

INCH-POUND

MIL-P-3984J
 25 May 1992
 SUPERSEDING
 MIL-P-003984H (AR)
 1 December 1989
 MIL-P-3984G
 10 December 1976

MILITARY SPECIFICATION
 PROPELLANTS FOR SMALL ARMS AMMUNITION

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

1. SCOPE

1.1 Scope. This specification covers propellant for use in small arms ammunition (see 6.1).

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards and handbooks. The following specifications, standards and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplemented thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

MILITARY

MIL-N-244 - Nitrocellulose

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document, should be addressed to: Commander U.S. Army ARDEC, ATTN: SMCAR-BAC-S, Picatinny Arsenal, New Jersey 07806-5000 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

STANDARDS

MILITARY

- MIL-STD-109 - Quality Assurance Terms and Definitions
- MIL-STD-286 - Propellants, Solids: Sampling, Examination, and Testing
- MIL-STD-652 - Propellants, Solids for Cannons Requirements and Packing
- MIL-STD-1168 - Lot Numbering of Ammunition
- DOD-STD-1468 - Small Caliber Ammunition Test Procedure, 9MM Cartridges

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, Bldg 4D, 700 Robbins Ave, Philadelphia, PA 19111-5094.

2.1.2 Other Government documents, drawings and publications.
The following other Government documents, drawings and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

DRAWINGS

U.S. ARMY ARMAMENT RESEARCH, DEVELOPMENT AND ENGINEERING CENTER

- 8858848 - Marking Diagram and Sealing of Metal Lined Wooden Packing Boxes for Shipment of Propellants

PUBLICATIONS

- TECP 700-700, Vol. III - Manual of Test Methods for Small Arms Ammunition
- AMCR 715-505 - Ammunition Ballistic Acceptance Test Methods, Vol-8, Test Procedures for 20MM Cartridges
- SCATP-5.56 - Ammunition Ballistic Acceptance Test Methods, Test Procedures for 5.56MM Cartridges
- SCATP-7.62 - Ammunition Ballistic Acceptance Test Methods, Test Procedures for 7.62MM Cartridges
- SCATP-45 - Ammunition Ballistic Acceptance Test Methods, Test Procedures for Caliber .45 Cartridges

- SCATP-5.56 (Heavy Bullet)- Small Caliber Ammunition Test
Procedures 5.56MM (Heavy Bullet)
Cartridges
49 CFR 100-199 - Interstate Commerce Commission
Rules and Regulations for the
Transportation of Explosives and
Other Dangerous Articles

(The Code of Federal Regulations (CFR) is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Orders for the above publications should cite "49 CFR 100-199 (latest revision)").

(Copies of other Government documents required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.2 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Chemical composition and physical properties. The finished propellant shall comply with the requirements specified on the applicable propellant drawing.

3.1.1 Nitrocellulose. Extracted Nitrocellulose recovered from propellant or new Nitrocellulose shall comply with the requirements of MIL-N-244 unless otherwise specified in the applicable drawings or in the contract. Extracted Nitrocellulose or propellant rework may be used in lieu of or in combination with new Nitrocellulose, and all propellant so manufactured shall comply with all chemical, physical and ballistic requirements.

3.2 Ballistics. The propellant, when loaded into appropriate test cartridges (see 6.3), shall comply with the ballistic requirements for the cartridge by caliber, type and model for which it is intended as specified in Tables I and III, referenced publications and the following:

3.2.1 Velocity. The velocity in feet per second (fps) obtained with test cartridges shall be within the limits specified in Table I.

3.2.2 Pressure.

3.2.2.1 Chamber. The chamber pressure in pounds per square inch (psi, piezo or Copper Unit of Pressure (CUP)) obtained with test cartridges shall be within the limits specified in Table I.

3.2.2.2 Port. The CUP/piezo port pressure (psi) obtained with test cartridges shall be within the limits specified in Table I.

3.2.2.3 Case mouth. The piezo case mouth pressure (psi) obtained with test cartridges shall be within the limits specified in Table I.

3.2.3 Action time. The action time (overall primer ignition, propellant burning and bullet-barrel time) in milliseconds (ms) obtained with test cartridges shall not exceed the limits specified in Table I.

3.2.4 Trace. Test cartridges, when tested for initiation of igniter and tracer mixtures, shall initiate a trace equivalent to at least 96% of the value obtained from the tracer bullets supplied. The tracer bullets supplied shall be from a lot having a minimum trace initiation performance of 96%.

3.2.5 Smoke and flash. The smoke and flash produced by test cartridges shall not exceed the smoke and flash produced by reference cartridges or by production components loaded with propellant from an accepted lot fired at the same time and under the same conditions (see 6.2). A flash assessment is not needed for 5.56MM blank propellant.

3.2.6 Fouling. The test cartridges shall not produce fouling of the barrel, barrel bearings muzzle attachments, ports or gas cylinders of automatic or semi-automatic weapons to the extent that it will impair or prevent the normal functioning of the weapon when fired according to the specified firing schedule in the specified gun.

3.2.7 Barrel erosion. The test cartridges shall not cause the average life per barrel of three barrels to be less than 5000 rounds. The barrel life shall be considered as having ended when the average velocity of an individual burst in the test drops 200 (fps) or more with respect to that of the initial burst or when the bullets from 20 percent or more of the cartridges in any burst shows key-holing which is defined as yaw exceeding 15 degrees at 1000 inch range, whichever occurs first.

3.2.7.1 Barrel erosion, 5.56MM (M855/M856 only). The M855 and M856 test cartridges (linked 4-Ball and 1-tracer) shall not cause the average life per barrel of three barrels to be less than 12,000 rounds. This test shall be for first article only, using the M249 Machine gun.

3.2.8 Screen perforation. Blank test cartridges shall not cause any perforations, due to unburnt propellant, in a paper screen placed 15 feet from the muzzle of the weapon. A screen perforation assessment is not needed for 5.56 blank propellant.

