

INCH-POUND

MIL-C-70725(AR)

2 July 1992

MILITARY SPECIFICATION
 CARTRIDGE, 5.56MM, M862
 SHORT RANGE
 TRAINING AMMUNITION
 PERFORMANCE SPECIFICATION FOR

This specification is approved for use by the U.S. Army Armament, Munitions and Chemical Command, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers quality assurance provisions and preparation for delivery for Cartridge, 5.56mm Short Range Training Ammunition (SRTA).

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 issue of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation.

SPECIFICATIONS

FEDERAL

O-I-503	-Insect Repellant
O-T-620	-Trichloroethane - 1,1,1, Technical, Inhabited (Methyl Chloroform)
P-D-680	-Dry Cleaning Solvent
PPP-B-636	-Box, Shipping, Fiberboard
VV-L-800	-Lubricating Oil, General Purpose, Preservative (Water-displacing, Low Temperature)

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.

AMSC N/A

FSC 1305

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

MIL-C-70725(AR)

MILITARY

MIL-P-116 -Preservation, Method of
MIL-C-372 -Cleaning Compound, Solvent, for Bore of
Small Arms and Automatic Aircraft Weapons
MIL-L-2104 -Lubricating Oil, Internal Combustion
Engine, Tactical Service
MIL-A-2550 -Ammunition, General Specification for
MIL-L-14107 -Lubricating Oil, Weapons, Low
Temperature
MIL-L-46000 -Lubricant, Semi-Fluid (Automatic Weapons)
MIL-L-46167 -Lubricant Oil, Internal Combustion Engine,
Arctic
MIL-A-48078 -Ammunition, Standard Quality Assurance
Provisions, General Specification for
MIL-L-63460 -Lubricant, Cleaner and Preservative
for Weapons and Weapon Systems (Metric)

STANDARDS

MILITARY

DOD-STD-100 -Engineering Drawing Practices
MIL-STD-105 -Sampling Procedures and Tables for
Inspection by Attributes
MIL-STD-109 -Quality Assurance Terms and Definitions
MIL-STD-129 -Marking for Shipment and Storage
DOD-STD-480 -Configuration Control - Engineering
Changes, Deviations and Waivers
MIL-STD-636 -Visual 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
MIL-STD-650 -Explosives: Sampling, Inspection and
Testing
MIL-STD-810 -Environmental Test Methods and Engineering
Guidelines
MIL-STD-1168 -Lot Numbering of Ammunition

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

MIL-C-70725(AR)

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 shall be those in effect on the date of the solicitation.

DRAWINGS (See 6.4)

U.S. ARMY ARMAMENT, RESEARCH, DEVELOPMENT AND ENGINEERING CENTER (ARDEC)

PRODUCT AND PACKING DRAWINGS

6006874	- "E" Cardboard Silhouette Target
6109086	- "F" Cardboard Silhouette Target
7643674	-Classification of Cartridge Case Defects Small Arms Ammunition, Arms Ammunition
8421679	-M31A2, Trainfire Target Holding Mechanism
8837375	-ARRADCOM Environmental Testing Criteria for OCONUS Shipping Containers
12002898	- "E" Polyethylene Silhouette Target
12002899	- "F" Polyethylene Silhouette Target
LI12576485	-Inspection Equipment List, Function and Casualty
12598589	-Cartridge, 5.56mm Short Range, M862

PUBLICATIONS

DEPARTMENT OF DEFENSE

JSSPM	-Joint Services Safety and Performance Manual for Qualification of Explosives for Military Use
SCATP-5.56mm Heavy Bullet	-Small Caliber Ammunition Test Procedures for 5.56mm heavy Bullet Cartridges
TB-700-2	-Department of Defense Explosives Hazard Classification Procedures
TOP-3-2-045	-TECOM Test Operating Procedure, Automatic Weapons, Machine Guns, Hand and should Weapons.
TECP-700-700 Vol. III	-Manual of Tests Methods for Small Arms Ammunition

DEPARTMENT OF TRANSPORTATION

Code of Federal Regulations, Title 49

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

MIL-C-70725(AR)

2.2 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted shall be those listed in the issue of the DoDISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS shall be the issue of non-Government documents which is current on the date of the solicitation.

AMERICAN NATIONAL STANDARDS INSTITUTE

ANSI Y14.5M-82

-Dimensioning and Tolerancing

(Application for copies should be addressed to ANSI, 1430 Broadway, New York, NY 10018)

2.3 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 shall take precedence. Nothing in this document, however shall supersede applicable laws and regulations unless specific exemption has been obtained.

3. REQUIREMENTS

3.1 General. The cartridges shall comply with the requirements shown on drawing 12598589, reference specifications and the requirements stated in this section. All of the cartridge components shall be compatible with each other. The primer mix shall be non-corrosive and the propellant shall be smokeless. The cartridge shall be compatible with the 5.56mm 20 and 30 round magazines, as well as bolts, chambers, barrel bores and feed systems of the M16A1 and M16A2 rifles when equipped with an M2 training bolt.

3.2 Qualification. A sample shall be submitted for qualification in accordance with the technical provisions specified herein (see section 4). The purpose of the qualification is to verify that a particular contractor's design is capable of meeting the requirements of this specification. Upon qualification, the contractor's design shall be considered qualified indefinitely. The contractor shall submit level 3 detailed item drawings in accordance with DOD-STD-100, MIL-A-2550 and ANSI Y14.5-82 to the Government for configuration control. All changes shall be submitted in accordance with DOD-STD-480 for review and approval by the Government. The Government reserves the right to subject the revised design to any or all the qualification evaluations specified in 4.3 at the expense of the contractor.

MIL-C-70725(AR)

3.3 First article inspection. When specified in the contract or purchase order, a sample shall be subjected to first article inspection (see 4.4).

3.4 Performance characteristics.

3.4.1 Primer sensitivity. The average height (h) and standard deviation(s) of the height of fire shall be such that $h+3s \leq 13"$ and $h-3s \geq 2.5"$.

3.4.1.2 Residual stress. The cartridge shall not split when subjected to the accelerated stress test for the applicable materials.

3.4.1.3 Bullet pull. The force required to separate the bullet from the cartridge case shall not be less than 156N (35 lbf).

3.4.1.4 Waterproof.

3.4.1.4.1 Waterproof (Bubble test). The cartridge shall release not more than one bubble of air when tested at a pressure 13.8 kPa (2 psi) below atmospheric pressure for 30 seconds. As an alternate procedure or for retesting use the waterproof (firing) procedure below.

3.4.1.4.2 Waterproof (Firing test). After immersion in 20°C (68°F) water for 24 hours the mean velocity of the test cartridges shall not vary from the mean velocity obtained in the 20°C dry test by more than ± 30 mps (98 fps).

3.4.2 Chamber pressure. The mean chamber pressure of cartridges, using a Government approved piezoelectric transducer, conditioned at 20°C (68°F) shall not exceed 220 MPa (32,000 PSIG). The chamber pressure of any individual cartridge shall not exceed 255 MPa (37,000 PSIG).

3.4.2.1 Chamber pressure at extreme temperatures. The mean chamber pressure of cartridges conditioned at 50°C (122°F) and -20°C (-4°F) shall not increase more than 20 MPa (2,900 PSI) above the mean chamber pressure obtained at 20°C. The chamber pressure of any individual cartridge, conditioned at -55, 20, 50 and 68°C (-65, -4, 122 and 165°F), shall not exceed 255 mpa (37,000 PSIG). Decreased chamber pressure is acceptable.

