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Describes procedures for collecting physical characteristics of ammunition and its components.

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US ARMY TEST AND EVALUATION COMMAND
TEST OPERATIONS PROCEDURE

DRSTE-RP-702-103
*Test Operations Procedure 4-2-500 9 November 1981
AD No.

AMMUNITION CHARACTERISTICS

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B. DEFINITIONS OF AMMUNITION COMPONENTS B-1

1. SCOPE. This TOP summarizes all of the characteristics to be obtained when testing various classes of ammunition. It also provides guidance for preparing a characteristics data sheet.

2. FACILITIES AND INSTRUMENTATION.

2.1 Facilities.

Facilities specified in TOP 2-2-800[1]** and other applicable TOPs.

2.2 Instrumentation.

ITEM	MAXIMUM PERMISSIBLE ERROR OF MEASUREMENT***
Micrometer	±0.025 mm
Calipers (Vernier)	±0.003 cm
Weighing scales	±1% of reading

*This TOP supersedes MTP 4-2-500 dated 23 February 1967.

**Footnote numbers correspond to reference numbers in Appendix A.

***Values may be assumed to represent ± 2 standard deviations; thus, the stated tolerances should not be exceeded in more than 1 measurement of 20.

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3. PREPARATIONS FOR TEST. As soon as possible after ammunition or components are received, prepare a comprehensive list of physical characteristics, based on reference documents, engineer design drawings, and technical manuals provided with the test item. In listing these characteristics, make sure any details that have a security classification higher than that of the project as a whole are excluded.

Obtain the nomenclature from technical manuals and engineer design drawings. If the nomenclature is incomplete, use that contained in the Federal stock catalogs or professional publications.

3.1 Characteristics Data Sheet. The characteristics data sheet (see Figure 1) consists of a page containing a photograph of the test item and an unclassified limited list of 15 to 25 of its principal dimensions and functional characteristics. After all characteristics have been confirmed (and the sheet corrected), it becomes part of the test report.

Any design data or tentative characteristics (to be confirmed during the test) must be identified as such on the data sheet.

The type of photograph depends on the depth of coverage desired (i.e., ammunition or component). The photograph should be as large as possible (to preserve clarity after reduction) with unnecessary background features eliminated. NOTE: The characteristics photograph should be taken near the end of the program if appearance changes are expected.

Adequate characteristic listings, when published in a formal report, include all significant engineering and performance data, along with all physical attributes that affect the military value of the ammunition/components. A complete list of characteristics forms a basis for preliminary evaluation of ammunition in fulfilling a given mission.

4. DATA TO BE COLLECTED. The following is a checklist of ammunition data that must be acquired before or during the test program. More or less data may occasionally be required.

4.1 Pre-Test Data.

a. Weigh, measure, and photograph the complete test item, as well as its components, interfacing parts, and ancillary items.

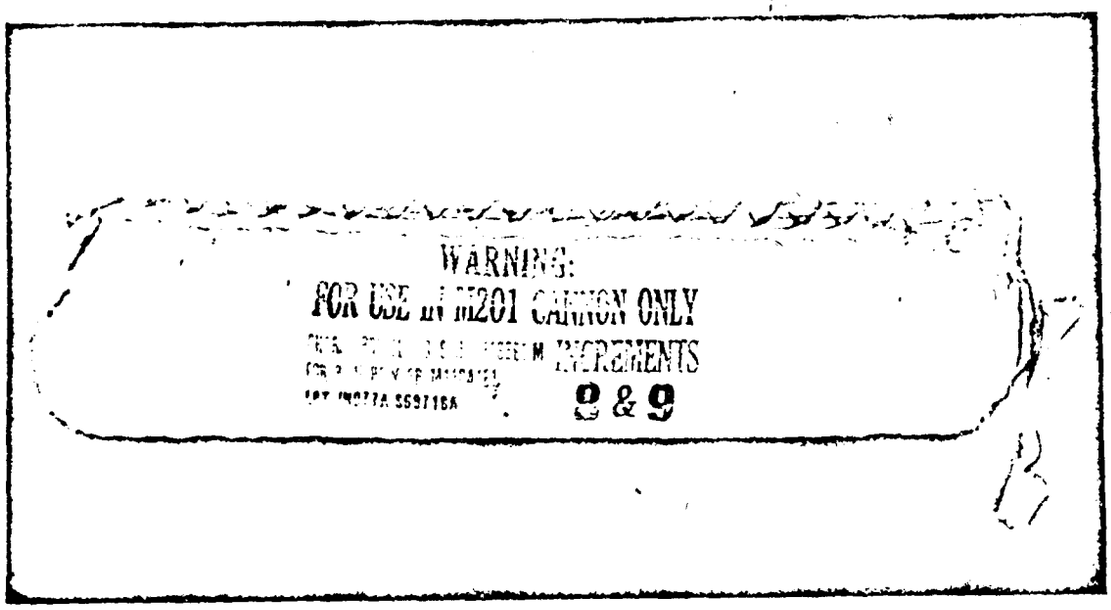
b. Repeat step a with the test item disassembled to minimum dimensions.