3.2.9 Cyclic rate. The cyclic rate per minute produced by blank test cartridges, when fired fully automatic, shall comply with the following:

<u>Weapon</u>	<u>Cyclic rate</u>
5.56MM (rifle)	550 to 920
7.62MM (rifle)	700 minimum
7.62MM (MG)	500 minimum
Caliber .30 (MG)	450 to 650
Caliber .50 (MG)	475-575

3.2.10 Noise level. The noise level produced by blank test cartridges shall be in accordance with the requirement shown below when the noise level of ball production cartridges of the same caliber fired under identical conditions and using the same equipment except for the use of a blank firing attachments is 120-130 decibels:

5.56MM Blank, M200	- 100 decibels min
7.62MM Blank, M82	- 105 decibels min
Cal .50 Blank	- 164 decibels max

3.2.11 Extreme temperature. Test cartridges conditioned for a minimum of 4 hours (except 5.56MM - 3.2.11.2 and 30MM - 3.2.11.4) and fired at the temperatures specified in Table III shall not exceed the ballistic limits specified in Table I and shall comply with the applicable requirements of 3.2.4 thru 3.2.10 and the following:

3.2.11.1 Cartridge 7.62MM. The average velocity and chamber pressure of test cartridges subjected to the following storage conditions shall not vary from the average velocity and chamber pressure of similar test cartridges conditioned and fired at 70 ± 2 degrees F by more than the following indicated amounts:

<u>Condition</u>	<u>Variation in average Velocity (FPS)</u>	<u>Variation in average Chamber Pressure (PSI)</u>
Stored at 125 ± 2 degrees F for 4 hours and fired at that temperature	± 150	± 5000
Stored at -65 ± 5 degrees F for not less than 6 hours and fired at that temperature	+ 150 - 250	+ 5000 - 10,000

3.2.11.2 Cartridge 5.56MM. The average velocity and average chamber and port pressure of test cartridges subjected to the following storage conditions shall not vary from the average velocity and average chamber and port pressure of similar test cartridges conditioned and fired at 70 ± 2 degrees F by more than the following indicated amounts.

<u>Condition</u>	<u>Variation in average Velocity 1/</u>	<u>Variation in average Chamber Pressure 1/</u>	<u>Port</u>
Stored at 125 ± 2 degrees F for not less than 1 hour at that temperature	- 250	+ 5,000 2/	± 2,000
Stored at -65 ± 5 degrees F for not less than 1 hour and fired at that temperature	- 250	+ 5,000 2/	± 2,000

1/ Any increase in velocity and decrease in chamber pressure of the test cartridges obtained under the above storage conditions are acceptable.

2/ For M855 and M856, variation shall be 6,500 p

3.2.11.3 Cartridge, 9MM. When conditioned and fired at 125 ± 4 degrees F and -65 ± 4 degrees F the average velocity shall not vary by more than ± 98.4 fps from that obtained at 70 degrees F and the average chamber pressure shall not vary by more than ± 9,425 psi from that obtained at 21 degrees C.

3.2.11.4 Cartridge, 30MM. The average pressure plus 3 standard deviations of test cartridges conditioned for a minimum of 4 hours and fired at the extreme temperatures specified in Table III shall not exceed 58,000 psi (400 MPa) and the velocity

will be recorded for information purposes only. The velocity standard deviation shall not exceed 49 ft/sec (15 m/sec). Test cartridges conditioned for a minimum of 4 hours and fired at 70 degrees F shall not exceed the ballistic limits specified in Table I.

3.2.12 Climatic storage 7.62MM. The 7.62MM test cartridges subjected to the following storage conditions shall comply with the requirements of 3.2.12.1 thru 3.2.12.4:

<u>Condition</u>	<u>Description</u>
Exposed Desert	Stored for 30 days; performing a cyclic procedure each 24 hours as follows: 3 hours slow heating to 150 ± 2 degrees F and $15\% \pm 5\%$ RH 9 hours at 150 ± 2 degrees F and $15\% \pm 5\%$ RH 3 hours slow cooling to 60 ± 2 degrees F and $90\% \pm 5\%$ RH 9 hours at 60 ± 2 degrees F and $90\% \pm 5\%$ RH
Continuous Heating	Stored for 30 days at 150 ± 2 degrees F and $15\% \pm 5\%$ RH or 120 days at 125 ± 2 degrees F and $30\% \pm 5\%$ RH
Continuous Arctic	Stored for 30 days at -40 ± 5 degrees F

3.2.12.1 Chamber pressure. The difference in the average chamber pressure between the cartridges stored at each of the specified conditions and cartridges conditioned at 70 ± 2 degrees F for 30 days or 120 days shall not exceed $\pm 5,000$ psi.

3.2.12.2 Velocity. The difference in the average velocity between the cartridges stored at each of the specified conditions and cartridges conditioned at 70 ± 2 degrees F for 30 days or 120 days shall not exceed ± 60 fps.

3.2.12.3 Action time. The action time (overall primer initiation, propellant burning and bullet-barrel time) of the cartridges stored at each of the three specified conditions for 30 days or 120 days shall not exceed 2.5 milliseconds (ms).

3.2.12.4 Trace. When tested for initiation of igniter and tracer mixtures after storage at each of the specified conditions for 30 days or 120 days, the propellant under test shall initiate trace in a minimum of 70% of the cartridge fired.

3.2.13 Position sensitivity. Caliber .38 and caliber .45 cartridges. The mean pressure and velocity value shall be within two standard deviations of the test values generated during the conducting of the tests specified in 3.2.1, velocity and 3.2.2 pressure (see 4.5.2.6).

3.2.14 Bullet Pull. Test cartridges shall be tested for bullet pull as specified in 4.5.2.1.1.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor 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 ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.1.2 Test equipment and inspection facilities. The manufacturer shall insure that test and inspection facilities of sufficient accuracy, quality and quantity are established and maintained to permit performance of required inspections as listed in 4.5.

