE PIT AND NOTIFY EOD.**

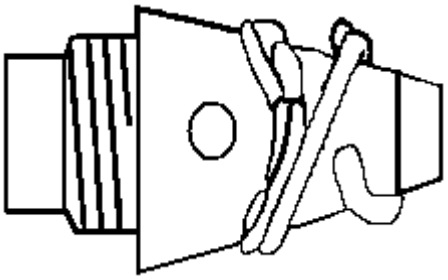

FIGURE 12. M525/M527 PD

(2) Point Detonating, M935/M936 Fuzes (Figure 13.)

(a) Function: Impact

(b) Settings: Super quick or 0.05 second delay action.

(c) Remarks: Fuze has a safety wire.

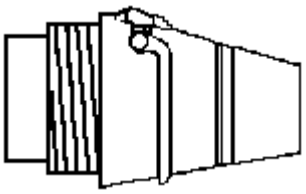

FIGURE 13. M935/M936 PD

(3) Point Detonating, Practice M745 (Figure 14.)

(a) Function: Impact

(b) Settings: Dummy Multi-option, PRX/NSB/IMP/DLY.

(c) Remarks: Fuze has a smoke charge and a safety-packing clip. Regardless of the setting on the fuze the round will function only as an impact fuze.

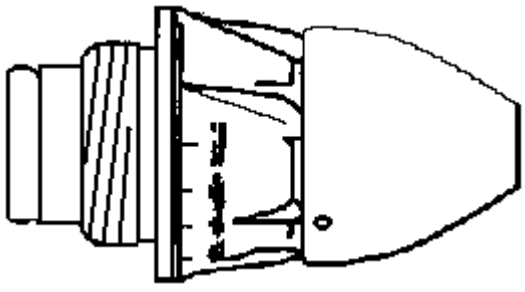

FIGURE 14. M745 PD

b. Time Detonating Fuzes

(1) Time, M65 Series Fuze. (Figure 15.)

(a) Function: Air burst

(b) Setting: None (fixed time)

(c) Remarks: Fuze has a time train expelling charge and safety wire.

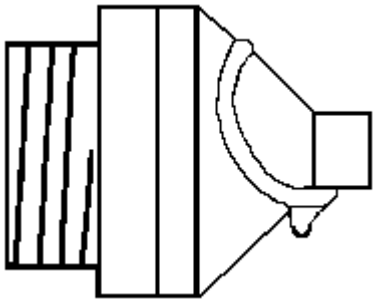

FIGURE 15. M65 TIME SERIES

(2) Mechanical time superquick, M776 Fuze (Figure 16.)

(a) Function: Airburst/Impact

(b) Settings: 6 to 52 seconds

(c) Remarks: Fuze has a mechanical arming/timing device, expulsion charge, and safety wire/pin. The round will function on impact if the timing device fails.

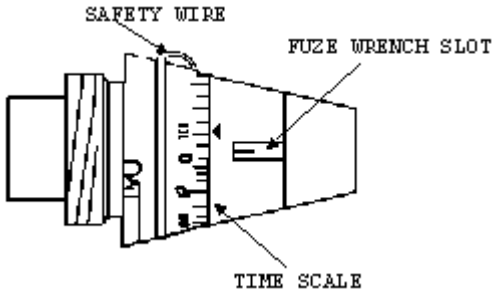

FIGURE 16. MTSQ M776

c. Multi-Option Fuze

(1) Multi-Option, M734 Fuze. (Figure 17.)

(a) Function: Proximity/impact.

(b) Setting: Proximity, near surface burst, impact, or 0.05-second delay action.

(c) Remarks: Fuze can be set by hand.

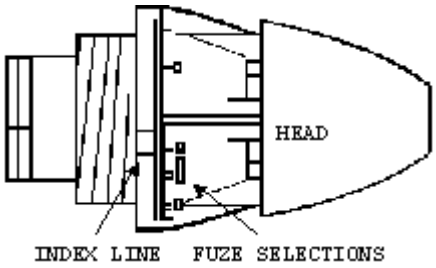

FIGURE 17. M734

4. **Care and handling**.

a. Ammunition is made and packed to withstand all conditions ordinarily encountered in the field. However, since explosives are affected by moisture and high temperature, they must be protected.

b. Before-firing checks include the following:

(1) Ammunition should be free of moisture, rust, and dirt.