c. Record the physical characteristics, including control markings or instruction plates, on the prepared list. NOTE: Identify those characteristics that do not meet specified criteria or requirements, and when appropriate, provide an objective and/or subjective analysis of the effects this would or could have on overall performance.

4.2 Cartridges or Complete Rounds.

4.2.1 Static.

Nomenclature
Federal stock number



CHARGE, PROPELLING, M188E1 (MODIFIED)

Charge type --------- separate loading, 2 increments, zones 8 and 9
Weapon ------ howitzer, self-propelled, 8-inch, M110A1E1
Cannon --------- M201 (zone 9 with M201 cannon with muzzle brake)
Projectiles ------- M106 HE, M650 HERA, M422A1 (Z8 only), M424A1 (Z8 only)
Primer ---------- M82
Length, maximum ----- 31.0 in. (787 mm)
Diameter, maximum ---- 8.0 in. (203 mm)
Propellant type ---------- M30A2
Propellant web ---------- 0.085 in. MP (2.16 mm) nominal
Propellant weight ---------- 38.2 lb (17.32 kg) zone 8, 42.5 lb (19.27 kg) zone 9
Base igniter ----- 1 oz (28.3 gm) black powder
Core igniter ---- 5 oz (141.7 gm) black powder
Core tube ------- molded nitrocellulose
Flash reducer (located at end of incr 9) ---- 4 oz (113.4 grams) black powder and 12 oz (340.2 grams) potassium sulfate
Decoppering agent ---------- 7.0 oz (198.4 grams) lead foil
Wear-reducing additive ------ 24.0 oz (680.4 grams) titanium dioxide/ wax
Lacing jacket length ---------- 28.0 in. (711 mm)
Storage compatibility group --------- J
Quantity distance class ---------- 2
DOT marking ----- propellant explosives class B (solid)
DOT bill of lading class ---------- explosive B
Gross weight (PA-66 container) ---------- 79 lb (35.8 kg)
Cube ---------- 2.4 ft^3 (0.0679 m^3)

Figure 1. Characteristics Data Sheet.

Manufacturer
Manufacturer's lot number
Total weight and projectile weight in flight
Length
Diameter in appropriate metric units (e.g., mm, cm, or m)
Markings
Type projectile filler and weight
Weapons in which ammunition is used
Gun tube wear profile

4.2.2 Dynamic.

Permissible Individual Maximum Pressure
Upper Pressure Limit for Propellant Proof
Using TOP 4-2-805[2],
Maximum and minimum muzzle velocity in m/s
Range probable error
Standard deviation

Using TOP 4-2-829[3] (direct fire),
Mean and standard deviation of dispersion
Target range
Time of flight

Using TOP/MTP 3-1-004[4] (indirect fire),
Mean and standard deviation of dispersion
Maximum and minimum range in meters
Time of flight

(if test results are intended to produce this information)