4.2. Classification of inspections. The inspections specified herein are classified as follows:

- a. First article inspection (see 4.3)
- b. Quality conformance inspection (see 4.4)

4.3 First article inspection.

4.3.1 Submission. The contractor shall submit a first article sample as designated by the contracting officer for evaluation in accordance with the provisions of 4.3.2 and Table III (acceptability shall be based on results of initial tests only, second tests are not permitted). A random sample shall be selected by sampling as described in 4.4.2. The sample shall be obtained from the first acceptable production lot, as prescribed by the procuring activity. Functioning tests will be performed by the Government. All samples submitted shall be obtained from the first production lot which has been produced by the contractor using the same production processes, procedures and equipment as will be used in fulfilling the contract. All materials, including packaging and packing, shall be obtained from the same sources of supply as will be used in regular production. The sample shall be accompanied by certificates as directed. Prior to submission, the contractor shall inspect the sample to the degree necessary to assure that it conforms to the requirements of the contract and submit a record of this inspection with the sample. A sample containing known defects will not be submitted unless specifically authorized by the contracting officer.

4.3.2 Inspections to be performed. The sample will be subjected to the tests specified in 4.5. Sample sizes shall be as specified in 4.4.2.

4.3.3 Rejection. If any sample fails to comply with any of the applicable requirements, the first article quantity shall be rejected. The Government reserves the right to terminate its inspection upon any failure of a sample to comply with any of the stated requirements.

4.4 Quality conformance inspection.

4.4.1 Lots. A lot shall consist of one or more batches of propellant, produced by one manufacturer, in accordance with the same specification, or same specification revision, under one continuous set of operating conditions. Each lot shall contain propellant of one type only and shall be identified with a lot number in accordance with MIL-STD-1168. Each batch shall consist of that quantity that has been subjected to the same unit chemical or physical process intended to make the final product homogeneous.

4.4.2 Sampling.

4.4.2.1 Lot sampling. Samples shall be selected, at random, from five packing containers within the lot. An equal amount of propellant shall be collected from each container, such that the total of the five samples shall be sufficient for all required chemical, physical, ballistic and ballistic uniformity tests. These samples shall be poured into clean containers, immediately closed with a hermetically tight seal and identified as "Representative Sample" with a label showing the container number from which the sample was taken, the Army lot number, propellant nomenclature, packing date, manufacturer, manufacturing plant and total weight of the lot as packed.

4.4.2.2 Test sampling. Samples shall be permitted to attain room temperature, then equal portions sufficient to make the required quantity of a composite sample shall be taken from each "Representative Sample", properly identified as to lot, manufacturer, manufacturing plant, etc., and blended. This composite sample shall be placed in two separate containers, immediately closed with a hermetically tight seal and identified respectively as "Chemical Sample" and "Ballistic Sample." The balance of the propellant remaining in each of the Representative Samples shall be used to perform the Ballistic uniformity test. If any sample fails to comply with the requirements, the lot shall be rejected.

4.4.2.3 Inspections to be performed. The sample will be subjected by the Government to any or all of the examinations or tests specified in 4.5 of this specification.

4.4.3 Examination and tests. Sampling plans and procedures are specified herein. Inspection for critical defects shall be 100 percent. Contractor's sampling plans, if used, shall be approved by the Government (see 6.7) and shall provide, as a minimum, the protection afforded the Government by the sampling specified herein.

4.4.3.1 Chemical composition and physical properties. The sample quantity of propellant to be tested for the chemical composition and physical properties requirements specified in the applicable propellant drawing shall be as prescribed in MIL-STD-286. In the event of a failure, see Note 3/.

4.4.3.1.1 Ballistics. The following ballistic tests shall be made in accordance with Tables II and III to determine compliance with the requirements of the caliber, type and model of the cartridge for which the propellant is intended. The "Ballistic Sample" shall be subjected to the tests as prescribed below:

TEST 3/REQUIREMENT PARAGRAPH

Velocity 4/	3.2.1
Pressure 4/	3.2.2
Action Time	3.2.3
Smoke and Flash	3.2.5
Fouling	3.2.6
Barrel Erosion 5/	3.2.7
Screen Perforation	3.2.8
Cyclic Rate	3.2.9
Noise Level	3.2.10
Extreme Temperature	3.2.11
Climatic Storage 5/	3.2.12
Position Sensitivity	3.2.13

3/ Failure of the propellant to comply with the requirements of 3.1 or 3.2 shall be cause for rejection of the lot subject to testing of a second sample for the characteristic(s) in which the failure occurred. The second test shall be made using the original sample, provided sufficient propellant remains. If additional propellant should be required, it shall be taken from the same boxes of propellant from which the initial "Representative Sample" were obtained. Failure of the second sample to comply with the requirements of the characteristic(s) under test shall be cause for rejection of the lot. The above provisions for testing of a second sample shall apply to the second and subsequent production lots. "Accept/Reject" decision for first production lot and first article sample shall be based upon results of initial test only, and no second tests shall be permitted.

4/ Velocity and pressure may be fired either separately or simultaneously, as prescribed in the appropriate inspection equipment list.

5/ Performed by the Government only.