3.4.3 Velocity. The mean velocity of cartridges conditioned at 20°C (68°F) measured at 4.57m (15 ft) from the muzzle of the weapon shall not vary more than $\pm 6\%$ from the design velocity. The design velocity is the mean velocity (uncorrected) obtained during qualification testing at 20°C. Design velocities shall be established for both 1 in 7" and 1 in 12" twist barrels.

MIL-C-70725(AR)

3.4.3.1 Velocity at extreme temperatures. The mean velocity of cartridges conditioned at 50° (122°F) and -20°C (-4°F) shall not vary by more than +10% from the mean velocity at 20°C (for both 1 in 7" and 1 in 12" twist barrels).

3.4.4 Action time. The action time (overall primer ignition, propellant burning, plus the time taken for the bullet to exit the barrel) of cartridges conditioned at 20°C (68°F), 50°C (122°F) and -20°C (-4°F) shall not exceed 2.5ms.

3.4.5 Dispersion. For both 1 in 7" and 1 in 12" twist barrels, the average of the mean radii of all 10-round targets fired at a distance of 25 meters (m) from the muzzle shall not exceed 30mm.

3.4.5.1 Match. The center of impact of the cartridges fired at targets located 25m from the weapon shall not deviate in a vertical direction by more than 20mm when compared to M193 Ball (when fired in a 1 in 12" twist barrel) and the M855 Ball (when fired in a 1 in 7" twist barrel).

3.4.6 Function and casualty. The cartridge shall function without casualty within the temperature range of -20° to 50°C in the M16A1 and M16A2 rifles equipped with the M2 training bolt. The cartridge shall safely function (no critical firing defects) within the temperature range of -55°C to 68°C.

3.4.6.1 Cyclic rate. The cartridge shall function in the M16A1 and M16A2 rifles equipped with the M2 training bolt at an average cyclic rate between 550 and 920 rounds per minute within the temperature range of -20°C to 50°C.

3.4.6.2 Noise level. The noise level of the cartridges shall be greater than 100 decibels when the noise level of ball cartridges fired under identical conditions is between 120 and 130 decibels. The noise level of the cartridges at the gunner's ear position shall not exceed 164 decibels.

3.4.6.3 Breech flash. Firing the cartridges shall not cause breech flash which would endanger the shooter.

3.4.6.4 Hot chamber effects. A cartridge inserted into the chamber immediately following the firing of 150 cartridges shall not fire (cook off). In addition the cartridge shall not deform to the extent that clearing of the weapon is made difficult following the proper waiting period.

MIL-C-70725(AR)

3.4.6.5 Chemical compatibility. The cartridge shall be safe to store and fire (no critical defects as defined by Table IV) when subjected to the lubricants and solvents listed below. The reliability of the cartridge shall not degrade by more than 0.10 after exposure to the following substances (see 6.7.2):

<u>Material</u>	<u>Specification</u>
Bore Cleaner (RBC)	MIL-C-372
Insect Repellent	0-I-503
Trichloroethane solvent	0-T-620
Dry-cleaning Solvent (SD-1)	P-D-680
Lubricating Oil (PL-S)	VV-L-800
Lubricating Oil (ICE, T)	MIL-L-2104
Lubricating Oil (LAW)	MIL-L-14107
Lubricating Oil (LSA)	MIL-L-46000
Lubricating Oil (ICE, A)	MIL-L-46167
Lubricant, (CLP)	MIL-L-63460

3.4.6.6 Bullet integrity. The bullet of the cartridge shall not burst or fragment in the barrel or during its effective range when fired.

3.4.6.7 Ricochet. The bullet or bullet fragments shall not ricochet back and endanger the shooter or others located on the firing line, when fired at wood, metal or masonry targets at a distance of 5 meters, and target obliquities between 0 and 30 degrees normal to the line of fire.

3.4.6.8 Muzzle flash. The muzzle flash made by firing cartridges shall be visible in darkness from 100 meters (109 yds) in front of the weapon.

3.4.6.9 Fouling. The fouling produced by firing 1000 rounds shall be readily removable through standard cleaning methods and shall not cause a change in the cyclic rate greater than 15%. The average mean radius of all targets (at 25 meters) fired after the firing of the 1000 fouling rounds, shall not exceed 40mm (1.57").

3.4.6.10 Target kill. The test cartridges shall mark standard polyethylene and cardboard "E" and "F" silhouette targets sufficiently to indicate target hits, and activate standard target mechanisms at a range of 25 meters.

3.4.6.11 Attitude. The cartridge shall be safe to fire (no critical defects as defined by Table IV) and the reliability shall not degrade by more than 0.10 (see 6.7.2) when fired at elevations between $\pm 85^\circ$.

MIL-C-70725(AR)

3.4.6.12 Maximum range. The maximum range of the cartridge (when fired at standard atmospheric conditions) shall be no greater than 250 meters. All bullets of cartridges fired at the maximum range shall impact the ground within a safety fan defined as 5° to the left and 5° to the right of the line of fire.

3.5 Environmental.

3.5.1 Sand and dust. The cartridges shall be safe to fire (no critical defects as defined in Table IV) when being subjected to sand and dust.

3.5.2 Corrosion. The cartridge shall be safe to store and fire (no critical defects as defined in Table IV) after being subjected to a 5% salt spray.

3.5.3 Temperature/humidity cycling. The cartridge shall be safe to store and fire (no critical defects as defined in Table IV) after being subjected to a 4 day temperature/humidity cycle. The reliability of the cartridge shall not degrade by more than 0.05 (see 6.7.2) and the cyclic rate shall not change by more than 15% after being subjected to the temperature/humidity cycle.

3.5.4 Long term high temperature. The cartridge shall be safe to store and fire (no critical defects as defined in Table IV) after being subjected to 120 days continuous heating at 50°C (125°F). The reliability of the cartridge shall not degrade by more than 0.05 (see 6.7.2) and the cyclic rate shall not change by more than 15% when the cartridge is subjected to continuous heating.

3.5.5 Long term low temperature. The cartridge shall be safe to store and fire (no critical defects as defined in Table IV) after being subjected to 30 days continuous cooling at -40°C (-40°F). The reliability of the cartridge shall not degrade by more than 0.05 (see 6.7.2) and the cyclic rate shall not change by more than 15% when the cartridge is subjected to continuous cooling.

3.5.6 Rough handling. The cartridge shall be safe to store and fire (no critical defects as defined in Table IV) when subjected to rough handling. The cartridge shall remain waterproof and the reliability of the cartridge shall not degrade by more than 0.05 (see 6.7.2) when subjected to rough handling.

3.5.7 Toxic fumes. The toxic fumes produced by the cartridge shall be acceptable to the Surgeon General for the applicable training scenarios and shall not exceed those produced by firing similar quantities of 5.56mm, Ball M193 ammunition.

MIL-C-70725(AR)

3.6 Safety.

3.6.1 Safety hazard classification. The safety hazard classification for the cartridge packed for shipping and storage shall be:

DOD Hazard Class: 1.4
 DOD Storage Compatibility Group: S
 DOT Hazard Class: Class C Explosive
 DOT Container Marking: Small Arms Ammunition

3.6.2 Net explosive weight. The net explosive weight of the cartridge (sum of propellant, primer and any other pyrotechnic material) shall not exceed 25 grains.

