

SMALL-CALIBER AMMUNITION IDENTIFICATION GUIDE (U)

Volume 2

20-mm to 40-mm Cartridges (U)

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PREFACE

This guide, Volume 2 of a series, supplements Volume I, which covers the identification of small-arms cartridges of 15-mm caliber and below. Volume 2 provides information and procedures to assist the reader in identifying military cartridges in calibers from 20 mm to 40 mm as to cartridge designation, country, and weapon or weapons for which the cartridges are intended. Like Volume 1 it provides persons without a technical background in ammunition basic information on cartridge types, construction, and terminology, as well as more detailed identification data on each cartridge.

Coverage in this volume is limited to cartridges in the 20- to 40-mm caliber range made since 1930 that are designed for service use; it excludes shotgun cartridges, riot-control cartridges, and signal cartridges, and, with few exceptions, subcaliber cartridges. Also excluded, because of their age and limited use, are 26-mm cartridges of several types that were developed during World War II by Germany for use in the 26-mm Kampfpistole, a rifled weapon that was developed from the signal pistol.

The information contained in this guide has been derived from a variety of sources: examination of cartridges, intelligence and explosive ordnance disposal reports, US and foreign technical publication, and contributions by knowledgeable individuals. A special word of thanks is due to those many individuals who have provided information used in this guide.

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TABLE OF CONTENTS

	Page
Preface	iii
SECTION I. INTRODUCTION	
1. General	1
2. Organization	4
3. Cartridge Cases	4
4. Projectiles	8
5. Primers	11
6. Propellant	13
7. Cartridge Designation	14
SECTION II. CARTRIDGE IDENTIFICATION PROCEDURES	
1. General	17
2. Caliber and Cartridge Designation	17
3. Country and Year of Manufacture	18
4. Functional Type	20
5. Safety in Handling	20
SECTION III. CARTRIDGE IDENTIFICATION DATA	
A. CARTRIDGE-CASE OUTLINE DRAWINGS	
1. General	23
2. Use	23
B. DIMENSIONAL AND REFERENCE DATA	
3. Dimensional Data	55
4. Cartridge Reference Data	64

TABLE OF CONTENTS (CONTINUED)

	Page
SECTION IV. MARKING PRACTICES BY COUNTRY	
A. GENERAL	
1. Scope	133
2. Organization	133
B. COUNTRY MARKING PRACTICES	
3. Czechoslovakia	133
4. Egypt	136
5. France	137
6. Israel	138
7. People's Republic of China	142
8. Switzerland	144
9. United Kingdom	147
10. United States	149
11. USSR	153
12. West Germany	159
13. World War II—Germany and Japan	162

LIST OF ILLUSTRATIONS

Figure	Page
1. Cartridge base types	6
2. Functional projectiles	10
3. Small-arms primers	12
4. Artillery-type and electric primers	12
5. Typical high-low pressure cartridge	14
6. Location of rim and head measurements	55
7. Czechoslovak cartridge markings	135
8. Egyptian cartridge headstamp markings	137
9. French cartridge markings	140
10. Israeli cartridge markings	141
11. PRC cartridge markings	143
12. Swiss cartridge headstamp markings	144
13. UK commercial cartridge headstamp markings	147
14. UK 20-mm cartridge-case markings	148
15. UK 30x113B cartridge-case markings	149
16. US cartridge markings	152
17. Soviet cartridge headstamp markings	157
18. Soviet 37-mm cartridge-case markings	158
19. West German cartridge markings	161
20. World War II German cartridge markings	163
21. World War II Japanese cartridge markings	165

LIST OF TABLES

Table	Page
I. 20-mm to 40-mm Cartridge Data	56
II. Abbreviations and Terms on French 20-mm to 40-mm Cartridges	139
III. Hispano-Suiza Projectile Types and Color Coding	145
IV. Oerlikon Projectile Types and Color Coding	146
V. NATO Ammunition Color Code	151
VI. Experimental US 30-mm Belted Cartridge Cases	154
VII. German Terms and Abbreviations Used on Ammunition or Packaging	160

Section I.

INTRODUCTION

1. General

a. This guide provides reference data on, and outlines procedures that will aid in the identification of, cartridges in the 20- to 40-mm range. It thus supplements Volume I, which deals with the identification of small-arms cartridges up to 15 mm; there are no service types of military cartridges between 15-mm and 20-mm. Much of the information that appears in Volume I is applicable in some degree to larger-caliber cartridges as well. Although the present volume provides information applicable to and adequate for the identification of cartridges in the 20- to 40-mm range, the reader will find it helpful to refer as well to Volume I.

b. Because of the proliferation within each country during the past 40 years of functional types, models, and color codes in many calibers of ammunition, the information in this guide is limited to cartridge designation and country and year of manufacture. Some guidance is provided as to the design and visual identification of functional types, but the determination of specific model designations or identification of color codes used by each country is outside the scope of this volume.

c. The term "cartridge identification" can encompass a wide span of activities, ranging from the simple determination of a cartridge's caliber and case length to a detailed examination that can include its country of origin, functional type, model or type

designation, and even lot number, year, and place of manufacture. The problems involved in the identification of cartridges may be summarized in three questions, which this guide will help to answer:

(1) What is the cartridge designation? This is expressed by a brief descriptive designation that includes the projectile caliber and case length. This designation is applicable to all cartridges that can be fired in guns chambered for this specific cartridge.

(2) Who made the cartridge, and when? Normally this information can be derived from the markings that appear on the projectile, on the case wall, or on the cartridge base. If the cartridge is unmarked, or if the markings are for any reason inadequate, a detailed examination and comparison with similar cartridges of known origin may be necessary. Because of its technical complexity, such a comparison falls outside the scope of this guide.

(3) What is its functional type? More specifically, does the projectile contain an explosive charge that demands added caution in handling and storage? Frequently this can be determined beyond doubt from markings data, but if any question exists, an examination by technically qualified ammunition specialists will be necessary.

d. Ammunition in the 20- to 40-mm range is frequently termed automatic gun ammunition, since with very few exceptions all of the cartridges produced today in these calibers are designed to be fired in fully automatic weapons similar in operation to, but larger than, heavy machineguns. Cartridges in these calibers vary widely in design and performance, ranging from low-power cartridges that differ little from small-arms cartridges except in

caliber and projectile construction to high-performance antitank (AT) and antiaircraft (AA) cartridges. Cartridges in the 20- to 40-mm range differ from small-arms cartridges principally in their use of artillery-type projectiles, frequently with an explosive charge, instead of the jacketed bullet construction typical of small-arms ammunition. In common with smaller-caliber cartridges, they almost invariably have a one-piece, drawn-metal cartridge case; the primer may be either a percussion primer of the type used in small-caliber cartridges or an artillery-type electric or percussion primer with a black-powder igniter charge.

e. Cartridges in this range originated with the 1-inch Gatling machinegun, introduced as early as 1866, which was followed by 1-pounder (approximately 37-mm) cartridges of several types, fired either from handpower-operated guns such as the Gardner, Nordenfeldt, and Hotchkiss systems or from single-shot, quick-firing guns. A self-powered automatic gun, the 37-mm Maxim, appeared as early as 1885. The term "pom-pom" was originally applied to this gun. Development since World War I has been directed primarily toward improved ammunition for automatic or power-operated guns for aircraft and antiaircraft use, with a reduced effort in the area of cartridges for semiautomatic weapons for accurate aimed fire against point targets.

f. Some of the cartridge types that are described in this guide were produced 40 or more years ago. Cartridges made during and even before World War II are not necessarily unserviceable because of their age; if they have been stored under favorable conditions of low humidity and low-to-moderate temperature, and if the brass cartridge case has not become brittle from exposure to the mercuric compounds in the primer or from improper annealing of the metal, they may be safe to fire, though fuzes and tracers may not function reliably. Serviceability must be determined through inspection and testing by qualified ammunition specialists.

2. Organization

This guide comprises four major sections.

a. Section I outlines the scope of this guide and its organization. It also provides general information on construction, characteristics, and terminology of automatic gun ammunition that will aid in the use of this guide.

b. Section II provides instructions for the use of this guide in the identification of cartridges from dimensional and visual data.

c. Section III provides a series of outline drawings of cartridge cases, a tabulation of major cartridge dimensions, and a brief description of each cartridge type in terms of its origin, using weapons, principal countries of manufacture and use, and current status. Cross-reference of information in these three areas is aided by the use of an index number that is assigned to each cartridge designation.

d. Section IV presents representative cartridge identification data for each of the major countries that has produced ammunition in this caliber range.

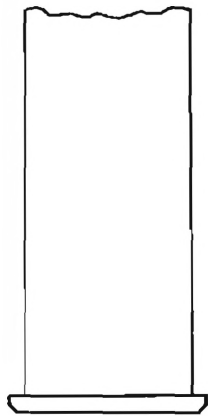
3. Cartridge Cases

The primary feature in cartridge identification is the cartridge case. Its shape and dimensions, which must conform to the chamber size of the gun for which designed, indicate the type and probable military role of the weapon, which in turn may suggest the country of origin or the political polarity of the user. Key aspects of cartridge-case design and construction are outlined in the following subparagraphs.

a. The cartridge case (which, incidentally, can account for more than half the weight of the complete cartridge) provides a sturdy, reusable, weatherproof container that unites the primer, propellant, and projectile into a unit and protects them from damage in storage, handling, and loading or feeding. During firing, the case provides obturation, sealing the breech end of the barrel to prevent the escape of hot propellant gases into the gun mechanism. When automatic weapons are fired, the cartridge case serves an equally important purpose in acting as a heat sink: It extracts a significant portion of excess heat from the gun chamber after each shot, thus reducing the risk of overheating the gun and the attendant possibility of premature firing (cook-off).

b. To provide desired performance characteristics, military cartridge cases must be robust; all are of centerfire construction, with a reinforced cartridge case head and a centrally located primer that ignites the propellant contained in the cartridge case. Cartridge cases are made principally of brass or mild steel (either plated or lacquered), though in recent years aluminum cases have made a strong appearance. Cases are manufactured by punch and die operations, termed "drawing," with heat treatment to provide desired metallurgical characteristics.

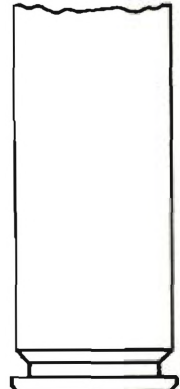
c. Cartridge base types, which serve a functional purpose in the feeding, positioning for firing, and extraction of the fired case or the unfired cartridge, are valuable identifying features. For convenience in cartridge identification, the cartridge base description is used as an element in the descriptive designation of the cartridge. The five base types in use, with their abbreviations, are as follows: rimmed (R), rimless (no abbreviation), semirimmed (SR), belted (B), and rebated (RB). These types, which are shown in figure 1, are described in the following subparagraphs.



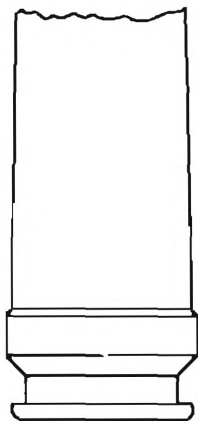
RIMMED



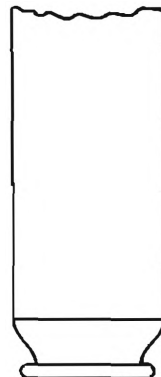
RIMLESS



SEMIRIMMED



BELTED



REBATED

Neg. 526091

Figure 1. Cartridge base types.

(1) Rimmed cartridge cases have a rim, or extractor flange, extending beyond the cartridge body; the rim seats against the breech face and aids in extracting the fired case. There may be a slight undercut or groove in the case body ahead of the rim.

(2) Rimless cases have an extraction groove in the case body, leaving a flange at the base of the case. The diameter of this flange is the same as, or very close to, the diameter of the cartridge case ahead of the groove.

(3) Semirimmed cases have an extraction groove in the case body. The diameter of the flange at the case base is distinctly larger than the diameter of the cartridge case ahead of the groove. A semirimmed case can be identified by laying a straightedge along the cartridge body; a distinct gap will be noted between the case body and the straightedge just ahead of the extraction groove.

(4) Belted cartridge cases have a pronounced raised belt around the cartridge case body ahead of the extractor groove. The rim diameter is not significant; it may be greater than, the same as, or less than the belt diameter.

(5) Rebated cartridge cases have a flange at the rear of the extractor groove; the diameter of the flange is distinctly less than the case body diameter.

d. Fired cartridge cases can provide information on caliber designation, country of origin, year of manufacture, and primer type. Cases may also carry markings that indicate the model and functional type of the fired projectile. Finally, examination of a fired case by a weapon expert can, under favorable conditions, provide information as to the type of gun that fired the cartridge.

4. Projectiles

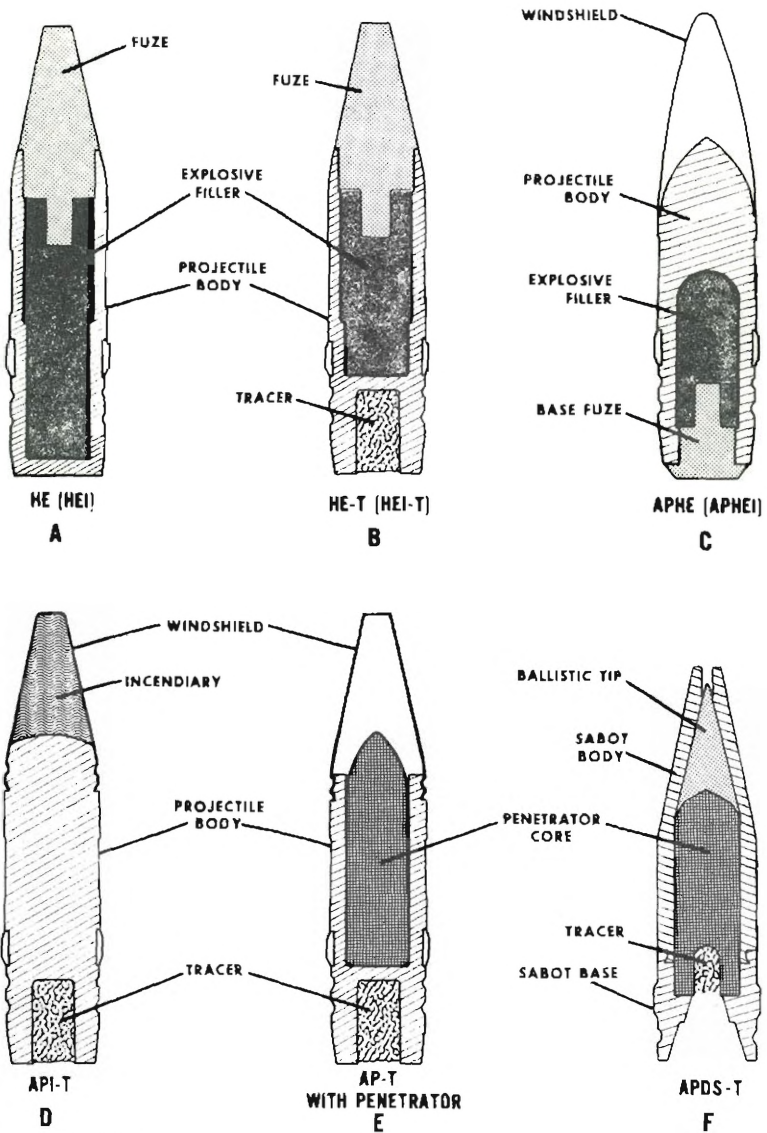
a. Projectiles in the 20- to 40-mm range follow the design of artillery projectiles rather than of small-arms bullets in that they have a well-defined rotating band and a bourrelet on the projectile body instead of a bullet jacket that is engraved by the rifling in the gun barrel. The relatively large mass (weight) of these projectiles permits a more sophisticated design and complex construction, tailored for a specific type of target, and frequently involving an armor-piercing penetrator or an explosive filler with some type of fuzing. These projectiles are intended primarily for use against materiel targets such as aircraft, armor, and defended positions; their antipersonnel effect is achieved principally by projectile fragments rather than, as for small arms, by direct impact.

b. In the designation of functional types, projectiles—and thus, cartridges—in this caliber range also follow artillery practice. For example, a cartridge whose projectile contains no explosive payload or penetrator, and which in small-arms ammunition terminology would be designated a ball cartridge, is normally termed a practice cartridge, although the term ball cartridge may occasionally be encountered. If the projectile contains a tracer, the cartridge will usually be designated a practice tracer (PT) cartridge, and only rarely a tracer cartridge.

c. Explosive projectiles include high-explosive (HE) and high-explosive incendiary (HEI); the latter may carry a tracer and then be termed HEI-T. Explosive projectiles have a fuze of some type to initiate detonation of the explosive charge; this may be a point-detonating (PD) or base-detonating (BD) type, depending on its location in the projectile. If the fuze has a self-destruct feature, to initiate detonation and thus destruction of the projectile at a predetermined time or distance after firing, the fuze will be

designated PDSD or BSDS. Such fuzes are frequently used in antiaircraft fire, or in air-to-air fire, to insure that a projectile that misses its intended target will detonate in the air and not land in a friendly area to create unintended damage or injury. Self-destruction can also be initiated upon tracer burnout. The tracer element is a body of pyrotechnic material in a cavity in the base of the projectile; the material is ignited by the burning propellant and emits a visible or smoke trace to enable the projectile's flight to be followed and permit adjustment of fire on the target. If a heat-sensitive detonator is placed between the tracer and the explosive filler, it will be initiated as the tracer burns out, perhaps two seconds after ignition, and thus detonate the projectile.

d. Kinetic-energy, armor-defeating projectiles include armor-piercing (AP) and armor-piercing-incendiary (API) projectiles, which may have a tracer and thus be termed AP-T and API-T. Solid AP projectiles were at one time termed "shot," and the term "AP shot" may still be encountered. If the projectile has an explosive filler and fuze (normally a base fuze) as well, it may be designated APHE, APHEI, or APHEI-T, depending on its construction. A special type of high-performance AP projectile, with a smaller-diameter core or penetrator of tungsten carbide (abbreviated WC) or tungsten alloy, may be combined with a projectile body that is designed to separate from the core as soon as the projectile has left the gun muzzle. The projectile base that is discarded is termed a "sabot"; the complete projectile is termed "armor-piercing, discarding sabot," or APDS. When a tracer is present, the projectile becomes APDS-T. If the projectile has a tungsten carbide penetrator, the designation is APDS (WC) or APDS-T (WC). The chief advantage to APDS projectiles is that the heavy, small-diameter penetrator encounters less air resistance during flight and thus does not lose its velocity as rapidly as a larger-diameter projectile; therefore, it has a shorter time of flight and higher impact velocity at longer ranges. Examples of functional types are found in figure 2.



Neg. 526092

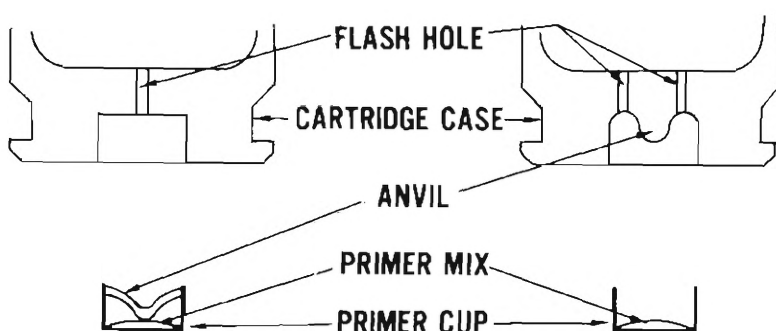
Figure 2. Functional projectiles.

5. Primers

Cartridges in the 20- to 40-mm range may use a wide variety of primers, from simple, small-arms-type primers for low-performance cartridges to complex, artillery-type primers. Electric primers are used almost exclusively for aircraft gun ammunition. These types are described in the following subparagraphs.

a. Small-arms primers may be of either the Boxer or the Berdan type. Boxer-type primers consist of a thin metal primer cup and an "anvil" of stamped metal. Between the primer cup and anvil is a pellet of primer mixture that is initiated when the primer is struck by a firing pin. The primer is inserted into a seat in the base of the cartridge. One axial flash hole normally conducts the flash to the propellant in the cartridge case. Berdan primers differ only in having the anvil made as a permanent feature of the primer pocket; the primer cup contains only the primer mixture. Berdan-primed cartridge cases normally have two flash holes, but cases with a single flash hole to increase the intensity of the primer flash have been found in small-arms cartridges. Boxer and Berdan-type primers are shown in figure 3.

b. Artillery-type percussion primers are separate assemblies that are either threaded or pressed into the base of the cartridge case. The primer body may contain merely a Boxer-type or Berdan-type primer and a black-powder primer charge, or it may be more complex, involving a firing plug that initiates the percussion element and also serves to prevent the escape of gas if the primer cup should perforate on firing. A primer of this type is shown in figure 4, view A.

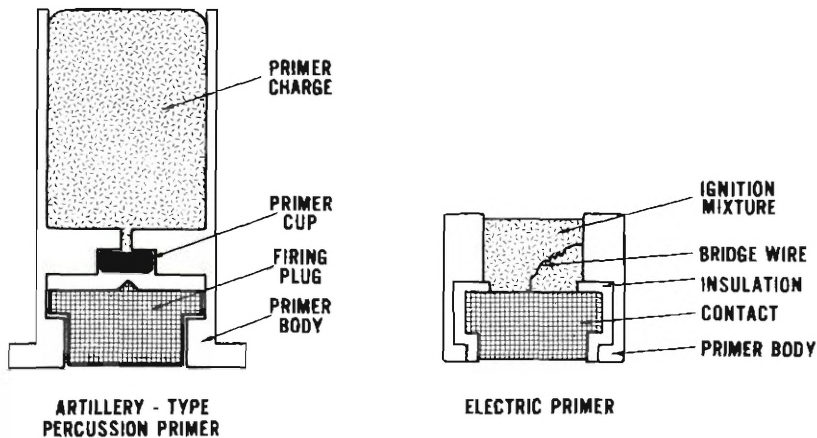


BOXER TYPE PRIMER

BERDAN TYPE PRIMER

Neg. 525253

Figure 3. Small-arms primers.



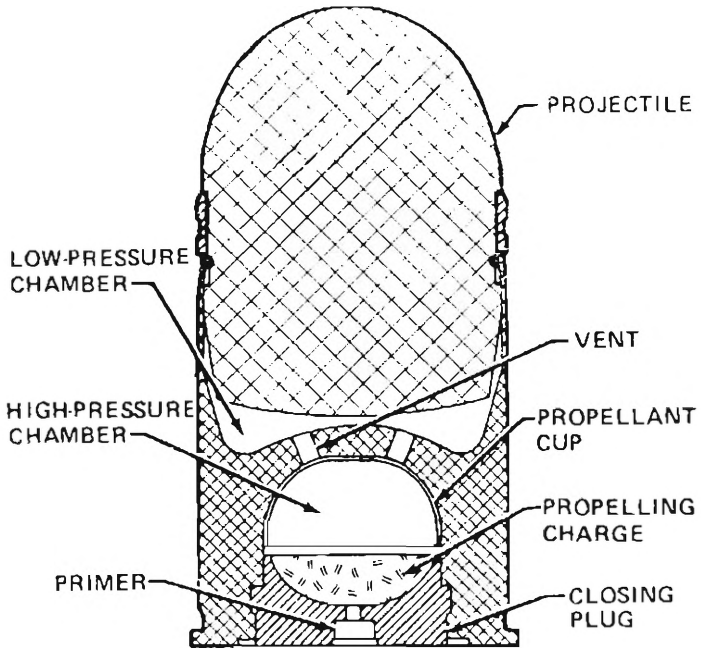
Neg. 526090

Figure 4. Artillery-type and electric primers.

c. Electric primers contain, instead of a percussion element, either a conductive primer mixture or a bridge wire embedded in the ignition mixture. A firing current (normally 24 to 28 V dc) is conducted through a contact on the cartridge base to the conductive ignition mixture or bridge wire, and returns through the cartridge case and chamber wall. This current ignites the primer mixture and initiates the propelling charge. Electric primers may be designed to be pressed into, or threaded into, cartridge cases; they may be dimensionally interchangeable with percussion primers, but they can be recognized by a ring of insulating material that surrounds the contact. A simple type of electric primer is shown in figure 4, view B.

