TECHNICAL REGULATIONS
No. 1350–37A

WAR DEPARTMENT,
WASHINGTON, April 23, 1928.

INFANTRY AND AIRCRAFT AMMUNITION

AMMUNITION FOR 37–MM. GUN, M1916

Prepared under direction of the
Chief of Ordnance

SECTION I

GENERAL

1. **Purpose and scope.**—These regulations are intended for the using branches. They give all necessary information regarding the construction, functioning, and identification of the different classes of ammunition for the 37-mm. gun, M1916.

2. **References.**—*a.* Before attempting to handle ammunition of any type, personnel should be thoroughly familiar with TR 1370–A.

b. For the preparation and use of blank ammunition for this gun, see TR 1370–B.

c. Drill ammunition for this gun is described in TR 1370–D.

d. Proper nomenclature for ammunition described herein is given in Standard Nomenclature List No. R–1, "Fixed Ammunition, All Types, for Mobile Artillery," and in Standard Nomenclature List No. R–3, "Service Fuzes and Primers for Mobile Artillery." This nomenclature is mandatory and will be used in all requisitions.

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e. The following firing tables are based upon the use of the ammunition herein described:

Projectile	Firing Table No.
High-explosive shell ammunition	37-A-1.
Low-explosive shell ammunition	37-B-1-abridged.

f. TR 1300–37A and 1400–37A (now printed as 1410–120) describe the operation, care, and maintenance of the guns and carriages for which this ammunition is designed.

SECTION II

GENERAL DISCUSSION

3. General remarks.—The ammunition used in 37-mm. guns, M1916, is known as fixed ammunition, because the round is issued with the cartridge case containing the propelling charge and primer firmly attached to the loaded and fuzed projectile, as shown in Figure 1. This is accomplished by forcing the projectile into the cartridge case and crimping the cartridge case into a groove in the projectile. Thus all components of the round are loaded into the gun as a unit and by one operation.

4. Types of ammunition.—*a. Characteristics.*—Two general types of ammunition are provided, high explosive (H. E.) and low explosive (L. E.). The low-explosive ammunition is not authorized for manufacture and its use will continue only until existing stocks are exhausted. The only difference between these two types of ammunition is in the projectile. In the high-explosive ammunition the projectile is loaded with T. N. T. and fitted with a base detonating fuze. In the low-explosive ammunition the projectile is loaded with black powder and fitted with a base percussion fuze. The projectile used in the high-explosive ammunition is longer and heavier than that used in the low-explosive ammunition. Figure 1 illustrates the round of high-explosive ammunition.