3.6.3 Explosive sensitivity. Explosive sensitivity data for all materials utilized in the cartridge must be on file with the ARDEC Safety office. The sensitivity for these materials shall be as indicated below:

<u>Sensitivity Test</u>	<u>Results</u>
a. Impact, ERL type 12 tool 2.4 kg, cm @ 50% point	20 cm (min)
b. Friction Pendulum -Steel Shoe -Fiber Shoe	Burn - no detonation Burn - no detonation
c. Electrostatic Discharge 0.030 Joule	No detonation in 20 tests
d. Differential Thermal Analysis	200 C (min)

3.7 Workmanship. All plastic parts shall exhibit thorough workmanship. They shall be free of porosity, twist, warpage, heat marks, sinks, voids, cracks, chipped edges, burrs, bubbles, blisters, burn marks or other defects that would affect their serviceability. All metal parts shall exhibit thorough workmanship. They shall be free of burrs, chips, chipped edges, gouges, cracks, splits, surface defects, dust, dirt, grease, oil, lacquer smears, and other foreign matter. The cleaning methods used shall not be injurious to any part, nor shall the parts be contaminated by any cleaning agent. All assemblies shall exhibit thorough workmanship. Extreme care should be exercised to avoid contamination of primers or propellant by oil, grease or other foreign matter. Salvage operations or rework shall not be permitted without prior approval of the contracting officer.

MIL-C-70725(AR)

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 utilize 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 inspection set forth in the specification where such inspection are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall 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 requirement 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 Quality assurance terms and definitions. Reference shall be made to MIL-STD-109 for definitions of quality assurance terms encountered.

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

- a. Qualification (See 4.3).
- b. First Article Inspection (See 4.4)
- c. Quality Conformance Inspection (See 4.5)

4.3 Qualification.

4.3.1 Submission. The contractor shall submit a Qualification sample of 75,000 cartridges as designated by the Contracting Officer for evaluation in accordance with the provisions of 4.3.3.

4.3.2 Qualification sample. The qualification sample shall be of the same design as will be submitted for normal production. It shall be manufactured using the same materials and processes as will be used in normal production. Equipment utilized to manufacture the qualification sample shall embody the process

MIL-C-70725(AR)

techniques to be used in normal production. Qualification samples shall not be custom made in such a way that causes the product quality to be different than that which can be expected in normal production.

4.3.3 Inspections to be performed. See MIL-A-48078 and Table I. Examination for critical, major and minor defects shall be performed on a class basis. The sample to be examined shall be drawn in such a way that it is representative of the entire quantity submitted. Non-conforming cartridges shall be rejected and put aside for further examination. Disposition instructions for non-conforming cartridges shall be provided by the contracting officer.

4.3.4 Rejection. See MIL-A-48078. The qualification sample shall be rejected if any one of the following occurs:

- a. The qualification sample fails to conform with the applicable drawings and requirements of Tables I and IV.
- b. The materials and process techniques utilized to manufacture the sample could not be applied in normal production.
- c. The equipment utilized to manufacture the sample does not represent the equipment to be used in normal production.

4.3.5 Basis for qualification. Contractors that meet all of the qualification requirements will be placed on the qualified vendor's list. The vendor shall remain on the list as long as the same design and materials are used.

TABLE I. QUALIFICATION

CLASSIFICATION OF CHARACTERISTICS

MIL-C-70725 (AR)

PARAGRAPH	TITLE	SHEET 1 OF 5		DRAWING NUMBER 12598589
	Cartridge, 5.56mm Short Range, M862			NEXT HIGHER ASSEMBLY
CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
	Examination for defects	800	3.1	4.3.3, Table V
	Major Class	2 - 3		
	Minor Class	12 - 13		
	Primer sensitivity	500 $\frac{1}{/}$	3.4.1.1	4.6.1
	Residual Stress	100 0 - 1	3.4.1.2	4.6.2
	Bullet Pull	100 0 - 1	3.4.1.3	4.6.3
	Waterproof	50 11 - 16	3.4.1.4	4.6.4, 4.6.5
	EPVAT (Electronic Pressure, Velocity, Action Time)	100 26 - 27	3.4.1.5	
	-550C $\frac{2}{/}$	40 $\frac{1}{/}$	3.4.2,	4.6.6
	-200C $\frac{2}{/}$	120 $\frac{1}{/}$	3.4.3,	
	+200C $\frac{2}{/}$	120 $\frac{1}{/}$	3.4.4	
	+500C $\frac{2}{/}$	120 $\frac{1}{/}$		
	+680C $\frac{2}{/}$	40 $\frac{1}{/}$		
	Dispersion	300 $\frac{1}{/}$	3.4.5	4.6.7
	1 in 12" test barrel	300 $\frac{1}{/}$		
	1 in 7" test barrel			
NOTES:	$\frac{1}{/}$ Check for compliance with the requirement. $\frac{2}{/}$ Divided equally among 1 in 7" barrels and 1 in 12" barrels.			

Replaces 1570, 1 Feb 85, which may not be used.

AMSMC Form 1570b, 1 Jul 89

TABLE I. QUALIFICATION
CLASSIFICATION OF CHARACTERISTICS

MIL-C-70725 (AR)

PARAGRAPH	TITLE	SHEET 2 OF 5		DRAWING NUMBER
	Cartridge, 5.56mm Short Range, M862			12598589
				NEXT HIGHER ASSEMBLY
CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
	Matching	300 1/ 300 1/	3.4.5.1	4.6.7.1
	M16A1 Function & Casualty	500 1/ 500 1/ 7500 Table IV 7500 Table IV 7500 Table IV	3.4.6	4.6.8, 4.6.8.1
	M16A2 Function & Casualty	500 1/ 500 1/ 7500 Table IV 7500 Table IV 7500 Table IV	3.4.6	4.6.8, 4.6.8.1
	Cyclic Rate	--	3.4.6.1	4.6.9 5/
	Noise (M16A2 only)	60	3.4.6.2	4.6.10
	Breechflash	0 - 1 18 - 19 74 - 75	3.4.6.3	4.6.11 5/
	Critical			
	Major			
	Minor			

NOTES: 1/ Check for compliance with the requirement.

3/ Divided equally among 5 weapons.

4/ Both the test weapons and the ammunition shall be temperature conditioned.

5/ Conducted simultaneously with function and casualty.

TABLE I. QUALIFICATION
CLASSIFICATION OF CHARACTERISTICS

MIL-C-70725 (AR)

PARAGRAPH	TITLE	SHEET 3 OF 5		DRAWING NUMBER
	Cartridge, 5.56mm Short Range, M862			12598589 NEXT HIGHER ASSEMBLY
CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
	Hot chamber effects (M16A1 only)	242 1/ 1100 1/	3.4.6.4 3.4.6.5 3.4.6.6	4.6.12 4.6.13 4.6.14
	Bullet integrity	M16A1 7/ M16A2 7/		5/ 5/ 4.6.15
	Ricochet	M16A1 8/ M16A2 8/		
	Muzzle Flash	M16A1 M16A2		4.6.16
	Fouling	--	3.4.6.9	4.6.17
	Cyclic rate test			
	Accuracy test	M16A1 11/ M16A2 11/	3.4.6.10	4.6.18
	Target kill	M16A1 M16A2		
	Attitude	M16A1 M16A2	3.4.6.11	4.6.19

NOTES: 1/ Check for compliance with the requirement. 5/ Conducted simultaneously with function and casualty. 6/ Conducted twice with 121 rounds each time. 7/ 100 rounds will be evaluated at each temperature (+20°C, -20°C, +50°C) in each weapon (M16A1, M16A2). For each weapon type, the results of all 3 temperatures combined shall meet 300-4-5. 8/ 30 rounds fired at each target type. 11/ Divided equally among 3 weapons.

TABLE I. QUALIFICATION

CLASSIFICATION OF CHARACTERISTICS

MIL-C-70725 (AR)

PARAGRAPH	TITLE	SHEET 4 OF 5		DRAWING NUMBER
	Cartridge, 5.56mm Short Range, M862			12598589
				NEXT HIGHER ASSEMBLY
CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
	Maximum range	480 480	3.4.6.12	4.6.20
	Sand & Dust	500 500	3.5.1	4.6.21
	Corrosion	100	3.5.2	4.6.22
	Temperature/Humidity cycling	1000 1000	3.5.3	4.6.23
	Long Term High Temperature	1000 1000	3.5.4	4.6.24
	Long Term Low Temperature	1000 1000	3.5.5	4.6.25

NOTES: 1/ Check for compliance with the requirement.