4.4.3.1.2 Velocity uniformity. Cartridges loaded with each of the "Representative Samples" shall be tested for velocity uniformity. These tests shall be conducted only at ambient conditions. Ten rounds using each of the "Representative Samples" shall be loaded at the same charge weight established for the "Ballistic Sample". The velocity shall be averaged for each ten-round test. Criteria for "Ballistic Sample" charge establishment velocity, variation of "Representative Sample" velocity from that of "Ballistic Sample" and standard deviations for "Representative Sample" velocities follow:

	"Ballistic Sample" Velocity	"Represent- ative Sample" Velocity Variation	"Representative Sample" Velocity Std Dev. (max) Init Test Retest
5.56MM Ball, M193	3165±10	+25	30 25
5.56MM Tracer, M196	3115±10	+25	30 25
5.56MM Ball, M855	3000±10	+25	30 25
5.56MM Tracer, M856	2990±10	+25	30 25
7.62MM Ball, M80	2750± 5	+20	24 20
7.62MM Tracer, M62 (GM)	2680± 5	+20	24 20
7.62 Tracer, M62 (GMCS)	2750± 5	+20	24 20
7.62 Dim Tracer, M276 (GM)	2680± 5	+20	24 20
7.62 Dim Tracer, M276 (GMCS)	2750± 5	+20	24 20
Cal. .30 Ball, M2	2740± 5	+20	24 20
Cal. .30 Tracer, M25	2665± 5	+20	24 20
Cal. .45 Ball, M1911	855± 5	+20	21 18
Cal. .45 Tracer, M26	885± 5	+20	21 18
Cal. .50 Ball, M33	2910±10	+20	36 30
Cal. .50 Tracer, M17	2860±10	+25	48 40
20MM, HEI, M56	3380±15	+30	36 30
20MM, TP, M99	2680±15	+30	36 30
20MM, HEI, PGU-17/B	3680±15	+30	36 30
20MM, SAPHEI, PGU-28B	3410±15	+30	36 30
20MM, TP, PGU-18/B	3680±15	+30	36 30
20MM, TP, PGU-27/B	3410±15	+30	36 30
20MM, TPT, PGU-30/B	3410±15	+30	36 30
20MM, MPT-SD M940	3350±15	+30	36 30
30MM, TP M788	2582±30	+50	60 50
30MM, HEDP M789	2582±30	+50	60 50
7.62MM Special Ball, M118	2550± 5	+20	24 20
7.62MM Match, M852	2550± 5	+20	24 20
9MM Ball M882	1230± 5	+20	21 18

Failure of the propellant to comply with the criteria of the uniformity test shall be cause for rejection of the lot subject to testing of a second sample. The second test shall be made using propellant from the original container in which sample failure occurred in the initial test. The second sample shall consist of twenty rounds. The criteria shall remain the same except for velocity standard deviation which shall not exceed the value indicated above under "Retest." Failure of the second sample to comply with the criteria of the uniformity test shall be cause for rejection of the lot. The velocity uniformity test is not required for cartridges not listed in the above table of cartridges.

4.4.3.2 Examination of fiber drum, reusable, prior to filling.

<u>CATEGORIES</u>	<u>DEFECTS</u>	<u>METHOD OF INSPECTION</u>
Critical:	None defined	
Major:	100% inspection	
101.	Drum design shall be in conformance with current para. 5.1.3 requirements.	Visual
102.	The drum shall be clean, free of foreign material-rust, propellant, grease, oil, mildew, watermarks, etc.	Visual
103.	The gasket shall not be missing, torn, damaged, loose from the lid groove, or show signs of permanent compression.	Visual/Manual
104.	The lid shall not be bent, creased or deformed in gasket area or around edge.	Visual
105.	The lid and bottom shall be free of holes, dents, and gouges which either penetrate or delaminate the surface.	Visual
106.	The sidewall shall be free of holes, dents, gouges which either penetrate or delaminate the surface, ridges, and accordion effect.	Visual
107.	The metal chime at the top and bottom of the sidewall shall be free of dents and tears.	Visual
108.	The closure ring and locking lever shall be in operating condition, free of rust, dents, bends, etc.	Visual/Manual
Minor:	None defined	

4.4.3.3 Packing and marking inspection. Packing and marking shall comply with the requirements of 5.1 when inspected as specified in MIL-STD-652.

4.4.3.4 Inspection equipment. All tests shall be made using equipment listed on the applicable inspection list.

4.4.4 Precautionary note. This specification covers the sampling and testing of toxic and hazardous materials. Accordingly, it is emphasized that all applicable safetyes, regulations and procedures must be followed in the handling and processing of propellants for small arms ammunition.

4.5 Methods of inspection.

4.5.1 Chemical composition and physical properties. The applicable tests shall be performed in accordance with the procedures set forth in MIL-STD-286.

4.5.2 Ballistics. Ballistics tests listed in 4.4.3.1.1 shall be performed in accordance with TECP 700-700 (Vol III), AMCR 715-505 (Vol 8) DOD-STD-1468, SCATP-5.56, SCATP-7.62, SCATP-5.56 (Heavy Bullet) or SCATP-45 as applicable, and the following:

4.5.2.1 Loading of test cartridges. Except as provided in 4.5.2.2, the propellant sample selected in accordance with 4.4.2 shall be used to load test cartridges with the charge weight established to obtain the specified average corrected velocity. When once established for a particular propellant lot, this charge weight may not be varied while the same lot is being tested. The test cartridges to be used for any velocity and pressure test shall be loaded by a method capable of maintaining propellant charge weight uniformity of ± 0.1 grain.

4.5.2.1.1 Bullet pull test. To assure that the sample test cartridges have been properly assembled and crimped a bullet pull test shall be performed on 20 random samples of the test cartridges for the first article test and all production lot testing. The force required to extract the bullet from the cartridge case shall not be less than 45 pounds (The 7.62MM, M852 and M118 Cartridges, shall not be crimped and the force required to extract the bullet from the cartridge case shall not be less than 10 pounds). If any of the 20 samples does not meet the force requirements, the test sample is unsuitable and is to be remanufactured and retested.

