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Vol. I

THE ORDNANCE SCHOOL

ORDNANCE SCHOOL TEXT

AMMUNITION - GENERAL

VOLUME 1

Parts I - II
Pages 1 - 79

MILITARY EXPLOSIVES, SMALL ARMS AMMUNITION

PREPARED BY
THE ORDNANCE SCHOOL
ABERDEEN PROVING GROUND, MARYLAND

THIRD EDITION
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Prepared under the direction of
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Third edition, November 1942
Supersedes all previous editions

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The Ordnance School
Aberdeen Proving Ground, Maryland

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PART I

MILITARY EXPLOSIVES

CHAPTER 1

GENERAL

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SECTION I

GENERAL

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Purpose	1
Scope	2
Definition of an explosive	3
Present military explosives and their uses	4

1. PURPOSE. - The purpose of part I is to present ordnance personnel with a nontechnical knowledge of explosives. The necessary requirements of military explosives and the tests to determine such requirements are discussed. Finally, there is a brief exposition on the most widely used military explosives.

2. SCOPE. - Part I is concerned only with basic information required for a proper understanding of military explosives. More detailed and technical information may be obtained from TM 9-2900, Military Explosives.

3. DEFINITION OF AN EXPLOSIVE. - Any mixture or chemical compound which, under the influence of heat or mechanical action, undergoes a sudden chemical change with the liberation of energy and the development of high gas pressure, is called an explosive. The chemical change develops heat which further expands the liberated gas.

4. PRESENT MILITARY EXPLOSIVES AND THEIR USES. - Our military explosives and their principal uses are as follows:

a. Smokeless Powder ---------- Propellants.

b. Compound Propellants --------- Shotgun shell, fragmentation hand grenades, small-arms blank ammunition.

c. Black Powder ---------- Saluting charges, spotting charges, primers, delay fuzes, time train fuzes.

d. TNT, Amatol, Trimonite --------- Bursting charge for high explosive shell, fragmentation and demolition bombs.

e. Explosive D ---------- Bursting charge for armor-piercing projectiles.

f. Picric Acid ---------- Manufacture of Explosive D.

g. Tetryl ---------- Boosters.

h. Mercury Fulminate, Lead Azide - Detonating agents.

i. Nitrostarch ---------- Demolition work.

j. PETN ---------- Detonating fuze.

SECTION II

PROPERTIES OF MILITARY EXPLOSIVES

	Paragraph
Determination of an explosive substance	5
High and low explosives	6
Basic requirements of an explosive	7
Additional requirements of an explosive	8
Stability	9
Sensitivity	10
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Selection of an explosive for a type of ammunition	12

5. DETERMINATION OF AN EXPLOSIVE SUBSTANCE. - From the definition of an explosive given in section I, it can be seen that an explosive differs from other substances in three respects. It must be a chemical compound or mixture sensitive to the application of heat or a blow upon any surface of its mass. Secondly, it must decompose or react with extreme rapidity. Thirdly, it must yield gaseous products and evolve a considerable quantity of heat. These three qualities determine an explosive; the absence of any one or more differentiates other substances from explosives.

a. Example. - A solution of sodium chloride added to a solution

of silver nitrate, under certain conditions, will yield the solid product silver chloride. The reaction proceeds at a speed virtually immeasurable and may be considered instantaneous. One other quality of an explosive is missing, therefore, this compound cannot be classified as an explosive.

b. Example. - A mixture of nitrogen and oxygen can be made to react with great rapidity yielding a gaseous product. Because heat is not evolved, but rather absorbed, this mixture cannot be considered an explosive.

c. Example. - Hydrogen and oxygen, upon application of heat, will react with extreme rapidity. Heat is evolved and the product of the reaction, steam, is a gas. The mixture is an explosive since all necessary qualifications are fulfilled.