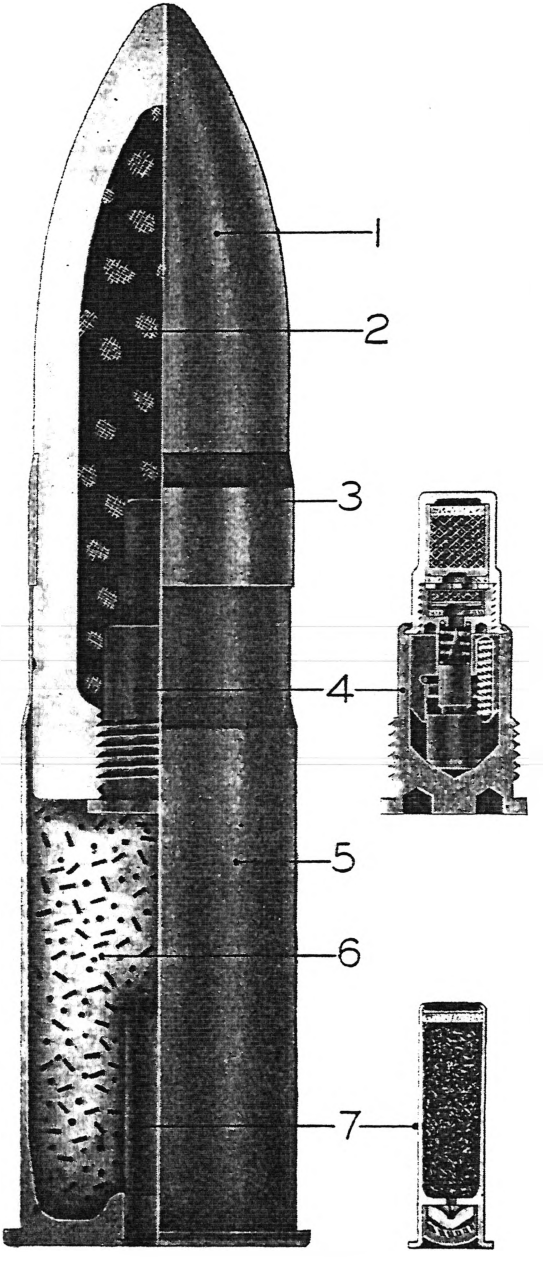

FIG. 1.—Complete round of high-explosive ammunition

1. High-explosive shell, Mk. II.
2. Bursting charge (T. N. T.).
3. Rotating band.
4. Base detonating fuze, Mk. IV.
5. Cartridge case, Mk. I.
6. Propelling charge (smokeless powder).
7. 20-grain percussion primer, Mk. II.

b. Components.—The two types of ammunition are made up of the following components:

Component	High-explosive ammunition	Low-explosive ammunition
Projectile	Mk. II shell	Mk. I shell.
Fuze	Mk. IV base detonating	Mk. I base percussion.
Bursting charge	T. N. T	Black powder.
Cartridge case	Mk. I	
Propelling charge	Nitrocellulose smokeless powder	
Primer	20-grain percussion, Mk. II	

c. Weights.—The weight of a round of ammunition as shipped varies with the kind of projectile used and is approximately as follows:

Component	High-explosive ammunition	Low-explosive ammunition
	Pounds	*Pounds*
Projectile (empty)	1.05	0.96
Fuze (loaded)	.12	.10
Bursting charge	.06	.04
Cartridge case with primer	.27	.27
Propelling charge	.07	.07
Total weight of round as issued	1.57	1.44

5. Identification of components.—For identification purposes practically all assembled units or components of a round of ammunition are given a mark number or model. The mark number form of identification was adopted in 1917, and in this system the first design of a certain component was called "Mark I," abbreviated as Mk. I or in some cases, MI. the second design "Mark II," abbreviated as Mk. II or in some cases, MII, and so on. The previous method was to designate the component as the model of a certain year, for instance "Model of 1916," abbreviated as Mod. 1916 or in some cases, M1916, indicating that it was designed in the year 1916.

SECTION III

PROJECTILES

6. Types.—*a.* The two types of projectiles authorized for use in this gun are made of steel and are—

(1) Low-explosive shell, Mk. I.

(2) High-explosive shell, Mk. II.

b. The low-explosive shell, Mk. I. is not authorized for manufacture and its use will continue only until existing stocks are exhausted.

7. General remarks.—*a. Rotating band.*—(1) Near the base of each projectile is a narrow, copper band, known as the rotating band, which forms an integral part of the projectile. The functions of the rotating band are to impart rotation and thus to maintain the stability of the projectile during flight and also to prevent the propelling charge gases from escaping past the projectile when the gun is fired. The rotating band is a cylindrical ring of copper, pressed into a groove near the base of the projectile. The surface of this groove is knurled or roughened to prevent the rotating band from slipping while the projectile is being rotated in the bore of the gun.

(2) When the gun is fired, the rotating band engages with the rifling in the gun barrel, which is of a spiral or screw shape, and thus the projectile is forced out of the barrel of the gun with a rotating motion. Since the diameter of the rotating band is greater than the diameter across the grooves of the rifling in the gun barrel, the rotating band completely fills the bore of the gun and prevents the propelling charge gases from escaping past the projectile.

(3) Rotating bands must be made of a comparatively soft material that will flow readily and fill the rifling grooves in the gun barrel. The material must be sufficiently soft to prevent excessive wear of the lands of the rifling in the gun barrel, and at the same time not so soft as to strip under the resistance met in rotating the projectile. The rotating band material should have a high melting point. Copper is probably the best available material and is used for all rotating bands.

(4) Care should be exercised to avoid rough handling of the projectile so as not to deform the rotating band. Improper handling may result in deformation to such an extent that the projectile can not be loaded in the gun.

b. Painting and marking.—The shell are painted externally to prevent deterioration by rust and for the purpose of ready identification. The high-explosive shell are painted yellow and the low-explosive shell are painted red. They are also stenciled to show the caliber and type of cannon used in and mark number of shell. (See fig. 2.)

