MIL-C-3066B
28 February 1969
SUPERSEDING
MIL-C-3066A
17 February 1964

MILITARY SPECIFICATION
CARTRIDGES, CALIBER .50: ARMOR-PIERCING-INCENDIARY, M8; AND ARMOR-PIERCING-INCENDIARY-TRACER, M20

This specification is mandatory for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 This specification covers Cartridges, Caliber .50: Armor-Piercing-Incendiary, M8; and Armor-Piercing-Incendiary-Tracer, M20 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.

SPECIFICATION

Military

MIL-S-13812	- Steel Plate, Wrought Homogeneous for Ammunition Testing #½ 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

FSC 1305

DRAWINGS

U.S. Army Munitions Command

C7670238	- Cartridge, Caliber .50, Armor Piercing Incendiary, M8
C7672003	- Cartridge, Caliber .50, Armor Piercing Incendiary, Tracer, M20
C7643674	- Classification of Cartridge Case Defects
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
D7692129	- Incendiary Flash Standards for Small Arms Ammunition
D44021	- Target, Incendiary
F8596993	- Packing and Marking Cartridges, Caliber .50 Linked M15 or M15A1; Box, Ammunition M2A1; Box, Wirebound
IEL7670238	- Inspection Equipment List for Cartridge, Caliber .50, Armor Piercing-Incendiary, M8
IEL7672003	- Inspection Equipment List for Cartridge, Caliber .50, Armor Piercing Incendiary Tracer, M20

PUBLICATIONS

AMCR 715-505 Volume 3	- Ammunition Ballistic Acceptance Test Methods - 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 the requirements specified on Drawing C7670238 or C7672003 as applicable and as specified herein (See 6.1.2).

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

3.3 Airtightness of base closure seal APIT M20.- The bullet shall not release more than one bubble of air under the application of a pressure differential of 2 pounds per square inch (psi) for 5 seconds.

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

3.5 Waterproof.- The cartridge shall not release more than one bubble of air when subjected to a pressure differential of $7\frac{1}{2}$ psi for 30 seconds.

3.6 Accuracy.- The average of the mean radii of all targets of the sample cartridges, fired at 600 yards, shall be not greater than 12 inches.

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

3.8 Velocity.- The average velocity of the sample cartridges, conditioned at 68° to 72° Fahrenheit (F), shall be 2910 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 36 ft/sec.

3.9 Chamber pressure.- The average chamber pressure of the sample cartridges, conditioned at 68° to 72°F, shall not exceed 55,000 psi.

3.10 Trace, APIT M20.- When viewed at night from a line parallel to the plane of the trajectory, with the line of sight perpendicular to the plane of the trajectory at each point of observation, the bullet of the trace cartridge shall exhibit a visible trace of full luminosity from a point not greater than 100 yards from the muzzle of the weapon to a point not less than 1600 yards from the muzzle.

3.11 Incendiary flash.- The incendiary composition of bullets of the sample cartridges shall ignite and produce an incandescent flash when fired against an aluminum target (Drawing D44021) at 175 yards. The flash shall be sufficiently intense and sustained to cause combustion of flammable liquids having a flash point not less than 100°F.

3.12 Penetration.

3.12.1 API, M8.- The bullet core or bullet of the cartridge shall completely perforate 7/8 inch of armor plate (MIL-S-13812) placed at 100 yards from the muzzle of the weapon.

3.12.2 APIT, M20.- The bullet core or bullet of the cartridge shall completely penetrate 7/8 inch of armor plate (MIL-S-13812) placed at 100 yards from the muzzle of the weapon.

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

3.14 Function and casualty.- The cartridge shall function without casualty.

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

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

3.15.2 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 in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by 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 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.