6. HIGH AND LOW EXPLOSIVES. - a. General. - Among the numerous compounds and mixtures, whether solids, liquids, or gases, which fulfill the requirements necessary to classify them as explosives, there are wide differences in the effects produced upon explosion. Some explosives may yield a greater quantity of heat or a greater quantity of gaseous products than others, and thus account for a difference in the force or power exhibited upon decomposition. Other compounds may evolve about the same amount of heat and gaseous products and yet differ markedly in explosive characteristics; this is due to a difference in the rate at which the heat and gas are evolved.

b. Definition. - If the decomposition, when once initiated, occurs with extreme rapidity, the substance is classed as a high explosive, while one having an appreciably lower rate of decomposition is often referred to as a low explosive. Smokeless powder, for example, has a rate of action in the gun that varies from 1 mm/sec., to 1 meter/sec. A high explosive has a rate of action varying from 5,000, to 8,000 meters/sec.

c. Basis. - The differences in the behavior of explosives as mentioned in paragraph 6b. above, have led to a distinction which is of assistance in considering the various uses to which explosives are applied. The principal distinction in behavior is the rate at which decomposition or reaction occurs when once initiated by heat or shock.

d. How classified. - There is no sharp line of demarcation, but with a full understanding of the properties of a given explosive, it is usually easy to recognize whether it falls into the one class or the other. Of the explosives commonly used in military ammunition, those employed as bursting charges for shells or bombs, and as charges for boosters and detonators are classified as high explosives, while black powder, smokeless powder, and most primer mixtures may be classified as low explosives.

tridge cases have a conical-shaped body, joined to the neck by a sharper cone called "the shoulder." The neck is the seat of the bullet and is very nearly cylindrical. The front end of the case is called "the mouth" and the rear end the "head." The case is made from a circular disk, cut from a flat strip of brass. The disk is first punched into the form of a cup, and then drawn out in successive operations by being forced, by punches, through dies successively diminishing in diameter. After the cupping operation and after each of the draws, except the last one, the case is annealed to remove the hardening strains caused by the drawing process. The head of the case and the primer pocket are formed in a press; the body is then annealed by passing the case through a gas-jet flame, this is followed by a reduction of the neck and shoulder, or the tapering operation. The extractor groove is turned into the head and the case is then primed.

b. Function. - The function of the case, in addition to holding the primer, propelling charge, and bullet, is to seal the breech of the gun. The thin walls of the case are expanded in the chamber by the powder gas, and a tight joint is made preventing the escape of gas to the rear. The case also serves as a waterproof container for the propelling charge. The extractor groove, mentioned above, provides a means of extracting the case from the chamber of the barrel. Present specifications on brass for cartridge cases require an alloy of approximately 70% copper and 30% zinc. Fired cartridge cases will be disposed of in accordance with AR 775-10.

c. Cal..30 carbine and cal..45 cases. - The cases for these cartridges are similar in methods of construction and function, to the cases for the cal..30 and .50 cases. The only exception is that the carbine cartridge case and the cal..45 cases have no neck.

d. Steel cases. - As a result of this country's entry into World War II, zinc, component of a cartridge case brass, has become a strategic metal. The Ordnance Department anticipating the situation had long experimented with steel cartridge cases. Many difficulties were encountered; the important difficulty being the tendency of such a case to seize in the breech. Continuing metallurgical research, however, has virtually solved this problem. Another and major difficulty was corrosion of the case. No paints, lacquers, or similar coatings may be used. Plating with some noncorrosive metal will probably be the answer. In the present war this problem of corrosion recedes in importance as storage periods of any ammunition will be relatively short.

22. PRIMERS. - a. Description. - Primers for cal..30 and cal..50 ammunition are similar in construction although of a different size. They are both of the center-fire type and consist of a cup, the priming mixture, a disk of shellacked manilla paper, and an anvil (see fig. 1).