8. Low-explosive shell, Mk. I.—*a.* The low-explosive shell, Mk. I, was the first shell designed for this gun. It is now obsolete for future manufacture, having been superseded by the high-explosive shell, Mk. II. Its use will continue only until existing stocks are exhausted. The Mk. I base percussion fuze is used in this shell.

b. This shell is made of steel and is about 3.56 inches long. The ogive has a radius of about 3.25 inches or about 2.2 calibers (by caliber is meant the diameter of the bore of the gun, in this case approximately 1.457 inches). The extreme point of the ogive is slightly rounded off. The rotating band is about 0.73 inch wide and is placed approximately 0.83 inch from the base. A groove is machined around the shell about midway between the rotating band and the base. The cartridge case is crimped at four equidistant places into this groove, to hold the shell firmly in the cartridge case. The diameter of the cavity in the shell is somewhat larger than that of the screw threads of the fuze seat. This cavity is filled with approximately 0.04 pound of loose, black powder, the weight of the loaded and fuzed shell being about 1.097 pounds.

c. The exterior of the shell is painted red and stenciled in black to show the caliber and type of cannon used in and the mark number of the shell. The rotating band is stamped to show the lot number of the unloaded shell, initials or symbol of manufacturer, caliber and type of cannon used in, mark number of shell, and inspector's initials. There may, however, be found in service some lots of shell in which the nose of the projectile is painted black. Such lots were manufactured prior to the adoption of the present color system. Also on some shell the stamping described above as appearing on the rotating band was stamped on the base of the shell.

9. High-explosive shell, Mk. II.—*a.* The high-explosive shell, Mk. II, is a later design, is longer, heavier, and carries more explosive than the low-explosive shell, Mk. I. It is the standard shell for issue and future manufacture. The Mk. IV base detonating fuze is used in this shell. This shell is shown in Figure 1.

b. The shell is made of steel and is about 4.45 inches long. The ogive has a radius of about 3.25 inches or about 2.2 calibers. The extreme point of the ogive is slightly rounded off. The rotating band

is about 0.73 inch wide and is placed approximately 1.19 inches from the base. A groove is machined around the shell about midway between the rotating band and the base. The cartridge case is crimped at four equidistant places into this groove to hold the shell firmly in the cartridge case. The diameter of the cavity in the shell is somewhat larger than that of the screw threads of the fuze seat. This cavity is filled with approximately 0.06 pound of loose T. N. T., the weight of the loaded and fuzed shell being about 1.234 pounds. Shell will be found in service which differ somewhat from the characteristics given above, which are for the latest design of this shell. For instance, some of the older shell are shorter than described, being about 4.2 inches long. Some have sharp-pointed ogives and the location of the rotating band is at different distances from the base, varying from that given above to about 0.6 inch. Some of the older lots have two grooves at the rear of the rotating band, one being a crimping groove for the cartridge case and the other a lubricating groove filled with a heavy lubricant. Also some shell have a steel bushing in the base. These are all authorized for use interchangeably with the standard shell.

c. The exterior of the shell is painted yellow and stenciled in black to show the caliber and type of cannon used in and the mark number of the shell. The rotating band is stamped to show the lot number of the unloaded shell, initials or symbol of manufacturer, caliber and type of cannon used in, mark number of shell, and inspector's initials. In future lots of shell this stamping will appear on the body of the shell, just forward of the rotating band. On some older lots this stamping was placed on the base of the shell. Figure 2 shows the marking of the complete round of high-explosive shell ammunition.

SECTION IV

FUZES

10. Types.—*a.* A fuze is a mechanical device inserted in a projectile and used to detonate or explode the bursting charge of the projectile at the time and under the circumstances desired. The following types of fuzes are authorized for use in 37-mm. ammunition:

(1) Base percussion fuze, Mk. I.
(2) Base detonating fuze, Mk. IV.

