This manual is correct to 21 August 1957

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TECHNICAL MANUAL
No. 9-1901-1
TECHNICAL ORDER
No. 11A-1-39

DEPARTMENTS OF THE ARMY AND
THE AIR FORCE

WASHINGTON 25, D. C., *18 December 1957*

AMMUNITION FOR AIRCRAFT GUNS

*This manual supersedes those portions of TM 9-1901 (TO 11A-1-22), 11 September 1950, including Changes No. 1 (TO 39B-1-20), 12 March 1954, that pertain to ammunition for aircraft guns.

CHAPTER 1

GENERAL

Section I. INTRODUCTION

1. Purpose and Scope

This manual is intended for instruction and the dissemination of general and technical information concerning ammunition for aircraft guns (cal. .50 machine guns and 20-mm guns). This manual covers the general characteristics of ammunition for aircraft guns, specific data, means of identification, precautions in handling and use, and general information on packing. General technical information pertaining to all types and kinds of conventional ammunition and explosives is contained in TM 9-1900/TO 11A-1-20. General information on care, handling, preservation, storing, and shipping of ammunition and explosives, and their demolition to prevent enemy use is contained in TM 9-1903/TO 11A-1-37. Small-arms cartridges with detailed data are covered in TM 9-1990/TO 11A-13-1-101. These publications should be available for use as required in connection with this manual.

2. Arrangement of Text

a. Sections I and II of chapter 1 cover purpose and scope, arrangement of text, definition, classifications, standard nomenclature, Federal stock number and Department of Defense Identification Code, classification of ammunition for aircraft guns, means of identification, grade of ammunition, explosive charges, and packing and marking for shipment.

b. Section I of chapter 2 presents specific data for ammunition for caliber .50 aircraft guns.

c. Sections II through IV of chapter 2 deal with specific data on ammunition for 20-mm guns M3, M24A1, M39, M39A1, and M61 (T171E3).

d. Chapter 3 describes fuzes, propelling charges, and primers for ammunition for aircraft guns.

e. Chapter 4 presents methods for the demolition of ammunition to prevent enemy use.

f. A list of references is given in the appendix.

Section II. GENERAL DISCUSSION

3. Definitions

Ammunition for caliber .50 and 20-mm aircraft guns is classed as fixed ammunition. Certain components have the same nomenclatures while the missiles are known as projectiles in 20-mm cartridges and as bullets in caliber .50 small-arms ammunition. A round of fixed aircraft ammunition consists of a cartridge case, a projectile or bullet, a quantity of propellent grains, and a primer. Certain 20-mm projectiles contain high explosives and are assembled with point-detonating fuzes. Upon impact of the percussion firing pin or upon closure of the electrical circuit, the composition within the primer is detonated; flames thereof in turn ignite the propellent grains. The high pressure of the generated combustion gases forces the projectile or bullet out of the cartridge case and drives this missile out of the weapon at high velocity. Upon impact, the fuze causes initiation of the explosive with certain 20-mm projectiles. Initiation of incendiary composition within other type projectiles or bullets is caused by the crushing force and heat generated upon impact. Throughout storage, feeding, and firing, the cartridge case acts as a container for the other cartridge components and also, during firing, prevents the rearward escape of propellent gases. As indicated by its classification of fixed ammunition, such cartridges are manufactured for issue and are as self-contained units; disassembly, modification of the propellent charge, and/or change of projectiles is not intended.

4. Classification

a. Caliber .50 ammunition is classified according to type as ball, armor-piercing, incendiary, tracer, armor-piercing-incendiary, armor-piercing-incendiary-tracer, blank, dummy, and high-pressure test. Caliber .50 ammunition is classified according to use as service and special, which includes training and test ammunition.

b. Twenty-millimeter ammunition is classified according to type as armor-piercing, armor-piercing-incendiary, armor-piercing-incendiary-tracer, ball, high-explosive with incendiary, incendiary, dummy, high-pressure test, and target practice. Twenty-millimeter ammunition is classified according to use as service and special, which includes training and test ammunition.

5. Standard Nomenclature

Standard nomenclature is established in order that each item supplied may be identified specifically by name. Standard nomenclature consists of an item name, a colon, and additional item identification established in accordance with Federal Item Identification Guides for Supply Cataloging. For ammunition for aircraft guns, other than blank and dummy ammunition, the item name consists of the word "cartridge"

unstained and marked in black. The wooden box M23 is a typical packing box which is used for both caliber .50 cartridges (fig. 1) and 20-mm cartridges (fig. 2). Packing for ammunition for the 20-mm gun M39 series is differentiated from that for the 20-mm gun M61 by marking the model number of the applicable cartridge link on the outer packing container. A space is left blank in front of the word LINKS which appears on the side of the container. Model number T61E3 is inserted in the blank space if the ammunition in the box is for the gun M39 series. If the ammunition is for the gun M61, model number T76 is inserted in the blank space.