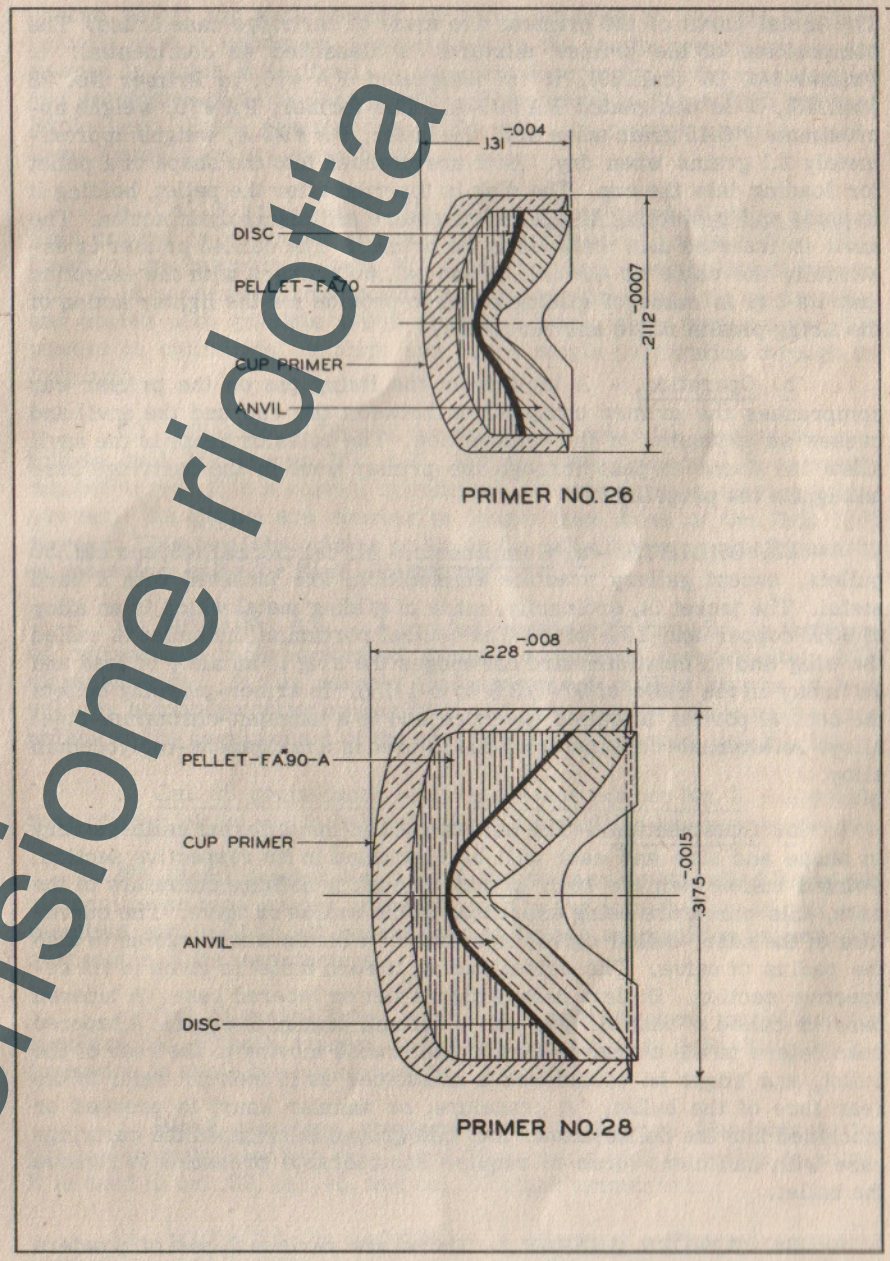


FIGURE 1. - CAL..30 AND CAL..50 PRIMERS.

voted to the type in question. Following are the general methods:

(1) In clips and bandoleers, in metal-lined wooden packing boxes.

(2) In cartons, in metal-lined wooden packing boxes.

(3) In clips in cartons, in metal-lined packing boxes.

(4) In cartons, in wooden packing boxes (without metal lining).

(5) In machine gun belts, in various types of outside containers.

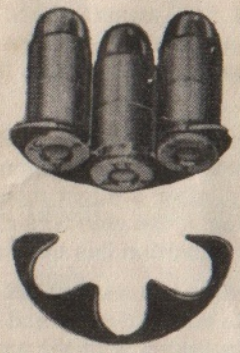
b. Identification. - (1) To assist in readily identifying types of ammunition, a system was devised which consists of painting different colored bands on the sides and ends of the packing box. The table below indicates the color scheme for each type and also the method of packing. Cal..30 and cal..45 packing boxes have vertical stripes on the front and rear faces and horizontal stripes on the ends just above the handle cuts. Cal..50 packing boxes have a diagonal stripe running from the upper right hand corner to the lower left hand corner on the front and rear faces; a diagonal stripe running from the lower right hand corner to the upper left hand corner on the ends. Just above the handle cuts is an oblong stripe half the width of the diagonal stripes. (See fig. 2.)