Using TOP 4-2-813[5],
Lethality

As established by TOP 4-2-016[6],
Small arms ammunition characteristics

Using TOP 3-2-810[7],
Chamber pressure
Maximum negative differential pressure

Using TOP 4-2-822[8],
Maximum noise levels at crew positions

4.3 Projectiles.

4.3.1 Static. Using TOP/MTPs 4-2-800 and 803[9-10], record the following in appropriate metric units:

Nomenclature
Manufacturer and manufacturer's lot number
Model number
Overall length (including fuzed projectiles)
Weight (as fired)

Bourrelet diameter above and below rotating band
Type of rotating band, diameter, and material
Width of band seat and type of knurling
Base type (boat tail, square, or hemispherical)
Baseplate size and thickness
Type of crimp and radius of projectile crimping groove
Radius of ogive
Composition of steel in projectile body
Cases used with projectile
Center of gravity
Axial and transverse moments of inertia
Tracers:
  Tracer visibility
  Maximum and minimum burning time
  Effectiveness of illumination
Using TOP 3-2-810,
  Maximum negative differential pressure

Using TOP 4-2-822,
  Maximum noise levels at crew positions

4.3.2 Dynamic.

Number and weights of propellant charges
Permissible Individual Maximum Pressure
Upper Pressure Limit for Propellant Proof
Yaw angle
Evidence of erratic flight

Using TOP 4-2-805,
  Muzzle velocity in m/s
  Ballistic coefficient
  Range standard deviation

Using TOP 3-2-810,
  Service pressure in kPa

Using TOP 4-2-811[11],
  Spin

Using TOP 4-2-829 (direct fire),
  Mean and standard deviation of dispersion
  Target range
  Time of flight

Using TOP 3-1-004 (indirect fire),
  Mean and standard deviation of dispersion
  Maximum and minimum range in meters
  Time of flight

Using TOP 4-2-809[12],
  Deformation

Using TOP 4-2-812[13],
Penetration

Using TOP 4-2-813,
Fragmentation and lethality

Using TOP/MTP 4-2-816[14],
Jump, yaw, and drift

4.4 Cartridge Cases. Use the manufacturer's specifications and/or pertinent measurements to obtain the following in appropriate metric units:

4.4.1 Static.

Nomenclature
Manufacturer and manufacturer's lot number
Model number
Weight
Maximum and minimum allowance length
Volume of case (empty)
Diameter
Material (metal, consumable, consumable, combustible)
Type primer used
Width of flange
Liner type
Primer booster
Type and composition
Number and size of perforations
Bullet pull force and torque resistance, as applicable, using TOP/MTP 4-2-800

4.4.2 Dynamic.

Using TOP 4-2-705[15] (metal cases),
Obturation
Extraction
Ejection
Ability to withstand excess pressure
Serviceability of base flange

Using TOP 4-2-705 (consumable and combustible cases),
Obturation
Cartridge case burning
Cartridge case metal part ejection and extraction characteristics

Using TOP 3-2-810,
Service pressure in kPa

4.5 Propelling Charges.

4.5.1 Static. Use the manufacturer's specifications and/or pertinent measurements to obtain the following in appropriate metric units:

Nomenclature
Manufacturer, year manufactured, manufacturer's lot number
Charge weight and diameter
Type (single perforated, multi-perforated, disk, flake, etc.)
Maximum and minimum grain diameter and length
Web size
Primer
Loading density
Method of assembly in cartridge case
Igniters, flash suppressors, or other components
Ratio of grain diameter to perforation diameter (D/D)
For bag type charges, composition, grade, and bag material

4.5.2 Dynamic. Using TOP 4-2-606 and TOP/MTP 4-2-607[16-17], obtain the following in appropriate metric units:

Maximum and minimum muzzle velocity in m/s
Chamber pressure in kPa
Temperature differential (°C per m/s, °C kPa)
Cookoff temperature in °C
Loadability
Time-pressure relationship in seconds:
  Time to peak pressure
  Ignition delay time
  Travel time in-bore
Composition and weight of flash reducer
Method of applying flash reducer to propelling charge
Composition and percent of other additives used to control such characteristics as bore erosion