TABLE I. QUALIFICATION

CLASSIFICATION OF CHARACTERISTICS

MIL-C-70725 (AR)

PARAGRAPH	TITLE	SHEET 5 OF 5	DRAWING NUMBER	INSPECTION METHOD REFERENCE
	Cartridge, 5.56mm Short Range, M862		12598589	
			NEXT HIGHER ASSEMBLY	
CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
	Rough handling M16A1 M16A2 Waterproof	1000 1000 150 <u>1/</u> <u>1/</u>	3.5.6 3.4.1.4	4.6.26 4.6.4, 4.6.5
	Toxic fumes M16A1 M16A2	150 150 <u>1/</u> <u>1/</u>	3.5.7	4.6.27
	Safety hazard classification Explosive Sensitivity <u>10/</u>	9/ <u>9/</u>	3.6 3.6.3	4.6.28 4.6.29
<p>NOTES: <u>1/</u> Check for compliance with the requirement. <u>9/</u> To be conducted by the contractor after all other requirements for qualification have been met. This will require approximately 10,000 rounds packed in accordance with Section 5, packing. <u>10/</u> Test as required by the ARDEC Safety Office.</p>				

MIL-C-70725(AR)

4.4 First article inspection.

4.4.1 Submission. The contractor shall submit a first article as designated by the Contracting Officer for evaluation in accordance with Table II. The first article sample shall be of the same design as will be submitted for regular production. It shall be manufactured using the same materials, equipment, processes and procedures as will be used for regular production. First article samples shall not be specially selected or custom made in a way that causes the product quality to be different than what can be expected from regular production. The first article sample shall consist of 30,000 cartridges.

4.4.2 Inspection to be performed. See MIL-A-48078 and Table II. Examination for critical, major and minor defects shall be performed on a class basis. The sample to be examined shall be drawn in such a way that it is representative of the entire quantity submitted. Nonconforming cartridges shall be rejected and put aside for further examination. Disposition instructions for non-conforming cartridges shall be provided by the contracting officer.

4.4.3 Rejection. See MIL-A-48078. Failure of the original first article sample to be in accordance with the applicable drawings, requirements and Table II will result in disapproval of the first article sample.

TABLE II. First article inspection

CLASSIFICATION OF CHARACTERISTICS

MIL-C-70725 (AR)

PARAGRAPH	TITLE	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
	Cartridge, 5.56mm Short Range, M862			SHEET 1 OF 3	DRAWING NUMBER 12598589 NEXT HIGHER ASSEMBLY
CLASSIFICATION			ACC-REJ		
	Examination for defects	Major class	800	3.1	4.4.2, Table V
		Minor class	2 - 3		
	Primer sensitivity		12 - 13	3.4.1.1	4.6.1
	Residual stress		1/	3.4.1.2	4.6.2
	Bullet pull		0 - 1	3.4.1.3	4.6.3
	Waterproof		0 - 1	3.4.1.4	4.6.4, 4.6.5
	EPVAT (Electronic pressure, velocity action time)		11 - 16	3.4.1.5	
			26 - 27	3.4.2,	4.6.6
				3.4.3,	
				3.4.4	
	Dispersion		120	3.4.5	4.6.7
		+20°C	1/		
		-20°C	1/		
		+50°C	1/		
		1 in 12" test barrel	300		
		1 in 7" test barrel	300		

NOTES: 1/ Check for compliance with the requirement.

TABLE II. First article inspection
CLASSIFICATION OF CHARACTERISTICS

PARAGRAPH		TITLE	SHEET 2 OF 3		MIL-C-70725 (AR)	
		Cartridge, 5.56mm Short Range, M862			DRAWING NUMBER	12598589
					NEXT HIGHER ASSEMBLY	
CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE		
	Matching	M16A1 M16A2	3.4.5.1	4.6.7.1		
	M16A1 Function & Casualty	+200C -200C +500C	3.4.6	4.6.8		
	M16A2 Function & Casualty	+200C -200C +500C	3.4.6	4.6.8		
	Cyclic Rate		3.4.6.1	4.6.9 3/		
	Breech flash		3.4.6.3	4.6.11 3/		
	NOTES: 1/ Check for compliance with the requirement. 2/ Divided equally among 3 weapons. 3/ Conducted simultaneously with function and casualty.					

TABLE II. First article inspection

CLASSIFICATION OF CHARACTERISTICS

MIL-C-70725 (AR)

PARAGRAPH	TITLE	SHEET 3 OF 3	DRAWING NUMBER 12598589 NEXT HIGHER ASSEMBLY
CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH
	Cartridge, 5.56mm Short Range, M862		INSPECTION METHOD REFERENCE
	Bullet integrity	M16A1 <u>4/</u> M16A2 <u>4/</u>	4.6.14 <u>3/</u> <u>3/</u>
	Fouling	Cyclic Rate Accuracy Test M16A1 <u>2/</u> M16A2 <u>2/</u>	4.6.17 <u>3/</u>

		2100 <u>1/</u> 2100 <u>1/</u>	
NOTES:	<p>1/ Check for compliance with the requirement. 2/ Divided equally among 3 weapons. 3/ Conducted simultaneously with function and casualty. 4/ 100 rounds will be evaluated at each temperature (+20°C, -20°C, +50°C) in each weapon (M16A1, M16A2). For each weapon type, the results of all 3 temperatures combined shall meet 300-4-5.</p>		

MIL-C-70725(AR)

4.5 Quality conformance inspection.4.5.1 Lot formation. In accordance with MIL-A-48078.

4.5.1.1 Component part. Unless otherwise specified, component parts shall be homogeneous and of a lot size convenient to the contractor and inspected, tested and accepted by the contractor. The cartridge lot shall contain:

- a. Cartridge cases from one interfix.
- b. Bullets from one interfix.
- c. Primers from one interfix and not more than 2 lots.
- d. Propellant from one interfix and not more than 2 lots.

4.5.1.2 Lot identification. Each lot of ammunition shall be identified as to type, caliber and model, as well as a lot number in accordance with MIL-STD-1168.

4.5.2 Inspections to be performed. Lot testing requirements, if necessary, for explosive materials unique to the cartridge shall be provided by the ARDEC Safety Office through the contracting agency prior to contract award.

4.5.3 Examinations and tests.

a. Major and minor defects. Examination for major and minor defects shall be performed on a class basis in accordance with the classification of defects using applicable sampling plans and acceptance criteria of MIL-STD-105, Inspection Level II. The acceptance quality level (AQL) shall be as specified in table V. All non-conforming cartridges shall be rejected.

b. Critical defects. Unless otherwise specified, one hundred percent examination shall be performed for all critical defects. If a visual critical defect is found in a sample either just prior to a firing test or after a firing test (and the defect is not due to the firing), the lot shall be rejected.

c. Special defects. Unless otherwise specified, one hundred percent examination shall be performed for all special defects. If a visual special defect is found in a sample either just prior to a firing test or after a firing test (and the defect is not due to the firing) the lot shall be rescreened and a failure analysis report submitted.

4.5.4 Test samples. Only cartridges having met the visual and dimensional 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.