Types	Large Band	Superimposed Band	Packing
Cartridge, ball, cal..30	red	-	5-rd. clips in cartons 5-rd. clips in bandoleers 8-rd. clips in bandoleers fiber MG belts metal link MG belts
Cartridge, ball, cal..45	red	-	cartons
Cartridge, ball, cal..50	red	-	cartons metal link belts
Cartridge, carbine, cal..30	red	-	cartons
Cartridge, A.P., cal..30	yellow	blue	cartons metal link belts
Cartridge, A.P., cal..50	yellow	blue	cartons metal link belts
Cartridge, tracer, cal..30	yellow	green	cartons

FIGURE 2. - PACKING BOXES FOR SMALL-ARMS AMMUNITION.

a. Cal..30 clip for use in M1903 and M1917 cal..30 rifle.

b. Cal..30 clip for use in M1 cal..30 rifle.



c. Cal..45 clip for use in cal..45 revolver.

FIGURE 3. - CARTRIDGE CLIPS.

volvers, the cartridges must be assembled in a semicircular steel clip (see fig. 3c). This clip is designed to hold three cartridges in the form of a revolver cylinder which has a capacity of two loaded clips. As the ammunition does not have a projecting rim, the clip acts as a stop for the cartridges, and affords a means of extracting the empty cases by giving a surface against which the extractor acts.

(2) Bandoleers. - (a) The purpose of the bandoleer is to afford an easy means of carrying ammunition in an accessible manner. The bandoleer is made of olive-drab cotton cloth and is divided into 6 pockets. A shoulder strap of webbing and a safety pin are attached to provide an easy means of carrying it on the person. In one pocket of the bandoleer a reference card is inserted showing the type, ammunition lot number, manufacturer, and powder lot with which the ammunition is loaded. Twenty-five bandoleers are packed in the standard packing box (see fig. 4); older packings had 20 bandoleers per box.

(b) The bandoleer, M1906, is designed to hold a carton of two 5-round clips in each pocket. The packed bandoleer weighs approximately 4 pounds.

(c) The bandoleer, M1, is designed to hold a carton containing one 8-round clip in each pocket. The packed bandoleer weighs about 3-1/2 lbs.

(3) Cartons. - Cartons for packing cal..30 ammunition other than carbine, consist of small cardboard boxes made of single, manila-lined chipboard (see fig. 5). Each carton contains 20 cartridges separated by a strawboard or chipboard comb and 9 strawboard or chipboard separators. Cal..50 cartridges are packed 10 per carton in a similar manner. After packing the cartridges in the cardboard box, the box is sealed by pasting a piece of paper over the top and sides. This paper serves as a label and contains information similar to that shown on the reference cards packed in bandoleers. The color scheme used for marking boxes of each type of ammunition previously listed, is also reproduced on the carton labels. Some types of cartons are provided with tearing strips as a means of opening, others with a tearing string, while the most common method is to leave a small semicircular recess in the chipboard at the top of one of the sides. This recess is covered by the label. The label is easily punctured by the thumb. Placing the thumb in the opening and pulling up on the cover will shear the label, thereby opening the carton. Cartons for cal..30 carbine ammunition are described in paragraph 107, volume 2 of this text.

d. Packing boxes. - Ammunition for small arms is packed for shipment and storage in wooden packing boxes having watertight terneplate liners. Because of heavy wartime production and the great demands

