CARTRIDGES, 40-MM:
HE, M386, M441,
AND M397

DEPARTMENTS OF THE ARMY AND THE NAVY
OCTOBER 1969
# Operator and Organizational Maintenance Manual

## Cartridges, 40-Mm: HE, M386, M441, and M397

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### Appendix. References

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CHAPTER 1
INTRODUCTION

Section 1. GENERAL

1–1. Scope

a. These instructions are published for the use of the personnel to whom the 40-mm cartridges M386, M441, and M397 are issued. They contain information on the use and care of the cartridges as well as a description of their components. These instructions apply only to the cited cartridges and related equipment.

b. The reporting of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications) and forwarded direct to Commanding Officer, Picatinny Arsenal, ATTN: SMUPA-DB7, Dover, N.J. 07801. Marine Corps units will report by letter to the Commandant of the Marine Corps (Code CSV).

c. Malfunctions Involving Ammunition or Explosives.

(1) A malfunction is defined as the failure of an ammunition item to function in accordance with the expected performance when fired, launched, or when explosive components function during a nonfunctional test. A critical malfunction is one which may cause a hazard in the circumstances described above. For purposes of clarity, malfunctions do not include accidents and incidents resulting from negligence, malpractice, or implications in other situations such as vehicle accidents, fires, etc. However, malfunctions do include abnormal or premature function of explosive ammunition items during normal handling, maintenance, storage, transportation, and tactical deployment.

(2) If a critical malfunction involving this materiel occurs, firing of the affected lot will be halted immediately. The commanding officer or senior individual in charge of the unit will immediately contact the officer under whose supervision the ammunition for the unit involved is maintained or issued, and will report all available facts concerning the malfunction.

(3) Ammunition malfunction reports from Army activities will be reported as prescribed in AR 700–1300–8.

(4) Ammunition malfunction reports from Marine Corps activities will be reported as prescribed in T7–8010–15/1B.

d. Report of Damaged or Improper Shipment.
All shipments of these cartridges received in damaged or otherwise unsatisfactory condition because of deficiencies in preservation, packaging, marking, loading, storage, or handling will
be reported on DD Form 6 (Report of Packaging and Handling Deficiencies) in accordance with AR 700-58. Reports of damaged or improper shipment due to transportation discrepancies are to be reported on SF 361 (Discrepancy in Shipment Report) in accordance with AR 55-38. Marine Corps units will submit such reports in accordance with Military Traffic Management Regulations (NAVMC 1175).

e. Disposition of Unserviceable Ammunition and Components. Ammunition condition report (Army) will be submitted on all unserviceable ammunition or ammunition components in order that appropriate disposition instructions may be issued. The report will be prepared for Army activities on DA Form 2415 (Ammunition Condition Report) in accordance with TM 28-750. Multiple reports of a similar nature can be submitted on the same DA Form 2415.

f. Equipment Improvement Recommendations. DA Form 2407 (Maintenance Request) will be used to submit equipment improvement recommendations (EIR's). The form will be prepared in accordance with TM 38-750 for Army activities. Marine Corps units will submit unsatisfactory equipment reports in accordance with MCO 4700.1D.

Section II. DESCRIPTION AND DATA

1–3. General

This manual pertains to 40-mm rounds designed to be fired from the launcher M79. These rounds may also be fired from the 40-mm grenade launcher XM203 (attached to the M16/M16A1 rifle).

1–4. Differences Among Models

a. Cartridges M386 and M441 are antipersonnel, ground-burst rounds, and are identical except for their fusing systems. The fuze in the M386 round arms at 14 to 27 meters from the launcher, after firing. The fuze in the M441 round arms at 2.4 to 3 meters from the launcher, after firing.

b. Cartridge M397 is an antipersonnel, ground-impact, air-burst round. The fuze in the M397 round arms at 14 to 27 meters from the launcher, after firing.

c. Further comparisons of rounds are tabulated in tables 1–1 through 1–4.