6. Propellant

Depending on the performance that is expected, propellants may vary from small-arms-type ball powder to multiperforate cylindrical grains. Single-base nitrocellulose propellant predominates. Closely related to propellants is the high-low pressure system, designed to provide a low-pressure force of relatively long duration that will impart a low to moderate velocity to heavy projectiles. This is achieved by confining a small quantity of propellant in a strong chamber within the cartridge case adjacent to the primer, and providing this chamber with only small openings into the case. Upon firing, the propellant creates a high pressure within the interior chamber; the pressure escapes at a predetermined rate into the cartridge case to provide a low but continuing pressure against the projectile. The advantage of this procedure is that the effective pressure against the projectile rises slowly and never exceeds a moderate limit, allowing the gun chamber to be designed for a much lower maximum pressure than would otherwise be the case. Figure 5 shows a section of a high-low pressure cartridge.



Neg. 526019

Figure 5. Typical high-low pressure cartridge.

7. Cartridge Designation

a. "Cartridge designation" denotes an identifying terminology, unique to a specific cartridge, that includes the approximate caliber of the projectile as well as further identifying data. For convenience, and because many cartridges already have a metric designation, the metric system of cartridge designation used in Volume 1 will also be followed in this guide.

b. The metric designation consists basically of two numeric elements—the projectile diameter and the case length—which are expressed in millimeters. The first element is the actual or nominal

caliber of the projectile, expressed for automatic gun cartridges to the nearest millimeter. The second element is the case length, also expressed in millimeters. Since case lengths may vary by several millimeters without impairing proper gun operation, this case-length figure is frequently a nominal or approximate length. The first and second elements are separated by the letter x, which is read as "by." Thus, the designation "20x110" indicates a cartridge with a projectile diameter of 20 mm and a nominal case length of 110 mm. To further distinguish between otherwise similar cartridges, a suffix letter is added that indicates the cartridge base shape for other than rimless cartridges. The suffix letters used are as follows: R for a rimmed case, SR for a semirimmed case, B for a belted case, and RB for a rebated case. The absence of a suffix letter indicates a rimless case. Thus, the preceding example, 20x110, indicates that the case is rimless. There is also a 20x110 case with a rebated case head; this is designated as 20x110RB. In this one instance two rimless cartridges have the same caliber and case length but differ in the case diameter and contour. In this guide one of these cartridges has been given the arbitrary suffix USN to distinguish it from the more common Hispano-Suiza cartridge; thus, 20x110 USN.

Section II.

CARTRIDGE IDENTIFICATION PROCEDURES

1. General

To identify an unknown cartridge or a fired cartridge case with the aid of this guide, all that is needed is an accurate measuring device. Since all measurements are given in metric units, a vernier caliper that reads to 0.1 mm is entirely adequate; in an emergency a metric scale that reads to 0.5 mm may be used. Calipers or micrometers graduated in inches will also serve, provided that the measurements are converted to metric units. Since 1 inch is equal to 25.4 mm, the inch measurement (in decimals, not in fractions of an inch) is multiplied by 25.4 to arrive at the metric measurement.

2. Caliber and Cartridge Designation

a. It has been noted that cartridge designation is expressed by a nominal caliber and case length. Dimensional data in section III of this guide are presented in order of caliber as the principal identifying factor, and thereafter in order of increasing case length. Once the projectile diameter and case length (or, for a fired case, the case-mouth diameter) of the unknown cartridge have been measured, and the type of cartridge base noted, either of two methods can be followed to establish the cartridge designation.

b. For a rough-and-ready identification, refer to the cartridge case outline drawings in section III. Look for a cartridge case drawing whose caliber and case length designation match the

unknown cartridge, and which has the same type of cartridge head. The case lengths may not be identical, but a case outline can usually be found that is a close match to the unknown cartridge or case. Having found a good fit, note the applicable cartridge designation and the corresponding index number. For further information refer to section III, part B of this guide, where data on the origin, characteristics, and use of this cartridge will be found by reference to its index number.

c. For further identification, or in case of doubt, measure the cartridge case length as before; in addition, measure the projectile diameter, if one is present, and the case diameters at the following points: rim (the rearmost diameter of the cartridge case), case head (or belt, for belted cartridges), and case mouth. Using the caliber and case length as key dimensions, refer to the tabulation of case dimensions in table I in section III to find the cartridge designation whose base type and dimensions match the unknown cartridge. The dimensions in this table are representative measurements; individual cartridges, and particularly fired cases, may vary from the dimensions shown. Although the projectile diameter should be very close to the indicated value, the case length may vary by several millimeters from the dimensions given, while diameters may be up to a millimeter more or less than the figures shown.

3. Country and Year of Manufacture

a. Identification as to country of manufacture must be based on several factors: the caliber designation, the headstamp marking, if present, and any other markings that may appear on the fuze, projectile, or cartridge case.

(1) When the caliber designation has been determined, the information provided for that cartridge in part B, section III will suggest countries that could have manufactured the cartridge and eliminate from consideration other countries that for reasons of political allegiance, or because of the year of production, could not have produced it. Cartridges in calibers used by the Soviet Union may be assumed with a very high degree of probability to have been produced within the Eurasian Communist countries (ECC), while cartridges in use in the Western countries can with equal probability be attributed to a non-Communist country. Exceptions to this general rule exist, but these can be identified from their markings.

(2) The headstamp marking, taken together with other markings that may be present, provides further identification; the type of alphabet, and the words and abbreviations used, can be compared with the information presented in section IV of this guide on characteristic cartridge markings practices of the major cartridge-producing countries, and also with the headstamp and markings data in Volume I.

b. The year of production is usually but not always given in the headstamp marking, if one is present; it also appears frequently in stamped or stenciled lot number markings that may be found on the cartridge, projectile, or fuze. The year may be indicated by a two-digit or four-digit number, in non-Western numerals (oriental or Arabic*), or in a letter code. Examples of these markings are given in section IV.

*Except for the numerals 1 and 9, the "Arabic" numerals used by Western countries do not equate to those used by Arabic-speaking, and some other, countries. (See section IV, para 4.)

4. Functional Type

a. Except for the APDS or APDS-T projectile, whose characteristic design is usually unmistakable, the determination of a projectile's functional type from its external appearance alone can be risky. A cartridge with a nose fuze that is stamped with a model designation must be presumed to contain HE filler unless its markings indicate beyond question that the projectile is inert-loaded. The converse, unfortunately, is not true; the absence of a nose fuze cannot be taken to mean that the projectile does not contain a hazardous filler of some type. Projectiles of typical AP construction may have an explosive filler and a base fuze, while projectiles without a fuze of any type whatever may contain a sensitive HE or a hazardous filler such as white phosphorus. A definite identification can be established only from the markings and color code (if present) on the projectile or, less often, on the cartridge case. Unfortunately, these markings and color codes have often changed over a period of years; as a result they exist in such a proliferation that a comprehensive guide, covering all countries and years of manufacture, is not feasible. The marking systems used today by the major countries that produce ammunition in this caliber range are given in section IV. Additional information on cartridges made by the United States and on ammunition used during World War II can be found in the bibliography.

5. Safety in Handling

a. Cartridges in the 20- to 40-mm caliber range, unlike small-arms cartridges, have projectiles that for the most part contain HE and a fuze, and thus present a safety hazard. It must be emphasized that no cartridge can be considered to have an inert-loaded projectile unless its functional type has been determined beyond question from markings or color coding that are correct for and applicable to its country of origin and year of

manufacture. Even projectiles that follow the US/NATO color marking system and are identified by the blue projectile body as practice types may contain a spotting charge or other functional element that presents some degree of hazard.

b. If any question exists as to the safety of a projectile or cartridge, it must be considered as possibly HE-loaded and thus hazardous, and referred to an explosive ordnance disposal (EOD) unit or to some other qualified agency for determination of its type and hazard. An X-ray examination by an activity qualified to do this work will provide information on a projectile's internal construction that may aid in its identification and indicate the degree of hazard that attends its handling; however, an X-ray examination alone will not indicate the specific type of filler.

c. Removal of an unidentified projectile from its cartridge case, or its disassembly, is hazardous and must not be attempted by unauthorized personnel.

d. Explosive projectiles that have been fired and have failed to function are especially hazardous, since the fuze may be armed and sensitive to shock or jarring. This is true even of fired projectiles of World War II vintage. Fired projectiles can be recognized by the rifling marks engraved into the rotating band. Such projectiles should be left in place, marked or guarded, and reported immediately to police or EOD personnel for disposition. If any question whatever exists as to its hazard, the projectile should be considered dangerous and reported.



Section III.

CARTRIDGE IDENTIFICATION DATA

A. CARTRIDGE-CASE OUTLINE DRAWINGS

1. General

Cartridge-case outlines are presented in this section in sequence of case length, as indicated by the second element of the metric designation. These drawings will be found particularly useful for identifying fired cartridge cases with dented or deformed mouths, which may prevent ready measurement of the case-mouth diameter.

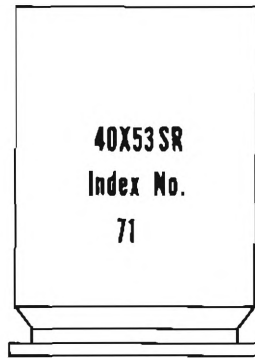
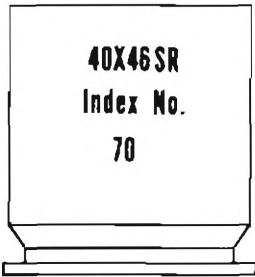
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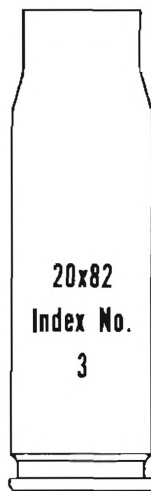
Because of space limitations, the outline drawings are reduced in scale. Cartridge cases 200 mm and less in length are shown at 75% of full size, while cases over 200 mm in length are shown at 45% of full size. Provided that the case length is known and the cartridge caliber can be estimated, these drawings can be used for a rapid preliminary identification from the case proportions, shoulder taper, and cartridge base type; this identification will frequently suffice when there is little likelihood of confusion between cartridge types. A tentative identification can be confirmed by reference to the dimensional data that appear in table I, following the outline drawings. Further information and background data on the cartridge's origin and development, and weapons in which it is used, appear in part B of section III. The index number that appears on each cartridge-case drawing can be used to locate a specific cartridge in table I or in section III, part B.

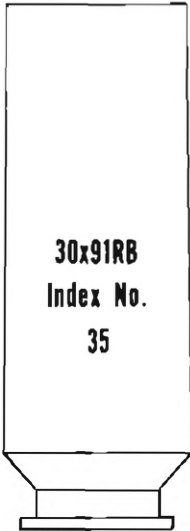
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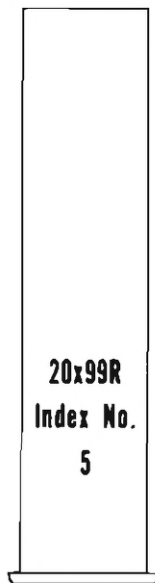
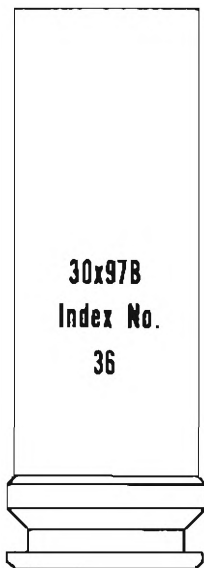
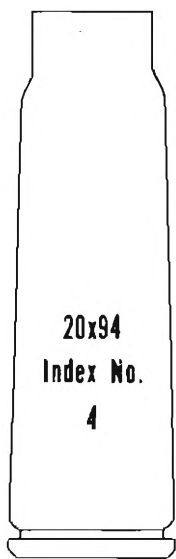
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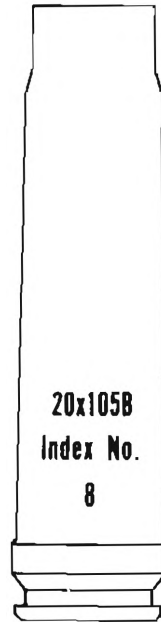
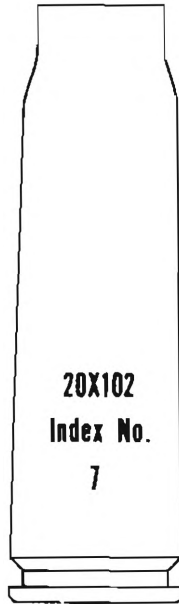
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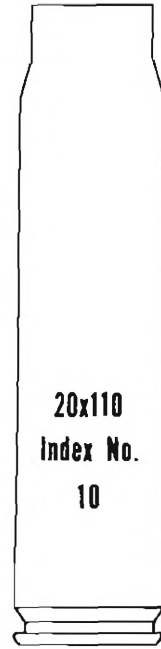
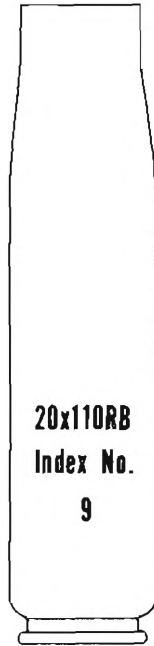
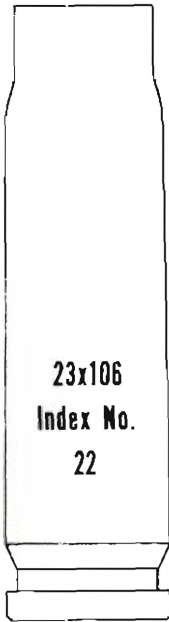


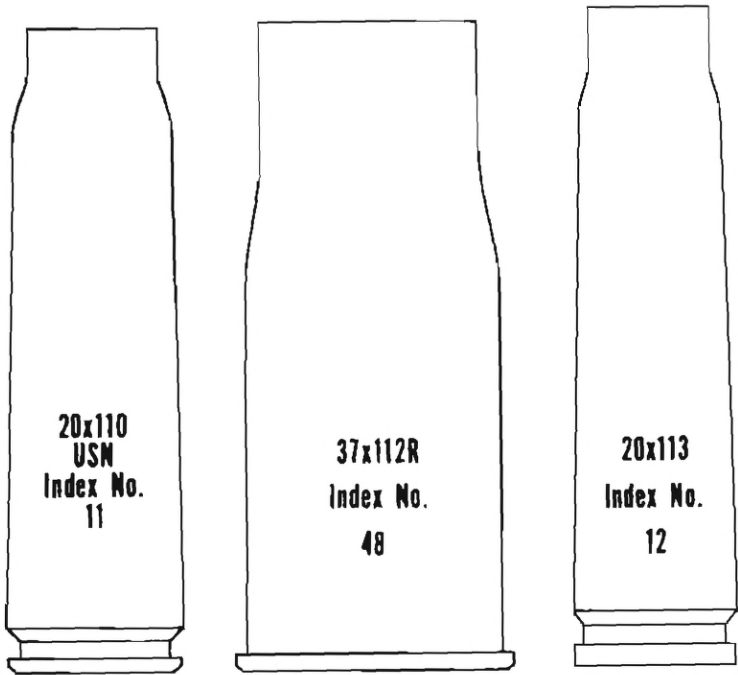


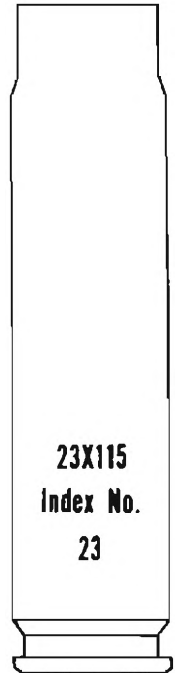
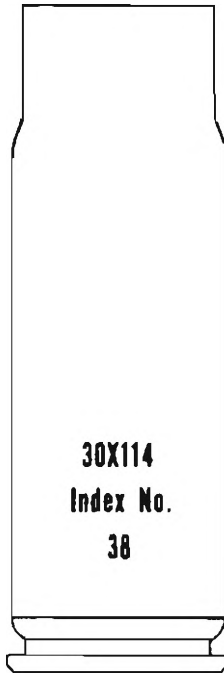
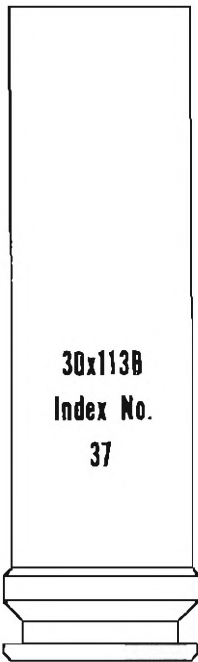


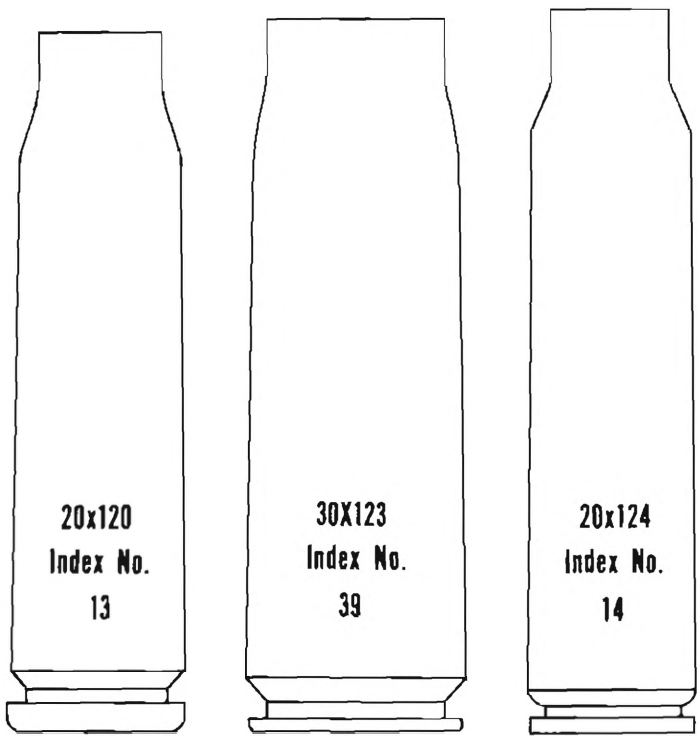


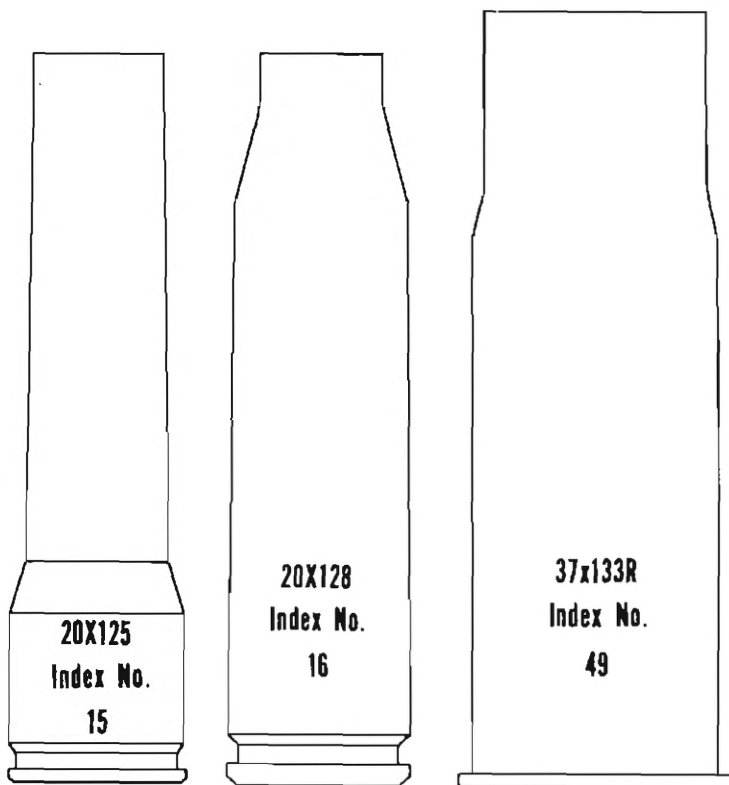


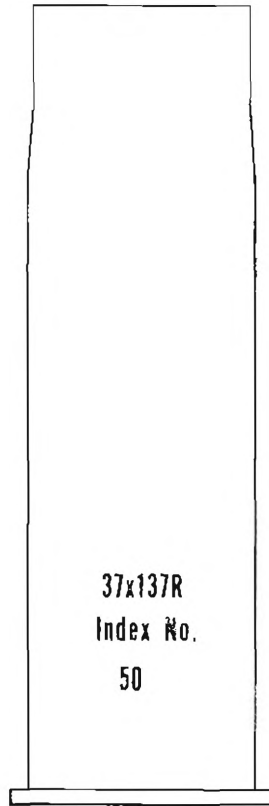
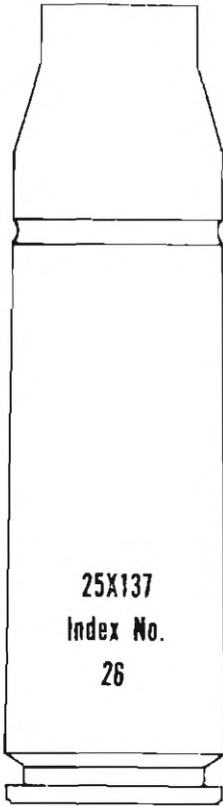


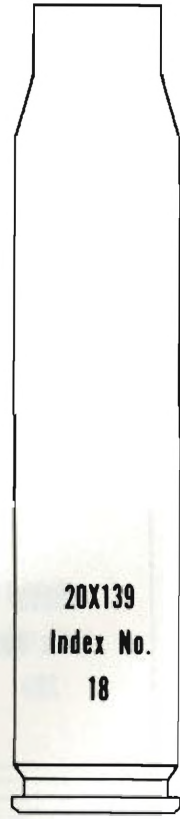
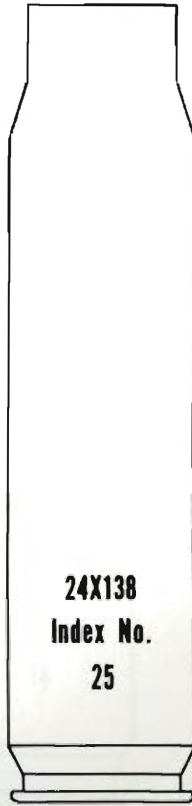
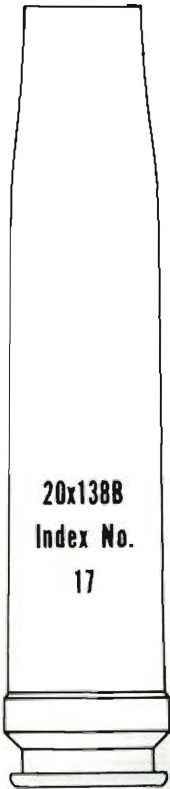


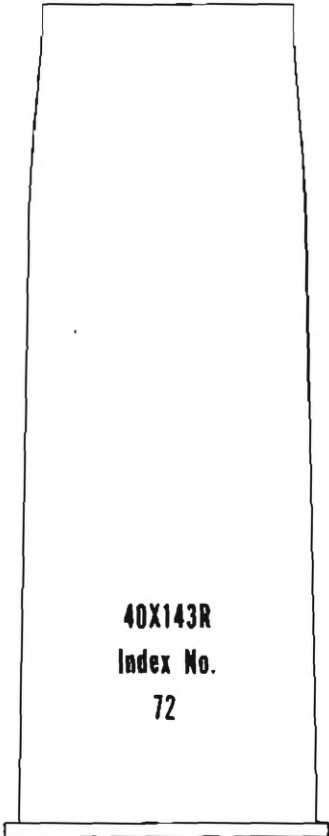
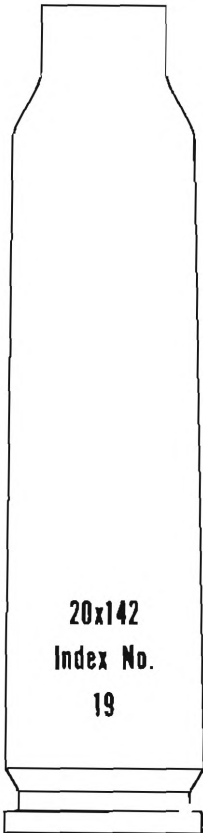