Figure 1. Caliber .50 ammunition packing box M23.

13. Forms and Reports

a. Authorized Forms. The forms generally applicable to units operating this materiel are listed in the appendix. For a listing of all forms, refer to DA Pam 310–2. For instructions on use of these forms, refer to FM 9–10.

b. Field Reports of Accidents. If an accident or malfunction involving the use of ammunition occurs during training or combat, the range officer for a unit in training or the officer or noncommissioned officer in charge of the firing unit in combat immediately will discontinue firing ammunition of the lot which malfunctions. He then will report the occurrence and all pertinent facts of the accidents or malfunction to the technical service officer under whose supervision the ammunition for the unit involved is

CHAPTER 2

CARTRIDGES

Section I. CARTRIDGES FOR CALIBER .50 AIRCRAFT GUNS

14. General

a. General Discussion. A round of caliber .50 ammunition (fig. 3) consists of a bullet, a propelling charge, a primer, and a cartridge case, all assembled into a unit assembly (table II).

Table II. Weights of Caliber .50 Ammunition
(In grains; maxima permitted in manufacture)

Cartridge	Complete (approx.)	Cartridge case	Propelling charge (approx.)	Primer	Bullet				
					Complete	Jacket	Core (slug)	Point filler	Base filler
AP, M2	1,822 or 1,812[1]	850	235	19.06	718 or 708	253	410 or 400[1]	56.5	
API, M8	1,739 or 1,726[1]	850	233	19.06	622 or 649[1]				
API, T49	1,591	850	25	19.06	501				
API–T, M20 (T28).	1,698 or 1,686[1]	850	2[illegible]0	19.06	624 or 612[1]				Tracer and igniter Comp–14.
Ball, M33	1,768	850	237	19.06	661.5	253	400	56.5	
Incendiary, M1.	1,703	850	240	19.06	628.5				
Incendiary, M23 (T48).	1,581	850	237	19.06	512				
Tracer, M1:									
w/gilding metal jacket.	1,789	850	240	19.06	681	408	207		Tracer and igniter Comp–70.
w/clad steel jacket.	1,750	850	240	19.06	641	368	207		

