

MIL-C-60666(MJ)
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SUPERSEDING
U.S. ARMY SPECIFICATION
NO. 50-4-15
18 March 1941

MILITARY SPECIFICATION
CARTRIDGE, CALIBER .50, ARMOR-PIERCING, M2

1. SCOPE

1.1 This specification covers Cartridge, Caliber .50, Armor-Piercing, M2 for use in Caliber .50 weapons.

2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

SPECIFICATIONS

Military
MIL-S-13812 - Steel Plate, Wrought Homogeneous for
Ammunition Testing # $\frac{1}{2}$ to 12 inches inclusive

STANDARDS

Military
MIL-STD-105 - Sampling Procedures and Tables for Inspection
by Attributes
MIL-STD-109 - Quality Assurance Terms and Definitions
MIL-STD-636 - Visual Inspection Standards for Small Arms
Ammunition through Caliber .50
MIL-STD-644 - Visual Inspection Standards and Inspection
Procedures for Inspection of Packaging,
Packing and Marking of Small Arms Ammunition

DRAWINGS

Munitions Command
D5569930 - Cartridge, Caliber .50, Armor-Piercing, M2
C7643674 - Classification of Cartridge Case Defects

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2.1 DRAWINGS (Cont'd)

Munitions Command

- F8596993 - Packing and Marking Cartridges, Caliber .50
Linked M15 or 15A1; Box, Ammunition M2A1;
Box, Wirebound
- D7553544 - Packing and Marking Cartridges, Caliber .50
Bulk; Box, Ammunition, M2A1; Box, Wirebound
- D7553346 - Packing and Marking Cartridges, Caliber .50,
Linked; Box, Ammunition, M2A1; Box, Wirebound
- IEL-5569930 - Inspection Equipment List for Cartridge,
Caliber .50, Armor-Piercing, M2

PUBLICATIONS

- AMCR 715-505, Vol. III - Ammunition Ballistic Acceptance Test
Methods, Vol. III, Test Procedures for
7.62mm Cartridges
- TECP 700-700, Vol. III - Manual of Test Methods for Small Arms
Ammunition

(Copies of specifications, standards, drawings and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

3. REQUIREMENTS

3.1 General. - The cartridge shall comply with Drawing D5569930, referenced specifications and the following:

3.2 Bullet extraction. - The force required to extract the bullet from the cartridge case shall be not less than 200 pounds.

3.3 Residual stress. - The cartridge case shall not split when subjected to a one percent mercurous nitrate solution for 15 minutes.

3.4 Waterproof. - The cartridge shall not release more than one bubble of air when subjected to an internal pressure differential of $7\frac{1}{2}$ pounds per square inch (psi) for 30 seconds.

3.5 Accuracy. - The average of the mean radii of all targets of the sample cartridges, fired at 600 yards, shall be not greater than 10.0 inches.

3.6 Action time. - The action time (overall primer ignition, propellant burning and bullet-travel time) of the cartridge shall not exceed 4 milliseconds.

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3.7 Velocity.- The average velocity of the sample cartridges, conditioned at 68° to 72° Fahrenheit (F), shall be 2810 feet per second (ft/sec) plus or minus 30 ft/sec at 78 feet from the muzzle of the weapon. The standard deviation of the velocities shall not exceed 50 ft/sec.

3.8 Chamber pressure.- The average chamber pressure of the sample cartridges, conditioned at 68° to 72°F, shall not exceed 53,000 psi.

3.9 Penetration.- The bullet core or bullet of the cartridge shall completely perforate a 7/8 inch armor plate (MIL-S-13812) placed at 100 yards from the muzzle of the weapon.

3.10 Stripping.- The jacket of the bullet or any part thereof, shall not separate from the core when the cartridge is fired.

3.11 Function and casualty.- The cartridge shall function with casualty.

3.12 Workmanship.- The requirements for workmanship are as specified on the applicable drawings, referenced specifications and the following:

3.12.1 Metal defects.- Metal defects.- The cartridge shall be free of folds, wrinkles, deep draw scratches, scaly metal, dents and other defects.

3.12.2 Foreign matter.- The cartridge shall be free of corrosion, stains, discolorations, dirt, oil, and smears of lacquer.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection.- Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure that supplies and services conform to prescribed requirements.