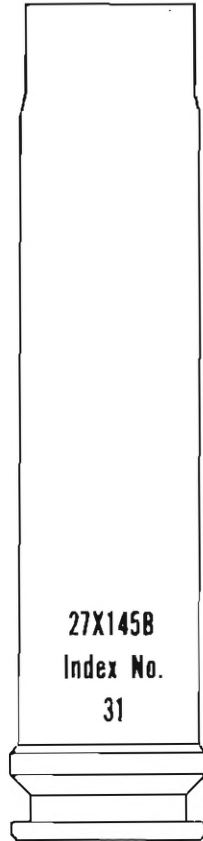
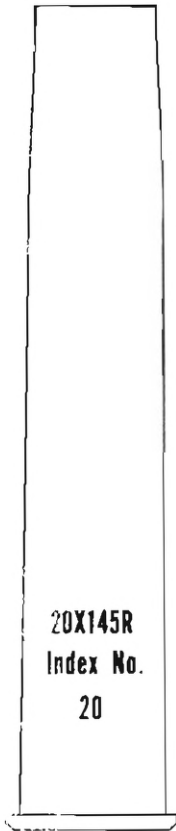


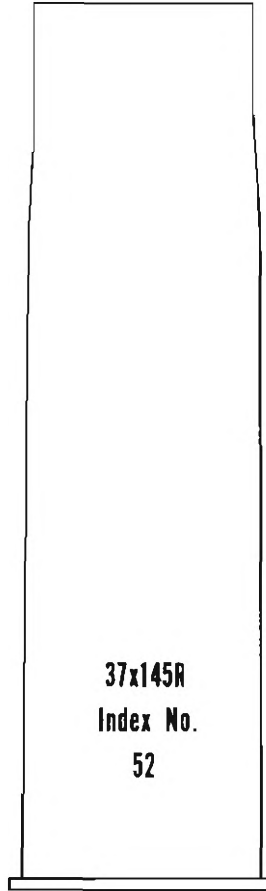
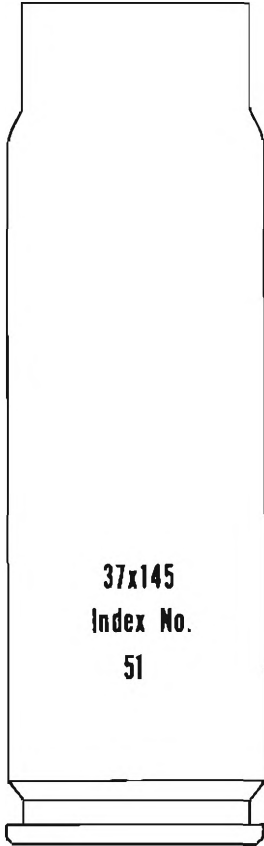


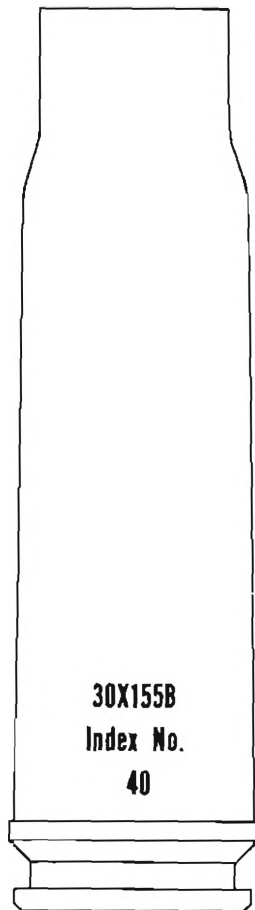
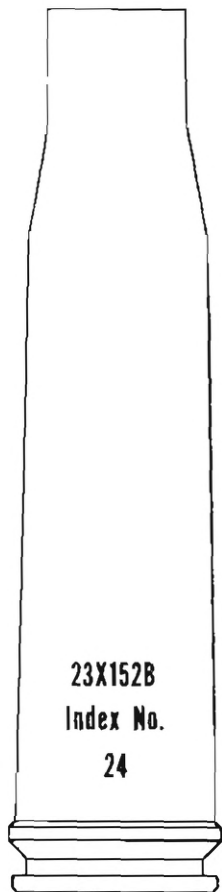


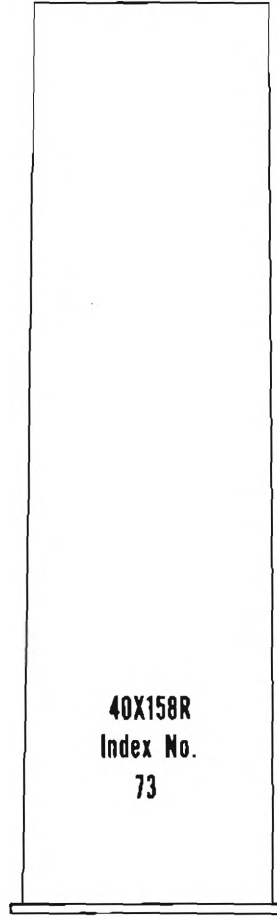
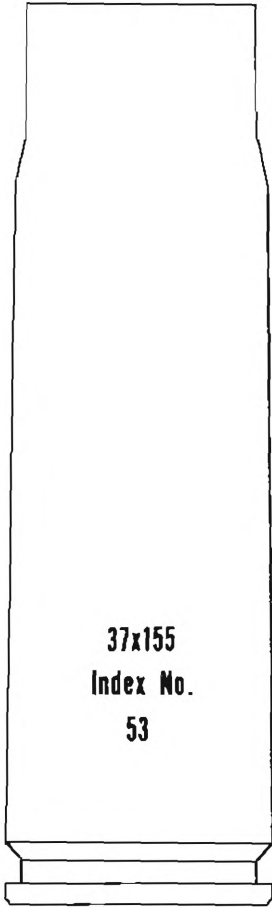


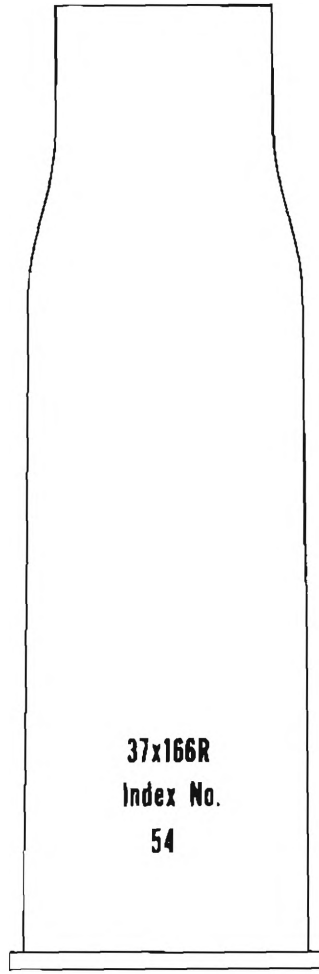
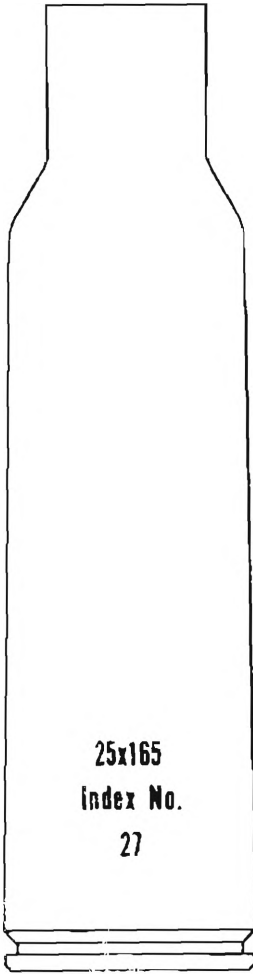


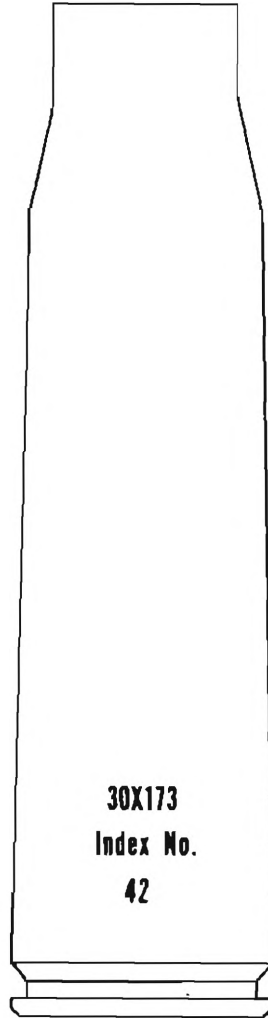
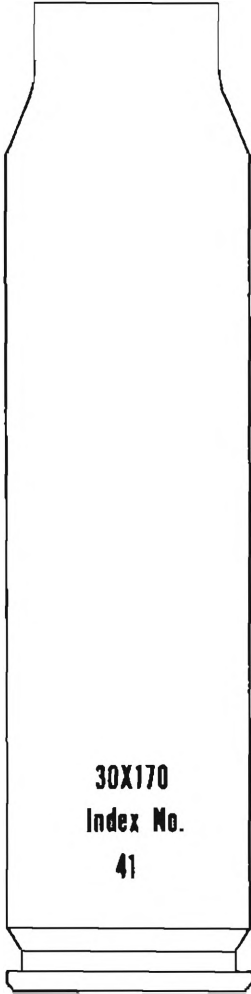


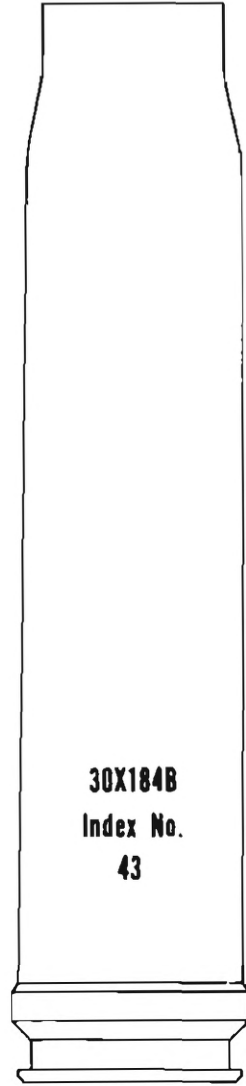
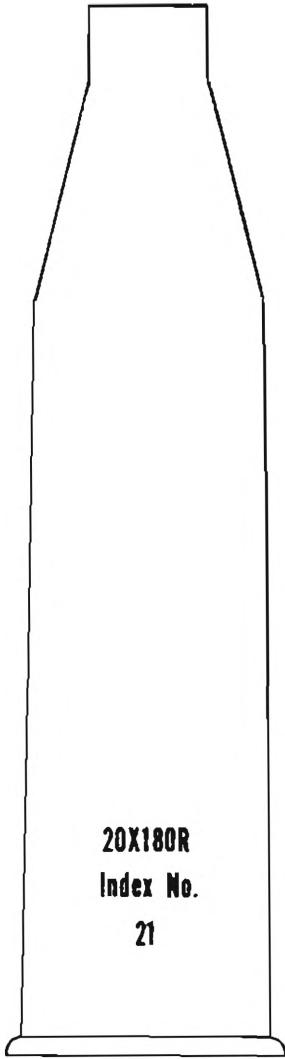


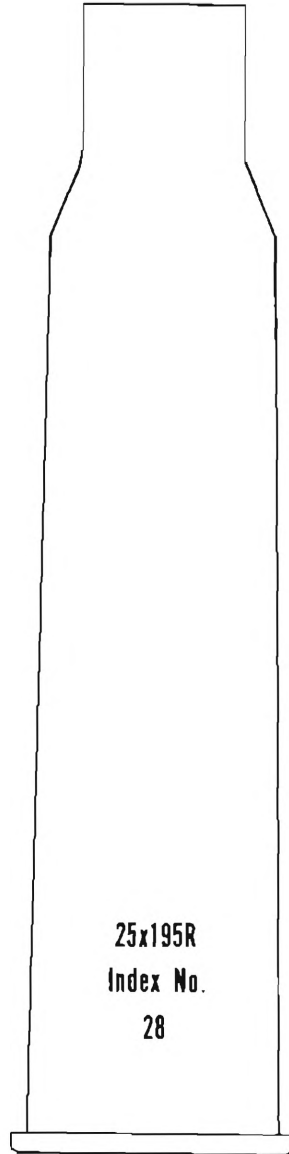
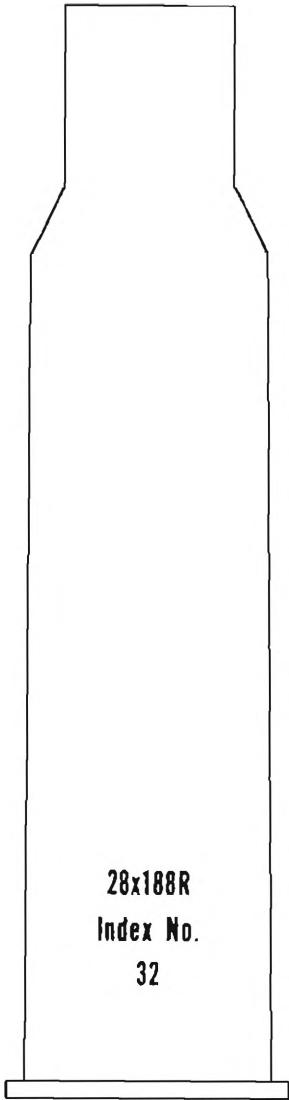


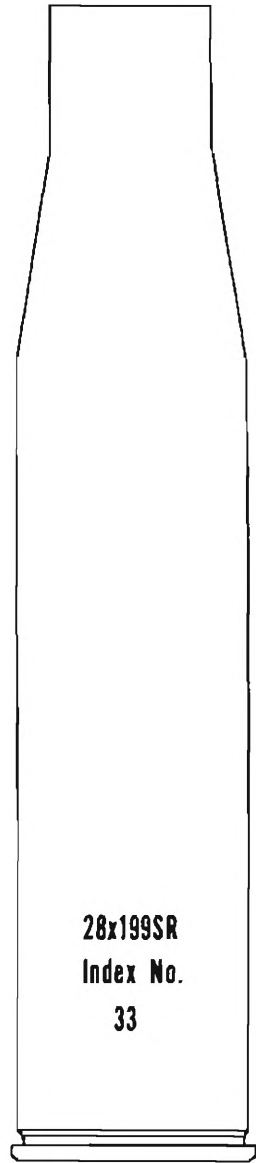
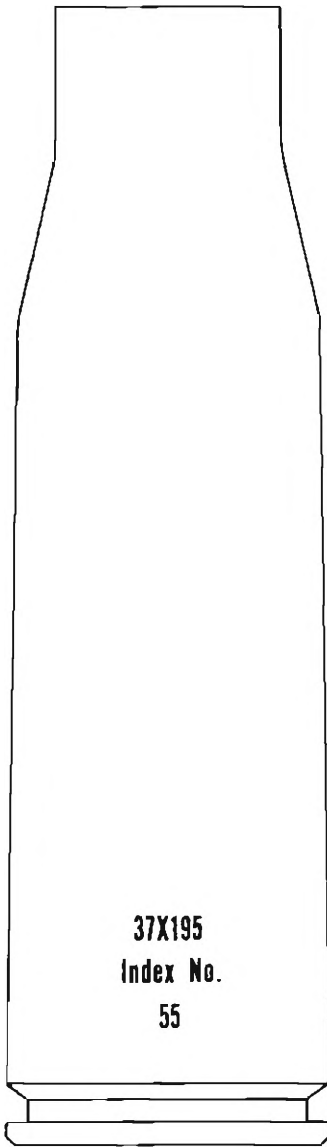


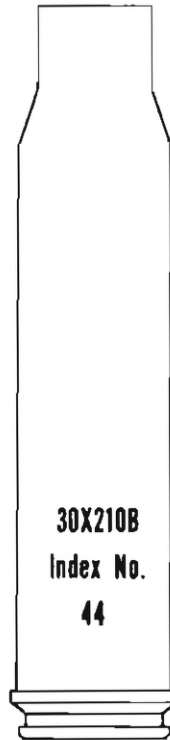
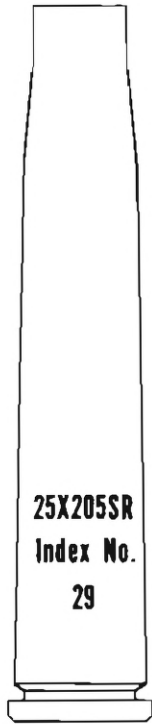
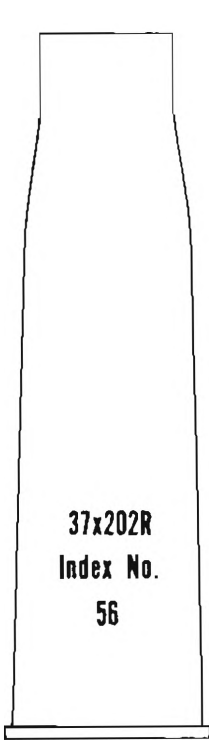


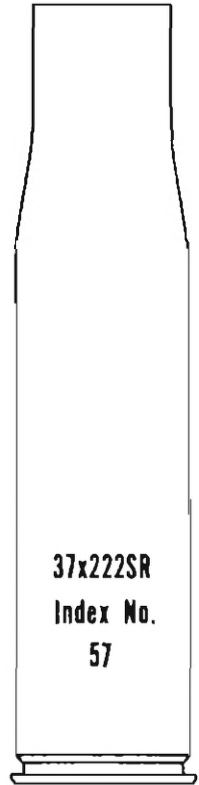


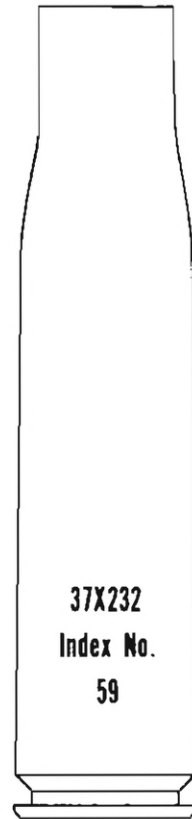
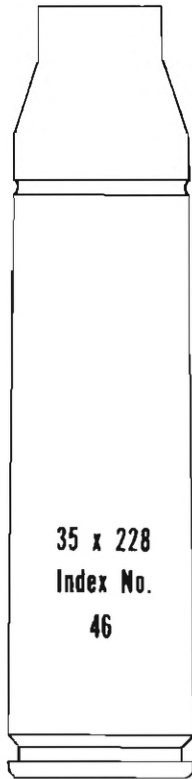
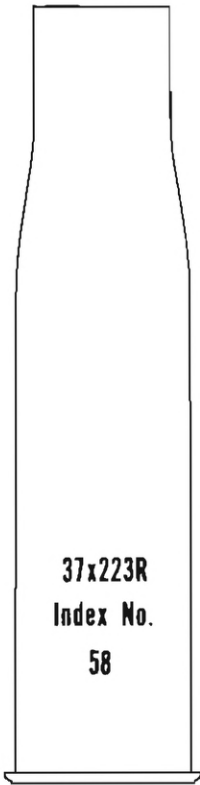


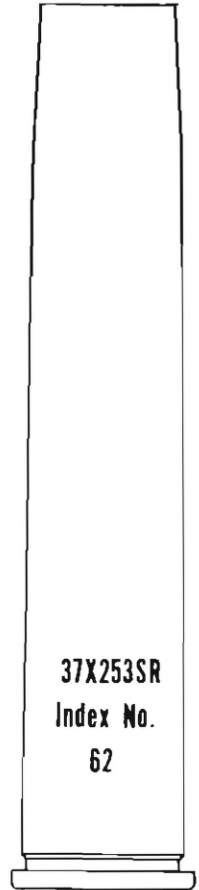
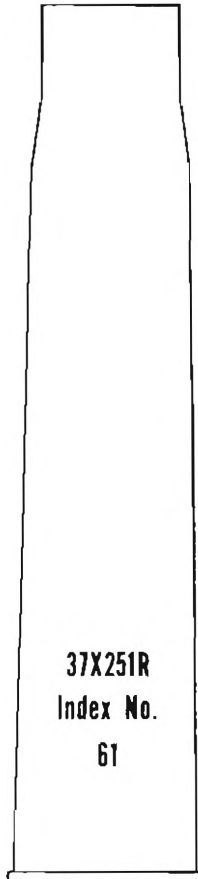
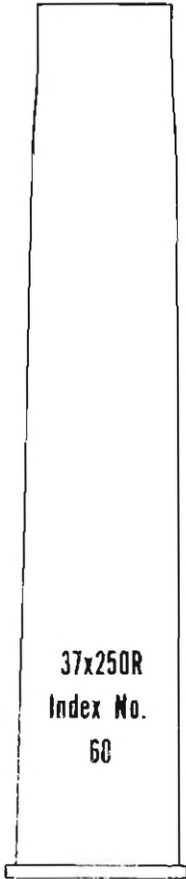


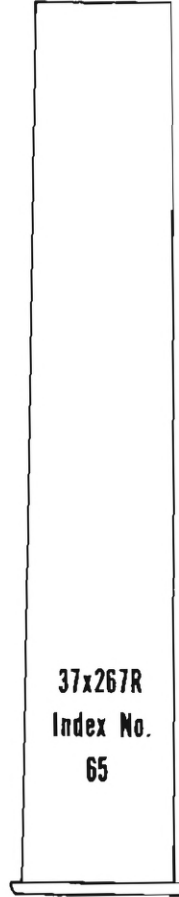
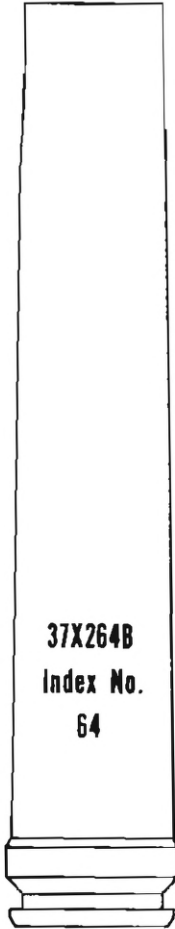
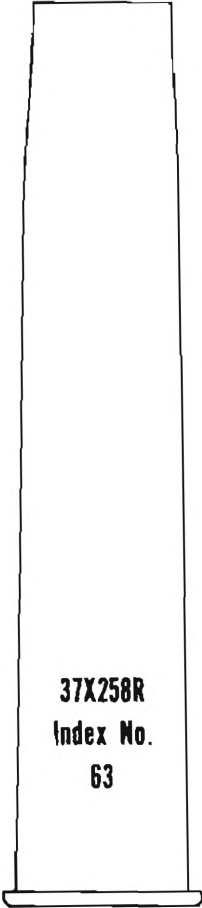


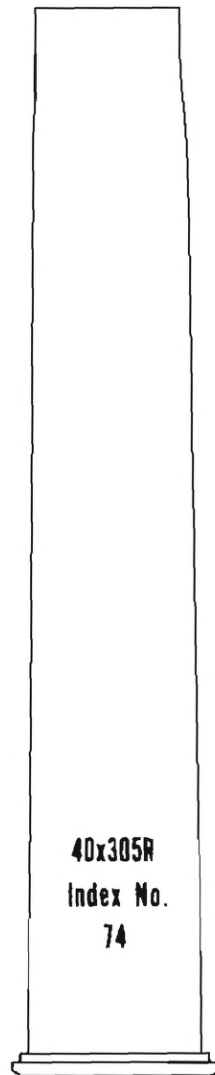
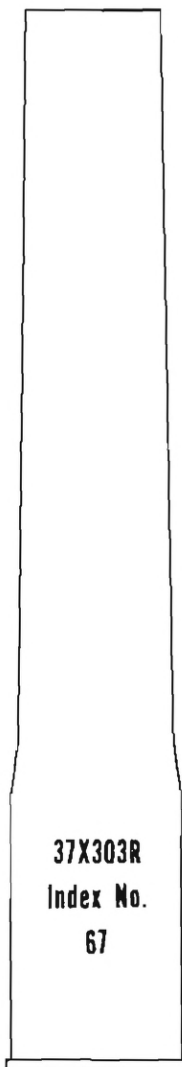
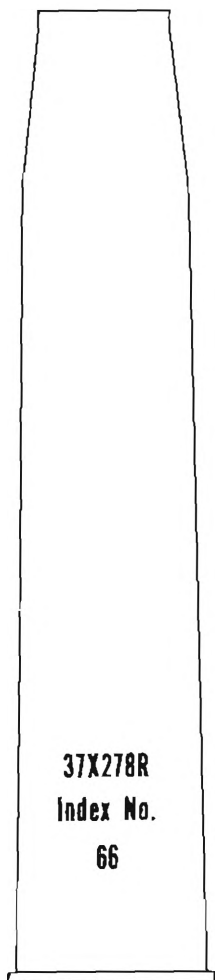