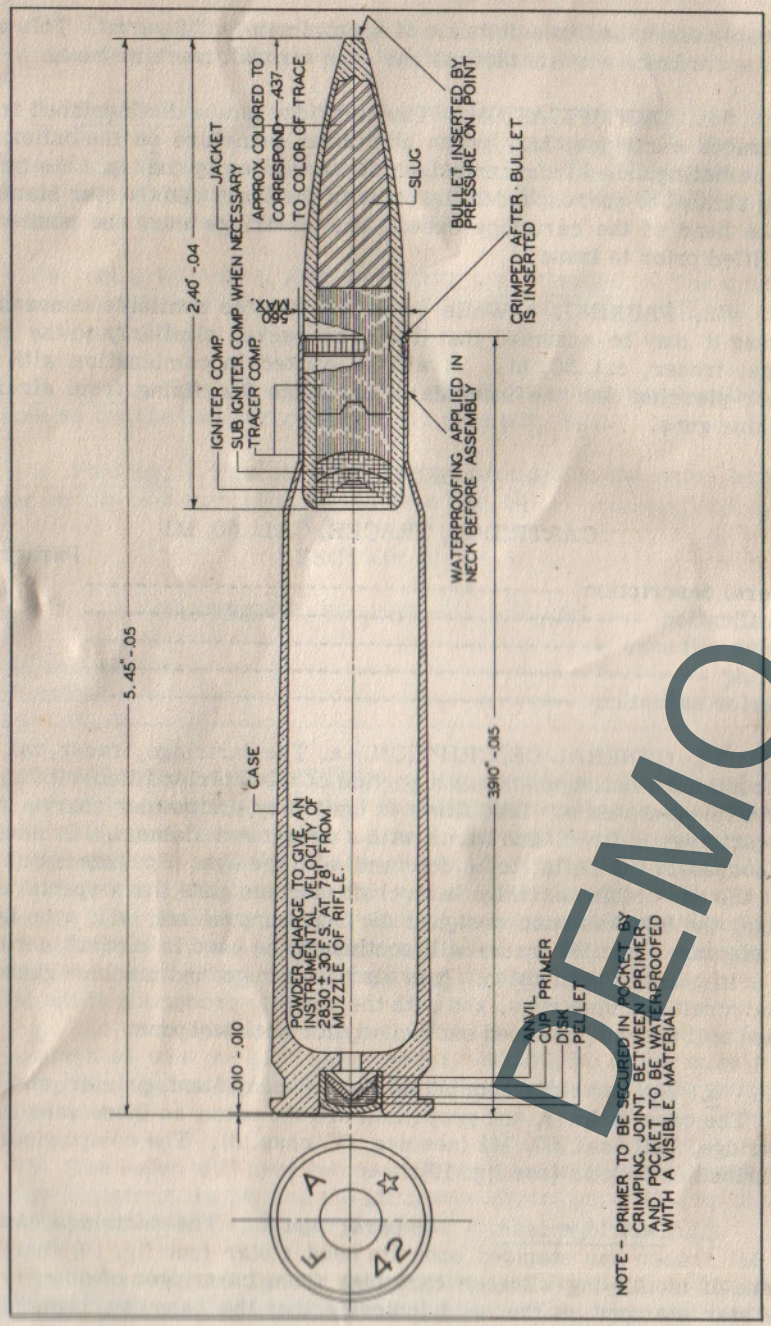


FIGURE 19. - CARTRIDGE, TRACER, CAL..50, M1.

annealed and is the only difference from the cases in other cal..50 ammunition.

(2) Propellant. - Sufficient powder is loaded into the case to provide a velocity at 78' from the muzzle of 2,830 ± 30 ft./sec.

(3) Bullet. - The bullet consists of a gilding metal jacket, a lead slug hardened with antimony encased in the jacket, and a tracer and igniter assembly in the rear half of the bullet (see fig. 19). Where necessary a subigniter assembly is pressed into the cavity of the bullet. The bullet retains its conical shape toward the base. Waterproofing is accomplished in the same manner as for the cartridge, ball, cal..50, M2.

c. Component weights:

Item	Weight in grains
Cartridge, complete (approximate)	1789. -68.
Cartridge case	850. -50
Primer	19.06 -1.11
Bullet	681. -17
Jacket	408. -10
Slug	207. -1.
Tracer composition	Approx. 70.
Subigniter composition	
Igniter composition	
Propellant (approximate)	240

74. IDENTIFICATION. - a. To distinguish this cartridge from the cartridge, tracer, cal..50, M2, see paragraph 71.

b. The cartridge may be identified as to type by the star stamped on the head of the cartridge case and the red tip of the bullet.

c. The cartridge must be identified positively prior to issue in the manner described in paragraph 44.

d. To assist in identification, personnel should be familiar with the markings on packing box and cartons described in paragraph 25.

75. GRADES AND USES. - The tracer cartridge, cal..50, M1, is graded for the uses explained in paragraph 27. No information is available concerning the possible restrictions in its use following the quantity production of the cartridge, tracer, cal..50, M2.

76. PACKING. - a. This cartridge is packed in cartons, and in metallic link machine gun belts in combination with other types of cartridges.