See footnotes at end of table

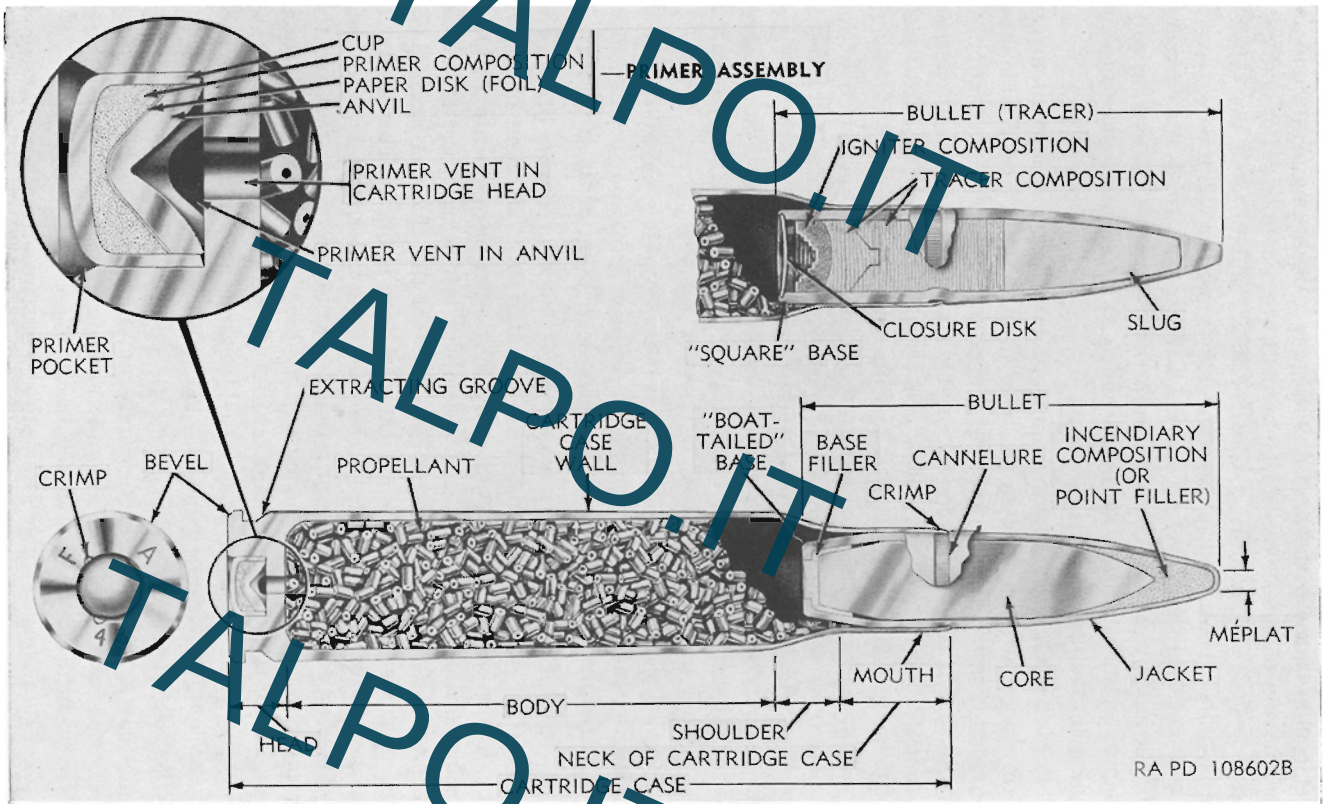

Figure 8. Cartridge terminology.

stamping of the manufacturer's initials and year of manufacture on the base of the cartridge case. For example, "FA 53" means the lot was loaded at Frankford Arsenal in 1953.

(3) From packings and containers, and markings thereon, the ammunition can generally be completely identified by—

(*a*) Markings on the original packing boxes and cartons.

(*b*) A functional reference data card inserted in each packing box containing functional lots of ammunition when component lots of the functional lot have not been marked on the outer packing box. Formerly, an identification card, usually 6½ x 15, was sealed inside the metal liner on top of ammunition in each box.

g. Packaging.

(1) The containers and methods for packing caliber .50 ammunition are given in the drawings, specifications, and Department of the Army Supply Manual 9–5–1305/United States Air Force Stock List 1300. Containers presently being manufactured have been designed to withstand all conditions commonly encountered in handling, storing, and transporting the ammunition.

(2) With few exceptions, caliber .50 ammunition is issued in metal containers packed for shipment in wooden boxes. There are two types of metal containers: Hermetically sealed can opened by means of a key and tear strip and metal boxes having hinged covers sealed by means of a rubber gasket.

(3) Packing materials used by Field Service for caliber .50 ammunition which are classed as containers, packaging, and packing supplies are listed in Department of the Army supply manuals and United States Air Force stock lists covering FCS group 81. These include boxes and cartons and certain box components. Box components which are classed as hardware, such as wingnuts and screwhooks, are listed in Department of the Army supply manuals and United States Air Force stock lists covering FCS group 53. Cartridge clips and cartridge links are classed as ammunition components and are listed in Department of the Army Supply Manual 9–5–1305/United States Air Force Stock List 1300.

15. Ballistics

The trajectories of caliber .50 service bullets, except those in the incendiary M23 and API T49 cartridges, for aircraft use match at 1,000 yards. The time of flight does not differ by more than 1/10 second under specified conditions. The bullets of incendiary M23 and API T49 cartridges are lighter than other service bullets weighing approximately 500 grains and have a muzzle velocity of 3,450 feet per second. They also have matched ballistics.