4.5.2.2 Cyclic rate: The charge weight of the propellant under test shall be established by trial and error to obtain proper functioning of the weapon fitted with the appropriate blank firing attachment at the prescribed cyclic rate (3.2.9). Prior to establishment of the charge weight of the propellant undergoing test, the weapon shall be qualified for use by firing the appropriate blank cartridges from an accepted lot, to determine that the cyclic rate of the weapon is within the limits prescribed for that cartridge. In the event the cyclic rate of the weapon is not within these limits, either the appropriate adjustments shall be made to the gun or a properly qualified replacement weapon shall be substituted before proceeding with the test. The cartridges shall be fired fully automatic in bursts of 100 rounds each in the weapon specified in the applicable inspection equipment list.

Table I. Ballistic Requirements for Propellants

CARTRIDGE CALIBER, TYPE AND MODEL	INSTRUMENT VELOCITY (FPS)			STANDARD DEVIATION (MAX)	CHAMBER PRESSURE PSI/CUP 1/		IND. MAX ACTION TIME (MS)	EXTREME TEMPERATURE 5/	
	AVERAGE AT				MAXIMUM AVERAGE 6/	STANDARD DEVIATION (MAX)		IND. MAX CHAMBER PRESS.(PSI)	IND. MAX ACTION TIME (MS)
	5.5 FT	25.5 FT	53.0 FT						
5.56 MM									
BALL M193				25	50000 CU, 10/	56000 Cu, 13/	2.5	58000 Copper	
TRACRE M196				25	53000 Piezo	59000 Piezo	2.5	61000 Piezo	
HPT M197					70000+-2000	3000			
GRENADE M195	155 +- 5			2					
BALL M855				25	53000 10/	59000 13/	2.5	58000 17/	2.5
TRACER M856				25	53000 10/	59000 13/	2.5	58000 17/	
BLANK M200									
7.62 MM									
BALL M80				20	48000 4/	53000 13/	2.5	55000	
AP M81				20	48000 4/	53000 13/	2.5	55000	
TRACER 2/ M62				20	48000 4/	53000 13/	2.5	55000	
GRENADE 3/ M64	160 +- 5			2					
HPT M60					67000+-2500	3000			
FRANGIBLE M160			1320 +- 30						
SPECIAL BALL M118				20	48000 4/	53000 13/	2.5		
MATCH 16/ M852				20	48000 4/	53000 13/	2.5		
BLANK M82									
DIM TRACER M276				20	48000 4/	53000 13/	2.5	55000	
9 MM									
BALL M882			1230 +- 25	20	31175			36250	
HPT M905					48000+-2500				
CALIBER .30									
BALL M2				20	48000		2.5	60000	
API M14				20	48000		2.5	60000	
TRACER M25				20	48000		2.5	60000	
GRENADE M3	180 +- 5			12					
HPT M1 & M2 ALT					67500+-2500	3000			
MATCH M72				20	48000				
BLANK M1909									

Table I. Ballistic Requirements for Propellants - Continued

CARTRIDGE CALIBER, TYPE AND MODEL	INSTRUMENT VELOCITY (FPS)			STANDARD DEVIATION (MAX)	CHAMBER PRESSURE PSI/CUP 1/		IND. MAX ACTION TIME (MS)	EXTREME TEMPERATURE 5/	
	AVERAGE AT				MAXIMUM AVERAGE & 1000	STANDARD DEVIATION (MAX)		IND. MAX CHAMBER PRESS.(PSI)	IND. MAX ACTION TIME (MS)
	5.5 FT	25.5 FT	53.0 FT						
CALIBER .38									
BALL M41	950 +/- 45	at 15 feet			15000			20000	
CALIBER .45									
BALL M1911		855 +/- 15 7/		18	16500	600		19500	
BALL, MATCH GRADE M1911		855 +/- 15 7/		18	16500	600		19500	
TRACER M26		855 +/- 15 7/		18	16500	600		19500	
BLANK M9									
HPT M1					22000 +/- 1000	1000			
CALIBER .50									
BALL M33			2910 +/- 15	30	53000		2.5	62500	
API M8			2910 +/- 15	30	53000		2.5	62500	
API M20			2910 +/- 15	30	53000		2.5	82500	
TRACER M17			2860 +/- 20	40	52000		2.5	61000	
SPOTTER-TRACER M48A2			1745 +/- 10	9	36000		3.5	48000	
HPT M1					62500 +/- 2500	3000			
HPT T251					62500 +/- 2500	3000			
BLANK M1A1/M928									
20 MM									
TARGET PRACTICE M99			2680 +/- 25	30	46000	2000	3.5		3.5
HEI 8/			3380 +/- 25	30	55000	2000	3.5		3.5
HPT M54					53000 +/- 2000	2500			
TPT M206			3430 +/- 25	30	47500		5.5	52000 14/	
HEI PGU 17B			3680 +/- 25	40	15/		3.5	69000	3.5
PGU 18/B			3680 +/- 25	40	15/		3.5	69000	3.5
TP PGU-27/B 11/			3410 +/- 25	30	55000		3.5		3.5
SAPHEI PGU-18/B 11/			3410 +/- 25	30	55000		3.5		3.5
TPT PGU-30/B 11/			3410 +/- 25	30	55000		3.5		3.5
MPT-SD M940			3350 +/- 25	30	55000	2000	3.5		3.5
30 MM									
TP M788			2582 +/- 32	49	42787 18/	58000 13/	4.0		4.0
HEDP M789			2582 +/- 32	49	42787 18/	58000 13/	4.0		4.0