1–5. Description

Each of the cartridges described in this manual is a fixed round of ammunition which is issued completely assembled and ready to fire. Figure 1–1 illustrates several 40-mm cartridges, including a partially-explored view, which are typical of the rounds described in this manual. Methods of functioning are described in paragraphs 1–6 and 1–7.

1–6. Complete Round Functioning

a. Firing (all rounds). Upon firing, the firing pin strikes the primer, igniting the propellant charge located in the high-pressure chamber of the cartridge case. The propellant charge generates sufficient pressure to rupture the metal propellant cup within which it is contained. This, in turn, releases the propellant gases (through vents) to the adjacent low-pressure chamber in the cartridge case. The pressure created by the propellant gases in the low-pressure chamber propels the projectile forward. The projectile rotating band engages the lands of the launcher tube which impart the necessary spin to the projectile.

<table>
<thead>
<tr>
<th>Cartridge</th>
<th>Primer</th>
<th>Fuse</th>
<th>Complete Round</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>Type</td>
<td>Model</td>
<td>Weight (grams)</td>
</tr>
<tr>
<td>M386</td>
<td>Ground-burst</td>
<td>M551</td>
<td>228</td>
</tr>
<tr>
<td>M441</td>
<td></td>
<td>M552</td>
<td></td>
</tr>
<tr>
<td>M397</td>
<td>Air-burst</td>
<td>M556</td>
<td>230</td>
</tr>
</tbody>
</table>

Table 1–1. Complete Round Data
Figure 1-1. Typical 10-mm cartridges.

Table 1-2. Major Explosive Components

<table>
<thead>
<tr>
<th>Model</th>
<th>Propelling charge</th>
<th>Explosive Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>M386</td>
<td>50-mm mortar M-9</td>
<td>Comp B</td>
</tr>
<tr>
<td>M441</td>
<td></td>
<td>OCTOL</td>
</tr>
<tr>
<td>M397</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1-3. Functional Characteristics

<table>
<thead>
<tr>
<th>Model</th>
<th>Average muzzle velocity (fps)</th>
<th>Maximum range (meters)</th>
<th>Arming delay distance (meters)</th>
<th>Burst height (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M386</td>
<td>247</td>
<td>400</td>
<td>14 to 27</td>
<td>Not applicable</td>
</tr>
<tr>
<td>M441</td>
<td>2.4 to 8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M397</td>
<td>14 to 27</td>
<td></td>
<td></td>
<td>5</td>
</tr>
</tbody>
</table>

Table 1-4. Logistical Data

<table>
<thead>
<tr>
<th>Model, PN, and DODIC</th>
<th>Quantity Distance class</th>
<th>Storage Compatibility Group</th>
<th>DOT Number/Description</th>
<th>Packing Box</th>
<th>Weight (lbs) Approx.</th>
</tr>
</thead>
<tbody>
<tr>
<td>M386 1310-724-8162</td>
<td>4</td>
<td>E</td>
<td>Ammunition for cannon with explosive projectiles</td>
<td>17 3/4</td>
<td>14 1/8     11 15/32</td>
</tr>
<tr>
<td>M441 1310-724-8163</td>
<td>4</td>
<td>E</td>
<td></td>
<td>16 13/16</td>
<td>13 3/8     11 5/16</td>
</tr>
<tr>
<td>M397 1310-979-3563</td>
<td>7</td>
<td>E</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
b. Impact.
(1) Cartridges M86 and M441 (ground-burst) (figs. 1-2 and 1-3). Upon impact, the detonator in the fuze (para 1-7) detonates, which, in turn, detonates a booster and then the high-explosive main charge in the projectile body. The projectile body is dispersed into fragments.

Figure 1-2. Cartridge M86—cutaway view.

(2) Cartridge M397 (air-burst) (fig. 1-4). Upon impact, the fuze (para 1-7) initiates the separation charge assembly (fig. 1-4) which ejects a ball (containing high explosive) into the air. At a height of approximately 5 feet, ball explodes into fragments.