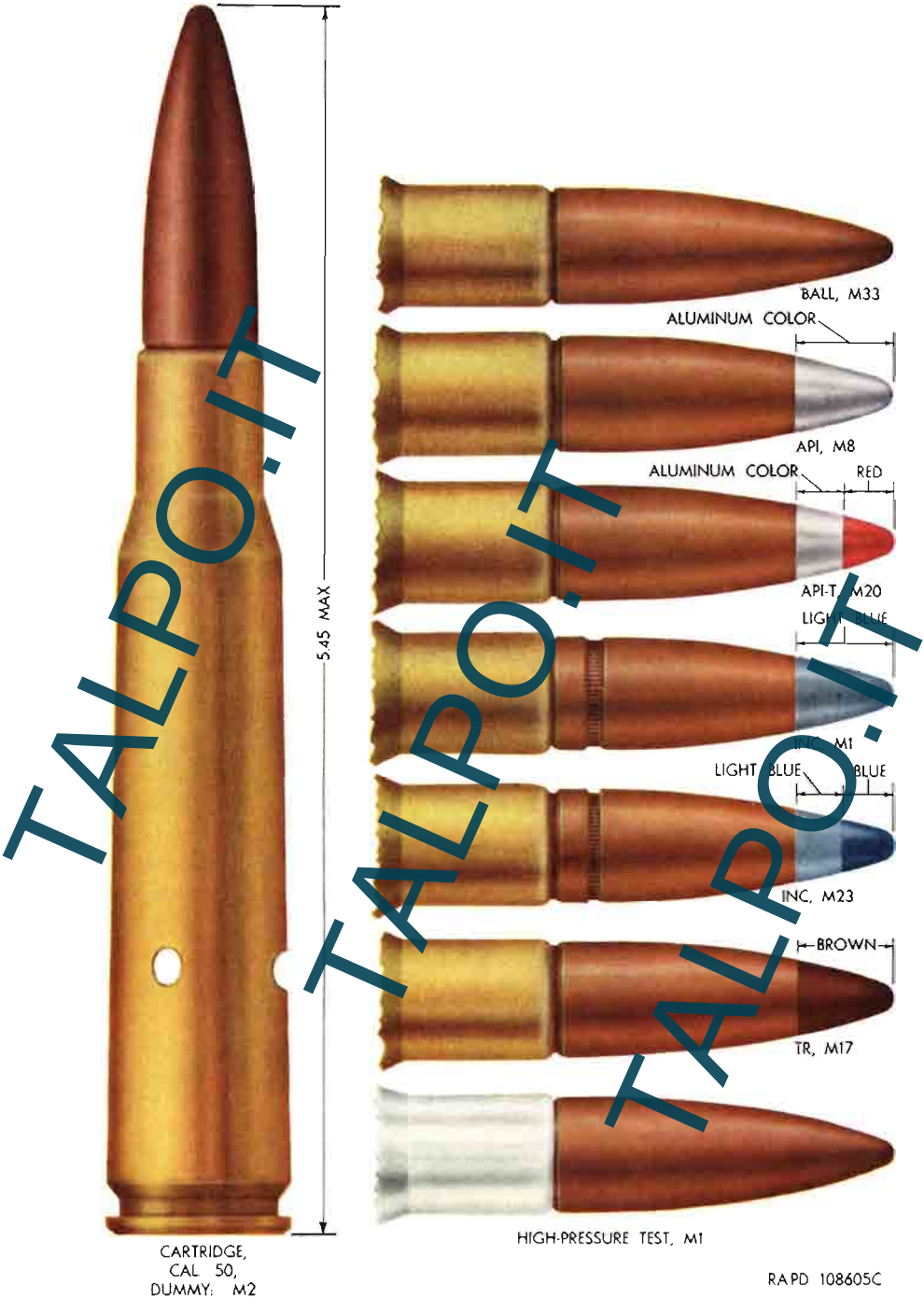

Figure 4. Caliber .50 cartridges.