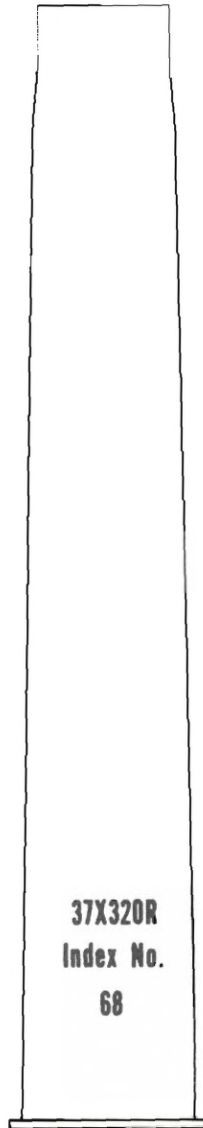
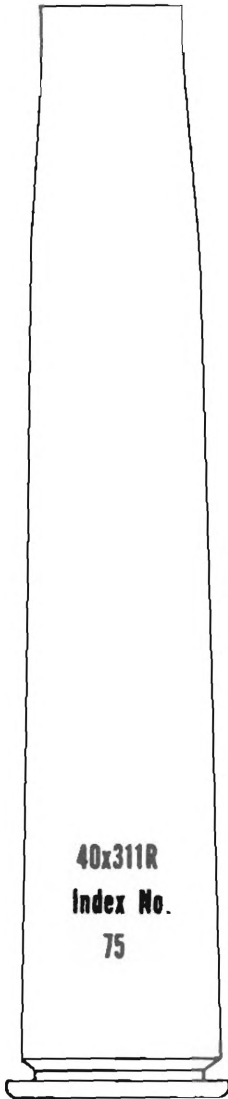


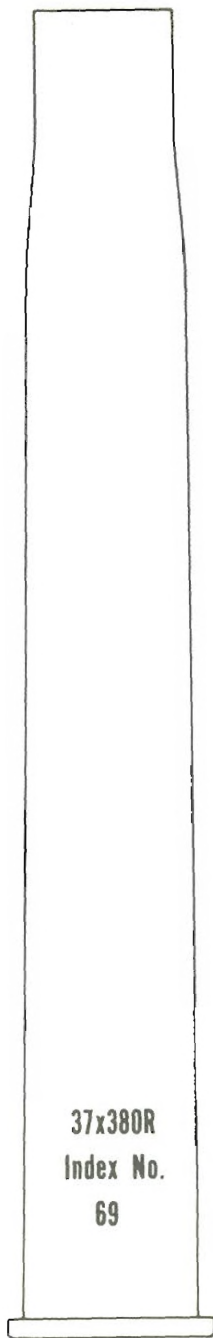
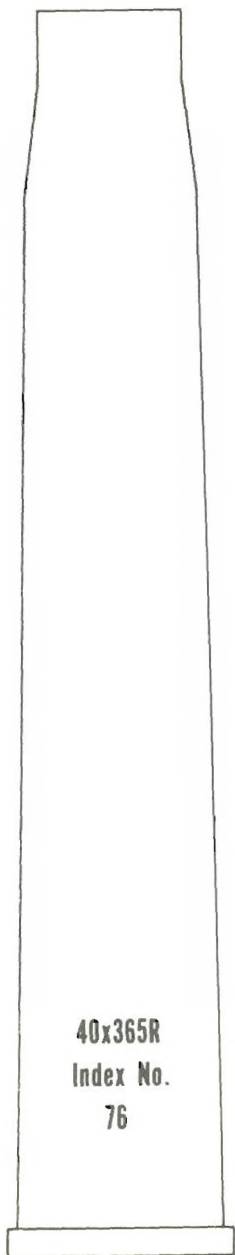










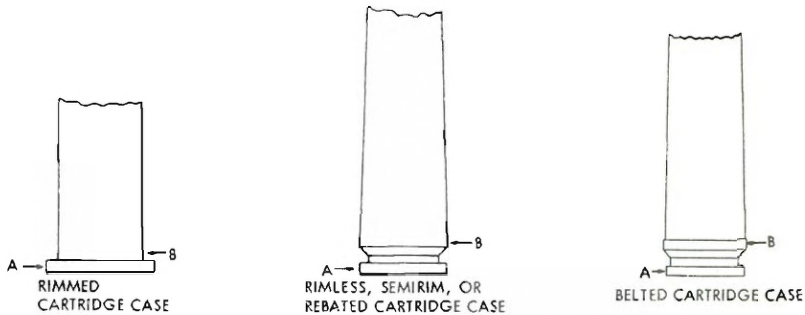


B. DIMENSIONAL AND REFERENCE DATA

3. Dimensional Data

a. Table I provides dimensional data on each of the cartridges covered in this guide. Cartridges are listed in order of their increasing caliber and by increasing case length within caliber. The index number aids in rapid cross-indexing between the case outline drawings and the cartridge reference data in paragraph 2.

b. Dimensions indicated in table I for "rim diameter" and "head/belt diameter" are measured at points A and B respectively, as shown in figure 6.



Neg. 524948

Figure 6. Location of rim and head measurements.

Table I. 20-mm to 40-mm Cartridge Data
(Dimensions are in millimeters.)

Index No.	Designation	Case type	Cartridge case dimensions					Projectile bourellet diameter	Cartridge length	Primer type	Country of origin or use	Notes
			Case length	Rim diameter	Head/belt diameter	Shoulder diameter	Mouth diameter					
1	20x72RB	Rebated	72.0	19.0	22.4	21.0	20.6	19.9	137-144	P	Switzerland	
2	20x80RB	Rebated	80.0	19.2	22.2	--	20.7	19.9	146	P	Switzerland	
3	20x82	Rimless	81.7	25.1	25.0	23.7	20.7	19.9	147	P or E	Germany	1
4	20x94	Rimless	94.0	24.8	25.0	23.7	21.0	19.9	147	P	Japan	
5	20x99R	Rimmed	98.9	25.2	21.9	--	20.7	19.8	147	P	USSR	
6	20x101RB	Rebated	101.0	19.0	22.1	21.1	20.6	19.8	174	P	Switzerland	
7	20x102	Rimless	102.0	29.5	29.2	26.6	20.6	19.9	168-174	E	United States	
8	20x105B	Belted	105.0	25.0	26.3 (belt)	23.8	20.7	19.9	170	P	Switzerland	
9	20x110RB	Rebated	109.8	22.2	24.7	23.9	20.6	19.9	181	P	Switzerland	
10	20x110	Rimless	110.1	24.5	24.9	23.9	20.6	19.9	184	P or E	Switzerland	2,3
11	20x110 (USN)	Rimless	109.5	29.5	29.0	26.1	20.6	19.9	185	E	United States	3
12	20x113	Rimless	112.7	28.0	28.0	23.7	20.9	19.9	172-176	P	Finland	4
13	20x120	Rimless	119.5	29.0	29.0	26.9	21.0	20.0	186	P	Denmark	4
14	20x124	Rimless	124.5	28.5	28.7	27.4	20.3	19.9	194	P	Japan	
15	20x125	Rimless	124.7	30.4	30.4	30.1	21.2	19.9	206	P	United States	

Table I. 20-mm to 40-mm Cartridge Data (Continued)
(Dimensions are in millimeters.)

Index No.	Designation	Case type	Cartridge case dimensions					Projectile bourrelet diameter	Cartridge length	Primer type	Country of origin of use	Notes
			Case length	Rim diameter	Head/belt diameter	Shoulder diameter	Mouth diameter					
16	20x128	Rimless	128.7	32.0	32.2	30.0	21.2	19.9	203	P or E	Switzerland	
17	20x138B	Belted	137.6	26.8	28.5 (belt)	25.5	20.8	19.9	205	P	Switzerland	
18	20x139	Rimless	138.5	28.4	28.4	27.5	21.5	19.9	213	P	Switzerland	
19	20x142	Rimless	142.0	33.4	33.4	31.5	20.5	19.8	213	P	Japan	
20	20x145R	Rimmed	145.0	29.5	25.4	23.0	21.0	20.0	197-222	P	Sweden	4
21	20x180R	Rimmed	180.0	47.9	42.6	39.0	20.8	20.0	232-235	P	Sweden	5
22	23x106	Rimless	106.0	29.0	29.0	27.0	23.8	22.8	186	P	Denmark	4
23	23x115	Rimless	114.5	26.8	26.9	26.0	23.9	22.8	200	P	USSR	
24	23x152B	Belted	151.0	33.2	34.6 (belt)	30.5	23.9	22.8	235	P	USSR	6
25	24x138	Rimless	138.4	31.4	32.4	31.1	25.2	23.8	210	P	Switzerland	
26	25x137	Rimless	136.5	37.8	38.0	35.5	26.1	24.8	223	P	Switzerland	7
27	25x165	Rimless	164.5	42.8	43.0	40.0	27.6	25.5	210-232	P	France	
28	25x195R	Rimmed	193.5	47.2	42.7	38.9	26.5	25.6	262	P	France	8
29	25x205SR	Semi-rimmed	204.5	42.0	36.9	31.5	25.7	24.9	282	P	USSR	

Table I. 20-mm to 40-mm Cartridge Data (Continued)
(Dimensions are in millimeters.)

Index No.	Designation	Case type	Cartridge case dimensions					Projectile bourellet diameter	Cartridge length	Primer type	Country of origin of use	Notes
			Case length	Rim diameter	Head/belt diameter	Shoulder diameter	Mouth diameter					
30	25x218	Rimless	218.7	34.9	34.8	31.0	26.1	24.7	292	P	USSR	
31	27x145B	Belted	145.0	34.1	34.5	31.7	28.7	27.0	239-243	E	West Germany	
32	28x188R	Rimmed	187.9	48.0	42.3	40.0	30.2	28.7	220	P	Germany	
33	28x199SR (1.1-in USN)	Semi- rimmed	198.5	43.5	41.5	40.4	29.0	27.8	308	P	United States	
34	30x86B	Belted	86.0	33.4	33.7 (belt)	--	31.1	29.9	200	E	Germany	9
35	30x91RB	Rebated	89.91	26.0	32.4	--	31.0	29.9	204	P or E	Germany	
36	30x97B	Belted	96.1	33.2	33.8 (belt)	--	31.0	29.8	198	E	France	
37	30x113B	Belted	112.0	33.3	33.8 (belt)	--	30.9	30.0	200	E	France, United Kingdom	10
38	30x114	Rimless	113.5	37.5	38.0	37.0	31.5	30.0	191	P	Japan	
39	30x123	Rimless	122.2	38.4	38.4	36.0	31.4	30.0	206	P	Japan	
40	30x155B	Belted	155.0	40.0	41.5 (belt)	37.0	31.8	29.8	265	P	USSR	
41	30x170	Rimless	170.0	42.9	42.9	41.5	31.5	29.8	284	P	Switzerland	

Table I. 20-mm to 40-mm Cartridge Data (Continued)
(Dimensions are in millimeters.)

Index No.	Designation	Case type	Cartridge case dimensions					Projectile bourelet diameter	Cartridge length	Primer type	Country of origin of use	Notes
			Case length	Rim diameter	Head/belt diameter	Shoulder diameter	Mouth diameter					
42	30x173	Rimless	173.0	44.0	44.0	39.4	31.5	29.9	288-290	P or E	Switzerland	11,12
43	30x184B	Belted	184.0	38.0	39.5 (belt)	35.6	30.8	29.9	298	P or E	Germany	13
44	30x210B	Belted	210.0	46.0	47.5 (belt)	43.7	32.2	29.8	305	E	USSR	
45	30x220	Rimless	220 ?	48 ?	?	31 ?	?	?	345 ?	P	Czecho- slovakia	
46	35x228	Rimless	227.5	54.6	55.0	52.0	35.8	35.0	387	P	Switzerland	14
47	37x93R	Rimmed	92.4	44.0	40.1	39.4	37.8	37.0	188	P	United States	15
48	37x112R	Rimmed	111.5	47.0	44.0	43.0	37.9	36.7	197-221	P	Japan	
49	37x133R	Rimmed	133.0	47.0	43.2	42.0	38.2	37.0	228	P	Japan	
50	37x137R (1-pdr USN)	Rimmed	136.9	45.0	39.4	38.8	37.1	37.0	206	P	United States	
51	37x145	Rimless	144.0	43.5	43.2	43.0	38.5	37.0	225-246	P	Japan	
52	37x145R	Rimmed	144.5	45.0	41.5	39.3	37.2	37.0	237-248	P	United States	16
53	37x155	Rimless	154.5	45.9	45.7	43.0	39.0	36.8	286	P	USSR	
54	37x166R	Rimmed	166.3	54.0	49.6	46.8	38.2	36.9	266	P	Japan	
55	37x195	Rimless	195.0	54.4	54.4	51.0	37.8	36.8	325	P	USSR	

Table I. 20-mm to 40-mm Cartridge Data (Continued)
(Dimensions are in millimeters.)

Index No.	Designation	Case type	Cartridge case dimensions					Projectile bore diameter	Cartridge length	Primer type	Country of origin of use	Notes
			Case length	Rim diameter	Head/belt diameter	Shoulder diameter	Mouth diameter					
56	37x202R	Rimmed	202.0	58.0	53.5	47.0	38.3	36.5	322-328	P	Italy	
57	37x222SR	Semi- rimmed	222.0	51.7	50.0	49.0	37.9	37.0	327	P	United States	
58	37x223R	Rimmed	222.3	55.6	50.0	48.6	38.1	37.0	337-369	P	United States	
59	37x232	Rimless	232.0	51.5	50.0	48.7	38.1	36.7	369	P	Italy	
60	37x250R	Rimmed	250.0	51.5	46.0	41.3	38.5	36.75	343-354	P or E	Germany	17
61	37x251R	Rimmed	250.2	54.0	49.6	44.5	38.5	36.9	333-354	P	Japan	
62	37x253SR	Semi- rimmed	252.0	52.0	46.0	41.5	38.5	36.9	384	P	USSR	
63	37x258R	Rimmed	257.0	56.1	49.9	43.0	38.5	36.93	369	P	Poland, Sweden	18
64	37x264B	Belted	264	46.8	48.6 (belt)	41.0	38.7	36.9	314-370	P		
65	37x267R	Rimmed	267	47.8	44.0	--	38.8	36.8	414	P	Czecho- slovakia	18
66	37x278R	Rimmed	278	?	?	?	?	?	400-420	P	France	
67	37x303R	Rimmed	303.4	50.3	46.8	46.4	38.9	36.9	407	P	United States	

Table I. 20-mm to 40-mm Cartridge Data (Continued)
(Dimensions are in millimeters.)

Index No.	Designation	Case type	Cartridge case dimensions					Projectile bourellet diameter	Cartridge length	Primer type	Country of origin of use	Notes
			Case length	Rim diameter	Head/belt diameter	Shoulder diameter	Mouth diameter					
68	37x320R	Rimmed	320.0	56.1	50.0	40.7	37.5	36.9	431	P	Sweden, Denmark	
69	37x380R	Rimmed	380.0	57.9	52.5 ?	44.5	39.4	36.8	515	P	Germany	
70	40x46SR	Semi- rimmed	46.0	43.5	41.0	--	41.0	40.0	64-133	P	United States	
71	40x53SR	Semi- rimmed	53.0	43.5	41.0	--	40.8	40.6	111	P	United States	
72	40x143R	Rimmed	143.0	?	?	?	?	?	291	P	Italy	
73	40x158R	Rimmed	157.7	48.1	44.0	41.8	41.0	39.9	263-294	P	United Kingdom	
74	40x305R (2-pdr AT gun	Rimmed	305.0	57.5	51.5	--	40.8	39.9	417	P	United Kingdom	
75	40x311R	Rimmed	311.0	62.0	56.0	48.0	41.5	39.9	447-480	P	Sweden	
76	40x365R	Rimmed	365.0	65.0	57.8	48.0	41.5	39.9	534	P	Sweden	

NOTES

1. Electric-primed as well as percussion-primed cartridges were used by Germany in World War II; electric-primed cases are identified by a brass-clad steel cartridge case instead of lacquered steel, and by the electric primer, Model P-2.
2. Electric-primed cartridges are used only in US M24 and M24A1 guns; percussion-primed cartridges are used in the US M3 gun, and in all Hispano-Suiza HS 404 and HS 804 guns.
3. Differences in case dimensions and in performance prevent interchangeability of electric-primed 20x110 cartridges for M24-series guns and Mk 11 and Mk 12 guns.
4. Cartridges for the Lahti 20x113 aircraft gun, the Swedish 20x145R antiaircraft (AA) gun, and for Madsen 20-mm and 23-mm automatic guns, have an exceptionally thick extracting rim, approximately 4 mm thick.
5. The cartridge case has a blow-out venturi in its base, for use in recoilless rifles.
6. Cartridges for obsolete VYa aircraft guns and for tank subcaliber guns have brass cases. Cartridges for ZU-23 and ZSU-23-4 AA guns have steel cases. Despite their dimensional similarity, the steel-case and brass-case cartridges are not functionally interchangeable.
7. The 25x137-mm cartridge case has an annular link-positioning groove located 98.5 mm from the base of the case.
8. Also made in a rimless version for a semiautomatic antitank (AT) gun.
9. In postwar trials with improved revolver-type cannon based on the Mauser MK-213 design, the United States produced experimental cartridge cases in lengths from 86 mm to 126.5 mm. Two types were produced in quantity: the 30x100B case for the WECOM 30 gun and the 30x126.5B cartridges for T182 and T212 guns. (See table VI for data on US experimental 30-mm belted cartridges.)

10. Cartridge cases for the United Kingdom's ADEN gun are of brass, with identification data stamped in the bottom of the extraction groove. Cases for DEFA guns are of steel, normally lacquered. The United States is developing aluminum-cased 30x113B cartridges that will be compatible with ADEN and DEFA guns.
11. Cartridges for Oerlikon 304RK (KCA) guns are all electric-primed, with lacquered steel or anodized aluminum cases. This cartridge case has also been used by the United States in GAU 8A and GAU 9A gun system trials. US-made cases are anodized aluminum, with electric primers for the GAU 9A gun and percussion primers for the GAU 8A gun. Percussion-primed 30x173 cartridges are not interchangeable with 30x170 cartridges.
12. A similar cartridge, but with a longer case neck and a case length of 178 mm to 180 mm, was made by Oerlikon in 1953-1954 for the 302RK aircraft gun. This gun and ammunition were not produced in significant numbers; the 302RK was soon replaced by the 304RK gun.
13. Cartridges for the German World War II aircraft gun MK 101 have percussion primer C/33; cartridges for the MK 103 gun use electric primer C/23. Cartridges can be distinguished by the stamped model designation on the primer; they are otherwise identical but, because of the primer, not interchangeable.
14. The 35x228 cartridges for Oerlikon KDA, GDP (5PF-2), and GDM-C guns have an annular link-positioning groove in the cartridge case, 176 mm from the base, to accommodate the feed belt used with these guns. Cartridges for other gun models do not have this groove. Cartridges are otherwise identical, and cartridges with link-positioning may be used in any model gun chambered for this cartridge.
15. Several similar foreign cartridges were made, none of which is now in use. Among these were a German M1897 howitzer cartridge; the French World War I 37/85 cartridge, with a case length of 94.5 mm, which is reported to be interchangeable with the US cartridge; and a similar World War I Italian cartridge, designated 37/20.6.
16. Also used in the now-obsolete US 1.457-inch subcaliber gun, Model 1918.
17. Cartridges for the German World War II 3.7-cm PAK (AT gun) have percussion primer C/13 or C/33; cartridges for the 3.7-cm KWK (tank gun) use electric primer C/23. Cartridges can be distinguished by the stamped model designation on the primer. The cartridges are otherwise identical but, because of the primer, not interchangeable.
18. Also made and used by Germany during World War II.

4. Cartridge Reference Data

a. This paragraph presents information on the development, service use, and weight and muzzle velocity of the cartridges listed in table I.

b. It is emphasized that this guide is limited to the identification of cartridges based on physical characteristics. Dimensional similarity does not imply and will not insure that a cartridge can be safely fired in, or will properly function in, any weapon other than an appropriately chambered weapon designed to fire that cartridge.

Index No. 1

20x72RB

Other Designations: 20-mm Oerlikon Type FF;
20-mm Japanese Type 99, Mark 1.

The 20x72 RB cartridge, developed in the 1920s by the Swiss firm of Seebach Maschinenbau AG, was based on a similar but shorter cartridge used in the Becker automatic gun late in World War I. This cartridge was used by the successor to the Seebach firm, Werkzeug Maschinenfabrik Oerlikon, in the Type FF aircraft gun in the 1930s. During World War II, Germany made and used this cartridge; Japan also made the same cartridge for use in an Oerlikon-type naval aircraft gun, Type 99 Mark 1. The gun and cartridge were obsolete by the end of the war and have not been manufactured since that time.

Characteristics

Cartridge weight	176 g (est)
Projectile weight	76-100 g (est)
Muzzle velocity	550 m/s (est)

Index No. 2

20x80RB

Other Designation: 20-mm Oerlikon Type FFM.

This cartridge was developed by the Oerlikon firm before World War II for use in Type FFM aircraft guns, as an improvement over the Type FF gun and cartridge. During World War II, Germany also made and used this cartridge.

Except for production of 20x80RB cartridges in Spain in 1953, these guns and this cartridge have not been reported in use since the close of World War II.

Characteristics

Cartridge weight	210 g
Projectile weight	113-130 g
Muzzle velocity	575-600 m/s

Index No. 3

20x82

Other Designations: 2-cm Mauser; 2-cm FLAK 38;
20-mm MG 151/20.

This cartridge was designed by Mauser before World War II for use in a 2-cm wheeled antitank gun, as well as the 20-mm MG 151/20 aircraft gun and a 20-mm AA gun, designated FLAK 38. These weapons and ammunition were made and used by Germany during World War II, while Japan made and used both aircraft and AA guns in this caliber. The MG 151/20 gun was made and used by France until the early 1970s; cartridges are still produced in this caliber by Manurhin. These cartridges can be recognized by the brass case and the French-style headstamp.

Characteristics

Cartridge weight	205 g
Projectile weight	112-120 g
Muzzle velocity	720 m/s

Index No. 4

20x94

Other Designation: 20-mm Japanese Ho-5 aircraft gun.

Used in the World War II Japanese Ho-5 aircraft gun, which was based on a Browning design, this cartridge may have a HEI or AP-T projectile.

The Ma-202 fuzeless HEI projectile, with a PETN charge under the thin brass nose cap, is especially hazardous. The projectile can be recognized by the characters $\equiv \circ \equiv$ (202) stenciled on the black projectile body. This gun and cartridge were obsolete at the war's end.

Characteristics

Cartridge weight	212-254 g
Projectile weight	78-120 g
Muzzle velocity	800 m/s (est)

Index No. 5

20x99R

Other Designation: 20-mm ShVAK aircraft gun.

Made only by the USSR, this straight-case cartridge was developed early in World War II for the ShVAK aircraft machinegun. HEI-T projectiles may have a K-6 or an A-20 PD fuze; cartridges with API projectiles were also produced. The gun has been obsolete in Soviet service since the early 1950s, but the cartridge is still in use for subcaliber training with the 122-mm howitzer, M1938 (M30).