MIL-C-70725(AR)

4.5.5 Function and casualty retest. The lot shall be rejected when function and casualty defects plus firing defects observed in all other firing tests exceeds the acceptance criteria of Table IV. A second sample, consisting of double the quantities specified under the function and casualty test, shall be fired. The retest quantity shall be fired in accordance with 4.6.8 and appendix C. If the total number of defects in the combined first and second samples exceeds the acceptance criteria of Table IV, the lot shall be rejected. If, in testing a second sample, defects other than those for which the second sample is being retested should occur to the extent that they exceed the acceptance criteria, the lot shall be rejected.

QUALITY CONFORMANCE INSPECTION

MIL-C-70725 (AR)

CLASSIFICATION OF CHARACTERISTICS

PARAGRAPH	TITLE	SHEET 1 OF 2		DRAWING NUMBER
4.5.3.1	Cartridge, 5.56mm Short Range, M862			12598589
				NEXT HIGHER ASSEMBLY
CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
	Examination for defects	---	3.1	4.5.3, Table V
	Major Class	500 <u>1/</u>	3.4.1.1	4.6.1
	Minor Class	50 <u>2/</u>	3.4.1.2	4.6.2
	Primer sensitivity	50 <u>3/</u>	3.4.1.3	4.6.3
	Residual stress	50		
	Bullet pull	50		
	Waterproof	50 <u>11-16</u>	3.4.1.4	4.6.4, 4.6.5
	EPVAT (Electronic pressure, velocity action time)	50 <u>4/</u>		
	+20°C	80 <u>5/</u>	3.4.2,	4.6.6
	-20°C	80 <u>5/</u>	3.4.3,	
	+50°C	80 <u>5/</u>	3.4.4	
	Dispersion	120 <u>1/</u>	3.4.5	4.6.7
	1 in 12" test barrel	120 <u>1/</u>		
	1 in 7" test barrel			

NOTES:

1/, 2/, 3/, 4/, 5/ - See Table III

QUALITY CONFORMANCE INSPECTION

CLASSIFICATION OF CHARACTERISTICS

MIL-C-70725 (AR)

PARAGRAPH	TITLE	SHEET 2 OF 2		DRAWING NUMBER		
		EXAMINATION OR TEST	CONFORMANCE CRITERIA		REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
4.5.3.1	Cartridge, 5.56mm Short Range, M862			12598589	NEXT HIGHER ASSEMBLY	
CLASSIFICATION	M16A1 Function & Casualty	+20°C -20°C +50°C	6/ <u>6</u> / <u>6</u> / 6	1000 Table IV 600 Table IV 600 Table IV	3.4.6	4.5.5, 4.6.8
	M16A2 Function & Casualty	+20°C -20°C +50°C	6/ <u>6</u> / <u>6</u> / 6	1000 Table IV 600 Table IV 600 Table IV	3.4.6	4.5.5, 4.6.8
	Cyclic Rate Bullet integrity	M16A1 M16A2	9/ <u>9</u> / <u>9</u> / 9	--- 7/ 9/ <u>9</u> / 9/	3.4.6.1 3.4.6.6	4.6.9 8/ 4.6.14 8/ <u>8</u> / 8/

NOTES:

6/
7/
8/
9/ - See Table III

MIL-C-70725(AR)

TABLE IIINOTES

1/ Failure to comply with the applicable requirement shall be cause for rejection of the lot subject to testing of a second sample consisting of double the quantity 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.

2/ Failure of 2 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 may be tested. If any failing cartridges are found in the second sample, the lot shall be rejected.

3/ Failure of 3 or more cartridges to comply with the applicable requirement shall be cause for rejection of the lot. If one or two 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 3 or more cartridges fail to comply with the applicable requirement.

4/ Failure of 16 or more cartridges to comply with the bubble test requirement shall be cause for the rejection of the lot. If more than 11 but less than 16 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, 27 or more cartridges fail to comply with the bubble test requirement. The waterproof firing/velocity test (3.4.1.4.2, 4.6.5) may be substituted for the bubble test in the first test or the retest, using the same sample sizes.

5/ Failure of the cartridges in any sample to comply with the applicable requirements, shall be cause for rejection of the lot, subject to testing of a second sample consisting of double the quantity of cartridges used in the first test, for the temperature or temperatures at which the failure occurred. The lot shall be rejected if the cartridges in the second sample fail to comply with the applicable requirements.

6/ Divided equally among 2 weapons.

7/ Check for compliance with the requirement.

8/ Conducted simultaneously with function and casualty.

MIL-C-70725(AR)

9/ 100 rounds will be evaluated at each temperature (+20°C, -20°C, +50°C) in each weapon (M16A1, M16A2). In the combined results for each weapon type (300 rounds), failure of 5 or more cartridges to comply with the applicable requirements shall be cause for rejection of the lot. If more than 2 but less than 5 cartridges fail in the first test, a second sample consisting of double the number of cartridges in the first sample shall be evaluated. The lot shall be rejected if in the combined first and second sample, 5 or more cartridges fail to comply with the requirement.

MIL-C-70725(AR)

TABLE IV. Firing defects

Class	Criteria <u>1/</u>
Critical	none allowed
1. Bullet in bore	
2. Complete or partial rupture (dwg. 7643674, locations S, J, K, and L)	
3. Detached material (upon firing)	
4. Burn through	
5. Slamfire <u>2/</u>	
6. Uncontrolled fire (3 rounds or greater) <u>3/</u>	
7. Other critical <u>4/</u>	
Major	Total majors allowed per 1000 rounds = 2.5
101. Blown or dropped primer	
102. Split body or head (dwg. 7643674, locations J, K, L, and M)	
103. Gas leak at body/head interface	
104. Misfire	
105. Uncontrolled fire (2 rounds or less) <u>5/</u>	
106. Other major <u>6/</u>	
Minor (Group A)	Total Group A minors allowed per 1000 rounds = 10
201. Split neck, shoulder or mouth (dwg. 7643674, locations I and S)	
202. Gas leak through or around primer cup	
203. Detached material (upon extraction)	
204. Other minor <u>7/</u>	
Minor (Group B)	Total Group B minors allowed per 1000 rounds = 10
205. Stoppage (attributable to ammunition) <u>8/</u>	

Notes:

1/ This table shall be applied separately to the results of each weapon type at each temperature condition.

2/ A slamfire occurs when a round is unintentionally fired by manually closing the weapon bolt, without depressing the trigger of the weapon.

3/ Uncontrolled fire of 3 rounds or greater occurs when 3 or more rounds are fired in excess of that expected to be fired. For example, if in single shot mode, one trigger pull produces 4 or more rounds to fire, or in three round burst mode, one trigger pull causes 6 or more rounds to fire.

MIL-C-70725(AR)

4/ Any other defect that is likely to result in hazardous or unsafe conditions.

5/ Uncontrolled fire of 2 rounds or less occurs when 1 or 2 rounds are fired in excess of that expected to be fired. For example, if in single shot mode, one trigger pull produces 2 or 3 rounds to fire, or if in three round burst mode, one trigger pull produces 4 or 5 rounds to fire.

6/ Any other defect that is not critical but is likely to result in failure or to reduce materially the usability of the round or weapon for its intended purpose.

7/ Any other defect that is not likely to reduce materially the usability of the round or weapon for its intended purpose or is a departure from established standards having little bearing on the effective use or operation of the round.

8/ Weapon Stoppages which are classified as Bolt Overriding Base (BOB) defects, will not be attributed to the ammunition. (See appendix C, section 70.1 for definition of BOB).