4.1.1 Quality assurance terms and definitions.- Reference shall be made to MIL-STD-109 for definition of quality assurance terms.

4.2 First article sample.

4.2.1 Initial production sample.- At the beginning of regular production, a sample shall be submitted in accordance with contract requirements and shall consist of 2000 cartridges. The sample shall be manufactured using the same materials, equipment, processes and procedures as will be used in regular production. All parts and materials, including packaging and packing shall be the same as used for regular production and shall be obtained from the same source of supply.

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4.2.1.1 Examination and test.- After inspection and provisional acceptance at source, the sample shall be inspected for all requirements of the drawings and specifications at a government laboratory or such other facility specified in the contract.

4.2.1.2 Initial production sample failure.- Failure of the sample to comply with the requirements of the drawings and specifications shall result in sample disapproval.

4.3 Inspection provisions.

4.3.1 Lot.

4.3.1.1 Submission of product.- The product shall be submitted in accordance with MIL-STD-105.

4.3.1.2 Lot identification.- Each lot of ammunition shall be identified as to type, caliber and model, as well as with a lot number and the supplier's identification as assigned by the procuring activity. Each lot shall be further identified by a Federal Stock Number assigned by the procuring activity.

4.3.2 Examination.- One hundred percent examination shall be performed for all critical defects. Examination for major and minor defects shall be performed on a class basis in accordance with the classification of defects, Table I, using applicable sampling plans and acceptance criteria of MIL-STD-105. The AQL for Major Class shall be 0.25 percent and the AQL for the Minor Class shall be 1.50 percent.

4.3.2.1 Classification of defects.- The classification of defects shall be as specified in Table I.

TABLE I

No.	Defect and Method of Inspection	Critical	Major	Minor	Major or Minor
Visual 1/					
Cartridge					
1	Discolored, dirty, oily, smeared				X
2	Corroded, or stained, if etched		X		
Case					
4	Round head		X		
5	Dent				X
6	Split case				
	in K, L or M location	X			
	in I, S or J location		X		

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4.3.2.1 (Cont'd)

TABLE I (Cont'd)

No.	Defect and Method of Inspection	Critical	Major	Minor	Major or Minor
7	Perforated case	X			
8	Draw scratch				X
9	Scratch			X	
10	Beveled underside of head		X		
11	Case mouth not crimped in canneulure		X		
12	Scaly metal				X
13	No chamfer on head (rim)		X		
14	Fold			X	
15	Wrinkle			X	
16	Buckle			X	
17	Bulge			X	
18	Illegible or missing head stamp			X	
19	Defective head			X	
20	Defective mouth			X	
21	No visible evidence of mouth anneal		X		
	Bullet				
22	Dent			X	
23	Scratch			X	
24	Split bullet jacket		X		
25	Loose bullet		X		
26	Missing cannulure		X		
27	Scaly metal				X
28	Upset (crooked) point			X	
29	Exposed steel (clad jacket)			X	
30	Blunt point			X	
31	Defective cannulure			X	
	Primer				
32	No primer	X			
33	Cocked primer	X			
34	Inverted primer	X			
35	Loose primer		X		
36	Nicked or dented primer			X	
37	No waterproofing material (Primer pocket joint)			X	
38	Defective crimp			X	

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4.3.2.1 (Cont'd)

TABLE I (Cont'd)

No.	Defect and Method of Inspection	Critical	Major	Minor	Major or Minor
Gaging					
39	Total length		X		
40	Cartridge profile failure (requiring more than 80 lbs. dead weight to insert in profile and alignment gage)		X		
41	Diameter of extractor groove, max.		X		
42	Diameter of extractor groove, min.			X	
43	Diameter of head		X		
44	Thickness of head		X		
45	Length to shoulder datum		X		
46	Depth of primer		X		
Weighing					
47	Weight, min. <u>2/</u>	X			

1/ Refer to MIL-STD-636 for visual defects standards for defects 1 through 38.

2/ Each lightweight cartridge shall be disassembled and the propellant weighed. Each such cartridge found to contain 100 grains or more of propellant shall be classed as a major defect. Any cartridge containing less than 100 grains of propellant shall be classed as a critical defect.

4.3.3 Tests.- The tests listed in Table II shall be conducted in accordance with the methods and procedures specified in 4.4.