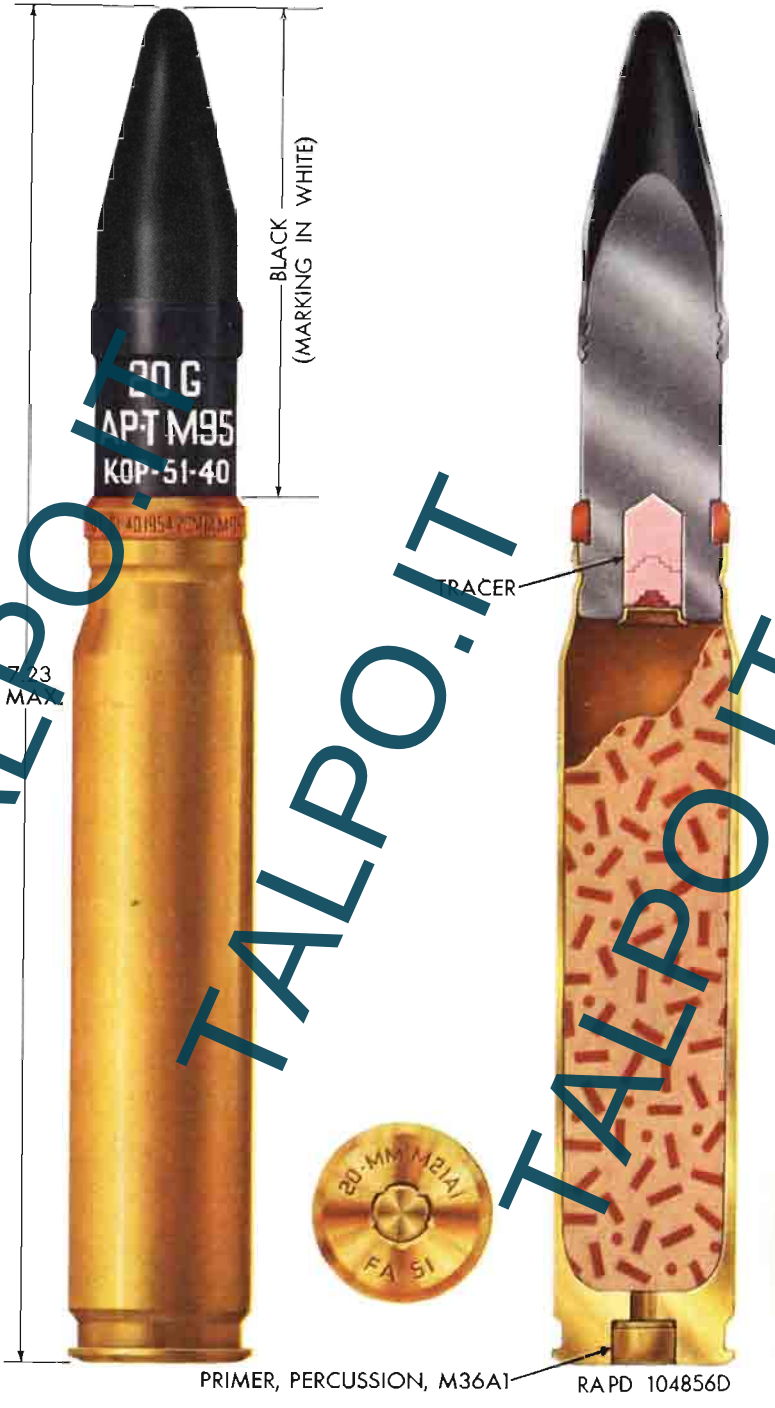

Figure 6. Cartridge, 20 millimeter: AP-T, M95.

33. Cartridge, 20 Millimeter: AP-T, M95, Steel Case

This cartridge is the same as the item in paragraph 32, except that the steel cartridge case M21A1B1 is substituted for the M21A1.

34. Cartridge, 20 Millimeter: HEI, M58 (T241), W/Fuze, PD, M505

a. General. This cartridge (fig. 7), which replaces the M97A1, differs from the M97A1 (par. 36) principally in the interior design and loading of the projectile. It provides an adequate ballistic match with the M97A1. The M58 is an improvement over the M97A1 in blast, fragmentation, and incendiary effect. The weight of the incendiary charge (MOX–2B) is 0.026 pound. The weight of explosive is 0.03 pound, composed of 0.026 pound of MOX–2B and 0.004 pound of RDX. Upon impact, the charge is functioned with a combined detonative and incendiary effect. A base cover is welded to the base of the projectile for additional safety. The PD fuze M505 is an instantaneous percussion fuze of the impact-type. See paragraph 66 for description of this fuze.

b. Data.

Weight of complete round	0.55 lb.
Length of complete round	7.25 in. (max.)
Length of fuzed projectile	3.31 in.
Length of cartridge case	4.34 in.
Type of base	squ

35. Cartridge, 20 Millimeter: HEI, M97, W/Fuze, PD, M75

This cartridge, which is replaced by the M97A1, differs from the M97A1 (par. 36) principally in the fuze. The fuze M75, which is described in paragraph 65, has no interrupter or other special devices for boresafety. In this respect, it differs from the fuze M505.

36. Cartridge, 20 Millimeter: HEI, M97A1, W/Fuze, PD, M505

a. General. This cartridge is for use against aircraft and light materiel targets, functioning with both explosive and incendiary effect. The high-explosive is tetryl and is located in the nose portion of the projectile, while the incendiary mixture is located in the base. The combined weight of the high-explosive-incendiary filler is 0.017 pound composed of 0.005 pound of incendiary mixture and 0.012 pound of tetryl. Upon impact, its filler is detonated, the shell shattered, and the incendiary composition ignited. Its fuze is an instantaneous percussion fuze of the impact-type. The thickness of the base is approximately 0.2 inch, and a base cover is welded thereon for additional protection.