TABLE V. Cartridge Inspections

CLASSIFICATION OF CHARACTERISTICS

MIL-C-70725 (AR)

PARAGRAPH	TITLE	SHEET 1 OF 3		DRAWING NUMBER
	Cartridge, 5.56mm Short Range, M862			12598589
				NEXT HIGHER ASSEMBLY
CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD REFERENCE
<u>Critical:</u>				
1.	Case split in K, L or M location (6)	100%	3.1	Visual
2.	Case split in S or J location with loss of powder (6)	100%	3.1	Visual
3.	Perforated case (7)	100%	3.1	Visual
4.	Low charge <u>2/</u>	100%	3.1	Visual/Gage
5.	Other <u>3/</u>	100%	3.1	Gage
<u>Special:</u>				
a.	Primer missing (32)	100%	3.1	Visual
b.	Primer cocked (33)	100%	3.1	Visual
c.	Primer inverted (34)	100%	3.1	Visual
<u>Major:</u>	(Class AQL-0.25% except for major 101)			
101.	Case split in S or J location with no loss of powder	100%	3.1	Visual
102.	Corroded or stained (if etched) case (2)			
103.	Round head (4)			
104.	Dented case (5)			
<u>NOTES:</u>	<p>1/ Numbers after defect descriptions refer to visual standards in MIL-STD-636.</p> <p>2/ The contractor shall submit an analysis that establishes the minimum charge required to preclude the possibility of a bullet in bore. Cartridges containing less than this minimum charge are critically defective.</p> <p>3/ Any other defect which is likely to result in hazardous or unsafe conditions.</p>			

MIL-C-70725(AR)

4.5.6 Packaging, packing and marking. Inspection for packaging, packing and marking shall be in accordance with MIL-STD-644 as applicable to the drawing or as required by the contract. During or immediately prior to the packaging operation, 100% examination of the cartridge shall be performed to ascertain that the cartridge type conforms to the drawing. All non-conforming cartridges shall be rejected.

4.5.7 Inspection equipment. The contractor shall submit inspection equipment designs for approval in accordance with the terms of the contract. See Section 6 of MIL-A-48078 and 6.2 herein.

4.6 Methods of inspection. All firings in the M16A1 and M16A2 rifles shall be performed utilizing a soft mount which simulates shoulder firing conditions. Type AA, 40 pound Kraft, Type I wrapping paper shall be utilized where witness screens are specified.

4.6.1 Primer sensitivity. Test in accordance with the SCATP-5.56mm, Chapter 4 Section 1, and TECP700-700 Vol. III, Subsection 7-25, utilizing the ball and firing pin identified on drawings 10520006 and 10524139. The Complete Rundown Test shall be performed until such time the Government authorizes use of the 2- Height Test (with Complete Rundown Tests performed at some specified interval).

4.6.2 Residual stress.

4.6.2.1 Cartridges with brass cases. Test in accordance with SCATP-5.56mm, Chapter 1, Section 8. Prior to testing, all lubricants and coatings shall be removed from the cartridge case using solvents or cleaning techniques appropriate to the particular lubricant or coating being used.

4.6.2.2 Cartridges with polyethylene cases. Test in accordance with Appendix B.

4.6.2.3 Cartridges with steel cases. Testing not required.

4.6.2.4 Cartridges with cases of other materials. Test in accordance with procedures approved by the Government appropriate to the material(s) used to manufacture the cartridge.

4.6.3 Bullet extraction. The cartridge shall be tested in a Government approved bullet extraction machine in accordance with SCATP-5.56mm, Chapter 1, Section 5. The rate of travel of the test machine head shall be from 75 to 150mm per minute.

MIL-C-70725(AR)

4.6.4 Waterproof. (Bubble test), Test in accordance with SCATP-5.56mm, Chapter 1, Section 14. If the cartridge fails the bubble test, the velocity/waterproof test may be used.

4.6.5 Velocity/waterproof. This test may be substituted for the bubble test. The cartridges shall be submerged in water at +20°C, for 24 hours, wiped dry, then placed in a temperature controlled room or chamber at +20 ± 2°C for at least 2 hours. Fire the cartridges one shot at a time in a universal receiver, recording the velocity at 15 feet in accordance with SCATP-5.56mm, Chapter 1, Section 13. Failure to meet the requirement shall be grounds for rejection.

4.6.6 Chamber pressure, velocity and action time. The test samples shall be conditioned at the test temperatures, + 2°C for at least two hours. The test shall be conducted in accordance with SCATP-5.56mm (Heavy Bullet), Section 7, except that port pressure need not be measured and the firing of reference cartridges shall be conducted only to qualify test barrels (range and equipment corrections will not be applied to test results). For Qualification and first article inspections, testing at +20°C, -20°C and +50°C shall be divided equally among three 1 in 7" and three 1 in 12" twist barrels. Testing at +68°C and -50°C shall be divided equally among one (1) in 7" and one (1) in 12" barrels. For lot acceptance inspection, testing shall be divided equally among two, 1 in 7" and two, 1 in 12" barrels. For acceptance, the average of the results in each barrel type shall meet the applicable requirements. Action time shall only be recorded in one barrel of each type, at each test temperature.

4.6.7 Dispersion. The test shall be conducted in accordance with SCATP-5.56mm, Chapter 1, Section 3 with the following amendments:

a. The rounds shall be tested in both a 1 in 12" twist accuracy barrel, and a 1 in 7" twist accuracy barrel. Three (3) barrels of each type shall be used.

b. Equipment lists for dispersion testing can be found in ARDEC drawings 8654126 and 8649433.

c. Ten round targets shall be fired with the targets located 25 meters from the muzzle of the test barrel. The target shall be of a size applicable to the expected dispersion of the bullet holes.

d. The dispersion test may be conducted concurrently with the matching test. The targets fired in the dispersion test can also be used as the test targets in the matching test.

MIL-C-70725(AR)

4.6.7.1 Accuracy match. The test shall be conducted in accordance with SCATP-5.56mm, Heavy Bullet, Section 11, with the following amendments:

a. The matching test will be conducted to ensure that the trajectory of the test cartridges at 25 meters will resemble the trajectory of the M193 cartridge when fired in the M16A1, and the M855 when fired in the M16A2.

b. The test will require the use of 1 in 12" twist barrels when testing for match with M193 ammunition, and 1 in 7" twist barrels when testing for match with M855 ammunition. For both qualification and first article tests, 3 barrels of each type shall be used.

c. The target for this test shall be located 25 meters from the muzzle of the weapon.

d. The test shall be conducted by comparing reference targets of M193 and M855 ammunition to targets fired with the test cartridges.

The mean center of impact of the ten (10) round reference targets shall be compared to the mean center of impact of the ten (10) round test targets for each barrel (the average of the results in each barrel type shall be compared to the requirement). So the center of impacts of the 10 round targets can be averaged, the targets shall be mounted and clearly marked against common reference points, such as marks on the target holding stand. This will assure consistency in the location of all targets.

e. The matching test may be conducted concurrently with the dispersion test. The test targets fired in the matching test may also be measured for mean radius, and the results used for the dispersion test.

4.6.8 Function and casualty. Function and casualty and the following tests shall be conducted in accordance with Appendix C: Cyclic rate, Bullet Integrity, Breech Flash, Fouling Cyclic Rate and Cartridge Ejection.

4.6.8.1 Function and casualty acceptance criteria for qualification. In view of the expenses associated with firing function and casualty tests with both ammunition and weapons temperature conditioned, the following shall be employed:

The occurrence of any critical defect shall be cause for rejection.