Characteristics

Cartridge weight	.....	182 g
Projectile weight	.....	97 g
Muzzle velocity	.....	860 m/s

Index No. 6

20x101RB

Other Designations: 20-mm Oerlikon Type FFL;
20-mm Japanese Type 99, Mark 2.

The 20x101RB cartridge was developed by Oerlikon before World War II for use in the Type FFL aircraft gun. During World War II Japan produced a copy of this gun, designated the Type 99 Mark 2 aircraft gun, for naval use. Japan used both Swiss-made and Japanese-made ammunition in this caliber. This gun and cartridge have not been reported in use since the close of World War II.

Characteristics

Cartridge weight	218-225 g
Projectile weight	120-132 g
Muzzle velocity	670-700 m/s

Index No. 7

20x102

Other Designations: 20-mm M39, M39A1; 20-mm M61; 20-mm, M50-series.

The 20x102-mm cartridge was developed by the United States after World War II for use in 20-mm aircraft guns M39, M39A1, and M61. Cartridges are made and used throughout NATO and other free world countries. Both steel cases and brass cases are used. Standard 20x102 M50-series cartridges are electric-primed; some lots were made up with percussion primers for the Mk22 automatic gun, a US Navy trial weapon for small-craft armament. Some European-made 20x102 cartridges with percussion primers are also reported to have been made for developmental trials. Although the cartridges frequently have no headstamp, the country of origin can usually be determined from stamped or stenciled identification markings on fuze, projectile body, or cartridge case.

Characteristics

Cartridge weight	235-263 g
Projectile weight	101 g
Muzzle velocity	1030 m/s

Index No. 8

20x105B

Other Designations: 20-mm S 18-100; 20-mm MG 204;
20-mm Short Solothurn.

This cartridge was developed in Switzerland during the 1930s by Solothurn for the S 18-100 antitank rifle, which saw service in the Russo-Finnish war of 1939. The cartridge was also used in the Solothurn S 12-100 aircraft gun, and during World War II in the Rheinmetall-designed MG 204, which was used on German naval seaplanes. Italy and Hungary, as well as Switzerland, Germany, and probably Finland, produced this cartridge during World War II.

The gun and cartridge have been obsolete since the close of World War II.

Characteristics

Not available.

Index No. 9

20x110RB

Other Designations: 20-mm Oerlikon Type "S";
20-mm Oerlikon Mk 2, Mk 3, or Mk 4.

The most powerful of the rebated-base Oerlikon 20-mm cartridges, this cartridge was developed before World War II for the Type "S" AA gun. Oerlikon guns firing this cartridge were used during World War II by Germany, by the United Kingdom in Polsten and Oerlikon guns, and by the US Navy in Mk 4 guns. Use by other countries is also reported. Although obsolete in US service since the close of World War II, this cartridge was made in Spain as recently as the 1950s and is still available from producers in Italy and Yugoslavia.

Characteristics

Cartridge weight	232-250 g
Projectile weight	120-135 g
Muzzle velocity	830-900 m/s

Index No. 10

20x110

Other Designations: 20-mm Hispano-Suiza HS 404;
 20-mm Hispano-Suiza HS 804;
 20-mm for M3 gun;
 20-mm for M24 gun (M24A1).

This cartridge was developed by the Swiss firm Hispano-Suiza during the 1930s as a percussion-fired cartridge for the HS 404 and HS 804 aircraft and AA guns.

During World War II both the United States and the United Kingdom used Hispano-Suiza aircraft guns and made cartridges in this caliber; the US-made gun was designated M3.

This cartridge is still in wide use; in addition to Switzerland, Sweden, Yugoslavia, the United States, and the United Kingdom, this cartridge has been made by Egypt, France, Israel, Italy, and Spain, among others.

In the postwar period the United States developed and provided an electric-primed version of this cartridge for the M24 and M24A1 aircraft guns. This variant type, which normally has the word "ELECTRIC" stenciled on the cartridge base, will not function in percussion-fired weapons. The electric-primed case can be recognized by the insulating ring that surrounds the primer cup. The 20x110 cartridge has been replaced in US service by the 20x102 and 20x110 USN cartridges.

Characteristics

Cartridge weight	252-263 g
Projectile weight	125-140 g
Muzzle velocity	820-880 m/s

Index No. 11

20x110 USN

Other Designation: 20-mm Mk 100 Series.

This electric-primed cartridge was developed by the US Navy after World War II for use in Mk 11 and Mk 12 Navy aircraft guns. The cartridges are frequently termed "Mk 100 Series" because cartridges in this caliber carry designations Mk 101 through Mk 109. The 20x110 USN cartridge is not made or used elsewhere.

The 20x110 USN cartridge has the same base diameter as the 20x102 cartridge, but a different case length and contour; it is not interchangeable with any other 20x110 cartridge. The guns and cartridge are currently in use.

Characteristics

Cartridge weight	268 g
Projectile weight	110 g
Muzzle velocity	1012 m/s

Index No. 14

20x124

Other Designations: 20-mm Japanese Type 97;
20-mm Japanese Ho-1, Ho-3.

This cartridge was developed by Japan for use in the Type 97 AT rifle, introduced in 1937. The same cartridge case was used with other projectiles in the Ho-1 (flexible) and Ho-3 (fixed) aircraft guns. A 20x124 aircraft gun cartridge that must be handled with caution is the HEI, Type Ma 201, which contains under the thin nose cap a charge of PETN that detonates if the nose cap is crushed. The projectile is identified by the black steel projectile body with a red band to the rear of the bourrelet, and an unmarked brass nose cap. The characters $\equiv \bigcirc -$ (201) are stenciled on the projectile body.

Characteristics

Cartridge weight	300-322 g
Projectile weight	133-156 g
Muzzle velocity	762 m/s

Index No. 15

20x125

Other Designation: 20-mm "Davy Crockett" spotter.

Developed in the early 1960s as a spotter cartridge for the US "Davy Crockett" M28 light weapon system, this cartridge fires a long, fin-stabilized spotter projectile through a smoothbore 20-mm gun mounted under the primary weapon barrel. The cartridge case contains a high-low pressure system to insure reliable ignition while holding chamber pressure to a proper working level. The cartridge case has two spanner wrench holes in the closing plug in the cartridge base. A stenciled marking on the cartridge case gives caliber and model designations: 20-mm SPOTTER M101.

The projectile has an electric impact fuze that on impact produces a flash and smoke of sufficient intensity to be visible at 2000 meters. The "Davy Crockett" weapon system is no longer in use.

Characteristics

Not available.

Index No. 16

20x128

Other Designations: 20-mm Oerlikon RK 206; RK 251;
KAB-001 (5TG); KAA (204 GK).

Designed by the Swiss firm of Oerlikon-Bührle in the 1950s, this cartridge is made in a percussion-primed version for the 5TG and 204 GK ground guns and in an electric-primed version for the now-obsolete revolver-type aircraft guns RK 206 and RK 251. Cartridges are identical except for the type of ignition. In 1972, when Oerlikon obtained a controlling interest in Hispano-Suiza, the belt-fed 204 GK gun was redesignated KAA, and the magazine-fed 5TG gun was redesignated KAB. Cartridges are also produced by the French firm of Luchaire. The Spanish firm CETME, in Madrid, now produces electric-primed cartridges in this caliber for the multibarreled MEROKA AA gun.

Characteristics

Cartridge weight	330-360 g
Projectile weight	122-138 g
Muzzle velocity	1085-1200 m/s

Index No. 17

20x138B

Other Designations: 2-cm Long Solothurn; 2-cm Rheinmetall;
2-cm Lahti AT gun; 2-cm Breda;
2-cm FLAK 30/38.

Developed during the 1930s by the Swiss firm Solothurn AG as an improvement over the 20x105B cartridge, the 20x138B has been used in a variety of AT guns and AA machineguns: the Swiss-designed tank gun S18-1000 and AT gun S18-1100; Italian Breda AT and AA guns; the Finnish Lahti 20-mm AT gun; and the Rheinmetall 2-cm FLAK 30/38 AA gun. Sweden used the Rheinmetall AA gun and the Swiss AT gun under the designation m/39. Cartridges have been produced in Switzerland, Sweden, Germany, Finland, and (before 1941) Greece; they are still offered for sale by Yugoslavia and by Bombrini Parodi-Delfino of Italy. Both brass-cased and steel-cased cartridges are known.

Characteristics

Cartridge weight	320 g
Projectile weight	148 g
Muzzle velocity	860-900 m/s

Index No. 18

20x139

Other Designations: 20-mm HS 820; 820A; 820L;
20-mm Rh 202; 20-mm M139.

Hispano-Suiza of Switzerland developed this cartridge at the close of World War II to provide improved performance over that of the 20x110 Hispano-Suiza cartridge. HS 820 guns were widely marketed during the 1950s, and ammunition improvements have kept pace with improved gun models. The same cartridge has been adopted by France for the M693 automatic gun, by Germany for the Rheinmetall Rh 202 gun, and by the United States for the M139 gun. Projectile and fuze designs, designations, and characteristics vary among the producing countries. Cartridges in this caliber are also made in the Netherlands, in Norway, and by Bombrini Parodi-Delfino of Italy.

In the postwar period Hispano-Suiza developed a 23x139-mm cartridge, based on the 20x139-mm design, for use in the 827C aircraft gun. This gun and ammunition were not produced other than in trial quantities. In the 1960s, the Mauser firm developed a 23-mm cartridge for the C-1 aircraft gun. Except for the larger diameter projectile, the cartridge is similar in dimensions and case outline to the 20x139-mm cartridge. No quantity production of this 23-mm cartridge is reported.

Characteristics

Cartridge weight	317 g
Projectile weight	120 g
Muzzle velocity	1100 m/s

Index No. 19

20x142

Other Designation: 20-mm Japanese Type 98.

This cartridge was introduced in 1938 for Type 98 AA and AT guns. HE-T and AP-T projectiles are known.

Characteristics

Cartridge weight	396-423 g
Projectile weight	129-156 g
Muzzle velocity	830 m/s

Index No. 20

20x145R

Other Designations: 20-mm Bofors m/40; 20-mm Tubkanon.

Developed by Bofors for the 20-mm Bofors AA gun, Model m/40, and used also in the m 40/70 gun. While these guns are obsolete for service, similar cartridges are used in subcaliber guns for 57-mm and 75-mm AT guns, and vehicle-mounted 75-mm and 105-mm guns.

Unlike other Bofors cartridges, this cartridge has no annular groove in the cartridge base for the Bofors feed clip.

Characteristics

Cartridge weight	290-300 g
Projectile weight	136-145 g
Muzzle velocity	815-845 m/s

Index No. 21

20x180R

Other Designation: 20-mm m/39.

The large propellant volume of this cartridge is due to its use in a recoilless AT gun, designated m/42. This cartridge is identified by its large-diameter rim, measuring nearly 48 mm, and by the blowout disk in the cartridge base surrounding the percussion primer. Both HE and AP projectiles were used. This gun and cartridge were in use during the 1940s but are no longer in service.

Characteristics

Cartridge weight	520-540 g
Projectile weight	115-136 g
Muzzle velocity	950 m/s

Index No. 22

23x106

Other Designation: 23-mm Madsen.

Developed during the 1930s in Denmark for the Madsen automatic gun, this cartridge saw limited production and use. Cartridges were made in Denmark and in the United Kingdom by Imperial Chemical Industries, Ltd. (Kynoch). The gun and cartridge are believed obsolete since the 1940s.

Characteristics

Cartridge weight	341 g
Projectile weight	174 g
Muzzle velocity	720 m/s

Index No. 23

23x115

Other Designations: 23-mm NR/NS 23; 23-mm AM-23.

This standard Soviet aircraft gun cartridge is used in three gun systems: NR/NS 23, AM-23, and GSh-23. Both HEI and API loadings are known. Although dimensionally similar, cartridges for AM-23 and GSh-23 guns differ in their loading and are not functionally interoperable with NR/NS-23 cartridges. AM-23 and GSh-23 cartridges are identified by a white band around the projectile body.

All 23x115 cartridges have percussion-primed brass cases. These cartridges have also been made by Czechoslovakia; they can be identified by the presence of the factory code dtp in the cartridge headstamp.

Characteristics

Cartridge weight	.....	321-345 g
Projectile weight	.....	174-200 g
Muzzle velocity	.....	690-740 m/s

Index No. 24

23x152B

Other Designations: 23-mm ZU; ZSU; 23-mm VYa aircraft gun.

This cartridge was developed by the Soviet Union for use in the World War II VYa aircraft gun. When this gun was replaced in service by the 23x115 NR/NS aircraft gun, the excellent performance of the 23x152B VYa cartridge led to its further development as a high-performance cartridge for the ZU-23 and ZSU-23-4 AA gun systems.

While closely similar in dimensions, the steel-cased ZU/ZSU cartridges are not functionally interoperable with the brass-case VYa cartridge. The latter, however, has continued in production for use in tank subcaliber guns. Steel-cased ZU/ZSU cartridges have been made in (or for) Egypt, and may have been produced elsewhere outside the Soviet Union.

Characteristics

Cartridge weight	.....	437-450 g
Projectile weight	.....	183-192 g
Muzzle velocity	.....	930-1000 m/s

Index No. 25

24x138

Other Designation: 24-mm TkB, K-38.

Introduced by Switzerland in 1938 for the Swiss Tankbuchse (tank gun) Model K-38, this gun and cartridge were probably withdrawn from service during the 1940s. HE and AT cartridges were made.

Characteristics

Cartridge weight	460 g
Projectile weight	225 g
Muzzle velocity	900 m/s

Index No. 26

25x137

Other Designations: 25-mm Oerlikon; Type KBA; Type KBB.

Introduced by Oerlikon in the 1960s, this high-performance cartridge can be recognized by the annular link-positioning groove located 98.5 mm from the base of the steel cartridge case. This groove disappears when the cartridge is fired but leaves an impression on the case. HEI-T and APDS-T projectiles are available.

The cartridge is used in the US-designed TRW 6425 gun and in Oerlikon's KBA and KBB guns.

The Netherlands is now using the KBA gun and ammunition, and its adoption is under consideration by other Western countries.

Characteristics

	HEI-T	APDS-T
Cartridge weight	502 g	435 g
Projectile weight	180 g	105 g
Muzzle velocity	1100 m/s	1463 m/s

Index No. 27

25x165

Other Designation: 25-mm Hotchkiss AA gun.

This cartridge was developed by France during the 1930s for use in a Hotchkiss-designed automatic AA gun. During World War II Japan produced for naval use a copy of this gun, designated the Type 96, Model 2 AA and AT automatic cannon. Cartridges are similar to French-made ammunition, but French and Japanese cartridges are not interoperable due to minor differences in cartridge-case dimensions. HE, HE-T, HEI (white phosphorus), and AP projectiles are known. The gun and ammunition have been obsolete since the close of World War II.

Characteristics

Cartridge weight	687 g
Projectile weight	252 g
Muzzle velocity	905 m/s

Index No. 28

25x195R

Other Designation: 25-mm Hotchkiss AT.

Used in the French-made 25-mm Model 37 Hotchkiss-Puteaux S.A.L. AT gun, this cartridge was in service during the opening years of World War II but was not produced after the war's end. Aside from an AT cartridge, a HEAT projectile, which weighs 2 kg and is thus an over-caliber projectile propelled by a blank cartridge, is reported to have been used. A rimless version of this cartridge was also produced for a semiautomatic AT gun.

Characteristics (AP cartridge)

Cartridge weight	861 g
Projectile weight	320 g
Muzzle velocity	900-960 m/s

Index No. 29

25x205SR

Other Designation: 25-mm Soviet AA gun, M1940.

This cartridge, which is very close in dimensions to the Swedish 25-mm Bofors L/64 cartridge that was adopted in 1933, differs in having three rotating bands; the rearmost band is inserted into the cartridge-case mouth, which is then crimped just to the rear of the middle rotating band. Dimensions of the Soviet cartridge case were scaled from a drawing and may vary from those given in table I. The cartridges, which are fed from 7-round Bofors-type clips, have an annular groove in the cartridge base, similar to the Soviet 37x253SR cartridge. HEI-T projectiles with A-23 fuzes, Index Y03P-132 (UOZR-132), and AP-T projectiles, Index Y3P-132 (UZR-132), are reported; these designations are stenciled on the cartridge case. These three-band projectiles were also used in 25x219 cartridges for a Soviet Naval AA gun. The 25x205SR cartridge was used in the Soviet towed AA gun, M1940. The gun and cartridges were obsolete in the Soviet service after the close of World War II, but may possibly be still in use in outlying areas of Soviet influence.

Characteristics

	HEI-T	AP-T
Cartridge weight	672 g	684 g
Projectile weight	288 g	295 g
Muzzle velocity	900 m/s	900 m/s

Index No. 30

25x218

Other Designation: 25-mm Soviet naval AA gun.

This rimless cartridge is fired in the Soviet naval twin AA gun systems, Models 2-M3 and 2-M8. Two types of projectiles have been noted; the older type, with three copper rotating bands, is identical to projectiles for the 25x205SR gun. The rearmost rotating band is inserted into the mouth of the brass cartridge case, which is crimped just to the rear of the middle rotating band.

Newer-pattern HEI-T projectiles with MG-25 fuzes have two copper rotating bands; again, the rearmost band is inserted into the mouth of the brass or steel cartridge case. Cartridge cases carry the index Y03P-85 (UOZR-85) or Y03P-85M (UOZR-85M) stenciled on the cartridge case.

Characteristics

Cartridge weight	639-644 g
Projectile weight	281-285 g
Muzzle velocity	900 m/s (est)

Index No. 31

27x145B

Other Designations: Mauser MK27; 27-mm Mauser MRCA gun.

This cartridge has been developed for the Mauser high-performance revolver-type MK27 aircraft gun intended for the West German-British-Italian "Tornado" aircraft. Like other aircraft gun cartridges developed from the Mauser MK 213 cartridge, it is electric-primed. Projectiles for this cartridge include AP, APHEI, and HEI.

Characteristics

Cartridge weight	500-530 g
Projectile weight	240-280 g
Muzzle velocity	1050 m/s

Index No. 32

28x188R

Other Designations: 28/20S PzB 41; 28/20 squeeze bore.

This cartridge, the smallest of a family of three squeeze-bore AT guns developed by Germany during World War II, was based on a tapered-bore gun designed by Max Gerlich. The cartridge was designed for use in a gun with a tapered, rifled bore, decreasing in bore diameter from 28 mm at the origin of the rifling to 20 mm at the muzzle. The purpose of this design was to achieve an extremely high velocity while reducing air resistance by decreasing the projectile's sectional area. The 28-mm projectile has skirts that are folded or squeezed into recesses in the smaller-diameter projectile body as the projectile moves down the barrel. AP projectiles with a tungsten-carbide core and HE projectiles are known. This ammunition was produced from mid-1940 to the close of 1943, when shortages of critical material forced the termination of the program. Excessive bore-wear is also reported to have been a factor in the decision to discontinue production. Some AP projectiles reportedly had cores of uranium as a substitute for tungsten carbide at the close of the program.

Characteristics

	AP (WC)	HE
Cartridge weight	650 g	630 g
Projectile weight	121 g	100 g
Muzzle velocity	1415 m/s	1500 m/s

Index No. 33

28x199SR

Other Designation: 1.1-inch US Navy heavy machinegun.

This cartridge was developed during the 1930s for a water-cooled, quad AA gun for shipboard use. Although this gun and ammunition saw some use in World War II, it was replaced in general service by the 20x110 RB Oerlikon Mark 4-series guns and was obsolete by the close of the war. Despite its US Navy origin, many cartridges were made by the Army's Frankford Arsenal in addition to naval contractors.

Characteristics

Cartridge weight	848 g
Projectile weight	416 g
Muzzle velocity	823 m/s

Index No. 34

30x86B

Other Designation: 30-mm Mauser MK-213.

The 30x86B cartridge was developed in Germany for the Mauser MK-213 revolver-type aircraft gun, which was one of the most advanced gun designs to appear during World War II. In postwar years this gun and ammunition provided a basis for further developments in several major Western arms-producing countries, notably the British ADEN and French DEFA designs. The original gun was not produced after the close of World War II, except possibly in other countries for trial purposes.

The United Kingdom made a similar 30x86B cartridge in the early 1950s for the Type 3M ADEN 30-mm aircraft gun, which was based on the MK 213 gun. UK-made cartridges can be distinguished from World War II German cartridges by the case material (brass instead of lacquered steel) and the British identification markings in the extraction groove and on the projectile. The US also made brass-cased 30x86B cartridges, designated T158 through T162, for the T121 revolver aircraft gun. US-made cases, which are similar to UK-made cases, may be unmarked.

Characteristics (World War II cartridges)

Cartridge weight	500 g
Projectile weight	330 g
Muzzle velocity	530 m/s

Index No. 35

30x91RB

Other Designations: 30-mm MK 108; 30-mm Japanese Type 2.

This cartridge was developed by Rheinmetall-Borsig during early World War II for a 30-mm low-velocity aircraft gun, the MK 108, which operated on the blowback principle. In 1944-1945, Japan used a closely similar cartridge type—but with a slightly larger diameter rim (29 mm) and a shorter projectile—in the 30-mm AA gun, Type 2. HEI, HEI-T, and incendiary loadings are reported. Neither the German nor the Japanese gun and ammunition have been used since the close of World War II.

Characteristics

Cartridge weight	475-487 g
Projectile weight	330 g
Muzzle velocity	500 m/s

Index No. 36

30x97B

Other Designations: 30-mm Type 3CGF; 30-mm DEFA 541.

This cartridge is the result of postwar French exploitation of the World War II Mauser MK213 gun and cartridge. It was developed during the 1950s for the French revolver-type aircraft gun, Type 3CGF, which was redesignated the DEFA 541. The cartridge can be identified by its electric-primed brass case with a French-style headstamp that includes the designation "3CGF." The gun and cartridge were soon replaced in service by the more powerful 30x113B DEFA 550-series gun and ammunition; the DEFA 541 gun and its ammunition are no longer in service.

During the late 1960s and early 1970s, the United States made similar experimental cartridges with brass or aluminum cartridge cases but with case lengths of 100 mm and 102 mm. The 100-mm cases, which are percussion-primed, may be marked XM193, XM210, or XM211; the 102-mm cases are electric-primed and may be marked FAT 33.

Characteristics

Cartridge weight	500 g
Projectile weight	296 g
Muzzle velocity	670 m/s

Index No. 37

30x113B

Other Designations: 30-mm DEFA Type 551 (553);
30-mm ADEN.

This cartridge designation is shared by two similar and generally (though not completely) interoperable cartridges: one for the French-developed DEFA Type 551 to Type 553 guns, the other for the UK-developed ADEN gun. Both are revolver-type aircraft guns that are derived from the World War II Mauser MK-213 gun. Like the Mauser gun ammunition, all 30x113B cartridges have electric primers. France developed its version of the 30x113B cartridge by 1957 for the Type 551 DEFA gun and in subsequent years introduced improved Type 552 and 553 guns. Ammunition has been developed along with the guns, but 550-series ammunition can be used in all three guns. Cartridges include air-to-air and air-to-ground types. Air-to-air cartridges have an HEI-T projectile with a self-destruct fuze, to reduce the hazard to friendly ground troops. Air-to-ground ammunition has a primer with a flash tube to insure ignition during a diving attack against ground targets. Air-to-ground explosive projectiles have a fuze without the self-destruct feature. French cartridges can be recognized by the steel cartridge case, the French-style headstamp, and a stenciled case marking indicating the type of cartridge. DEFA ammunition has also been made by Oerlikon and Hispano-Suiza, by West Germany, and by Israel.

Characteristics (DEFA ammunition)

Cartridge weight	440-480 g
Projectile weight	236-275 g
Muzzle velocity	760-818 m/s

UK development of the ADEN gun and cartridge paralleled that of France. The first types, in the early 1950s, used a low-velocity 30x86B cartridge in the Type 3M ADEN gun; this was superseded in the mid-1950s by the current 30x113B cartridge. ADEN ammunition can be recognized by the brass cartridge case with UK-style model designations on projectile and fuze, and by producer, model, and year data stamped in the bottom of the extraction groove of the cartridge case. ADEN cartridge cases are slightly shorter in case length than DEFA cases; they may be as short as 111 mm. This poses no problem in functioning in revolver-type guns, since the cartridge case belt indexes the cartridge in the revolver chamber. ADEN cartridges have been produced by Hispano-Suiza and Oerlikon, as well as by Sweden, West Germany, the Netherlands, and Belgium. The United States is developing a family of aluminum-cased 30x113B cartridges, designated XM 788, XM 789, and XM 709 and intended for the XM 188E1 gun, which will be functionally interoperable with ADEN and DEFA guns.