1. Caliber and type of cannon (G=gun).
2. Mark number of shell.
3. Mark number and lot number of projectile and initials of manufacturer (stamped on rotating band).
4. Lot number of propelling charge powder.
5. Muzzle velocity of projectile (in feet per second). Rectangle as shown denotes service charge.
6. Ammunition lot number.
7. Caliber and type of cannon and model of gun.
8. One black stripe as shown denotes service charge.
9. Head of primer is stamped to show the initials or symbol of the loader, lot number of loaded primer, and the year of loading.
10. Lot number of cartridge case and initials or symbol of manufacture.

NOTE.—3, 6, 7, 9, and 10 are stamped; others are stenciled in black.

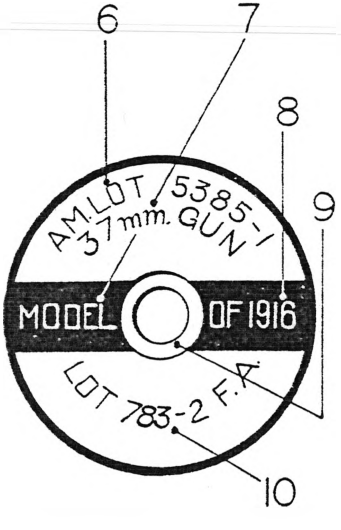

FIG. 2.—Marking of complete round of high-explosive ammunition

b. The base percussion fuze, Mk. I, is used in the low-explosive shell, Mk. I, and the base detonating fuze, Mk. IV, is used in the high-explosive shell, Mk. II. A percussion fuze is one used in projectiles containing low explosive, such as black powder. A detonating fuze is one used in projectiles containing high explosive, such as T. N. T.

11. Base detonating fuze, Mk. IV.—*a.* The base detonating fuze, Mk. IV (fig. 1), is used in the 37-mm. high-explosive shell, Mk. II, and is standard for issue and future manufacture. It is made principally of brass and weighs approximately 0.12 pound. This fuze is about 1.77 inches long, and the diameter of the head is about 0.81 inch.

b. The fuze consists essentially of the body, containing the firing pin and plunger, into which is crimped the detonator casing, containing the primer and detonator. The firing pin is prevented from accidentally coming in contact with the primer in transportation, in handling, or in the gun by a shear pin and two springs.

c. When the round is fired from the gun, the shock of discharge or set-back causes the plunger to move rearward, bending or breaking the shear pin and compressing and locking one of the two springs. When the plunger strikes the conical-shaped cavity in the base of the fuze body, the tapered end of the plunger is crimped around the beveled end of the firing pin, thus locking these parts together. The other spring still holds the firing pin away from the primer until the projectile is suddenly checked by striking an object. When this occurs, the firing pin and plunger move forward, overcoming the spring resistance and the sharp point of the firing pin penetrates the primer, exploding it. This causes the detonator to function, which in turn detonates the explosive charge in the shell.

d. The base of the fuze is stamped to show the type and mark number of the fuze, name of manufacturer, and lot number.

12. Base percussion fuze, Mk. I.—*a.* The base percussion fuze, Mk. I, is used in the 37-mm. low-explosive shell, Mk. I, and since no more of this type of shell will be manufactured, this fuze is obsolete for future manufacture. It is made principally of brass and weighs approximately 0.10 pound. This fuze is about 1.17 inches long, and the diameter of the head is about 0.81 inch.

b. This fuze is essentially the same as the base detonating fuze, Mk. IV, except that it has no detonator and only one safety spring. The point of the firing pin is relatively blunt, as compared with that in the base detonating fuze, Mk. IV. The action of the two fuzes is exactly the same, except that in the base percussion fuze, Mk. I, the

explosion of the primer flashes directly into the explosive charge of black powder in the shell. The same information is stamped on the base of the fuze as described for the base detonating fuze, Mk. IV.