4.6 Fuze.

4.6.1 Static. Use the manufacturer's specifications and/or pertinent measurements to obtain the following in appropriate metric units:

Nomenclature
Manufacturer and manufacturer's lot number
Model
Weight (loaded)
Length and diameter
Thread type and size
Safety features
Minimum arming setback (g's and angular acceleration)
  Type projectile with which it is used

NOTE: If the fuze is used with a piezoelectric assembly, the full circuit will be shown photographically and the resistance values indicated.

4.6.2 Dynamic. Use applicable sections of TOP 4-2-806 and TOP/MTPs 4-2-807 and 808[18-20] to obtain the following:

Arming and/or functioning time in seconds
Reliability, sensitivity, and safety
Maximum and minimum arming distance centimeters/meters

Plate performance
Burst height in meters

4.7 Booster.

4.7.1 Static. Use the manufacturer's specifications and/or pertinent measurements to obtain the following in appropriate metric units:

Nomenclature
Manufacturer and manufacturer's lot number
Model
Weight
Length and diameter
Thread type and size
Type projectile with which it is used

4.7.2 Dynamic. Use applicable sections of TOP 4-2-806 and TOP/MTPs 4-2-807 and 808 to obtain the following:

Safety features and reliability
Maximum and minimum arming distance in centimeters/meters

4.8 Primer.

4.8.1 Static. Use the manufacturer's specifications, appropriate measurements, and/or applicable sections of TOP/MTP 4-2-701[21] to obtain the following:

Nomenclature
Manufacturer and manufacturer's lot number
Model
Weight
Length and diameter
Number of grains
Web size and type
Method of fit (threaded or pressed)
Weight of load
Type of loading
Propellant with which it is used

For electric primers, resistance

4.8.2 Dynamic.

Using TOP/MTP 4-2-701,
Reliability and obturation

Using TOP 4-2-705,
Ability to withstand excess pressure and effect on pressure

Using TOP 4-2-805,
Effect on velocity

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APPENDIX A
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APPENDIX B
DEFINITIONS OF AMMUNITION COMPONENTS

Booster. Assembly of metal parts and explosive charge provided to augment the explosive component of a fuze, to cause detonation of the main explosive charge of the munition; may be an integral part of the fuze.

Cartridge. Ammunition for a weapon that contains in a unit assembly all of the components required to function the weapon one time, and is loaded in the gun in one operation. Tank, mortar, and small arms ammunition are issued in the form of cartridges.

Cartridge Case. The case that holds the propellant for cartridges (excluding mortar ammunition).

Charge. 1) A given quantity of explosive, either by itself or contained in a projectile, mine, or the like; or a given quantity of the propellant for a bullet or projectile; 2) That with which a projectile, mine, or the like, is filled, as a charge or explosive, thermite, etc; also called the "filler"; preferably modified by an adjective such as "explosive charge" or "propelling charge".

Filler. An ammunition charge (see Charge: sense 2).

Fixed Ammunition. Ammunition that has a cartridge case attached to the projectile.

Fuze. A device with explosive components designated to initiate a train of fire or detonation in an item of ammunition.

Primer. Device used to initiate the functioning of an explosive or igniter train; it may be actuated by friction, flow, pressure, or electricity.

Projectile. A ballistically designed body projected by external force and continuing in motion by its own inertia.

Propellant(n). 1) For projectiles, a very fast-burning solid fuel that burns in a controlled manner and develops pressure used to launch the projectile; 2) For rockets and missiles, a very fast-burning fuel, solid, liquid, or gas, that burns in a controlled manner and expels gases that launch and sustain the flight of rockets and missiles; propellent is a less desirable spelling; although propellant and propellent may be used as adjectives, propelling as in "propelling charge" is preferred.