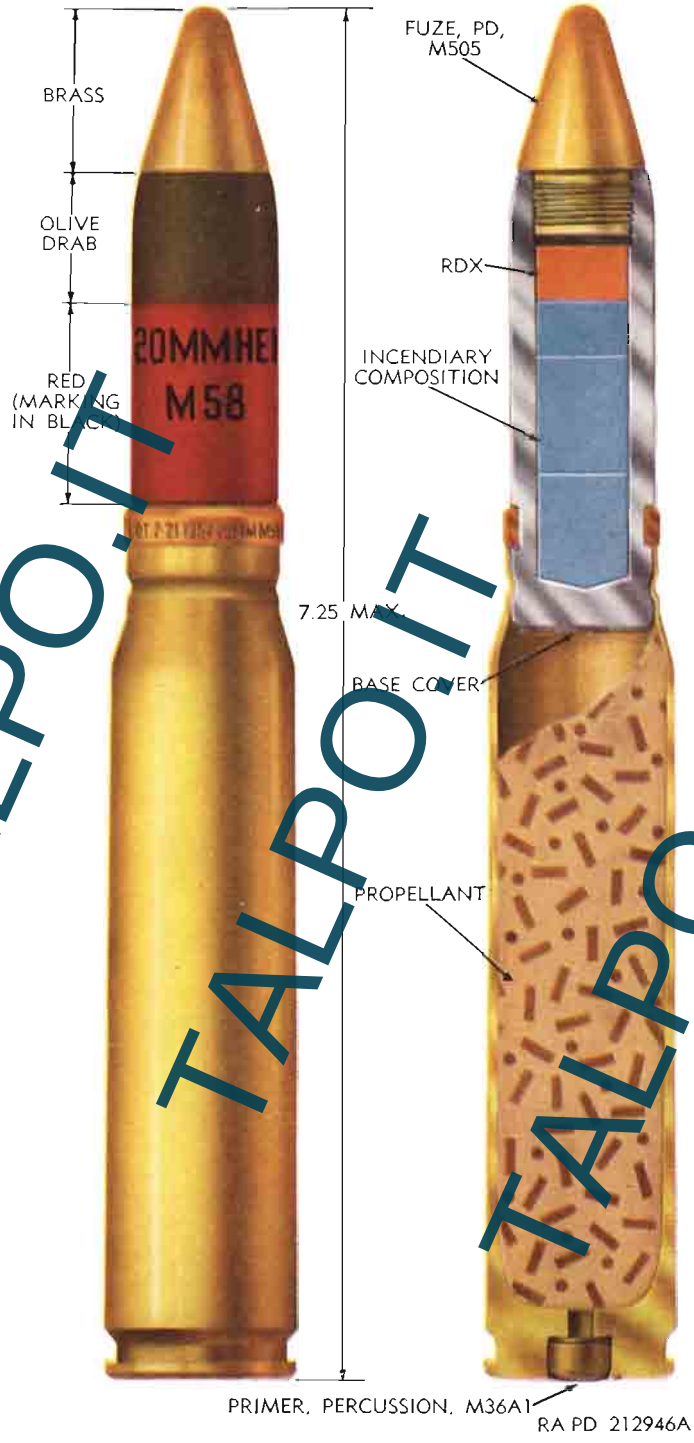

Figure 7. Cartridge, 20 millimeter: HEI, M58 (T241), w/fuze, PD, M505.