Characteristics (ADEN ammunition)

Cartridge weight	440-503 g
Projectile weight	226-270 g
Muzzle velocity	590-800 m/s

Index No. 38

30x114

Other Designation: 30-mm Japanese Ho-155.

The 30x114 cartridge was developed by Japan during World War II for the 30-mm aircraft cannon, Ho-155. The gun and ammunition have been obsolete since the end of the war.

Characteristics

Not available.

Index No. 39

30x123

Other Designation: 30-mm Japanese Type 5.

The 30x123 cartridge was used during World War II in the Japanese naval aircraft gun, Type 5. Cartridge case dimensions were scaled from World War II drawings, and measured dimensions may vary from those shown in table I. The gun and ammunition have been obsolete since the close of World War II.

Characteristics

Not available.

Index No. 40

30x155B

Other Designation: 30-mm Soviet N-30.

Introduced by the USSR in the mid-1950s for the N-30 aircraft gun, this cartridge is still in service. Cartridge types include a fragmentation-HEI cartridge with a PD fuze, Model A-30 or B-30, and a fragmentation-HE cartridge with a BD fuze and a sheet-metal windshield that gives the appearance of an API cartridge. There is no visible indication that the projectile contains HE filler. Cartridge cases are of brass.

The fragmentation-HEI cartridge is also made in Czechoslovakia; the cartridge can be recognized by the characteristic Czechoslovak headstamp marking, which includes a three-letter factory (producer) code, dtp.

Characteristics

Cartridge weight	838-850 g
Projectile weight	392-418 g
Muzzle velocity	780 m/s

Index No. 41

30x170

Other Designations: 30-mm HS 830, HS 831L.

Developed at the close of World War II by Hispano-Suiza and still produced by Oerlikon, this cartridge remains one of the world's high-performance automatic gun cartridges. Cartridge types include point-fuzed HEI cartridges; double-fuzed HEI cartridges with a windshield; and API and APDS-T types. This cartridge is used in HS 830-series and HS 831L guns, and the United Kingdom's RARDEN gun. Cartridges have been produced also by West Germany, France, and Egypt, as well as by the United Kingdom, which has developed a high-performance APDS-T cartridge for the RARDEN gun.

Characteristics

Cartridge weight	725-900 g
Projectile weight	360-452 g
Muzzle velocity*	920-1080 m/s

*The RARDEN APDS-T cartridge reportedly has a muzzle velocity in excess of 1200 m/s.

Index No. 42

30x173

Other Designation: 30-mm KCA (304 RK).

This modern, high-performance, electric-primed cartridge was developed during the 1950s by Oerlikon for the KCA (formerly 304 RK) revolver gun for aircraft.

Cartridge types include HEI, API, and SAPHEI cartridges. A variant of this cartridge was the 30x180, an electric-primed cartridge produced by Oerlikon in 1953 for the RK 302 gun; cartridges were made for trials but were never mass-produced.

In recent years the United States has produced aluminum-cased cartridges in 30x173 caliber; these have percussion primers when made for the GAU 8A gun and electric primers when made for the GAU 9A gun.

Characteristics

Cartridge weight	800-910 g
Projectile weight	325-433 g
Muzzle velocity	950-1100 m/s

Index No. 43

30x185B

Other Designations: 30-mm MK 101; MK 103.

This cartridge was introduced in Germany about 1936 as a percussion-primed cartridge for the MK 101 aircraft gun. An electric-primed version of the cartridge was made for the MK 103 gun. The cartridges have similar case dimensions but can be distinguished by the presence of a c/33 percussion primer or a c/23 electric primer. HE, HEI, HEI-T, API, APHEI, and AP-T cartridge types are known; the AP-T cartridge had a projectile with a tungsten carbide core and a muzzle velocity of 960 m/s. The guns and cartridges were not used after the close of World War II.

Characteristics

Cartridge weight	770-960 g
Projectile weight	295-500 g
Muzzle velocity	700-960 m/s

Index No. 44

30x210B

Other Designations: 30-mm Type NN-30.

This electric-primed, brass-case cartridge is used in the Soviet naval AA gun, Type NN-30. Cartridges are identified by the stenciled case markings, which include the Cyrillic cartridge designation УФ-83 (UF-83) and gun designation HH-30 (NN-30), and by the typical Soviet cartridge headstamp marking.

A similar and probably identical cartridge is reported to be manufactured by Yugoslavia under the designation M69. The HE projectile has a PD fuze, Model UT M69-SM.

Characteristics

Cartridge weight	1140 g
Projectile weight	435 g
Muzzle velocity	1000 m/s

Index No. 45

30x220

Other Designation: 30-mm AA gun, M53/70.

This cartridge is used in the Czechoslovak twin AA gun, M53/70, which was introduced in the 1950s and is still in use.

Cartridge dimensions have been scaled from a catalog drawing; case dimensions have not been verified and may be different from the dimensions given in table I.

Characteristics

Cartridge weight	1050 g
Projectile weight	420 g (est)
Muzzle velocity	1000 m/s

Index No. 46

35x228

Other Designations: 35-mm Oerlikon; 35-mm KDA, KDB, or KDC.

Oerlikon developed this high-performance AA gun cartridge in the early 1960s. Two cartridge case types are known; cases with a link positioning groove below the case shoulder are intended for use in the indexing feed belt of the KDA gun, but can be used in all models. This type of case is in current production. Cases without the belt groove were made for use only in the KDB and KDC guns.

Cartridge types include HEI and HEI-T; APHE; and APDS-T (WC). HE projectiles have a PDSF fuze, Model KZD-242 or KZD-238. The gun and cartridges are widely distributed throughout the free world; Austria, Finland, France, Greece, Iran, Japan, Libya, the Netherlands, Saudi Arabia, and West Germany are reported to have these guns, and several of these countries produce the cartridge under license from Oerlikon.

Characteristics

	Explosive projectiles	APDS-T
Cartridge weight	567 g	1460 g
Projectile weight	550 g	380 g
Muzzle velocity	1175 m/s	1385 m/s

Index No. 47

37x93R

Other Designations: 37-mm M1916; 37-mm M63 Mod 1.

This cartridge and its gun were adopted by the United States in 1916 for infantry use as an adaptation, with very few changes, of a lightweight, man-portable French field howitzer. Although replaced before World War II for combat use, the M1916 cartridge continued in service for subcaliber training with larger artillery pieces and for firing salutes. US-made cartridge cases can be identified by the gun designation "Model of 1916" or the case designation Mk1A2 or Mk1A2B1 in the headstamp of the brass or steel case. The current model of target practice cartridge is designated Cartridge, TP, M63 Mod 1. This cartridge has a blue projectile with white markings. The black-powder-filled projectile has a BD fuze. This cartridge is used in subcaliber guns M1916, M12, M13, M14, and M15. This cartridge is quite close in dimensions to, and in some instances interchangeable with, other low-power cartridges made since the 1890s by the following countries: Russia, France, Germany, Italy, and the United Kingdom. Best known of these is the French 37/85 field howitzer cartridge, which is interoperable with the US cartridge and saw wide use in World War I. The French cartridge can be identified by the marking "37-85" and the initials "PdPs" in the headstamp, and by the presence of two rotating bands on the projectile (the US projectile has one wide rotating band). A similar cartridge, but with a case length of 102 mm, was used in the Maxim automatic gun (nicknamed the Pom Pom) at the turn of the century, while a 37x120R cartridge made by Winchester was used by the United States in the Hotchkiss quick-firing naval gun in the 1890s. Even though none of these guns saw service use during World War II, the ammunition may still be found.

Characteristics (US data)

Cartridge weight	730-912 g
Projectile weight	550-730 g
Muzzle velocity	328-390 m/s

Index No. 48

37x112R

Other Designations: 37-mm Japanese Type 11;
37-mm Japanese Ho-203 aircraft gun.

This cartridge was introduced by Japan in 1922 for the Type 11 infantry accompanying gun, a light, man-portable field gun much like the US M1916 infantry howitzer. The Japanese infantry used this gun in their campaigns in the 1930s and during World War II. The same cartridge case with slightly different projectiles and fuzes was used in a Japanese aircraft gun, the Ho-203, during World War II. Aircraft gun cartridges carry the mark **ホ二〇三** (Ho-203) stenciled on the projectiles. The guns and cartridges have been obsolete since the close of World War II.

Characteristics

	Type 11	Ho-203
Cartridge weight	728-863 g	723 g
Projectile weight	460-595 g	436 g
Muzzle velocity	400 m/s (est)	400 m/s (est)

Index No. 49

37x133R

Other Designation: 37-mm Type 94 tank gun.

Japan adopted this cartridge in 1934 for the Type 94 tank gun. It was used during World War II but has not been produced since that time.

Characteristics

Cartridge weight	803-938 g
Projectile weight	460-595 g
Muzzle velocity	640 m/s

Index No. 50

37x137R

Other Designation: US Navy 1-pdr.

Although the official US terminology for this gun and ammunition is Gun, 1-pounder, the metric designation is used in this guide for the sake of uniformity. This gun, another carryover from the early 1900s, saw limited use in World War II, principally as a saluting gun. A Japanese report states that some ammunition was captured, probably when the Philippine Islands were taken, and was used in a 37-mm Japanese battalion gun.

Cartridge cases will carry the designation "Gun, 1-pdr" and sometimes "Case, Mk 2" in the headstamp. Some guns may still be found in use for saluting purposes. Blank cartridges for salutes are shorter in length than the service cartridge.

Characteristics

Cartridge weight	754 g
Projectile weight	500 g
Muzzle velocity	610 m/s

Index No. 51

37x145

Other Designation: 37-mm Japanese Ho-204 aircraft gun.

This cartridge was made and used by Japan during World War II in the Ho-204 aircraft gun. Projectiles will bear the stenciled designation **ホニ〇四** (Ho-204). The guns and ammunition were obsolete at the close of the war.

Characteristics

Cartridge weight	893 g
Projectile weight	436 g
Muzzle velocity	450 m/s (est)

Index No. 52

37x145R

Other Designations: 37-mm aircraft gun M4, M10.

Used in US aircraft guns M4 (AN-M4) and M10 during World War II and early postwar years, this rimmed cartridge case was made both of brass (Mk IIIA2 case) and steel (Mk IIIA2B1 case). These designations will be found in the cartridge headstamp. The guns and ammunition are no longer in use.

Characteristics

	HE	AP shot
Cartridge weight	875 g	1020 g
Projectile weight	608 g	753 g
Muzzle velocity	610 m/s	556 m/s

Index No. 53

37x155

Other Designation: 37-mm Soviet N-37.

This Soviet-developed cartridge is used in the N-37 aircraft gun, introduced in the 1950s and still in use.

HEI (Type OZT) and AP-T (Type BZT) cartridges are known. Soviet-made cartridges have brass cases that carry the designation "H-37" (N-37) and other data containing Cyrillic letters stenciled on the case wall. The cartridge headstamp is also of the Soviet type. This cartridge is also made by Czechoslovakia, using lacquered steel cartridge cases that carry the designation 37 LK over (for AP-T cartridges) PzSv, together with propellant data. The headstamp will include the factory designator aym.

Characteristics

	HEI-T (OZT)	AP-T (BZT)
Cartridge weight	1280 g	1300 g
Projectile weight	735 g	754 g
Muzzle velocity	690 m/s	675 m/s

Index No. 54

37x166R

Other Designations: 37-mm Japanese Type 94; Type 98;
Type 100

This cartridge was used in three Japanese-designed guns developed from 1934 to 1940: the Type 94 AT gun and Types 98 and 100 tank guns. Neither guns nor cartridges continued in use after the close of World War II.

Characteristics

Cartridge weight	950-1115 g
Projectile weight	460-624 g
Muzzle velocity	700 m/s

Index No. 55

37x195

Other Designations: 37-mm Type NS-37 aircraft gun.

This cartridge was used in the Soviet NS-37 aircraft gun, which saw some use during World War II but was replaced in the postwar period by the N-37 aircraft gun. Cartridge dimensions and performance data are estimates.

Characteristics (est)

Cartridge weight	1700 g
Projectile weight	730 g
Muzzle velocity	720 m/s

Index No. 56

37x202R

Other Designation: 37/40 Italian AT gun.

Reported in use as early as World War I, this gun and cartridge were still in use during World War II, but no more recent use is known. The designation "37/40" is not a model year indicator; the second element indicates the length of the gun barrel in "calibers." This is multiplied by the bore diameter to give the length of the barrel. A gun of 40 calibers is by current standards a rather short-barreled gun. HE and APHE projectiles are reported. Case dimensions were scaled from a drawing, and actual case measurements may vary from those given in table I.

Characteristics

Cartridge weight	.....	1300 g
Projectile weight	.....	677-698 g
Muzzle velocity	.....	Unknown

Index No. 57

37x223SR

Other Designations: 37-mm M1A2; ANM9.

The United States developed this cartridge before World War II for use in the M1A2 automatic AA gun, which was used during World War II and again during the Korean War. The same cartridge was used, briefly, in the ANM9 aircraft gun during World War II. Both brass (M17) and steel (M17B1) cases were made; they can be recognized by the model designation in the cartridge headstamp. HE and AP projectiles were used. Although obsolete in the US service, the M1A2 gun and its ammunition were used in other countries, particularly France, during postwar years and may still be found in service.

Characteristics

	HEI-T	APC-T
Cartridge weight	1210 g	1440 g
Projectile weight	610 g	87 g
Muzzle velocity	792 m/s	792 m/s

Index No. 58

37x223R

Other Designations: 37-mm AT gun M3; 37-mm tank gun M5, M6.

Designed before World War II for the single-shot 37-mm AT gun M3 (M3A1), and used in tank guns of the M5 and M6 series on prewar light tanks, this cartridge resembles the preceding 37x222SR cartridge; the two types, however, are not interchangeable. Aside from the cartridge rim, this case can be identified by the M16 cartridge-case designation that appears in the headstamp. The gun and ammunition were obsolete in the US service before the end of World War II, but some may be found in use elsewhere.

Characteristics

Cartridge weight	1400-1500 g
Projectile weight	730-870 g
Muzzle velocity	793-823 m/s

Index No. 59

37x232

Other Designation: 37/54 Italian AA gun.

This cartridge was designed for use in the tray-loaded, semiautomatic, Model 37/54 AA gun. With a propellant weight nearly double that of the older 37/40 cartridge, and fired in a longer-barreled gun, this cartridge clearly develops a higher muzzle velocity and a longer range. The gun was developed before World War II but has not been in use since the close of the war.

Case dimensions were scaled from a drawing, and actual case measurements may be expected to vary somewhat from those given in table I.

Characteristics

Cartridge weight	1590 g
Projectile weight	800 g
Muzzle velocity	Undetermined

Index No. 60

37x250R

Other Designation: 3.7-cm PAK 36.

This cartridge was developed in Germany for the PAK 36, a two-wheeled, towed AT gun that closely resembles its US counterpart. It was also used in a tank gun designated the 3.7-cm KWK and in a Swedish 37-mm AT gun, m/39.

A closely similar and probably interchangeable cartridge was produced in Japan before World War II for the Type 97 (1937) AT gun. Although not now in service with any major power, this gun and ammunition may be in use elsewhere.

Characteristics

	German data	Japanese data
Cartridge weight	1350 g	1030-1165 g
Projectile weight	695 g	460-595 g
Muzzle velocity	760 m/s	760 m/s (est)

Index No. 61

37x251R

Other Designation: 37-mm Japanese Type 1.

Although this cartridge is very similar to the 37x250R cartridge in dimensions and, probably, in performance, it is not interchangeable because of differences in case diameter and contour. This cartridge was developed for the Japanese Type 1 (1941) tank and AT guns. The guns and ammunition have not been used since the end of World War II.

Characteristics

Cartridge weight	1375-1410 g (est)
Projectile weight	595-624 g
Muzzle velocity	760 m/s

Index No. 62

37x263R

Other Designation: 37-mm Soviet AA gun, M1939.

This Soviet cartridge was developed for the M1939 AA gun; its brass cartridge case can be identified by the annular groove in the base for a Bofors-type clip and by the characteristic Soviet headstamp marking. HEI-T and API-T cartridges are known; the former have YOP-167 (UOR-167) stenciled on the case wall together with lot and propellant data, and the latter have УБР-167 (UBR-167). The gun and cartridges are now obsolete in the USSR, but HE-T cartridges have been produced in the People's Republic of China, and production in Yugoslavia has been reported.

Characteristics

Cartridge weight	1440-1500 g
Projectile weight	710-770 g
Muzzle velocity	880-906 m/s

Index No. 63

37x258R

Other Designations: 37-mm m/34 (m/38); 3.7-cm Wz 36.

This cartridge was designed by Bofors for single-shot, artillery-type AT guns and thus does not have the deep annular groove that is found on the base of cartridge cases for Bofors-type automatic guns. The cartridge was used in several Swedish AT gun models: m/34, m/38, m/39-43, and m/40-43, as well as in tank gun m/38. The same cartridge was used by Poland in the Wz36 (Model 36) AT gun, and cartridges in this caliber were made by Germany early in World War II. The gun and cartridge were also adopted by Denmark under the designation M37. Guns and ammunition went out of use following World War II as increased armor protection made this caliber AT gun obsolete.

Characteristics

Cartridge weight	1350-1390 g
Projectile weight	700-740 g
Muzzle velocity	785-800 m/s

Index No. 64

37x264B

Other Designations: 3.7-cm FLAK 18 and 36; 3.7-cm M38,
M39 AT gun.

Developed in the 1930s by Germany for use in the FLAK 18 and 36 AA guns and the M38 and M39 AT guns, this cartridge was also used in an aircraft gun during World War II. Like many other cartridges of the period, it has not been used since the close of World War II.

Characteristics

Cartridge weight	1580 g
Projectile weight	700 g
Muzzle velocity	over 900 m/s

Index No. 65

37x267R

Other Designation: 3.7-cm M34 AT gun.

This cartridge was used in the prewar Czechoslovak M34 AT gun. Germany made ammunition for this gun during World War II, but no postwar use is reported.

Characteristics

Not available.

Index No. 66

37x278R

Other Designation: 37-mm Hotchkiss Mle 1925.

This cartridge is reported to have been used in a French Hotchkiss gun, Model 1925, and in subsequent Models 1929, 1930, and 1934, as well as in a Casement M1934 gun. Projectiles include an APC-T (Mle 1934) and an HE (Mle 1938). No further information is available on the guns that used it.

Characteristics

Not available.

Index No. 67

37x303R

Other Designation: 37-mm "Davy Crockett" spotter.

The 37x303R cartridge was developed in the early 1960s as a spotter cartridge for the US "Davy Crockett" M29 heavy weapon system. It fires a long, fin-stabilized spotter projectile through a smoothbore 37-mm gun mounted below the muzzle of the primary weapon. The cartridge case contains a high-low pressure system to insure reliable ignition while holding chamber pressure to a proper working level. The projectile has an electric impact fuze that on impact produces a flash and a column of smoke visible at a range of 4000 meters. (Caution! Spotter projectiles contain a small PETN burster charge!) Two versions of this cartridge exist: the M415E7 for shorter ranges, the M446E2 for longer ranges. Cartridge cases can be distinguished by the cartridge model designation, which is stamped on the cartridge base. The M415E7 case also has an identifying annular groove in the case base. Both cartridges have spanner wrench holes in the closing plug in the cartridge base. The "Davy Crockett" system is no longer in service.

Characteristics

	M415E7	M446E2
Cartridge weight	2200 g	2070 g
Projectile weight	1030 g	1030 g
Muzzle velocity	167 m/s	247 m/s

Index No. 68

37x320R

Other Designation: 37-mm Bofors M1939 AA gun.

This cartridge is known to have been produced by Bofors in 1939 and by Denmark in 1940, but how long the gun and ammunition were made is a question. Probably they could not compete with the Bofors 40-mm gun performance and were soon dropped. Both HE-T and AP-T cartridges are reported.

Characteristics

Not available.

Index No. 69

37x380R

Other Designation: 3.7-cm C-30.

Developed in Germany before World War II, this high-performance cartridge was used in the naval AA gun, Model C-30. This gun and cartridge were used during World War II, but no later use is reported.

Characteristics

Cartridge weight	1814 g
Projectile weight	Not available
Muzzle velocity	Not available

Index No. 70

40x46R

Other Designation: 40-mm M79.

This cartridge is designed to be fired from the single-shot, shoulder-held grenade launcher M79, which resembles a shotgun with a short, over-size barrel, or on the M203 launcher attached to the M16 rifle. It utilizes a high-low pressure system to reduce recoil and provide adequate velocity to the projectile. HE and pyrotechnic cartridge types are used. The cartridge headstamp may include the case model designation XM 118, M118, or XM199.

Characteristics

Cartridge weight	228 g
Projectile weight	175 g
Muzzle velocity	76 m/s

Index No. 71

40x53SR

Other Designations: 40-mm XM 174, XM 175.

This cartridge is a higher-velocity version of the 40x46R cartridge, designed to be fired from M75 and M129 tripod-mounted, automatic-loading grenade launchers and from the Mk19 Mod 1 US Navy machinegun. These high-velocity cartridges are not to be used in launchers designed for the low-velocity 20x46R cartridge. Cases may be marked with the case model XM 169 (M169), either stenciled on the case wall or as part of the cartridge headstamp.

Characteristics

Cartridge weight	340 g
Projectile weight	175 g
Muzzle velocity	240 m/s

Index No. 72

40x143R

Other Designation: 40-mm AA gun, Model 43/39.

This cartridge was used in the Italian 40-mm AA gun, Model 40/39, which dates from the World War I period. The designation "39" indicates a barrel length of 39 calibers, or 1.56 meters. Data on the ammunition are incomplete; the case length has been scaled from a drawing in TM 9-1985-6; actual measurements will probably be different from those given in table I.

Characteristics

Cartridge weight	1450 g
Projectile weight	Not available
Muzzle velocity	Not available

Index No. 73

40x158R

Other Designation: 40-mm Vickers-Armstrong.

Developed by Vickers-Armstrong in the post-World War I period, this gun saw very limited use in World War II, having been replaced by the Bofors 40-mm automatic gun. Japan, however, made and used cartridges for this gun during World War II. The gun and ammunition were obsolete at the war's end.

Characteristics

Cartridge weight	1325 g
Projectile weight	1000 g
Muzzle velocity	853 m/s

Index No. 74

40x305R

Other Designation: 2-pdr AT gun.

Developed by the United Kingdom before World War II, this cartridge was used in single-shot, quick-firing, 2-pounder AT guns, Marks 9 (9A) and 10 (10A and 10B). HE-T and AP-T cartridges are reported. The guns and ammunition saw some use in World War II but are now obsolete.

Characteristics

	HE-T	AP-T
Cartridge weight	1900 g (est)	2025 g (est)
Projectile weight	860 g	1075 g
Muzzle velocity	792 m/s	850 m/s

Index No. 75

40x311R

Other Designations: 40-mm Bofors M/40 AA gun; 40-mm Bofors L-60; 40-mm Bofors Mk I, Mk II.

Developed by Bofors during the 1930s, this was probably the most widely used AA gun in World War II; it was used by the United States, United Kingdom, Germany, Italy, as well as Sweden. Both brass and steel cartridge cases were used. The cartridge is still produced by such major ammunition producers as Bombrini Parodi-Delfino in Italy; Fabrique Nationale in Belgium; Diehl in West Germany; Yugoslavia; and Sweden.

US-made cartridge cases of army design carry the case designation M25 (brass) or M25B1 (steel). Cases of navy design will have the Mk2 or Mk2 Mod 1 brass case or Mk3 steel case. US-made ammunition of British design uses the M22 case, which differs in having a primer seat threaded for the British primer.

The United States made HE-T and AP-T cartridges in this caliber.