TABLE I. Ballistic Requirements For Propellants-Continued

NOTES

- 1/ Cases to be drilled: except caliber .45, 5.56MM, and 30MM.
- 2/ Average velocity shall be 2680 +/- 15 fps if bullet is assembled with gilding metal bullet jacket.
- 3/ When tested with proof slug - Drawing B1052289
- 4/ The average port pressure shall be 12,500 psi +/- 2,000 psi
- 5/ For permissible variation in 7.62MM average velocity and chamber pressure, see 3.2.11.1 and for 5.56MM, see 3.2.11.2
- 6/ HPT shows permissible limits for average pressure in lieu of max average.
- 7/ In universal gauge.
- 8/ Inert projectile
- 9/ NOTE HAS BEEN DELETED
- 10/ For the M193/M196 cartridges, the average port pressure shall be 14,00 +/- 2,000 psi (piezo), or the average port pressure shall be 15,000 +/- 2,000 psi (copper). For the M855 the mean port pressure minus three standard deviations shall be equal to or greater than, 12,700 psi. For the M856 this value shall be 12,700
- 11/ The M99, M56 and M206 components are used as test vehicles for the series of cartridges respectfully.
- 12/ NOTE HAS BEEN DELETED
- 13/ Mean chamber or case mouth pressure, as applicable, plus three (3) standard deviations.
- 14/ Individual Max applies at 70 +/-2 degrees F only.
- 15/ The average pressure plus 3 standard deviations shall not exceed 66,000 psi when tested using Pressure Transducer Model PCB 118A mounted in accordance with PCB drawing 108-1010-90 and Mann Barrel Dwg 7259356.
- 16/ The Ballistic Requirements (Table I) and Sample Sizes (Table II) for the M852 shall be the same as shown for M118.
- 17/ Maximum average.
- 18/ The maximum average case mouth pressure of 48,588 psi (335 MPa) shall be the value when tested in the M230 test barrel.

Table II. Sample Size of Test Cartridges for Ballistic Tests

CARTRIDGE CALIBER, TYPE AND MODEL	VELOCITY	CHAMBER PRESSURE	ACTION TIME 9/	TRACE	SMOKE 9/ 2/	FLASH 9/	FOULING	
							9/	2/
5.56 MM								
BALL M193	20	20 8/	20		100	100	1000	
TRACER M196	20	20 8/	20	100	100	100	1000	
HPT M197		20						
GRENADE M195	25							
BALL M855	20	20 8/	20	200	100	100	1000	
TRACER M856	20	20 8/	20		100	100	1000	
BLANK M200					100	100	500	
7.62 MM								
BALL M80	20	20 1/	20		100	100	100	
AP M61	20	20 1/	20		100	100	100	
TRACER 2/ M62	20	20 1/	20	100	100	100	100	
GRENADE 3/ M64	20	0						
HPT M60	0	20						
FRANGIBLE M160	20	0						
SPECIAL BALL M118	20	20 1/			100	0	100	
MATCH 16/ M852	20	20 1/			100	0	100	
BLANK M82					100	100	500	
DIM TRACER M276	20	20 1/	20	100	100	100	100	
9 MM								
BALL M882	30	30						
HPT M905		30						
CALIBER .30								
BALL M2	20	20	20		100	100	100	
API M14	20	20	20		100	100	100	
TRACER M25	20	20	20	100	100	100	100	
GRENADE M3	20	0						
HPT M1 & M2 ALT	0	20						
MATCH M72	20	20			100		100	
BLANK M1909					100	100	100	
CALIBER .38								
BALL M41	20				100	100		
CALIBER .45								
BALL M1911	20 7/	20 7/			100	100	100	
BALL MATCH GRADE M1911	20 7/	20 7/			100	0	100	
TRACER M26	20 7/	20 7/		100	100	100	100	
BLANK M9					100	100	100	
HPT M1		20						
CALIBER .50								
BALL M33	20	20	20		100	100	100	
API M8	20	20	20		100	100	100	
APIT M20	20	20	20	100	100	100	100	
TRACER M17	20	20	20	100	100	100	100	
SPOTTER-TRACER M48A2	20	20	20	100	100	100	100	
HPT M1		20						
HPT T251		20						
BLANK M1A1/M928						20	500	
20 MM								
TARGET PRACTICE M99	20 7/	20 7/	20		100	100		
HEI 8/ M56	20 7/	20 7/	20		100	100		
HPT M54		20						
TPT M206	20	20 7/	20	50	100	100		
HEI PGU 17/B	20	20 7/	20		100	100		
PGU 18/B	20	20 7/	20		100	100		
TP PGU-27/B 11/	20 7/	20 7/	20		100	100		
SAPHEI PGU-18/B 11/	20 7/	20 8/	20		100	100		
TPT PGU-30/B 11/	20 7/	20 7/	20	50	100	100		
MPT-SD M940	20	20 8/	20		100	100		
30 MM								
TP M788	20	20	20					
HEDP M789	20	20	20					

Table II. Sample Size of Test Cartridges for Ballistic Tests - Continued

CARTRIDGE CALIBER, TYPE AND MODEL	BARREL EROSION 9/	SCREEN PERFOR- ATION	CLIMATIC STORAGE 9/	CYCLIC RATE		NOISE LEVEL		EXTREME TEMP. 9/ 4/
				RIFLE	MG 3/	RIFLE	MG	
5.56 MM								
BALL M193								120
TRACER M196								320
HPT M197								50
GRENADE M195								80
BALL M855								480
TRACER M856								480
BLANK M200				100		20		
7.62 MM								
BALL M80	6/		6/					80
AP M61	6/		6/					80
TRACER 2/ M62			6/					280
GRENADE 3/ M64								40
HPT M60								40
FRANGIBLE M160								40
SPECIAL BALL M118								40
MATCH 16/ M852		0						40
BLANK M82		100		100	100	20	100	
DIM TRACER M276			6/					280
9 MM								
BALL M882								120
HPT M905								
CALIBER .30								
BALL M2								40
API M14								40
TRACER M25								240
GRENADE M3								
HPT M1 & M2 ALT								
MATCH M72								
BLANK M1909					100		100	
CALIBER .38								
BALL M41								40
CALIBER .45								
BALL M1911								40
BALL MATCH GRADE M1911								40
TRACER M26								240
BLANK M9		100						
HPT M1								
CALIBER .50								
BALL M33								40
API M8								40
API M20								240
TRACER M17								240
SPOTTER-TRACER M48A2								240
HPT M1								
HPT T251							100 12/	
BLANK M1A1/M928		200			100 12/			
20 MM								
TARGET PRACTICE M99								20
HEI 8/ M56								20
HPT M54								20
TPT M206								20
HEI PGU 17/B								20
PGU 18/B								20
TP PGU-27/B 11/								20
SAPHEI PGU-18/B 11/								20
TPT PGU-30/B 11/								20
MPT-SD M940								20
30 MM								
TP M788								20
HEDP M789								20