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 Acceptable Quality Level (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		

TABLE I (Cont'd)

No.	Defect and Method of Inspection	Critical	Major	Minor	Major or Minor
	Visual 1/				
7	Perforated case	X			
8	Draw scratch				X
9	Scratch			X	
10	Beveled underside of head		X		
11	Case mouth not crimped in cannelure		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 cannelure		X		
27	Scaly metal				X
28	Upset (crooked) point			X	
29	Exposed steel (clad pocket)			X	
30	Blunt point			X	
31	Defective cannelure			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	

TABLE I (Cont'd)

No.	Defect and Method of Inspection	Critical	Major	Minor	Major or Minor
	Visual 1/				
	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 2/	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 Ctgs.	Requirement Paragraph
Bullet Extraction 1/	25	3.2

TABLE II (Cont'd)

Test	Number of Cartridges	Requirement Paragraph
Airtightness of Base Closure Seal 2/ (APIT, M20)	--	3.3
Residual stress (Mercurous nitrate) 1/	50	3.4
Waterproof 3/	20	3.5
Accuracy 4/	90	3.6
Action time 1/	50	3.7
Velocity 4/	20	3.8
Chamber pressure 4/	20	3.9
Trace 5/ (APIT, M20)	100	3.10
Incendiary flash 6/	20	3.11
Penetration 7/	20	3.12
Stripping 8/	--	3.13
Function and Casualty 9/	--	3.14
Gun, Machine Cal. .50 Browing M2, HB (Turret type)	300	---
Gun, Machine Cal. .50 Browing M2, HB (Flexible type)	300	---
Gun, Machine Cal. .50 M85 (Fixed type)	300	---
Gun, Machine Cal. .50 AN-M3 Aircraft (Basic)	300	---

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/ The bullets extracted from the cartridges in the bullet extraction test shall be used for this test. Failure of seven or more bullets to comply with the applicable requirement shall be cause for rejection of the lot. If more than three but less than seven bullets fail in the first test, a second sample consisting of double the number of bullets in the first sample shall be tested. The lot shall be rejected if, in the combined first and second sample, seven or more bullets fail to comply with the applicable requirements.

3/ Failure of nine or more cartridges to comply with the applicable requirement 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.

4/ Failure of the cartridges to comply with the applicable requirement shall be cause for rejection of the lot, subject to testing a second sample consisting of double the quantity of cartridges used in the initial test. Failure of the cartridges in the second sample to comply with the applicable requirement shall be cause for rejection of the lot.

5/ Failure of thirty-one or more cartridges to comply with the applicable requirements shall be cause for rejection of the lot. If more than ten but less than thirty-one 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, thirty-one or more cartridges fail to comply with the applicable requirement.

6/ The lot shall be rejected when upon completion of the test the films showing the flash of the bullets under test are compared with the flash standards (Drawings D7692129) are less than 70 out of a possible score of 100. No second sample is permitted.

7/ a. API, M8 - Failure of nine or more cartridges to comply with the applicable requirement 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.

b. APIT, M20 - Failure of five or more cartridges to comply with the applicable requirement shall be cause for rejection of the lot. If more than two but less than five 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, five or more cartridges fail to comply with the applicable requirement.

8/ Determination of compliance with the bullet stripping requirement shall be made during the action time test.

9/ 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.

9/ (Cont'd)
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	Acceptance Cumulative (1st & 2nd Sample)
1. Misfire	1	2
2. Bullet remaining in bore 1/	0	-
3. Primer leak		
a. Perforation in firing pin indent in primer cup	24	55
b. Escape of gas through primer cup other than 3a.	7	15
c. Escape of gas around primer cup more than 50% of periphery	15	31
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)	24	55
(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 & S)	1	2
(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/	0	1
7. Bullet bursting before striking terminal or target 1/	0	-

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/ This defect shall be counted in the incendiary flash test only.

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-7670238 or IEL-7672003, as applicable.

4.4 Test methods and procedures.

4.4.1 Bullet extraction.- The cartridges shall be tested in accordance with AMCR 715-505, Volume 3. The rate of travel of the test head shall be not less than three or more than six inches per minute.

4.4.2 Airtightness of base closure seal, APIT, M20.- The bullets shall be placed base up under approximately 1.5 inch head of freshly boiled water in a vacuum jar test unit. The desiccator or jar shall be evacuated to a pressure of 2 pounds per square inch (4 inches of mercury) below atmospheric pressure and held at that pressure for not less than 5 seconds. The number of bubbles liberated from each bullet shall be observed.