Characteristics

Cartridge weight	2030-2150 g
Projectile weight	900-940 g
Muzzle velocity	823-875 m/s

Index No. 76

40x365R

Other Designation: 40-mm Bofors L-70.

Developed by Bofors in the 1950s and standardized in 1954, this cartridge provides improved performance over that of the L-60 gun. Bofors has introduced advanced design features into this ammunition, including controlled fragmentation projectiles and proximity fuzes. Ammunition is produced in many countries: in Sweden; by Diehl in West Germany; by Oerlikon in Switzerland; by Bombrini Parodi-Delfino in Italy; and in the United Kingdom and Yugoslavia.

Characteristics

	HE-T	APDS-T
Cartridge weight	2420-2510 g	2250 g
Projectile weight	880-960 g	705 g
Muzzle velocity	1005-1025 m/s	1200 m/s

Section IV.

MARKING PRACTICES BY COUNTRY

A. GENERAL**1. Scope**

This section summarizes cartridge marking practices for selected ammunition-producing countries.

2. Organization

Countries are arranged in alphabetical order, with the addition of World War II--Germany and Japan as a separate element, following West Germany in sequence.

B. COUNTRY MARKING PRACTICES**3. Czechoslovakia**

a. **General.** Postwar Czechoslovak cartridge manufacture has followed Soviet practice in calibers and functional types, with the exception of cartridges for the twin 30-mm AA gun, Model 53/70. Czechoslovak ammunition can be recognized by the characteristic factory code composed of three lowercase letters, which resembles, but is different from, the letter code used by Germany during World War II. Cartridge cases (and other items as well) may carry a crossed-sword mark (see view C in fig 7).

b. Cartridge Markings.

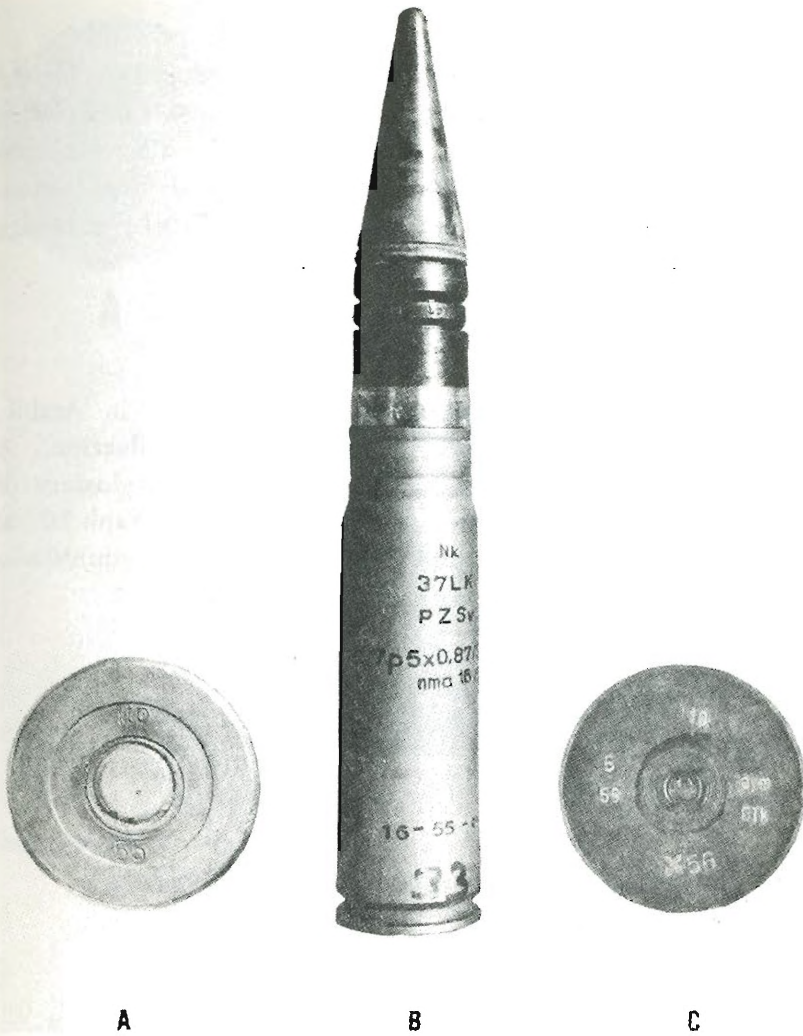
(1) Markings on Czechoslovak Soviet-caliber ammunition follow the Soviet pattern, but differ in that designations and terms are in Czech.

(2) Fuzes are stamped with a Czechoslovak model designation, a factory code, and lot and year data.

(3) Projectiles carry a stamped factory code and lot and year data. Stenciled markings are occasionally found as well.

(4) The 23x115 and 30x115B aircraft gun cartridges, like their Soviet counterparts, have no stenciled marking on the cartridge case. The 37x115 cartridge cases, which differ from Soviet cases in that they are made of lacquered steel rather than brass, carry a stenciled marking that includes caliber, projectile type, propellant data, factory code, lot number and year (view B, fig 7).

(5) Headstamp markings vary in layout but include the characteristic three-letter factory code. View A in figure 7 shows a headstamp from a 23x115 cartridge; view C shows a 37x155 headstamp. The letters OTK in the latter headstamp are the initials of a government production directorate that can be equated roughly to "Office of Technical Control."



Neg. 526263

Figure 7. Czechoslovak cartridge markings.

4. Egypt

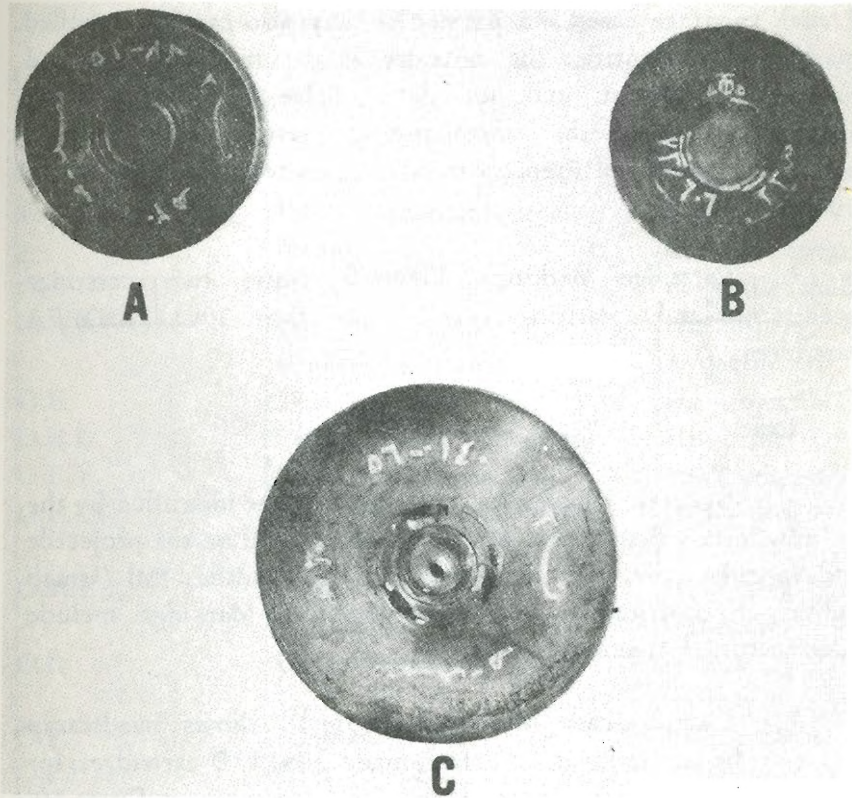
a. **General.** In recent years Egypt has produced steel-cased 23x152B cartridges of Soviet design and Hispano-Suiza cartridges in calibers of 20x110 and 30x170. In appearance and construction these cartridges are similar to their Soviet and Swiss counterparts. They have no identifying markings other than the cartridge headstamp.

b. **Cartridge Headstamp Markings.**

(1) The headstamp markings, which are in Arabic, include caliber, manufacture, and year of production. A description of the Arabic numbering system and a glossary of ammunition terms are given in section IV, paragraph 10 of Volume I. The Arabic numerals and their Western equivalents appear below:

١	1
٢ or ٢	2
٣	3
٤	4
٥	5
٦	6
٧	7
٨	8
٩	9
.	0

(2) View A in figure 8 shows the headstamp marking on a 20x110 Hispano-Suiza-type TP cartridge, view B that on a Soviet-type steel-cased 23x152B cartridge for ZU-23 (ZSU-23-4) guns, and view C the marking on a 30x170 Hispano-Suiza type HE-T cartridge.



Neg. 526262

Figure 8. Egyptian cartridge headstamp markings.

5. France

a. **General.** Identification of French-made cartridges can be established from the headstamp markings, which include as a minimum the manufacturer and year, and may include the producer of the case material. Headstamp markings for 30x113B DEFA cartridges include the gun designation as well. Abbreviations (codes) for cartridge manufacturers and case-metal

suppliers are shown in section IV, paragraph 12b, of Volume I. French cartridge cases and projectiles may also carry a stenciled marking that identifies the cartridge as to functional type and provides propellant and lot data. Table II provides some abbreviations, with the corresponding French terms and US equivalents, found in French cartridge nomenclature in the 20- to 40-mm range.

b. Cartridge Markings. Figure 9 shows two cartridge headstamps and a cartridge case marking from 30x113B DEFA cartridges.

6. Israel

a. General. Israeli-made cartridges can be identified by the Hebrew letters that appear in the headstamp and on the projectile and cartridge case, or by the manufacturer's initials IMI (Israeli Military Industries) if made for export. Markings include manufacture, lot, and year data.

b. Cartridge-case Markings. Figure 10 shows headstamp and case body markings on Israeli-made 30x113B cartridges for the DEFA 500-series aircraft guns. The headstamp in figure 10, view A is from a cartridge made for export; the marks in views B and C are from cartridges made for internal use. The Hebrew letters to the right of "30-550" read "DEFA."

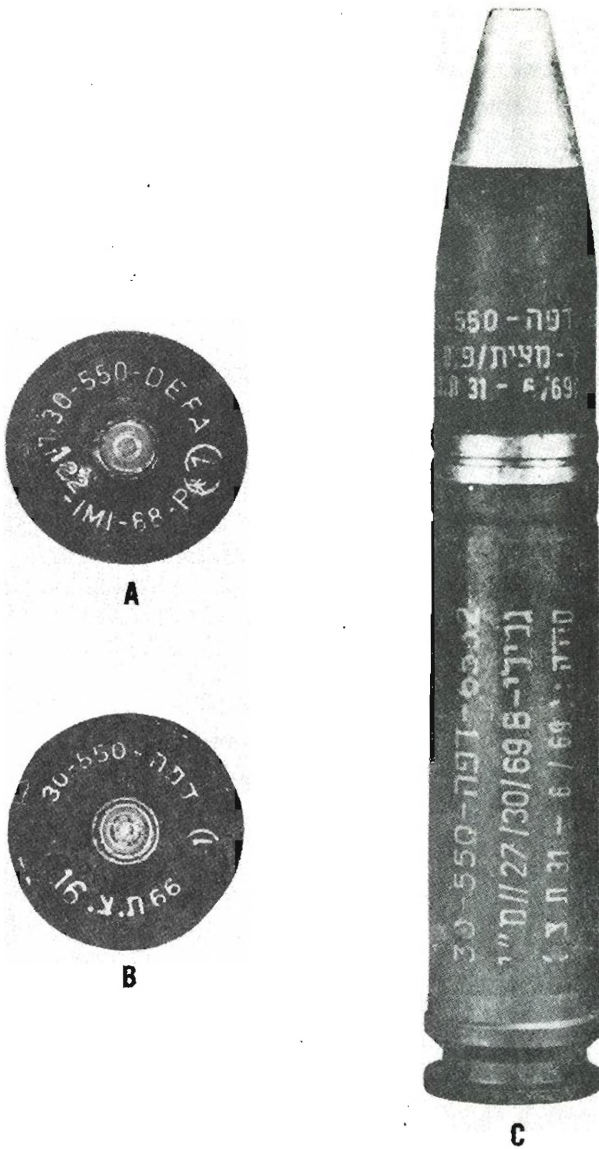
Table II. Abbreviations and Terms on French
20-mm to 40-mm Cartridges

Abbreviation	French	US Equivalent
Fu	Fusée	Fuze
F.U.A.D. (FUA)	Fusée autodestructrice	Fuze, PDSD
—	Noyau	Core; penetrator
O.	Obus	Projectile (shell)
O.A.P.E.I.	Obus anti-personnel, explosif, incendiaire	HEI (Apers) projectile
O.E.	Obus explosif	HE projectile
O.E.I.	Obus explosif incendiaire	HEI projectile
O.E.T.	Obus explosif traceur	HE-T projectile
O.E.I.T.	Obus explosif incendiaire, traceur	HEI-T projectile
O.M.E.I.	Obus mine explosif, incendiaire	HEI (mine) projectile
O.I.	Obus incendiaire	Incendiary (I) projectile
O.P.	Obus perforant	AP projectile
O.P.I.	Obus perforant, incendiaire	API projectile
O.P.T.	Obus perforant, traceur	AP-T projectile
O.P.I.T.	Obus perforant, incendiaire, traceur	API-T projectile
O.P.T. Soc	Obus perforant, traceur, sous-calibre	APDS-T projectile
O.X.	Obus exercice	Practice (P) projectile
O.X.L.	Obus exercice, lesté	Practice (P) projectile inert-loaded
O.X.T.	Obus exercice, traceur	Practice tracer (PT) projectile



Neg. 526201

Figure 9. French cartridge markings.



Neg. 526261

Figure 10. Israeli cartridge markings.

7. People's Republic of China

a. **General.** The People's Republic of China (PRC) has manufactured copies of Soviet cartridges in several calibers, of which the 37x253R cartridge is typical. This cartridge is used in the PRC Type 55 AA gun, a copy of the Soviet M1939 gun.

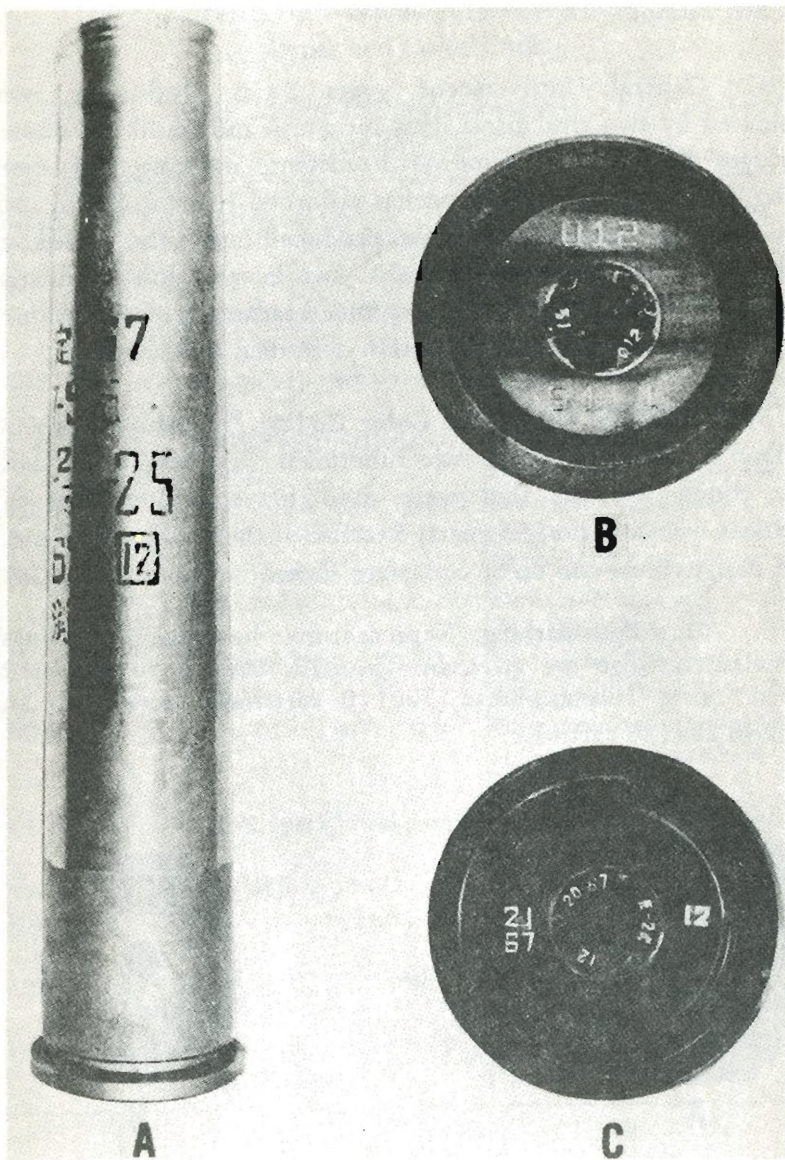
b. **Cartridge Marking Practice.** The markings that appear on the Chinese-made cartridge of this caliber are as follows:

(1) The fuze, if present, and projectile carry stamped Western numerals that provide factory code, lot number, and year of manufacture. A Chinese character may also be present.

(2) The cartridge case is stenciled in four lines with caliber, gun model, and propellant and cartridge lot data, using block-style Western numerals. One or more Chinese markings may also appear.

(3) The headstamp is marked in block-style Western numerals that include a factory number, lot, and year of manufacture. The percussion primer may carry a Chinese character together with factory, lot, and year data.

(4) Figure 11, view A shows a 37x253R cartridge case of 1962 manufacture that includes the number 167, which is the Soviet index number for cartridges of this caliber; the designation 37-55, which represents the caliber; and the Chinese designation, Type 55, for the gun that uses this cartridge. Cartridges of recent manufacture have dropped the index number 167 from the marking. Views B and C show two styles of headstamp markings. Both indicate manufacture by a plant with the code number 12, but in different years—1951 and 1967. The block numerals are characteristic of PRC markings.



Neg. 526260

Figure 11. PRC cartridge markings.

8. Switzerland

a. **General.** Until recent years Swiss production was dominated by two rival firms, Hispano-Suiza and Oerlikon, whose cartridges differed in designation, headstamp marking, and color coding. In recent years Oerlikon has absorbed Hispano-Suiza, and both cartridge families are now produced with the Oerlikon headstamp. The Swiss government has in addition produced cartridges in 20- to 40-mm calibers with headstamp markings that follow the small-arms marking pattern described in Volume I.

b. **Projectile Types and Color Coding.** Hispano-Suiza and Oerlikon each had characteristic functional type designation and color coding systems that were used for several calibers of cartridges over a period of years. Because of their widespread use, these designations and color codes are shown in tables III and IV.

c. **Cartridge Marking.** Representative headstamp markings on Swiss cartridge are given in figure 12. View A of figure 12 appears on a Hispano-Suiza 30x170 cartridge, view B on an Oerlikon 20x128 cartridge.



Neg. 526259

Figure 12. Swiss cartridge headstamp markings.

**Table III. Hispano-Suiza Projectile
Types and Color Coding**

NOTE: "Body" refers to "projectile body"; RB stands for "rotating band."

Letter code	Functional type	Color marking
EP	Practice (P)	Silver body.
ET	Practice tracer (PT)	Silver body; red band above RB.
EDS	Practice spotter-tracer	Orange-brown body.
RI	API	Pink ogive, olive-green body.
RIA	APHEI (SD), w/fuze, BDSD	Olive-green body with broad pink band above RB.
RIC	API w/fuze, base, igniting	Olive-green ogive, pink body.
RID	APHEI, double effect (PD and BD fuzes, no SD)	Pink fuze and body; olive-green band on lower projectile body.
RIF	APHEI w/fuze, BD (no SD)	Pink ogive; olive-green body; yellow band above RB.
RINT	API-T (HC) with tracer	Olive-green body; red band above RB; black band above red band.
RT	AP-T, special steel core	Olive-green body, red band above RB.
UA	HE w/fuze, PDSD	Yellow body, silver fuze.
UAT	HE-T w/fuze, PDSD	Yellow body; silver fuze; red band above RB.
UIA	HEI (SD), mine, with fuze, PDSD	Pink body, yellow (brass) fuze.
UIAT	HEI-T (SD), mine, with fuze, PDSD	Pink body, yellow (brass) fuze, red band above RB.

Table IV. Oerlikon Projectile Types and Color Coding

NOTE: "Body" refers to "projectile body."

Letter code	Functional type	Color marking			
		Body	First ring	Second ring	Fuze or windshield
MSB/K	HEI (mine) with PDS D Fuze	Olive	Light green	None	Unpainted
MSBL/K	HEI-T (mine) with PDS D fuze	Olive	Light green	Red	Unpainted
MU	Practice (P) (HEI, mine type)	Blue	Light green	None	Blue
MUL	Practice tracer (PT) (HEI-T mine type)	Blue	Light green	Red	Blue
PKLHT	APDS-T (HC)	*Black	Black	Black	Black
PKHT	APDS (HC)	Black	Black	Black	Black
PKLH	AP-T (HC)	Black	Light gray	Red	Black
PLH	AP-T	Black	Red	None	Black
PSBH/B	APHEI w/fuze, BDS D	Olive	Black	None	Olive
PSBLH/B	APHEI-T, w/fuze, BDS D	Olive	Black	Red	Olive
PU	Practice (P), AP type	Blue	Black	None	Blue
PUL	Practice tracer (PT), AP-T type	Blue	Black	Red	Blue

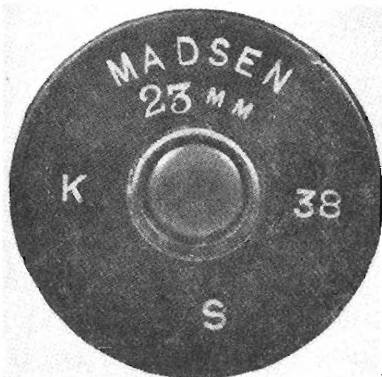
*Tracer indicated by white T's on body.

9. United Kingdom

a. **General.** Cartridges made in the United Kingdom present a diversity of markings, reflecting the period of manufacture, using arm or service, and type of weapon. Markings indicating model designation, functional type, and producer may be found on the fuze, projectile body, cartridge case, and headstamp.

b. Cartridge Case Markings.

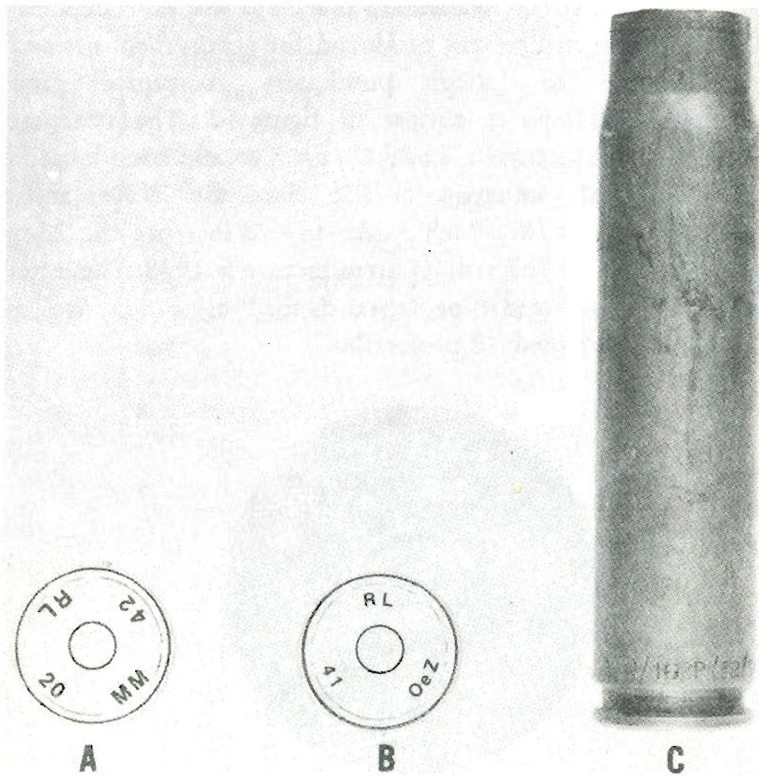
(1) Cartridge headstamp markings will vary, depending on whether the cartridge was produced for government use or for commercial sale to foreign purchasers. A typical prewar commercial headstamp is shown in figure 13. The headstamp includes the manufacturer's initial K (for Kynoch, a mark used by Imperial Chemical Industries, or ICI, since the 1930s) and an indicator of the gun for which made—in this instance the 23-mm Danish Madsen gun. The year of manufacture is 1938. The letter S designates the functional type; it stands for "service practice" and indicates an inert-loaded TP projectile.