MIL-C-70725(AR)

Function and Casualty Qualification testing at -55°C and $+68^{\circ}\text{C}$ shall be conducted with both ammunition and weapons conditioned at the test temperature. The acceptance criteria on Table IV, for all defect classes, shall be applied to the results of this testing.

a. If acceptable performance in accordance with Table IV at -55°C and $+68^{\circ}\text{C}$ is achieved, the remainder of the function and casualty tests (-20°C , $+20^{\circ}\text{C}$, $+50^{\circ}\text{C}$) may be conducted with only the ammunition being temperature conditioned. The results of these firings must meet all Table IV acceptance criteria.

b. Failure of the -55°C or $+68^{\circ}\text{C}$ firings to meet all Table IV criteria for major or minor defects does not cause rejection, however, requires firing a portion of the function and casualty (F&C) testing at the less extreme temperatures (-20°C or $+50^{\circ}\text{C}$), with both weapon and ammunition conditioned at the test temperature. This shall be accomplished as follows:

(1) Failure at -55°C will require firing 1000 rounds at -20°C with both ammunition and weapon conditioned at the test temperature.

(2) Failure at $+68^{\circ}\text{C}$ will require firing 1000 rounds at $+50^{\circ}\text{C}$ with both ammunition and weapon conditioned at the test temperature.

(3) The 1000 rounds shall be divided equally among 2 weapons of the type that failed testing at either -55°C or $+68^{\circ}\text{C}$. All firings must meet all acceptance criteria of Table IV.

(4) If the 1000 rounds fired above pass all the Table IV criteria, the remainder of the F&C testing with that weapon, at that temperature, (6500 rounds) may be conducted with only the ammunition being temperature conditioned. These firings must also meet all the acceptance criteria of Table IV.

4.6.9 Cyclic rate. Cyclic rates shall be recorded during Function and Casualty testing.

4.6.10 Noise. Test in accordance with Appendix E.

4.6.11 Breechflash. Observe for Breech flash during Function and Casualty testing (see Appendix C, 30.5).

4.6.12 Hot chamber effects. Using an M16A1 Rifle with an M2 training bolt, fire 120 rounds in 30, round bursts, changing magazines as quickly as possible. The last round shall be chambered but not fired. The maximum time allowed for the firing of 120 rounds shall be 2 minutes. If the round fires (cooks-off) the time shall be recorded. After 25 minutes the weapon shall be cleared by either manually ejecting or firing the cartridge.

MIL-C-70725(AR)

Failure to readily clear the gun shall be cause for rejection. If 120 rounds can not be fired in 2 minutes, the weapon shall be cooled, and the test shall be repeated.

4.6.13 Chemical compatability. Test in accordance with Appendix D.

4.6.14 Bullet integrity. Observe for bullet integrity during function and casualty. (See appendix C, 30.4)

4.6.15 Ricochet. The test shall be performed using both the M16A1 and M16A2 rifles with M2 training bolts, fired from a rigid test mount. The following target materials shall be evaluated:

- a. Plywood - 1/2 inch thick
- b. Concrete block wall
- c. Steel plate - 1/4 inch thick

Each target shall be a minimum of 1 meter wide x 2 meters high. The point of impact of the target shall be 5 meters from the muzzle of the weapon. The target shall be capable of being maneuvered to obtain target obliquities of 0° to 30° (0° representing the condition where the target is perpendicular to the line of fire). A Kraft paper witness screen shall be placed at the muzzle of the weapon, perpendicular to the line of fire. The purpose of the witness screen is to determine if bullets or fragments of bullets will ricochet back into an area where gunners might be located in a typical training scenario. The witness screen shall be a minimum of 10 meters wide x 2-1/2 meters high and shall be located on ground level. The screen will be situated so that there will be 8 meters of paper to the side of the weapon that will indicate ricochets when target obliquity is greater than zero. All firings shall be performed remotely in a single shot mode. The cartridges shall be fired at each target type at 0°, 15° and 30° target obliquities. Equal quantities of test cartridges shall be fired at each target material and at each obliquity angle from the weapon. The screen shall be inspected for perforations following each shot. The occurrence of any perforations greater than 1/10" caused by ricocheted bullet material or fragments of the target material shall be cause for rejection. The test shall not be conducted when the wind velocity is greater than 5 miles per hour in any direction.

4.6.16 Muzzle flash. Using an M16A1 and M16A2 Rifle equipped with M2 training bolts, test in accordance with appendix F.

4.6.17 Fouling. The entirety of the fouling test shall be conducted at ambient (+20°C) temperature. A portion of part a. of the test may be conducted as part of the Function and Casualty testing at +20°C. The following procedure shall be used:

MIL-C-70725(AR)

a. In each weapon, fire 1000 rounds and record the cyclic rate of the initial 90 rounds and the final 90 rounds fired. The firing shall be conducted in accordance with the 500 round firing schedule in Table C1 of appendix C, which shall be repeated twice, with the exception that the weapons shall not be cleaned or lubricated, between the two 500 round cycles. The first 500 round cycle for each weapon may be fired as part of the Function and Casualty firings at +20°C. The second 500 rounds are fired for the purpose of fouling only, the results of which shall not be used in the Function and Casualty test.

b. After firing the 1000 rounds for part a. above, 100 rounds (10 - 10 round targets) shall be fired for accuracy in each of the M16A1 and M16A2 rifles used in part a. The weapons shall be secured in rigid test mounts and the target shall be 25 meters from the muzzle of the weapons. The test shall be fired one shot at a time and in accordance with SCATP-5.56mm, Section 3. The weapons shall not be cleaned prior to this portion of the test.

4.6.18 Target kill. The test is to be conducted using two weapon types (M16A1 and M16A2), four target types (polyethylene "E", polyethylene "F", cardboard "E" and cardboard "F") and two target supports (M31A1 target mechanism, and any suitable Government approved stationary target support). Targets shall be placed 25 meters from the muzzle of the weapons. Twenty rounds shall be fired using each possible weapon, target type, target support combination (for a total of 320 rounds). Cartridges shall be fired single shot from M16A1 and M16A2 rifles equipped with M2 training bolts, and secured in a Government approved test fixture. Observers should be present down range to determine if fired projectiles actually strike the targets. If it is determined that a shot missed the target, a non-penalty replacement shot shall be fired. The results of each shot regarding the activation of the mechanism and the impact on the target shall be recorded as follows:

M - Marked target	A - Activated Mechanism
P - Penetrated target	NH - No Hit (missed target)
NM - No Mark	NA - No Mechanism Activation

Equipment List:

M31A1 - Trainfire Target Holding Mechanism	Dwg. 8421679
"E" Cardboard Silhouette Target	Dwg. 6006874
"F" Cardboard Silhouette Target	Dwg. 6109086
"E" Polyethylene Silhouette Target	Dwg. 12002898
"F" Polyethylene Silhouette Target	Dwg. 12002899

MIL-C-70725(AR)

The criteria will be considered met if both:

a. All targets held by stationary supports are either marked or penetrated by every shot.

b. The target mechanism is activated by every round that strikes a target supported by the target mechanism.

4.6.19 Attitude. The weapons (M16A1, M16A2) shall be fired from a mount which allows the elevation to vary from -85° to $+85^{\circ}$. The test shall be conducted with one weapon of each type. In each weapon, 150 rounds shall be fired at each of 3 weapon attitudes ($+85^{\circ}$, 0° , -85°) and the firings shall take place as follows:

M16A1 Firing Schedule

30 Rounds Full Auto
 30 Rounds Full Auto
 30 Rounds Single Shot
 30 Rounds Short Bursts
 30 Rounds Full Auto

150 Rounds

M16A2 Firing Schedule

30 Rounds 3 Round bursts
 30 Rounds 3 Round bursts
 30 Rounds Single shot
 30 Rounds 3 Round bursts
 30 Rounds Single Shot

150 Rounds

All fired cases shall be inspected, and all weapon stoppages shall be recorded.

The criteria shall be considered met if:

a. No critical defects occur upon firing.

b. The reliability at either $+85^{\circ}$ or -85° does not degrade by more than 0.10 from the reliability at 0° for both weapons.