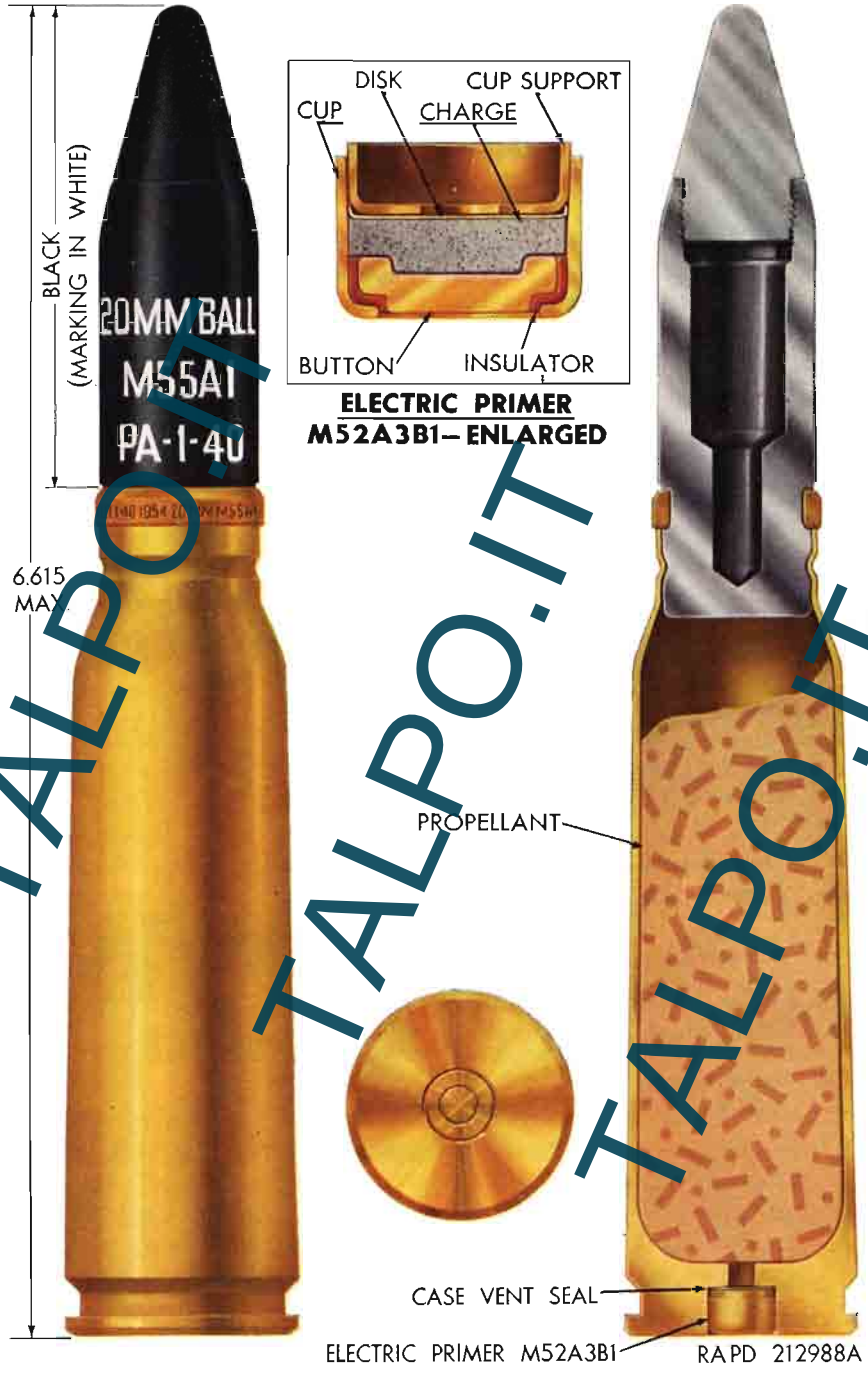

Figure 12. Cartridge, 20 millimeter: electric, ball, M55A1

60. Cartridge, 20 Millimeter: Electric, HEI, M56A1 (T198E1), W/Fuze, PD, M505

a. General. This cartridge (fig. 13) is for use against aircraft and light materiel targets, functioning with both detonative and incendiary effect. The projectile body is a steel, relatively thin-walled casing. The weight of the incendiary composition, which is MOX–2B, is 0.26 pound. The total weight of explosive is 0.03 pound, composed of 0.026-pound MOX–2B and 0.004-pound RDX. The RDX explosive is loaded between the base of the fuze and the incendiary composition which occupies the rest of the interior of the projectile body. The thickness of the base of the projectile is approximately 0.21 inch and the base cover is crimped thereon for additional safety. Upon impact, the charge is functioned with a combined detonative and incendiary effect. Functioning is initiated by the PD fuze M505, an instantaneous fuze of the impact type, which is described in paragraph 66. The PD fuze M505E1 which is described in paragraph 67 may be used instead of the fuze M505. The cartridge case M103, loaded with approximately 0.083 pound of double base (Western Ball) propellant, and the electric primer M52A3B1 are used in the cartridge M56A1. A cellulose case vent seal is assembled in the primer recess, between vent and primer.

b. Data.

Weight of complete round	0.56 lb.
Weight of projectile, as fired	0.22 lb.
Length of complete round	6.615 in. (max.)
Length of fuzed projectile	3.025 in.
Length of cartridge case	4.015 in.
Width of rotating band	0.203 in.
Type of base	square

61. Cartridge, 20 Millimeter: Electric, HEI, M56A1, Steel Case, W/Fuze, PD, M505

This cartridge is identical with the cartridge described in paragraph 60, except that this round is assembled with the cartridge case M103B1 (steel) instead of the cartridge case M103 (brass). The steel cartridge case is approximately 0.01 pound lighter than the brass case.