Neg. 526202

Figure 13. UK commercial cartridge headstamp markings.

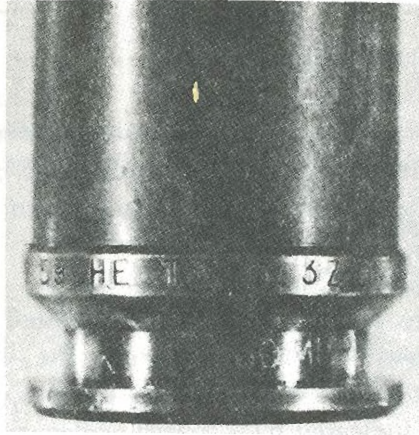
(2) Figure 14 shows typical markings on 20-mm cartridge cases made at government arsenals. The headstamps resemble those on UK small-arms cartridges of the World War II period. The markings shown in figure 14, view A are on a 20x110 Hispano-Suiza cartridge. Those shown in view B, are on a 20x110RB Oerlikon cartridge, identified by the letters Oe; the letter Z indicates that a nitrocellulose propellant is used rather than double-base cordite. View C shows a 20x110 Hispano-Suiza case that has producer and functional type data stamped above the extraction groove.



Neg. 526258

Figure 14. UK 20-mm cartridge-case markings.

(3) The 30x113B ADEN gun cartridges do not have a headstamp; instead, caliber, producer, and year data are stamped into the extraction groove, while functional type, lot, and producer data are stamped on the cartridge case belt. Figure 15 shows the marking on a 30x113B cartridge case.



Neg. 526203

Figure 15. UK 30x113B cartridge-case markings.

10. United States

a. General.

(1) Markings on US-made cartridges have varied widely over the years, depending on the cartridge caliber, branch of service for which made, and type or purpose of gun.

(2) Fuzes carry stamped model designations, and projectiles frequently bear stamped or stenciled markings, or both, that include functional type and model designations. Stenciled markings may appear on the cartridge case body as well. For the most part, 20x102 and 30-mm cartridges have no headstamp, and

identification must be established from markings on the projectile or case body.

(3) Headstamp markings normally include a gun model or cartridge case model designation, manufacturer's initials, and a lot number. The year of manufacture may appear as well.

b. Color Identification.

(1) Several color marking systems have been used by the United States, depending on the cartridge's proponent branch of service and weapon type: aircraft gun, AA gun, or tank or AT gun.

(2) The United States has adopted for all four services—Army, Navy, Air Force, Marines—the standard NATO color coding system. Under this system the projectile's primary functional type is indicated by a specific color, normally applied to the projectile body. When the projectile combines two or more functional roles, such as HEI or APHE, the projectile will be painted in an appropriate combination of colors.

(3) When a color for a primary role does not in itself indicate the presence of an explosive or other hazardous component that could either cause the projectile to function in a high-explosive or low-explosive mode or be especially hazardous to the user, its presence may be indicated by a narrow color band of the appropriate color, whose width "may not exceed 1 inch," or one-quarter of the projectile caliber.

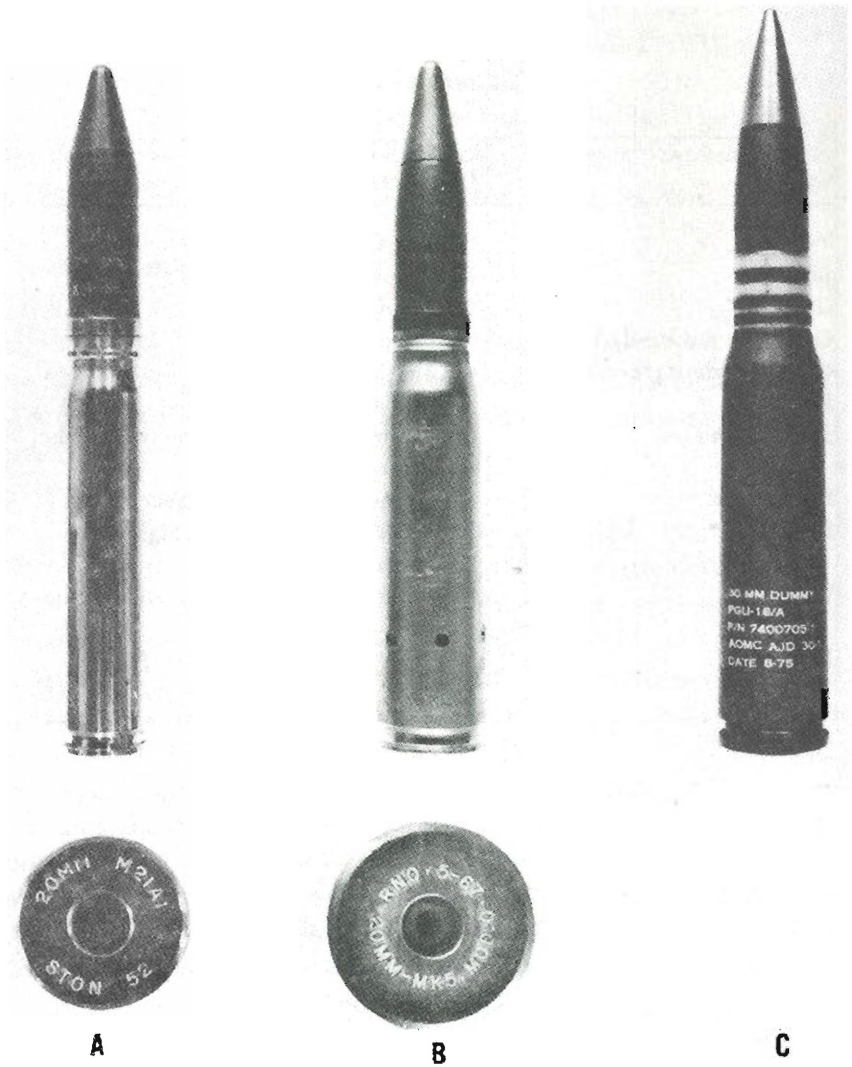
(4) Table V shows the color marking system that has been adopted by NATO for cartridges in calibers of 20 mm and greater.

Table V. NATO Ammunition Color Code

NOTE: This code is applicable to cartridges in calibers of 20 mm and greater.

Color	Interpretation
Yellow	High-explosive
Brown	Low-explosive
Gray	Chemical, general
Gray with red band(s)	Chemical agent, harassing
Gray with dark green band(s)	Chemical agent, casualty
Black	Armor-defeating
Silver/aluminum	Countermeasure ammunition (radar echo, leaflets, etc.)
Light green	Smoke; smoke-producing agent
Light red	Incendiary ammunition, or highly inflammable contents
White	Illuminating ammunition or pyrotechnic contents
Light blue	Practice (training) projectile. The ammunition may have explosive contents

c. **Cartridge Markings.** Figure 16 shows representative US cartridge markings. Figure 16, view A shows the headstamp and projectile markings on an army 20x110 cartridge; the headstamp gives the caliber and case model, while the projectile marking shows projectile model and functional type (TP, for target practice). View B shows similar markings on a 20x110 USN cartridge. View C shows the stenciled markings on a 30x173 dummy cartridge with anodized aluminum case. The cartridge has no headstamp.



Neg. 526257

Figure 16. US cartridge markings.

d. **US Experimental 30-mm Cartridges.** In the course of postwar trials with improved revolver-type aircraft cannon based on the World War II German Mauser MK-213 design, the United States produced many types of experimental 30 mm belted cartridge cases in case lengths ranging from 86 mm to 126.5 mm. Table VI provides data on these cases and on the guns and cartridges with which they were used. Although most of these cases were made in small quantities, the 30x100B cartridge for the percussion-primed WECOM 30 helicopter gun and the 30x126.5B cartridge for the T182 and T212 guns were produced in significant quantity. The United States has decided to standardize on the 30x113B cartridge and is now developing a family of cartridges in this caliber that can be used in the United Kingdom's ADEN gun and in the DEFA 500-series aircraft guns, as well as in US-designed guns.

11. USSR

a. **General.** Two nomenclature and marking systems are in use for Soviet cartridges in the 20- to 40-mm caliber range. All cartridges below 25 mm in caliber, and the 30x152B and 37x155 aircraft gun cartridges as well, are identified as to functional type in the same way as small-arms ammunition, by a two-letter or three-letter cyrillic designator. In the second system, AA gun cartridges such as the 25x205SR, 25x218, and 37x253R calibers follow the practice for larger-caliber artillery ammunition. Each cartridge type is assigned a designator composed of three or four cyrillic letters and a multidigit number. The first letter of the designator is always *у* (U), indicating that the cartridge is of the fixed type. The other two or three cyrillic letters identify the cartridge as to functional type, as in the first system just described, while the number is specific to the gun in which the cartridge is used.

Table VI. Experimental US 30-mm Belted Cartridge Cases

Case length (mm)	Case designations	Cartridge designations	Gun designations
86	none	T158, T159, T160, T161, T162 (electric-primed)	T121; T241?
100	XM193, XM210, XM211	XM639, XM552, XM554, XM756, XM757 (percussion-primed)	WECOM 30; XM140; XM188; XM230
102	FAT 33	T158 series (electric-primed)	probably T121, T182
113	none as yet	XM788, XM789, XM799 (electric-primed)	ADEN; DEFA 500-series; also XM188E1, XM230E1
114	FAT 15	T204, T205, T206, T207, T208 (electric-primed)	T182
126.5	FAT 15E1, FAT 40 FAT 50, FAT 55 FAT 56, FAT 58	T206E10, T239, T240, T252, T253, T270, FAT 48 (usually electric-primed; some percussion-primed)	T182, T212

b. **Functional Types and Designators.** A limited number of functional types of cartridges exist in this caliber range. Explosive projectiles are normally HEI or HEI-T types, with PD fuzes, although one 30-mm frag-HE type with a BD fuze is known. API and API-T projectiles are today of monobloc type; up to the 1950s, API projectiles with hard steel penetrators were used. An incendiary mixture is found under the windshields of API and API-T types. This incendiary is composed of powdered aluminum, magnesium, and barium nitrate and poses no hazard in storage or handling. Projectile designators are presented in their abbreviated cyrillic form and in transliteration, together with their meaning, in the following tabulation:

Cyrillic	Transliteration	Meaning
БЭ	BZ	API
БЭА	BZA	API (improved or modified model)
БЭТ	BZT	API-T
ОЭ	OZ	HEI
ОЭТ	OZT	HEI-T

c. **Cartridge Markings.**

(1) Fuzes carry stamped markings that include the fuze model number and lot and year data.

(2) Cartridge cases that follow the first nomenclature system described in a, above, do not bear stenciled markings on the cartridge case, with the sole exception of 37x155 aircraft gun ammunition. Cartridges that have artillery-type designators all follow larger-caliber practice in having stenciled markings on the cases.

(3) Headstamp markings resemble those on small-arms cartridges in that they contain a numeral-type manufacturer's or factory code and a year indicator. Normally the year indicator is composed of the last two digits of the year, but from 1952 to 1956 cyrillic letter year codes were used. These are:

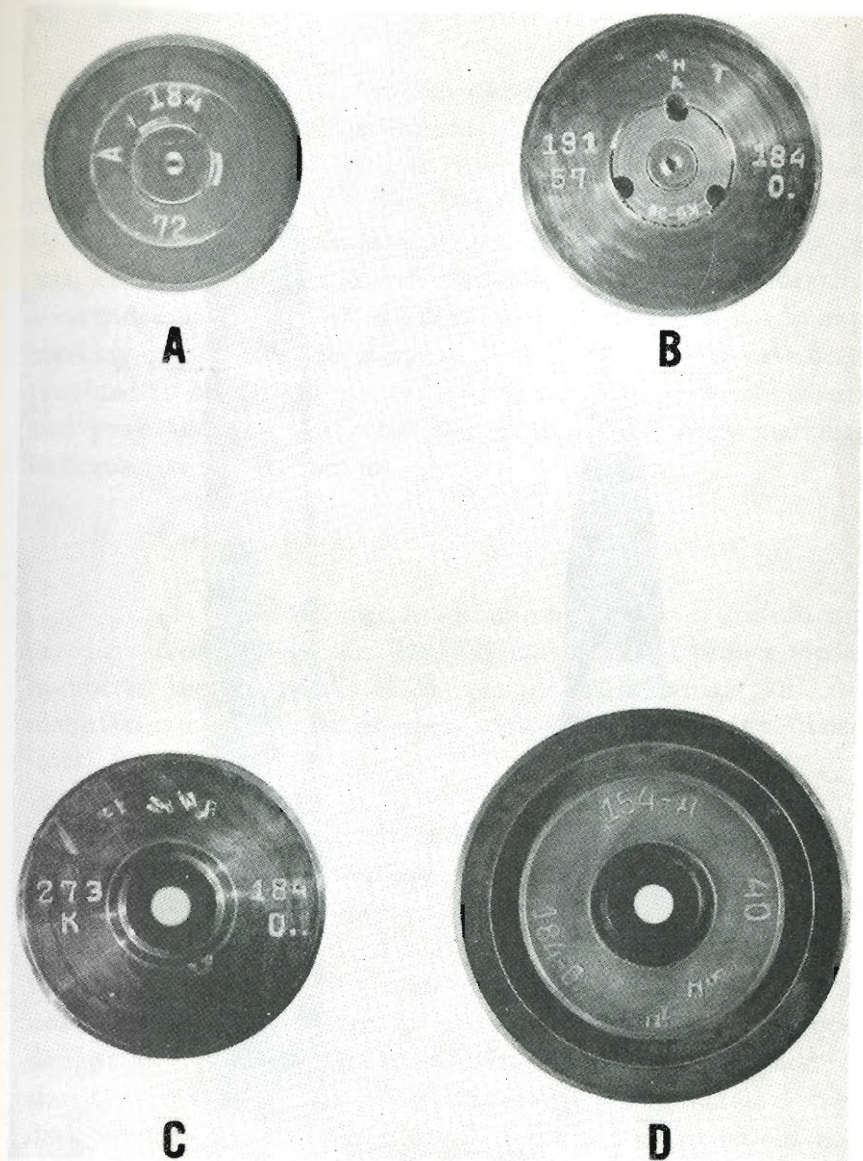
Г	1952
Д	1953
Е	1954
И	1955
Н	1956

d. Representative Markings.

(1) Figure 17 shows representative Soviet cartridge headstamp markings, all with the producer (factory) code 184. View A is from a 23x152B steel-cased cartridge, views B and C are from 30x155B aircraft gun cartridges, and view D is from a 37x253R cartridge. The headstamps in views C and D have cyrillic alphabetical year codes instead of numerals.

(2) In figure 18, view A shows the case markings on a 37x155 aircraft gun cartridge, and view B those on a 37x253R cartridge.

(3) In addition to factory code 184, factory codes 513 and 606 are in wide use for 20- to 40-mm cartridges.



Neg. 526256

Figure 17. Soviet cartridge headstamp markings.



Neg. 526255

Figure 18. Soviet 37-mm cartridge-case markings.

12. West Germany

a. **General.** West German cartridges can be identified by the characteristic cartridge headstamp, projectile, and fuze model designation markings. Artillery-type primers will also carry the model designation. The letters DM (Deutsches Modell) followed by a one-, two-, or three-digit number indicate that the item is, or was, a standard adopted model. Care must be taken not to identify a cartridge as West German solely on the basis of the headstamp marking or primer model alone, since these components have been provided to other countries for loading with their own propellants and projectiles. In this event the projectile will carry markings indicating its national origin.

b. Cartridge Markings.

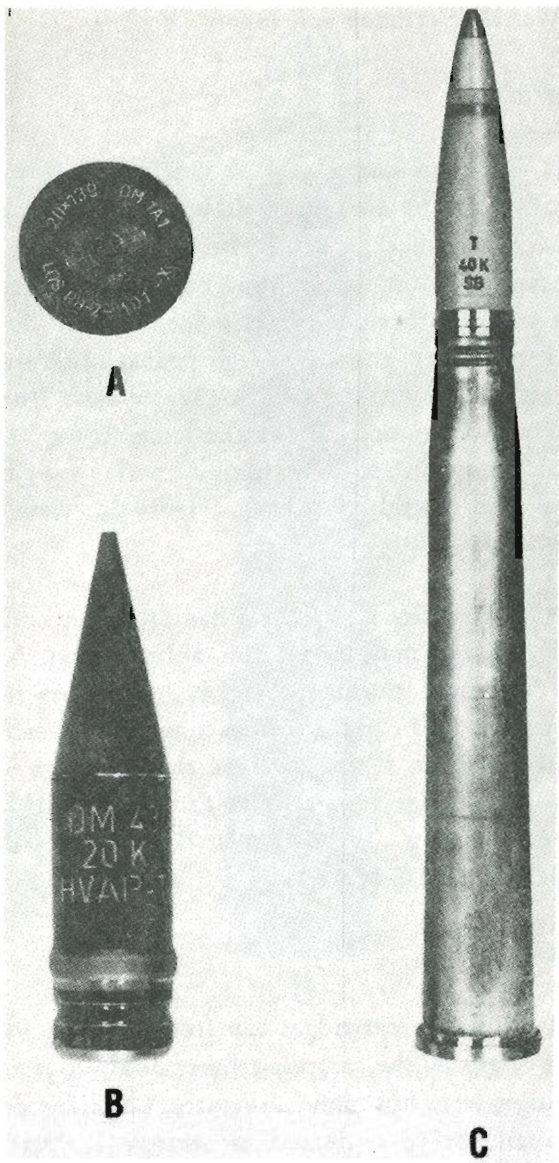
(1) The cartridge headstamp marking may include the cartridge designation (i.e., 20x139) and case and primer model numbers, and normally will include the initials of the manufacturer and a lot number, indicated by the word "Los" (lot).

(2) The projectile is stamped with its model number, the manufacturer's initials, and projectile body lot data. It may have stenciled markings indicating functional type, caliber, model, and lot number of the filled projectile. Color markings will follow the NATO color marking system described in paragraph 10. A nose fuze will carry the prefix letters AZ or AZZ and the model designation, e.g., AZZ DM 131A1. Projectiles and cases made for the United States may carry US model and functional type designations. Some of the German terms and abbreviations that appear on ammunition or packaging are presented in table VII.

**Table VII. German Terms and Abbreviations
Used on Ammunition or Packaging**

Abbreviation	German Term	English Equivalent
AZ	Aufschlagzünder	Impact (PD) fuze
AZZ	Aufschlagzünder, Zerleger	Self-destruct (PDSD) fuze
BZ	Bodenzünder	Base (BD) fuze
BZZ	Bodenzünder, Zerleger	Self-destruct (BDSD) fuze
BR	Brand-	Incendiary
—	Geschoss	Projectile
HK	Hartkern	Tungsten carbide (WC) core
L'spur	Leuchtspur	Tracer (may be indicated by T's stenciled on the projectile body)
Pz	Panzer-	AP
SB	Sprengbrand-	HEI
Spr	Spreng-	HE
Üb	Übungs-	Practice

(3) View A in figure 19 shows the headstamp marking on a 20x139 cartridge; view B shows a typical projectile marking in the same caliber; and view C shows a 40x365R cartridge with projectile marking.



Neg. 526254
Figure 19. West German cartridge markings.

13. World War II—Germany and Japan

a. Germany.

(1) German cartridges of World War II manufacture can be identified by the characteristic headstamp, projectile, and, often, cartridge-case markings. Despite a considerable variety of styles, headstamp markings from 1941 on include a producer code made up of two or three lower-case letters that identifies the producer; a lot number; and a two-digit year date. A stylized eagle stamp with either the letters WA for "Waffenamt" (or Ordnance Bureau, for ground ammunition), or the letter L for "Luftwaffe" (for aircraft ammunition), together with a number may be found in the headstamp or on the projectile. Figure 20, view A shows a typical headstamp marking.

(2) Projectiles carry a similar producer code, lot, and year marking. Fuzes may carry the abbreviation AZ or AZZ followed by a model number, or they may carry merely the number. Projectiles and cartridge cases may carry stenciled data as well. Views B and C in figure 20 show the markings on a 20x82 and a 37x250R cartridge respectively. Further details on German ammunition during World War II can be found in TM 9-1985-3/TO 39B-1A-10.

b. Japan.

(1) Japanese cartridges can frequently be identified as to country of origin by the cartridge dimensions alone, since many of their cartridges were not made elsewhere. Cartridge designations unique to Japan are so indicated in section III, part B of this guide. For other cartridges, the presence of stamped or stenciled markings that include Japanese characters is conclusive as to their origin.

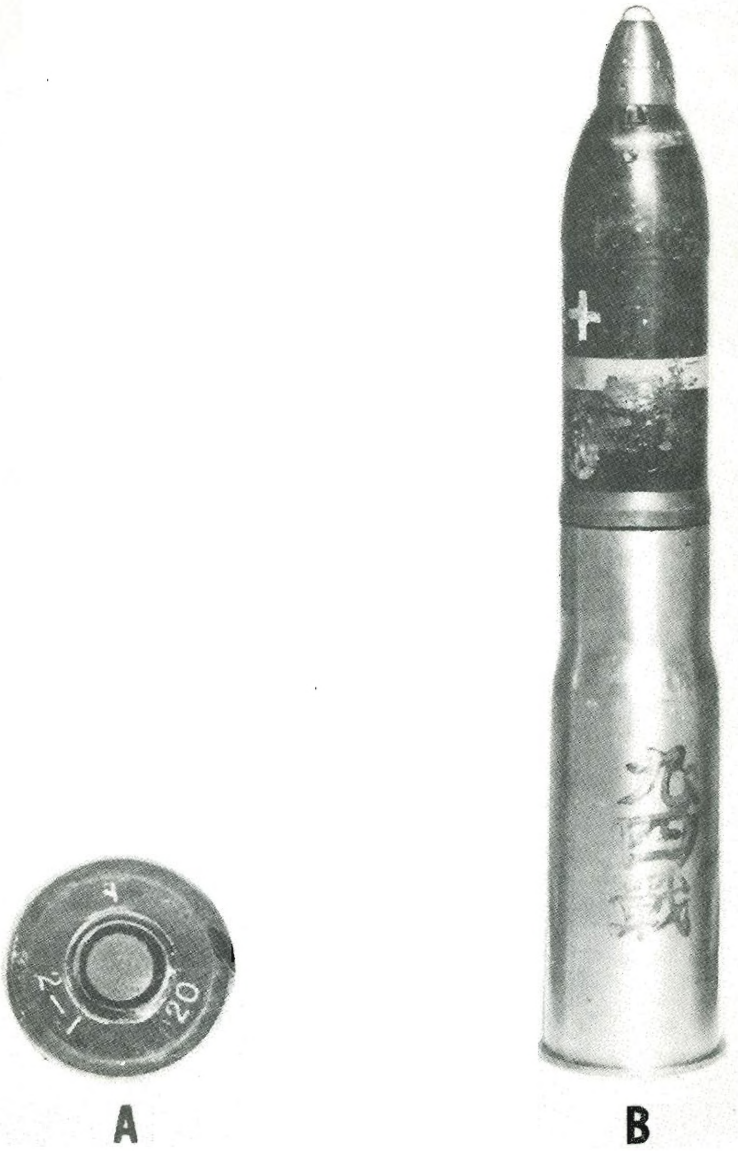


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Figure 20. World War II German cartridge markings.

(2) Cartridge cases may have no headstamp or may bear a character that indicates the producing arsenal together with either Western or oriental numerals showing the month and Japanese year date of production. Figure 21, view A shows the headstamp on a 20x72RB cartridge for a naval AA gun.

(3) Projectiles and cartridge cases may carry stamped or stenciled markings that can identify the gun in which used, or the model or functional type of the projectile. Figure 21, view B shows the marking on a 37x133R cartridge for a Type 94 army AT gun. Further details on Japanese ammunition markings during World War II can be found in TM 9-1985-5/TO 39B-1A-12.



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Figure 21. World War II Japanese cartridge markings.