TABLE II. Sample Size of Test Cartridges For Ballistic Tests - Continued

NOTES:

- 1/ Same quantity required for port pressure.
- 2/ Examination of weapon in the smoke test may constitute the fouling test or vice versa except for 5.56MM cartridges.
- 3/ Appropriate blank attachment to be used for each weapon.
- 4/ See Table III for extreme temperature conditions.
- 5/ Inert projectile.
- 6/ Barrel erosion and climatic storage tests will be performed by the Government only.
- 7/ Velocity and pressure fired simultaneously. For 20MM fixed reference cartridges are to be used for obtaining barrel corrections.
- 8/ Chamber pressure and port pressure fired simultaneously.
- 9/ Test not required for reference propellant.
- 10/ The ballistic requirements (Table I.) and sample sizes (Table II.) for the M852 shall be the same as shown for M118.
- 11/ 20 rounds for the position sensitivity test.
- 12/ 300 rounds: 100 at each 0.70 and 125 degrees F.
- 13/ 100 rounds from the cyclic rate test at each temperature.

Condition Requirements By Characteristics and Caliber											Testing Req. By Lots				
Characteristics	Temperature Conditions (deg F) 2/ 3/										First Article	Production Lot			
Test Cartridges	5.56MM			Col. .38, .30		20MM		30MM			Sample Tests	Acceptance Tests			
Conditioned And Fired At	125	-65	70	-40	125	70	-65	70	160	-65	70	By Govt Only	First Lot	Second Lot	Sixth Lot On
Chem Comp Phys Prop												X	X	X	X ^{5/}
Velocity	X	X	X			X		X	X	X	X	X	X	X	X
Pressure 6/	X	X	X ^{4/}	X	X	X		X	X	X	X	X	X	X	X
Action Time			X			X	X	X	X	X	X	X	X	X	X
Trace	X	X	X	X	X	X		X ^{8/}				X	X	X	X ^{9/}
Smoke			X			X		X				X	X		
Flash			X			X		X				X	X		
Fouling			X			X						X	X		
Screen Perf.			X			X						X	X	X	X
Cyclic Rate			X			X						X	X	X	X
Noise Level			X			X						X	X	X	X
Barrel Erosion			X ^{7/}									X			
Climatic Stor.			X ^{7/}									X			
Position Sensivity						X						X	X		

NOTES:

- 1/ Table II denotes when test are applicable by specific and sample size of test cartridge required.
- 2/ Cartridge cases for pressure test to be drilled prior to being stored at specific temp., except cal. .45 and 5.56mm.
- 3/ Test cart. to be loaded in links, belt magazines or charge prior to be stored at specified temp. (+/- 2 F for hot and ambient, +/- 5 F for cold temp.)
- 4/ For 7.62mm cartridge, port pressure test is also required.
- 5/ Except hygroscopicity.
- 6/ The 5.56mm cart. require port pressure as well as chamber pressure tests at temperature conditions.
- 7/ This requirement applies to 7.62mm cart. only. Evaluation will be made by the Government independently of all other tests.
- 8/ This requirement applies to 20mm TPT M206 and PGU-30/B.
- 9/ Test conducted at 70 F only.

4.5.2.3 Extreme temperature. The test cartridges shall be conditioned and fired as indicated in Table III and 3.2.11. Characteristic(s) applicable to the cartridge under test shall be tested in accordance with 4.5.2.

4.5.2.4 Climatic storage. The test cartridges shall be conditioned and fired as indicated in 3.2.12. Characteristic(s) applicable to the cartridge under test shall be tested in accordance with 4.5.2. If a failure should occur in the 30 day continuous heating test, a second test at the 120 day continuous heating conditions indicated in 3.2.12 shall be made.

4.5.2.5 Trace. The initiation shall be observed from a position behind the gun. The test shall be conducted on a range of sufficient length that the initiation or lack of initiation can be observed. The range length shall be determined by the contractor. Failure of the sample to meet the trace requirements shall be cause for rejection of the propellant lot.

4.5.2.6 Position sensitivity. Caliber .38 and caliber .45 cartridges. This test shall be conducted with the propellant located toward the projectile end of the cartridges rather than the primer end. This is accomplished by modifying the procedure in which the cartridge is inserted in the test barrel. The cartridge is to be inserted with the projectile end down and slowly chambered. The firing mechanism is to be slowly closed and the cartridges fired.

5. PACKAGING

5.1 Unit packing. The propellant shall be packed Level A, B, or C as specified herein.

5.1.1 Level A (Worldwide shipment or long term storage. None approved.

5.1.2 Level B. None approved.

5.1.3 Level C (CONUS shipment and short term storage. For trucks or trailer on flat car shipment and short term storage (2 years maximum), not more than 100 pounds net weight for HPC and WC-type propellants nor more than 150 pounds net weight for IMR-Type propellants, as approved by the Department of Transportation (DOT), shall be packed in a fiber drum, certified in accordance with DOT 21C Code of Federal Regulation, Title 49 (CFR 49)k, Section 173.93 (a) (10). Additionally, the fiber drums must meet the following requirements: The body shall be wound with hot melt or thermoplastic adhesive. The bottom shall be waterproof laminated fiberboard. A layer of aluminum foil shall be laminated into the body. The bottom and top edges of the drum shall have galvanized steel chimes. The cover shall have a moisture-proof gasket and shall be secured with a lever-locking galvanized band. The cover shall be steel with a galvanized or baked varnish finish, resistant to chipping, peeling or cracking.