62. Cartridge, 20 Millimeter, Dummy: M51 (T228)

a. General. This cartridge (fig. 14) is a completely inert assembly that is used for drill purposes and for testing the feeder assembly of the weapon. The service cartridge is simulated by assembling the projectile of the ball cartridge M55 (par. 56) or M55A1 (par. 57) with the cartridge case M103 (dummy). The cartridge case contains approximately 0.086 pound of inert material in order to produce an average overall weight equal to that of the service cartridges.

b. Data

Weight of complete round	0.56 lb.
Length of complete round	6.615 in. (max.)
Length of cartridge case	4.015 in.

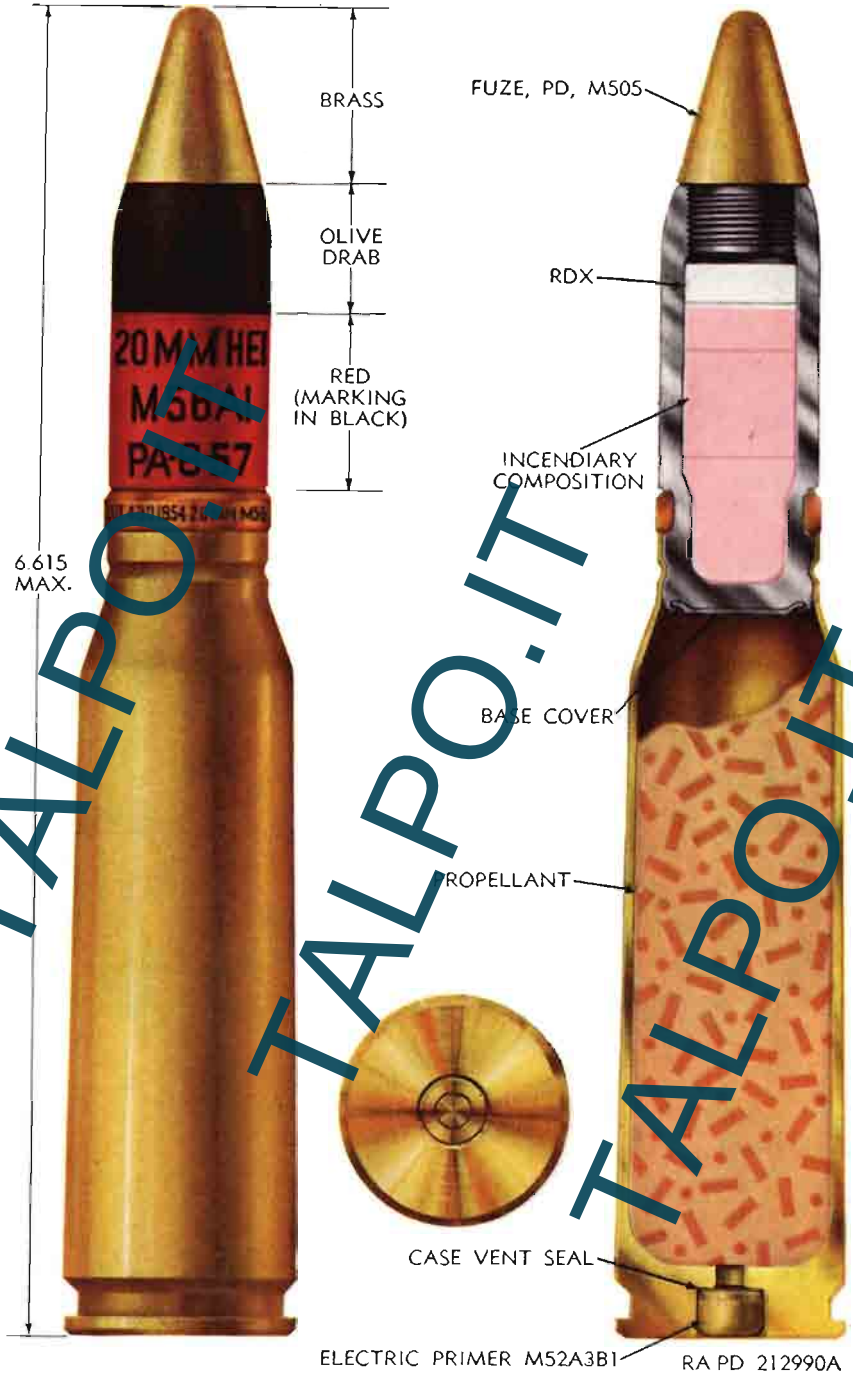

Figure 13. Cartridge, 20 millimeter: electric, HEI, M56A1 (T198E1), w/fuze, PD, M505.

Figure 14. Cartridge, 20 millimeter, dummy: M51 (T228).