4.3.3.1 Test sample.- The quantities for the various tests shall be as specified in Table II. Only cartridges having met the visual, dimensional and weight requirements shall be used in the ballistic tests and shall have been selected in such a manner that the sample is representative of the entire lot. The cartridges shall be thoroughly mixed before being divided into samples for the various tests.

TABLE II

Test	Number of Cartridges	Requirement Paragraph
Bullet Extraction <u>1/</u>	25	3.2
Residual stress (Mercurous Nitrate) <u>1/</u>	50	3.3
Waterproof <u>2/</u>	20	3.4

4.3.3.1 (Cont'd)

TABLE II (Cont'd)

Test	Number of Cartridges	Requirement Paragraph
Accuracy <u>3/</u>	90	3.5
Action Time <u>1/</u>	50	3.6
Velocity <u>3/</u>	20	3.7
Chamber Pressure <u>3/</u>	20	3.8
Penetration <u>2/</u>	20	3.9
Stripping <u>4/</u>	20	3.10
Function and Casualty <u>5/</u>	--	3.11
Gun, Machine Cal. .50 Browning M2, HB (Turret Type)	400	---
Gun, Machine Cal. .50 Browning M2, HB (Flexible Type)	400	---
Gun, Machine Cal. .50, M85 (Fixed Type)	400	---

- 1/ Failure of two or more cartridges to comply with the applicable requirement shall be cause for rejection of the lot. If one cartridge fails in the first test, a second sample consisting of double the number of cartridges in the first sample shall be tested. If any failing cartridges are found in the second sample, the lot shall be rejected.
- 2/ Failure of nine or more cartridges to comply with the applicable requirements shall be cause for rejection of the lot. If more than four, but less than nine cartridges fail in the first test, a second sample consisting of double the number of cartridges in the first sample shall be tested. The lot shall be rejected if in the combined first and second sample, nine or more cartridges fail to comply with the applicable requirement.
- 3/ Failure of the cartridges to comply with the applicable requirements shall be cause for rejection of the lot, subject to testing a second sample consisting of double the quantity of cartridges used in the first test. Failure of the cartridges in the second sample to comply with the applicable requirement shall be cause for rejection of the lot.
- 4/ This test shall be conducted on the initial production sample only. Determination of compliance with the bullet stripping requirement shall be made during the function and casualty test.

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4.3.3.1 (Cont'd)

- 5/ The lot shall be rejected when function and casualty defects plus firing defects observed in all other firing tests exceed the acceptance number for the cumulative sample in Table III. If the number of defects found in the first test exceeds the acceptance number for the first sample, but is equal to or less than the acceptance number for the cumulative sample, a second sample, consisting of double the quantities specified under function and casualty test, shall be fired in all the service weapons specified therefor. This procedure shall apply regardless of the weapon or weapons in which the firing defects occurred in the first test. If the total number of defects in the combined first and second sample exceeds the acceptance number for the cumulative sample, the lot shall be rejected. If, in testing a second sample, defects other than those for which the second sample is being tested should occur to the extent that they exceed the acceptance number for the cumulative sample, the lot shall be rejected.

4.3.3.2 Firing defects.- Firing defects and acceptance numbers shall be as specified in Table III.

TABLE III

Defects	Acceptance	
	First Sample	Cumulative (1st & Second Sample)
1. Misfire	1	2
2. Bullet remaining in bore 1/	0	-
3. Primer leak		
a. Perforation in firing pin indent in primer cup, Machine Guns	24	60
b. Escape of gas through primer cup other than 3a.	7	15
c. Escape of gas around primer cup more than 50% of periphery	14	30
d. Blown primer or primer falls out of pocket on retraction of bolt	0	1
4. Case casualties		
a. Longitudinal split 2/		
(1) Neck and shoulder (I or S)	27	65
(2) Body (J)	7	15
(3) Body (K)	1	2
(4) To head (L)	0	1
(5) Through head (M)	0	1
b. Circumferential rupture 2/		
(1) Partial, shoulder or body (J or S)	2	4
(2) Partial, body (K)	0	1
(3) Partial, head (L)	0	1
(4) Complete	0	1
5. Failure to extract	0	1
6. Weapon stoppage 3/		

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4.3.3.2 (Cont'd)

- 1/ No second sample permitted. Lot shall be rejected.
- 2/ For location of defects indicated by letters in parentheses, see Drawing C7643674.
- 3/ All stoppages attributable to the ammunition, with the exception of misfire, complete rupture or failure to extract, observed in all tests shall be included.