1-7. Fuze Functioning

a. Fuze M551 (fig. 1-5) (Used in Cartridge M86). Before firing, the rotor is held in the unarmed position by a firing pin, a centrifugal lock, and a setback pin. Upon firing, setback force causes the setback pin to move rearward and clear the rotor. Rotation of the projectile causes three pivoted inertia weights and the centrifugal lock to move outward causing the spring loaded firing pin and lock to retract from the rotor and gear train, respectively. The rotor, now free to rotate, lines up the detonator with the remainder of the explosive train. An escapement mech-
anism controls the movement of the rotor and delays arming until the projectile has traveled at least 14 meters (45 feet). Upon impact, the firing pin is driven into the detonator which initiates the explosive train and detonates the high-explosive charge in the projectile.

b. *Fuse M552 (fig. 1-6) (Used in Cartridge M441).* Before firing, the rotor ball assembly is held in an out-of-line position with respect to the explosive train by the firing pin. As the projectile leaves the tube of the launcher, setback forces cause the firing pin to be withdrawn from the ball detent and rotation of the projectile causes the rotor ball assembly to align the detonator with the remainder of the explosive train. The fuse becomes armed after the projectile has traveled approximately 2-4 meters (8 feet) from the launcher. Upon graze or impact, the inertial ring acts on the push pins, pivoting the levers inward, forcing the firing pin into the detonator, thereby initiating the explosive train.

c. *Fuse M536 (fig. 1-7) (Used in Cartridge M397).*

(1) In the unarmed position, a setback pin, a firing pin, and a centrifugal lock combine to prevent movement of the rotor which keeps the detonator from aligning with the separation charge assembly. When the projectile is fired, setback force causes the setback pin to retract from the rotor. Rotation of the projectile causes three pivoted inertia weights and the centrifugal lock to move outward causing the spring-loaded firing pin and lock to retract from the rotor and gear train, respectively. The rotor, now free to rotate, lines up the detonator with the separation charge assembly. An escapement mechanism controls the movement of the rotor and delays arming until the projectile has traveled at least 14 meters (45 feet) from the launcher.

(2) Upon impact, the firing pin is driven into the detonator, which initiates the separation charge assembly. The flash from the separation charge assembly initiates the delay detonator of the auxiliary fuze in the explosive ball assembly. Gas pressure drives the delay detonator into the armed position. Simultaneously, the ball assembly (with the auxiliary fuze) is ejected into the air. Approximately 120 milliseconds from the time of ejection, the pyrotechnic delay detonator detonates the booster which, in turn, detonates the OCTOL filler of the ball assembly. The ball
assembly detonates approximately 5 feet above the impact surface.

1-8. Packaging and Packing  

a. Cartridge M397 (Air-Burst) (fig. 1-8).  

(1) Packaging. Three cartridges are placed ogive-down in two three-pocket plastic containers connected with a webbed band. This assembly forms a six-round bandoleer which weighs slightly more than 3 pounds. Six folded bandoleers are placed in individual compartments of a cardboard box to form a bottom layer. A separator is placed on top followed by a second compartmented layer of folded bandoleers. Fillers are added, as required, to assure a tight pack and the box flaps secured with adhesive. A tear strip is provided so that the box may be opened easily. A marking label (para 1-9b) is attached, the box corners are blunted, the box is placed in a moisture-proof bag, and sealed.

(2) Packing. Three packages (1 above) are placed on their sides in a wooden box. Fillers are added, as required, to assure a tight pack. The cover is secured with a hasp and swivel and steel strapping. The box is sealed with a metallic seal (car seal), passed through the eyelet of the hasp and swivel. The box is marked as described in paragraph 1-9c.