The fiber drums may be reused if they comply with the inspection requirement of 4.4.3.2.

5.2 Marking.

5.2.1 Level A. All level A containers shall have a printed label affixed to the side with the following information:

AFTER FIVE YEARS FROM DATE OF MANUFACTURE, APPROVAL BY THE RESPONSIBLE PROCURING AGENCY IS REQUIRED PRIOR TO THE LOADING OF THIS PROPELLANT INTO SMALL ARMS AMMUNITION

5.2.2 Level C. Containers shall be marked on the side with the same markings as required for the side of the box shown on Drawing 8858848. DOT markings shall be in accordance with CFR 49, section 173.93 (f) and the applicable Hazardous Component Safety Data Statement.

5.2.3 Special marking. All level C containers shall have a printed label affixed to the side with the following information:

AFTER TWO YEARS FROM DATE OF MANUFACTURE, APPROVAL BY THE RESPONSIBLE PROCURING AGENCY IS REQUIRED PRIOR TO THE LOADING OF THIS PROPELLANT INTO SMALL ARMS AMMUNITION

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not manatory.)

6.1 Intended use. Propellants procured under this specification are intended to be used in small arms ammunition listed in Table I by caliber, type and model.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- (a) Title, number, and date of this specification
- (b) Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1)
- (c) Nomenclature of propellant and the caliber, type and model of cartridge for which it is intended.
- (d) Quantity required
- (e) Applicable technical data package
- (f) Provisions for the supply of the following, when applicable: 1) test equipment, 2) production cartridges, 3) production components, 4) reference cartridges, 5) reference propellant, 6) trace initiation performance data of the tracer bullets (percentage) will be available from the supplying agency

- (g) Type of packing required (see 5.1)
- (h) Provisions for submission of first article samples and acceptance inspection reports containing propellant description sheets and ballistic acceptance test results for each lot of propellant presented to the Government.

6.3 Definition of appropriate test cartridge. The appropriate test cartridges for all propellant acceptance tests shall be the same caliber, type and model for which the propellant is intended and shall be assembled from components manufactured under production conditions as follows: 1) Propellant under test, 2) Primed case, 3) Bullet or wadding as applicable. The test cartridges shall also be waterproofed and crimped if specified on the appropriate cartridge drawing.

6.4 Submission of first article samples. Instructions as to the location for evaluation of the first article shall be obtained from the contracting officer. Upon receipt of such request, the contracting officer shall advise Picatinny Arsenal. All inquiries should be forwarded to : Commander, AMCCOM, ATTN: AMSMC-QAM-A, Rock Island, Illinois 61299.

6.5 Submission of inspection equipment designs for approval. Submit equipment designs, as required, to Commander, ARDEC, AMCCOM, ATTN: SMCAR-QAR-I, Picatinny Arsenal, NJ 07806-5000. This address will be specified on the Contract Data Requirements List, DD Form 1423 in the Contract.

6.6 Submission of surveillance samples. Five (5) pounds of propellant shall be forwarded to Commander, AMCCOM, ATTN: SMCAR-AEE-WE (D), Picatinny Arsenal, NJ 07806-5000 for the 65.5 degree C surveillance test.

6.7 Equivalent test method approval. Prior approval of the contracting officer is required for use of equivalent test methods. A description of the proposed method should be submitted thru the contracting officer to: Commander, ARDEC, AMCCOM, ATTN: SMCAR-QAR-R, Picatinny Arsenal, NJ 07806-5000. This description should include, but not be limited to, the procedures used, the accuracy and precision of the method, test data to demonstrate the accuracy and precision, and drawings of any special equipment required.

6.8 Qualification of sources. Propellant sources who have not produced the item or have been out of production of the item for more than 5 years shall submit a process description for the propellant to be procured which shall include process quality control measures to: Commander, ARDEC, AMCCOM, ATTN: SMCAR-CCL-SP, Picatinny Arsenal, NJ 07806-5000. If the process is

unfamiliar to ARDEC, a Hazard Classification Evaluation in accordance with Technical Bulletin (TB) 700 will be required. Additionally, the first production lot shall be subject to the following test which will be witnessed by the Government:

- a. A First Article Test in accordance with paragraph 4.3 of this specification.
- b. A First Article Test in accordance with MIL-C-60616 for 5.56MM Blank Cartridge type propellants and MIL-C-46933 for 7.62MM Blank Cartridge type propellants.

6.9 Material Safety Data Sheets. Contracting Officers will identify those activities requiring copies of completed Material Safety Data Sheets prepared in accordance with FED-STD-313. The pertinent mailing addresses for submission of data are listed in appendix B of FED-STD-313.

6.10 Subject term (key word) listing.

Powder
Small Caliber Ammunition
Small Caliber Propellant

Custodians:
Army - AR
Navy - OS

Preparing activity:
Army - AR

(Project 1376-0404)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:

1. DOCUMENT NUMBER
MIL-P-3984J

2. DOCUMENT DATE (YYMMDD)
25 May 1992

3. DOCUMENT TITLE

PROPELLANTS FOR SMALL ARMS AMMUNITION

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets if needed.)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle initial)

b. ORGANIZATION

c. ADDRESS (Include Zip Code)

d. TELEPHONE (Include Area Code)

7. DATE SUBMITTED
(YYMMDD)

(1) Commercial
(2) AUTOVON
(if applicable)

8. PREPARING ACTIVITY

a. NAME
US ARMY ARDEC
STANDARDIZATION OFFICE

b. TELEPHONE (Include Area Code)

(1) Commercial (2) AUTOVON
(201) 724-6675 880-6675

c. ADDRESS (Include Zip Code)

ATTN: SMCAR-BAC-S
PICATINNY ARSENAL, NJ 07806-5000

IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:
Defense Quality and Standardization Office
5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466
Telephone (703) 756-2340 AUTOVON 289-2340