4.3.4 Packaging, packing and marking inspection.- During or immediately prior to the packaging operation, 100 percent examination of the cartridges shall be performed to ascertain that the cartridge type conforms to the drawing. Occurrence of a high pressure test, dummy or blank cartridge shall be classed as a critical defect. Occurrence of any incorrect type other than those listed shall be classed as a major defect. All non-conforming cartridges shall be rejected. Inspection for packaging, packing and marking shall be in accordance with MIL-STD-644 as applicable to the drawing.

4.3.5 Inspection equipment.- The examination and tests shall be made using the equipment listed on IEL-5569930.

4.4 Test methods and procedures.

4.4.1 Bullet extraction.- The cartridges shall be tested in an approved bullet extractor machine. The rate of travel of the test head shall be not less than three or more than six inches per minute.

4.4.2 Residual stress (Mercurous Nitrate).- The test shall be conducted in accordance with TECP 700-700, Vol. III.

4.4.3 Waterproof.- The ammunition to be tested, not to exceed five cartridges at one time, shall be placed horizontally on a perforated tray. The tray shall be placed in a desiccator containing sufficient quantity of freshly boiled water to maintain a head of 2 to $2\frac{1}{2}$ inches. The desiccator shall be evacuated to a pressure of $7\frac{1}{2}$ pounds per square inch (15 inches of mercury) below atmospheric pressure and held at that pressure for 30 seconds. The number of bubbles liberated from the mouth or primer of each cartridge shall be observed.

4.4.4 Accuracy.- The test shall be conducted in accordance with TECP 700-700, Vol. III.

4.4.5 Action time.- The test shall be conducted in accordance with methods and procedures of AMCR 715-505, Volume 3 using equipment listed in IEL-5569930.

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4.4.6 Velocity.- The test shall be conducted in accordance with TECP 700-700, Vol. III.

4.4.7 Chamber pressure.- The test shall be conducted in accordance with TECP 700-700, Vol. III.

4.4.8 Penetration.- The test shall be conducted in accordance with TECP 700-700, Vol. III.

4.4.9 Stripping test.- The test shall be conducted in accordance with TECP 700-700, Vol. III, simultaneously with the function and casualty test of the initial production sample.

4.4.10 Function and casualty.- In these firings, the weapons shall be at room temperature at the beginning of the test, and the machine guns shall be cooled between bursts. The number of cartridges to be fired shall be as specified in Table II. The test shall be conducted in accordance with TECP 700-700, Vol. III and as indicated below:

- a. Gun, Machine, Caliber .50 Browning, M2, Heavy Barrel (Turret Type) - Fire in bursts of 100 cartridges
- b. Gun, Machine, Caliber .50 Browning M2, Heavy Barrel (Flexible Type) - Fire in bursts of 100 cartridges
- c. Gun, Machine, Caliber .50, Tank M85 (Fixed) - Fire in bursts of 100 cartridges.

4.4.11 Defect penalty.- In any ballistic test, except function and casualty, in which the occurrence of a firing defect listed in Table III prevents the obtaining of a reliable result for the characteristic being tested, an additional shot shall be fired. That particular test shall not be penalized, but the total ballistic sample shall be penalized for such defects in accordance with Table III.

5. PREPARATION FOR DELIVERY

5.1 Packing, Level A (Worldwide shipment).- The cartridge shall be packed in accordance with Drawing D7553346, D7553544 or F8596993.

5.2 Marking and labeling.- Packing boxes shall be marked and labeled in accordance with the applicable drawing cited in 5.1.

6. NOTES

6.1 Ordering data.- Invitations for bids and contracts or orders will specify the following:

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6.1.1 Title, number and date of this specification.

6.1.2 Type and level of packing.

6.1.3 Provisions for the supply, maintenance and disposition of mandatory ballistic test equipment for acceptance inspection purposes.

6.1.4 Provision for the submission of acceptance inspection reports containing final inspection results for each lot of ammunition presented to the Government.

6.1.5 Requirements for contractor to provide and maintain an inspection system in accordance with MIL-I-45208, Inspection System Requirements.

Asterisks are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

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