1-9. Painting and Marking  

a. Cartridge Case and Projectile. The cartridge case and projectile are chemically finished to obtain a green color. The ogive is colored gold. Identification markings are stenciled on the projectile with yellow stencil ink. Figure 1-9 illustrates markings on the cartridge M397. Car-
tridges M386 and M441 have similar markings, located on the bottom of the cartridge case, rather than the side.

b. Interior Packages. An identification label is attached to the center of one of the top outer flaps. Alternatively, markings may be applied to the box by printing or stamping. Typical markings are shown in figure 1–10. The same markings applied to the box are also applied to the protective bag by stamping or painting.

c. Exterior Packing. The wooden packing box is not painted but is marked with black stencil ink as illustrated in figure 1–11.

NOTES:

1. DOD IDENTIFICATION CODE
2. TYPE
3. MODEL NUMBER
4. BURSTING CHARGE
5. NUMBER OF CARTRIDGES

SIZE OF MARKING (HEIGHT)
LOT NUMBER AND DODIC: 1/4 IN. MIN.
ALL OTHER MARKINGS: 1/8 IN. MIN.

Figure 1–10. Markings on interior package.
Figure 1–11. Markings on wooden packing box.
CHAPTER 2
HANDLING AND USE

Section I. SERVICE UPON RECEIPT OF MATERIEL

2-1. General

a. When 40-mm cartridges M386, M441, or M397 are first received by the using organization, it is the responsibility of the officer in charge to determine that the ammunition has been properly prepared for service by the supplying organization and to assure it is in condition to perform its assigned mission. This responsibility extends to assuring that the cartridges received are the model requisitioned, that they are the type required for actual or anticipated operations, and that required safety warnings (para 2-2) are issued.

b. The ammunition issued to the using organization will be inspected for the following conditions:

(1) Proper ammunition and model designation.

(2) Serviceability of outer packing.
   (a) Presence of rust, mold, or mildew.
   (b) Rotted or broken wooden boxes.
   (c) Any other nonstandard condition which affects the package so that it cannot afford protection to its contents.

(3) Serviceability of inner package.
   (a) The outer packing (wood box) will not be opened for inspection of its contents unless it is damaged to such an extent that the inner package may be affected. If it is suspected that the inner package has sustained damage, the wood box will be opened and the barrier material inspected to assure that the contents are in serviceable condition. If the barrier bag is torn, punctured, rotted, or improperly sealed, follow (b) below.

   (b) Open barrier bag and inspect for presence of mildew, rot, mold, moisture, or any other condition which may affect the ammunition within the fiber box. If the package is in good condition, all defects will be repaired and the ammunition repacked. If the package is defective and damage to the contents is suspected, open the fiberboard container and inspect the ammunition as instructed in (4) below.

(4) Serviceability of ammunition.
   (a) Proper markings.
   (b) Ogive and cartridge case firmly seated on the projectile.
   (c) Presence of cracks on the cartridge case.
   (d) Rust or corrosion.
   (e) Presence of mold or mildew.
   (f) Dents in the cartridge case.
   (g) Presence of moisture.

c. Ammunition damaged to the extent that improper functioning may occur will be segregated and destroyed. Destruction will be done by authorized personnel only, in accordance with TM 9-1300-206. Serviceable ammunition will be repacked and returned to storage when not needed for immediate use.

2-2. Safety Precautions

a. The cartridges described in this manual have high-explosive bursting charges. Normal safety precautions prescribed for the handling of high-explosive ammunition apply to these cartridges.

b. The ground-burst cartridges M386 and M441 are interchangeable and are identified by the same DOD identification code (R574). HOWEVER, THE CARTRIDGE M441 WILL ARM WITHIN 3 METERS (8 FEET) OF THE LAUNCHER. When firing from concealed positions, assure that no obstructions, such as thickets or overhanging tree limbs, are in the line of fire. The other cartridges will normally arm between 14 and 27 meters.

c. DUD PROJECTILES (those projectiles that did not function after launching) WILL BE CONSIDERED ARMED AND WILL NOT BE MOVED UNDER ANY CIRCUMSTANCES! Avoid, mark location, and notify explosive ordnance disposal personnel.
d. Troops moving into an area that has been subjected to fire from the cartridges described in this manual must be warned that all unexploded projectiles and all unexploded hull assemblies from cartridges M397 are extremely dangerous and must not be touched or disturbed in any manner.