SECTION V

CARTRIDGE CASE

13. Cartridge case, Mk. I.—*a. Description.*—The cartridge case, Mk. I (fig. 1), is of drawn brass and is about 3.64 inches long. A cartridge case, Mk. I, assembled with a loaded primer weighs about 0.27 pound. A projecting rim or flange is formed on the head of the cartridge case and the extractor of the gun engages this rim to eject the cartridge case from the gun after firing. This rim or flange also acts as a stop for the round of ammunition when it is loaded into the gun. The 20-grain percussion primer, Mk. II (fig. 1), is fitted in the center of the head of the cartridge case and is forced into its seat by a press.

b. Function.—The function of the cartridge case is to contain the propelling charge and to act as an obturator in preventing the propelling charge gases from escaping into the breech mechanism of the gun. The metal near the mouth of the cartridge case is thin and comparatively soft, so that the pressure of the propelling charge gases expands it tightly against the walls of the gun, thus preventing any leakage of gases past the cartridge case. The metal of the cartridge case, however, is springy enough so that, when the gas pressure is released, the cartridge case will contract and can be extracted from the gun without difficulty. Cartridge cases can be used many times if resized and proper care taken of them. They should be handled carefully, since being made of thin, comparatively soft metal they are easily dented.

c. Marking.—The cartridge case, Mk. I, is stamped and stenciled for identification as shown in Figure 2.

SECTION VI

PRIMER

14. 20-grain percussion primer, Mk. II.—*a. Type.*—37-mm. gun ammunition uses a percussion primer, that is, the round is fired by the primer being struck by the point of the firing pin of the gun

in a manner similar to the way that a rifle cartridge is fired. The primer is called the 20-grain percussion primer, Mk. II, because it contains 20 grains of black powder. This black powder acts as an igniter to the smokeless powder in the cartridge case.

b. Action.—Figure 1 shows this primer. When the cap in the base of the primer, which is made up of a cup and anvil with percussion composition between them, is struck by the firing pin of the gun, the cup is indented and the percussion composition is crushed on the anvil and thereby exploded. The flame of this explosion passes through a hole in the primer body and ignites the loose black powder charge, which in turn ignites the propelling charge in the cartridge case. The cap in the base of the primer is sensitive and care must be taken not to hit it with any hard object.

c. Marking.—The base of the primer is stamped to show the initials or symbol of the loader, lot number of loaded primer, and the year of loading.

SECTION VII

PROPELLING CHARGE

15. Propelling charge.—*a. General.*—(1) The propelling charge is nitrocellulose smokeless powder. The amount used is the same for either low-explosive or high-explosive ammunition and is approximately 500 grains in weight, or slightly more than 1 ounce. Since the weight of propelling charge is the same, but the weight of projectiles used is different, the muzzle velocity of the projectiles is therefore different. The muzzle velocity of the low-explosive projectile is approximately 1,312 feet per second and that of the high-explosive projectile is approximately 1,276 feet per second. The weight of propelling charge used varies slightly with different lots of powder, since the charge is adjusted to give the prescribed muzzle velocity.

(2) The propelling charge is contained in the cartridge case, as shown in Figure 1. In some older lots of ammunition, a felt wad was placed over the propelling charge, directly under the primer. This wad is no longer used.

(3) A grain of smokeless powder will burn freely in the open and has none of the characteristics of an explosive until it is confined. If the powder is confined in a chamber, the rate of burning is very rapid, and the rate of burning increases as the gases are liberated and the pressure in the chamber increases.

b. Action.—(1) The pressure of the gases from the burning smokeless powder expels the projectile from the gun. If these gases are created too rapidly, too much pressure will be developed and the gun may burst. On the other hand, if the gases are not generated rapidly enough, the projectile will leave the muzzle of the gun before the powder grains are entirely burned and at a lowered velocity. It is, therefore, necessary to make the grains of smokeless powder of such size that when the projectile has reached the muzzle of the gun they will have completely burned and the pressure will not have exceeded a certain prescribed limit. The maximum allowable pressure in the 37-mm. gun, M1916, is 18,500 pounds per square inch. To meet this condition it has been found convenient to make the powder grains with a hole or perforation running lengthwise of the powder grain. Since the grain is perforated, it will burn on the inside and outside surfaces at the same time, and gases will be created much faster than if the powder grain is solid. The size of the grain of smokeless powder used in the 37-mm. gun, M1916, is about 0.03 inch in diameter by about 0.085 inch long, with a hole or perforation about 0.007 inch in diameter passing lengthwise through it. The color varies from a light brown to a black.

(2) This powder is affected by moisture, and therefore great care should be taken to have the assembled round kept in a dry condition.