(2) The fin and fuze assembly must be checked for tightness, damage and proper alignment with the body.

(3) Charges must be kept dry.

(4) Extra increments are removed if the round is to be fired with less than full charge. Extra increments must be protected from moisture and sparks.

(5) With the exception of a few unused increments (within the same ammunition lot number) as replacements for defective increments, excess increments should be removed from the mortar position.

(6) The primer cartridge is checked for damage and dampness.

c. Complete cartridges are always handled with care. The explosive elements in primer and fuzes are sensitive to shock and high temperature. Fuzes are not disassembled.

d. The moisture resistant seal of the container is broken when the ammunition is to be used. When a large number of cartridges are needed for a mission, they may be removed from the containers and prepared. Propelling charges are covered or protected from dampness or heat.

e. The ammunition is protected from mud, sand, dirt, and water. If it gets wet or dirty, it must be wiped off at once. The powder increments, mainly, should not be exposed to direct sunlight. More uniform firing is obtained if ammunition is kept at the same temperature.

f. The pull wire and safety wire are removed from the fuze just before firing. When cartridges have been prepared for firing, but are not used, all powder increments and safety wires are replaced. The cartridges are returned to their original containers. These cartridges are used first in subsequent fire missions so that once-opened stocks can be kept at a minimum.

g. Crated ammunition should be stacked with ventilation spaces between the crates to allow air to flow throughout the stack. Properly stacking the ammunition will help maintain a uniform temperature of the cartridge and the propellants.

h. Ammunition should be stored under cover. If it is necessary to leave the ammunition uncovered, it should be raised on dunnage at least 6 inches above the ground. The stack is covered with a double thickness of tarpaulin. Trenches are dug to prevent water from flowing under the stack. WP cartridges are stored with the fuze end up. Since phosphorus liquefies at about 100 degrees Fahrenheit, the ammunition is protected against an uneven hardening of the filler. An air cavity can form on one side of a cartridge and unbalance it causing instability in flight.

5. **Unused propelling charge increments**.

a. Excess increments should be destroyed daily.

b. Destroy increments by burning.

(1) Burning increments must be at least 100 meters from the nearest mortar position, parked vehicles, ammunition stacks or other flammable materials.

(a) Burning increments make a very large signature. The selected burn area should be remote to prevent the enemy from locating your mortar position.

(2) The burn area shall be cleared of all dead grass or brush within 30 meters.

(a) Place increments on the ground. Form a row 4 to 6 inches wide and as long necessary. Do not pile increments more than 1 to 2 inches high.

(b) End train of increments with a row of single increments, followed by at least a meter of inert material such as dry grass or dead leaves. The inert material will be placed so that the fire will burn against the wind.

(c) Sound off “Burning increments”.

(d) Ignite dry grass or leaves.

(e) Quickly move away from the increments. Move away at least 30 meters.

(f) Allow ensuing fire to self-extinguish. DO NOT TRY TO STOMP OUT THE FIRE!

(g) Check the burn area to assure that all the embers are extinguished.

REFERENCES. TM 08206-10/1A Operator’s Manual for Lightweight Company Mortar, 60mm M224 pages 00024 00-1 through 00024 00-18 and FM 23-90 Mortars pages 3-18 through 3-25.

EXAM ID: MM1311P

EXAM TITLE: 60mm Mortar Ammunition Performance Examination

TLO/ELO: 41TR.03.01

STUDENT INSTRUCTIONS:

1. You are an ammunition man and have received a fire command requiring you to prepare a round of mortar ammunition.

2. There is no time limit for this task.

3. To achieve mastery, you must perform each of the performance steps correctly and prepare the round in accordance with the fire command.

PERFORMANCE STEPS AND/OR PERFORMANCE STANDARDS:

Performance Steps	Master	Non-Master	Remarks
1. Remove a round from the container.			
2. Examine the round for burrs, deformities, cleanliness and serviceability.			
3. Using a fuse wrench, set the fuse in accordance with the fire command by turning the fuse setter ring in a clockwise direction until the time scale is aligned with the index line.			
4. Reduce the charge in accordance with the fire command by removing increments or propellants.			
5. Remove the safety wire.			