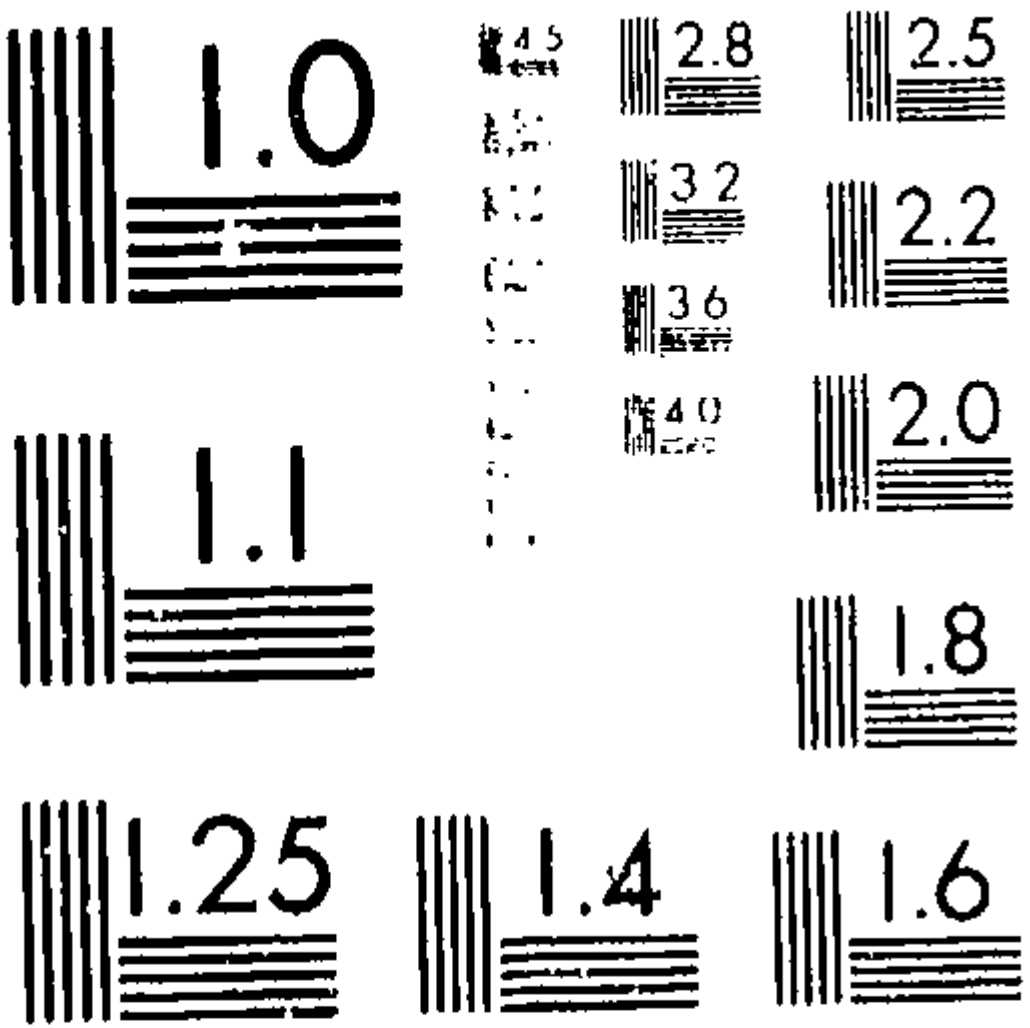
Round. All of the components necessary to fire the weapon once. Generally, these components consist of a primer, propellant, container or holder for propellant (cartridge case or bag), and projectile with fuze and booster, if necessary, for the proper functioning of the projectile.

Semifixed Ammunition. Ammunition that has a cartridge case that is not bound to the projectile so that the quantity of propellant can be changed to fit the zone being fired.

Separate Loading Ammunition. Artillery ammunition in which the projectile is loaded in the weapon chamber first, followed by the loading of the propellant usually in a bag.

Shell. A hollow projectile filled with explosive, chemical, or other material, as opposed to shot, which is a solid projectile.

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