SECTION VIII

PACKING

16. Packing of assembled rounds.—*a. Description.*—(1) Assembled rounds of ammunition for the 37-mm. gun, M1916, are packed and shipped in wooden packing boxes. The packing box contains 60 rounds of ammunition. It is provided with a rope handle at each end and the lid is held in place by two hinges and two hasps and is also secured by screws. The rounds are packed point downward and are held in position in the box by a crate near the top and one at the bottom. In some boxes the rounds are held by a crate near the top and by recesses cut in the bottom of the box, into which the points of the projectiles fit. A strip of corrugated pasteboard is placed on top of the rounds, under the lid, to prevent excessive movement of the rounds and to protect the primers. There are two wooden cleats on both the lid and bottom of the packing box.

(2) The high-explosive shell, being longer than the low-explosive shell, requires a larger packing box. The general characteristics of the packing boxes are as follows:

	Height (including cleats)	Width	Length	Cubic displacement	Total weight
	Inches	*Inches*	*Inches*	*Cubic feet*	*Pounds*
High-explosive ammunition	10⅜	12¼	20	1.42	121
Low-explosive ammunition	9⅜	12⅛	19 1/16	1.27	105

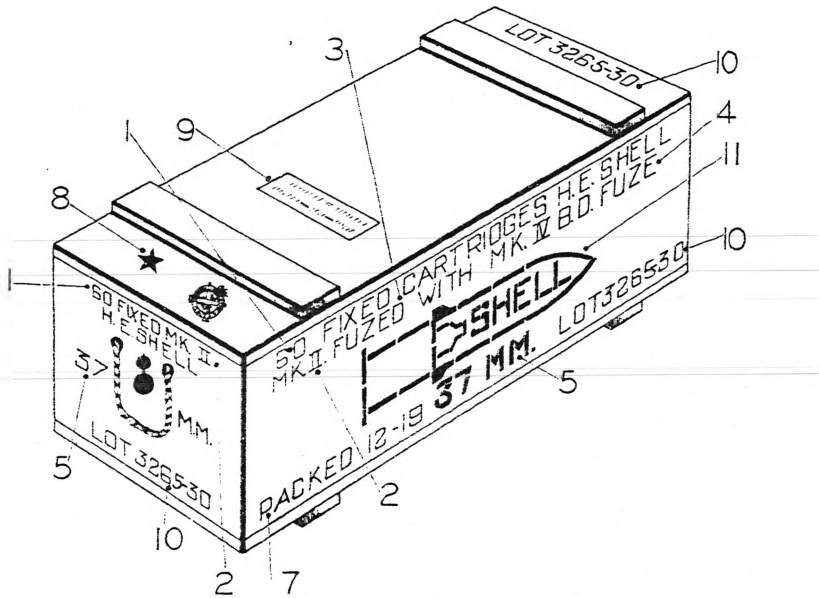

FIG. 3.—Marking of packing box for complete rounds

1. Number of complete rounds packed in box.
2. Mark number of shell.
3. To show that fuze is assembled in shell.
4. Mark number and type of fuze used.
5. Caliber of gun for which ammunition is intended.
7. Month and year of packing.
8. Inspection stamps and name of place where packed.
9. To comply with I. C. C. regulations ("Ammunition for cannon with explosive projectiles").
10. Ammunition lot number.
11. Symbol of type of ammunition in box.

NOTE.—Both ends of box are marked alike. Side not shown is address side of box, containing shipping instructions, etc.

(3) Each packing box contains a completely filled in ammunition data card, which gives complete information regarding the lot number, manufacturer, date of manufacture, date of packing, etc., of the complete round, together with similar information about each of the components of the round.

b. Marking.—The marking which appears on both ends, top, and one side of the packing box is shown in Figure 3, which shows the marking on the box for high-explosive ammunition. The side not shown is the address side, giving the following information for the proper shipment of the box:

(1) Number of shipping ticket.
(2) Designation and address of consignee.
(3) Consignor.
(4) Gross weight.
(5) Cubic displacement.
(6) Ammunition lot number.
(7) Initials "U. S.", to indicate United States property.

[A. G. 062.12 (1–19–25).]

BY ORDER OF THE SECRETARY OF WAR:

C. P. SUMMERALL,
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Chief of Staff.

OFFICIAL:

LUTZ WAHL,
Major General,
The Adjutant General.

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