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

4.4.4 Waterproof.- The cartridges (not exceeding five at one time) shall be placed horizontally under a 2 to $2\frac{1}{2}$ inch head of freshly boiled water in a glass container and the container shall be evacuated to a pressure of $7\frac{1}{2}$ pounds per square inch (15 inches for mercury) below atmospheric pressure and held at that pressure for 30 seconds. The number of bubbles liberated from the mouth or primer or both of each cartridge shall be observed.

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

4.4.6 Action time.- The test shall be conducted in accordance with methods and procedures of AMCR 715-505, Volume 3, using equipment listed in IEL-7670238 or IEL-7672003, as applicable.

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

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

4.4.9 Trace (APIT, M20).- The test shall be conducted in accordance with methods and procedures of TECP 700-700, Vol. III and the following:

Observation for trace performance shall be conducted on a range of at least 1600 yards in length. All trace testing shall be performed at night. Observation for trace performance shall be made at the weapon and at points 100 yards and 1600 yards beyond the muzzle of the gun on a line parallel to and approximately 75 yards from the plane of trajectory. Lights or other suitable visible markers shall be placed opposite the 100 and 1600 yards observing points to insure a line of sight from each point perpendicular to the plane of the trajectory. The ammunition shall not be conditioned to temperature but shall be fired under existing conditions. Three cartridges shall be fired to sight, warm and foul each weapon prior to the test. The sample cartridges shall be fired in regular sequence permitting sufficient time between shots for each observer to record trace characteristics at each observation point. Each cartridge shall be considered as a defective one only in the event it fails at more than one observation point. During the performance of this test, observation shall also be made for (a) bullet bursting before striking terminal or target; (b) trace muzzle flash and (c) erratic flight.

4.4.10 Incendiary flash.- The test shall be conducted in accordance with TECP 700-700, Vol. III.

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

4.4.12 Stripping.- The test shall be conducted simultaneously with the action time test. The size of the paper target shall be 6' x 6'; this size may be achieved by stapling two pieces of paper together. Two paper screens (6' x 6') shall be placed 10 and 50 feet from the muzzle of the gun, so that the bullets will pass through the screen near its center. The screen(s) shall

4.4.12 (Cont'd)

be recovered or replaced as necessary to facilitate observation. At completion of the test, each target screen shall be examined, in detail at close range, for any irregular perforations which provide evidence of stripping. Any evidence of stripping shall be classified as a defect.

4.4.13 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 HB (Turret Type) - Fire in bursts of 100 cartridges.

b. Gun, Machine, Caliber .50, Browning, M2 HB (Flexible Type) - Fire in bursts of 100 cartridges.

c. Gun, Machine, Caliber .50 Tank, M85 (Fixed) - Fire in bursts of 100 cartridges.

d. Gun, Machine, Caliber .50, AN-M3, Aircraft (Basic) - Fire in bursts of 100 cartridges.

4.4.14 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 D7553544, D7553346, D7553058 or F8596993, as required by contract.

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

6. NOTES

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

6.1.1 Title, number and date of this specification.

6.1.2 Applicable cartridge drawing number (See 3.1).

6.1.3 Type and level of packing.

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

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

6.1.6 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.

Custodians:

Army - MU

Air Force - 70

Review activities:

Army - MU

Air Force - 70

User activities:

Navy - OS

Preparing activity:

Army - MU

Project No. 1305-0399

SPECIFICATION ANALYSIS SHEET

Form Approved
Budget Bureau No. 22-R255

INSTRUCTIONS: This sheet is to be filled out by personnel, either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity. Comments and suggestions submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or serve to amend contractual requirements.

SPECIFICATION

ORGANIZATION

CITY AND STATE

CONTRACT NUMBER

MATERIAL PROCURED UNDER A

☐ DIRECT GOVERNMENT CONTRACT ☐ SUBCONTRACT

1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?

A. GIVE PARAGRAPH NUMBER AND WORDING.

B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES

2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID

3. IS THE SPECIFICATION RESTRICTIVE?

☐ YES ☐ NO *(If "yes", in what way?)*

4. REMARKS *(Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)*

SUBMITTED BY *(Printed or typed name and activity - Optional)*

DATE

DD FORM 1 JAN 66 1426

REPLACES EDITION OF 1 OCT 64 WHICH MAY BE USED.