Section II. USE

2-3. Unpackaging Procedure

a. Open the wooden box by breaking the wire seal, cutting the steel strapping (if present), and opening the binding wire or hasp and swivel.

b. Remove the barrier material bags and open the bag at the point of sealing.

NOTE

These bags are constructed so that they may be resealed two times after the original sealing. If it is anticipated that the bags will be reused, they should be opened with care.

c. Remove the fiber box from the bag, open the box, and carefully remove the bandoleers.

CAUTION

Check each pouch on the bandoleer to assure that the flap (or strap) is securely fastened to prevent the cartridges from falling to the ground.

d. To the maximum extent practicable, fillers and packing material should be replaced in the container (fiber box, barrier-material bag, wood box) from which they were removed.

2-4. Firing

Refer to TM 9-1010-205-12 for instructions on firing the grenade launcher M79.

2-5. Maintenance

The cartridges described in this manual will be afforded the same degree and type of maintenance prescribed for conventional rounds covered in TM 9-1010-205-12.
CHAPTER 3
SHIPMENT AND LIMITED STORAGE AND DESTRUCTION
TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

3–1. Shipment
Shipment of the ammunition will be in accordance with TM 9–1300–206.

3–2. Limited Storage
The storage of the ammunition will be in accordance with TM 9–1300–206.

Section II. DESTRUCTION OF AMMUNITION TO PREVENT ENEMY USE

3–3. Destruction of Ammunition To Prevent Enemy Use
Refer to TM 9–1300–203 for procedures on destruction of ammunition to prevent enemy use.
APPENDIX
REFERENCES

1–1. Publication Indexes
The following publication indexes should be consulted frequently for the latest changes or revisions of references given in this appendix and for new publications relating to material discussed in this volume:

Index of Administrative Publications ........................................ DA Pam 310–1
Index of Blank Forms ................................................................... DA Pam 310 2
Index of Technical Manuals, Technical Bulletins, Supply Manuals (Types 7, 8, and 9), Supply Bulletins, and Lubrication Orders ........................................ DA Pam 310–4

1–2. Forms
The following forms pertain to the material discussed in this volume:

Accident Report ........................................................................ DA Form 286
Ammunition Condition Report .................................................. DA Form 2415
Maintenance Request (Used as Equipment Improvement Recommendation) ........................................ DA Form 2407
Recommended Changes to Publications ...................................... DA Form 2028
Report of Packaging and Handling Deficiencies ......................... DD Form 6

1–3. Reports

Accident Reporting and Records ................................................ AR 386–40
Discrepancy in Shipment Report ............................................... SF 361
Reporting of Transportation Discrepancies in Shipments .......... AR 55–38
Report of Damaged or Improper Shipment ................................ AR 700–58

1–4. Other Publications
The following publications contain information pertinent to the material discussed in this volume:

Army Equipment Record Procedures .......................................... TM 38–750
Artillery Ammunition ................................................................. TM 9–1300–203
Care, Handling, Preservation, and Destruction of Ammunition ........ TM 9–1300–206
Malfunctions Involving Ammunition and Explosives .................. AR 700–1800–8
By Order of the Secretaries of the Army and the Navy:

W. C. WESTMORELAND
General, United States Army,
Chief of Staff.

WALLACE H. ROBINSON, JR.,
Major General, U.S. Marine Corps
Quartermaster General of the Marine Corps.

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FA Rde (2)
FA Co (2)
FA Det (3)
Ord Rde (2)
Ord Gp (2)
Ord Rn (2)
Ord Co (2)
Ord Det (2)

Units organized under following TOE:
9-500 (BB, FA, IA, KA-KC) (2)

NG: None.
USAR: None.
For explanation of abbreviations used, see AR 310-50.