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MM1411
03 Jun 04

STUDENT OUTLINE

81MM 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 and a mission, select a mortar round by choosing the round most appropriate for the mission. (41TR.03.01c)

(2) Given a list of choices, identify the characteristics of an 81mm mortar round in accordance with FM 23-90. (41TR.03.01g)

(3) Given a list of choices and a diagram of a 81mm mortar round, identify the nomenclature of a 81mm mortar round in accordance with TM 09922A-10/1. (41TR.03.01h)

(4) Given an 81mm mortar round, inspect an 81 mm mortar round in accordance with FM 23-90. (41TR.03.01i)

(5) Given an 81mm mortar round, a fire command, and required tools, set an 81mm mortar round fuse in accordance with the fire command. (41TR.03.01j)

(6) Given an 81mm mortar round, a fire command, and required tools, set an 81mm mortar round charge in accordance with the fire command. (41TR.03.01k)

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.

(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

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) **Obturator band.** The obturator band functions like a piston ring in a combustion engine. As the heat and gasses make contact with the crimped obturator band the crimp is melted. The force of the round being pushed forward forces the obturator 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 obturator band and forces the cartridge out of the barrel.

2. 81mm ammunition

a. TYPES OF AMMUNITION: There are four types of ammunition used with the 81mm mortar:

(1) High Explosive

a. The M821 HE cartridge is a British-made cartridge fitted with the US M734 multi-option fuze. It is constructed from ductile cast iron and contains about 1.5 pounds of cyclonite (RDX)/trinitrotoluene (TNT) composition explosive. The aluminum tail assembly has six integral fins equally spaced around the rear, which stabilize the round in flight. The cartridge is painted olive drab with yellow markings. Each cartridge weighs about 10 pounds and is provided with the M223 propelling charge, consisting of four horseshoe shaped increments fitted around the tail.

1. Type/use: High explosive/Fragmentation and blast.
2. Identification: Olive drab with yellow markings.
3. Components: Fuze-M734 Multi-option, Propelling charge- M223
4. Max. Range: **5608** meters (3.48 miles)
5. Effective burst area **40 meters diameter**.

b. The M889 HE cartridge is of the same construction as the M821 cartridge in every detail except the fuze which is the M935.

1. Type/use: High explosive/Fragmentation and blast.
2. Identification: Olive drab with yellow markings.
3. Components: Vary by cartridge; fuzes may be P.D.-M524, M526, M567 or proximity-M532.
4. Max. Range: 4500 meters (2.79 miles)
5. Effective burst area **40 meters diameter**.

c. The M374A3 HE cartridge is constructed from pearlitic malleable cast iron and contains about 2.10 pounds of composition B explosive. It uses the M205 propelling charge, consisting of four horseshoe-shaped increments fitted around the tail. The cartridge is painted olive drab with yellow markings and weighs about 9.05 pounds.

1. Type/use: High explosive/Fragmentation and blast.
2. Identification: Olive drab with yellow markings.
3. Components: Fuze- point detonating M58 or M524. Propellant M205.
4. Max. Range: 4800 meters (2.98 miles)
5. Effective burst area 34 meters diameter.

(2) Smoke (Phosphorus)

(a) M375, M375A1 and M375A2 White phosphorus

1. Type and use: Smoke with phosphorous/Spotting and incendiary
2. Identification: Light green with red markings and a yellow band.
3. Components: Fuze-Point det. M524 or M526series. Propellant charge M90 on the M375. M90A1 on the M375A1/A2
4. Max. Range 4500 Meters (2.79 miles)

b. M819 Red phosphorus. The M819 cartridge has a cylindrical body and contains red phosphorus that produces white smoke on contact with air.

1. Type/use: Smoke (red Phosphorous)
2. Identification: Light green with black markings and a brown band
3. Components: Fuze, mechanical time superquick, M772. Propelling charge, M218
4. Max. Range: 5100 meters (3.162 miles)

(3) Illumination. White with black markings

a. M853A1 cartridge has a cylindrical body that contains an illuminating candle and parachute assembly. It provides illumination for about **60 seconds** with **600,000 candlepower** illumination.

1 Type/use: Illumination/battlefield illumination, marking for air support.

2 Identification: White with black markings

3 Components: Fuze, mechanical time superquick, M772, or M768 time fuze.

4 Max. Range. 5100 meters (3.162 miles)

(4) Training Ammunition

(a) M879 Practice Cartridge. The M879 practice cartridge is a full range (5600 meter) training cartridge. The M879 contains inert filler.

1 Type/use: Training/Full range target practice.

2 Identification: Blue with white markings.

3 Components: Fuze, point det. M751. Propelling charge, M220.

4 Maximum Range: 5600 meters (3.47 miles)

3. Types of fuzes.

(a) The fuzes used on 81mm mortar ammunition are made to cause the fired round to function at the desired time or point. The fuzes used with 81mm

mortar ammunition are classified as point detonating, time, proximity and multi-option.

(b) Point detonating (PD) fuze. PD fuzes are designed to function on impact with any object, or .05 seconds after impact when set on the delay setting.

(1) M935 Point detonating.

a. Settings: Super quick/Delay.

b. Used with: M889 HE.

(b) Time fuzes. Time fuzes are designed to cause the cartridge to function after a set time has elapsed. The time setting is adjusted by aligning the time scale to the index line on the fuze.

(1) M772 Mechanical time superquick.

a. Settings: 4-55 seconds (half second graduations on the time scale).

b. Used with: M819 smoke (RP) and M853A1 Illumination.

c. Functions: Airburst/Impact. The round will function on impact if the time setting has not elapsed.

(2) M84 and M84A1 Mechanical time. An M25 fuze setter is necessary to set the fuze.

a. Settings: M84, 0-25 seconds. M84A1, 0-50 seconds

b. Used with: the M84 is used with the M301 and the M301A2 illumination. The M84A1 is used with the M301A3 illumination.

c. Functions: Airburst or when the time has elapsed.

(c) Multi-option fuze. Are designed to offer a variety of functions in one fuze without having to calculate time settings.

(1) M734 Multi-option

a. Settings: Proximity (PRX), Near Surface Burst (NSB), Impact (IMP), or Delay (DLY).

b. Used with: M821 HE

c. Function: PRX (burst height is 3-13 feet above impact area), NSB (burst height is 0-3 feet above impact area), IMP (on contact), DLY (.05second after impact)

(d) Proximity fuze.

(1) M532 Proximity Fuze

a. Settings: Prox/Super quick.

b. Used with: M374A1/A2/A3

c. Functions: Proximity (use as shipped)/Impact (Rotate nose of the fuze 1/3 of a turn in either direction). ONCE THE FUZE HAS BEEN SET TO FUNCTION AS POINT DETONATE, IT WILL NOT FUNCTION AS A PROXIMITY FUZE. DO NOT ATTEMPT TO RESET THE FUZE.

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. Red phosphorus cartridges are stored the same as HE cartridges.

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:

FM 23-90 Mortars; pages 5-18 through 5-20
Operator's Manual for Mortar, 81mm M252 TM 09922A-10/1; pages 4-0 through 4-54.

EXAM ID: MM1411P

EXAM TITLE: 81mm 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.			