4.6.20 Maximum range. The Maximum Range Test will be conducted with test ammunition conditioned at the temperature which has yielded the greatest average muzzle velocity as determined in the velocity section of the Qualification test. The test shall be performed using both the M16A1 and M16A2 rifles equipped with M2 training bolts, fired from a test fixture capable of firing both weapons at various angles of muzzle elevation from 0 degrees to 45 degrees. The test shall be conducted in a location where the impact area is a clean flat surface such that projectile ground impacts can be readily seen, such as an airfield runway or a flat sand or dirt covered area. There should be a protected shelter down range where observers will be able to witness ground impacts. The test shall not be conducted when the wind velocity is greater than 5 mph in any direction.

MIL-C-70725(AR)

For each weapon, the test shall be conducted at quadrant elevations from 0 to 45 degrees above the horizontal. Fifteen shots shall be fired, in fifteen round bursts, at each 5 degree increment from 0 to 45 degrees. After each burst, observers down range will note where the projectiles impact the ground, and will measure and record the distance to the muzzle of the weapon. Each 15 round burst shall be considered valid if a minimum of 12 rounds are discovered. If less than 12 rounds are found, that 15 round burst shall be repeated. A determination shall then be made as to what 10 degree elevation band is most likely to provide the maximum range. Once this band has been identified, 30 round burst shall be fired at each 1 degree increment within that band. After each burst, the observer(s) shall locate the bullets and shall measure the distance from the impact location to the muzzle of the weapon. For each 30 round burst fired, the results shall be considered valid if a minimum of 25 projectiles are found. If less than 25 are found, that 30 round burst shall be repeated. The mean distance plus 3 standard deviations shall be calculated for each 30 round shot group, at each 1 degree increment. The greatest of these mean distances plus 3 standard deviations is the maximum range for the sample cartridge.

For each of the 30 rounds fired at the angle which gives the maximum range, the distance from the ground impact location to the line of fire in a perpendicular direction shall be measured. Each shot must fall within a fan of safety defined as the area bounded by two lines, 5° to the left and 5° to the right of the line of fire.

4.6.21 Sand and dust. The procedures outlined in TOP 3-2-045, type A, shall be followed. The sand and dust mixture in the TOP shall be used with the sand and dust feeder calibrated to dispense the mixture at a rate of 100 ± 25 grams per minute per square meter over the area concerned. One lubricated M16A1 and one M16A2, shall be placed in a mount inside the dust chamber, along with the required ammunition. The dust dispenser shall be turned on and allowed to operate for one minute before firing. The function and casualty firing schedule for 500 rounds shall be followed for each weapon. The cyclic rate measurements shall not be recorded, they are not required in this test. All fired cases shall be inspected for defects. The criteria shall be considered met if there are no critical defects in accordance with Table IV.

4.6.22 Corrosion. The sample shall be subjected to the salt-fog test outlined in method 509.2 of MIL-STD-810. After 48 hours of exposure to the 5% mixture the sample shall be examined and its condition documented. It shall be then loaded into magazines. The rounds shall then be chambered and fired in the specified weapons. Failure of the rounds to safely function (critical defects in accordance with Table IV) shall be cause for rejection.

MIL-C-70725(AR)

4.6.23 Temperature/humidity cycling. The temperature/humidity cycling test shall be conducted as follows:

a. One half of the sample shall be subjected to the schedule below for a period of four days.

<u>Hours</u>	<u>Temperature</u>		<u>Relative humidity (%)</u>
2	increase to	40.6	and 90
16	maintain at	40.6	and 90
2	decrease to	21.1	and 95
4	maintain at	21.1	and 95

b. Following the conditioning period, the conditioned cartridges shall be fired in accordance with the function and casualty firing schedule for 500 rounds with the cyclic rates recorded as indicated. The same shall be repeated with the unconditioned cartridges in the exact same weapon.

c. For each weapon type, the average cyclic rate obtained with conditioned cartridges shall be statistically compared to the average cyclic rate obtained with unconditioned cartridges. The cyclic rates and their difference shall be recorded.

d. The estimated time required to clear all jams and stoppages shall be recorded for each incident.

4.6.24 Long term high temperature storage. The long term high temperature storage test shall be conducted as follows:

a. One half the sample shall be subjected to continuous heating at +50°C (+125°F) and 15% relative humidity for 120 days.

b. Following the conditioning period, the conditioned cartridges shall be fired in accordance with the function and casualty firing schedule for 500 rounds with the cyclic rates recorded as indicated. The same shall be repeated with the unconditioned cartridges in the same exact weapon.

c. For each weapon type, the average cyclic rate obtained with conditioned cartridges shall be statistically compared to the average cyclic rate obtained with unconditioned cartridges. The cyclic rates and their difference shall be recorded.

d. The estimated time required to clear all jams and stoppages shall be recorded for each incident.

4.6.25 Long term low temperature storage. The long term low temperature storage test shall be conducted as follows:

MIL-C-70725(AR)

a. One half the sample shall be subjected to continuous cooling at -40°C for 30 days.

b. Following the conditioning period, the conditioned cartridges shall be fired in accordance with the function and casualty firing schedule for 500 rounds with the cyclic rate recorded as indicated. The same shall be repeated with the unconditioned cartridges in the exact same weapon.

c. For each weapon type, the average cyclic rate obtained with conditioned cartridges shall be statistically compared to the average cyclic rate obtained with unconditioned cartridges. The cyclic rates and their difference shall be recorded.

d. The estimated time required to clear all jams and stoppages shall be recorded for each incident.

4.6.26 Rough handling. The rough handling test shall be conducted as follows:

a. One half the sample plus 75 rounds shall be placed (loose) in M2A1 ammunition containers, with between 100 and 200 rounds in each container. The interior surfaces of the M2A1 cans shall be free of paint. Up to three containers at a time shall be placed on the test table and subjected to the loose cargo test #14 of drawing 8837375. Test only on surface.

b. Following the test period, 500 of the conditioned cartridges shall be fired in accordance with the function and casualty firing schedule for 500 rounds with the cyclic rates recorded as indicated. The same shall be repeated with 500 of the unconditioned cartridges in the same weapon.

c. For each weapon type, the average cyclic rate obtained with conditioned cartridges shall be statistically compared to the average cyclic rate obtained with unconditioned cartridges. The cyclic rates and their difference shall be recorded.

d. The estimated time required to clear all jams and stoppages shall be recorded for each incident.

e. The 150 extra cartridges shall be waterproof tested using the same method previously used (bubble method or firing method) for waterproof testing. Check for compliance with the requirements.

MIL-C-70725(AR)

4.6.27 Toxic fumes. Each weapon, (M16A1 or M16A2) shall be placed inside a closed chamber with the muzzle through an orifice on one side. The chamber shall be a cube, 2.13 meters on a side (9.67 cubic meters). Fire five trials of 30 rounds each, in each weapon, in short bursts. Draw air samples continuously to monitor for carbon monoxide, ammonia, nitrogen dioxide and sulfur dioxide. Repeat the test using 5.56mm, Ball M193 Cartridges for reference.

4.6.28 Safety hazard classification. The test shall be conducted by the contractor at his expense. The Government reserves the right to observe all testing. The tests shall be conducted in accordance with TB 700-2, paragraph 5-3e Single stack test, 5-3g External fire stack test utilizing one outer packing unit placed on a wooden stand.

4.6.29 Explosive sensitivity. Upon design submission the ARDEC Safety Office shall determine which materials utilized in the cartridge require sensitivity evaluation testing by the contractor. The sensitivity tests required shall be as follows:

<u>Test</u>	<u>Test Document</u>	<u>Test Procedure/ Paragraph</u>
a. Friction Test - Apparatus and comparison values	JSSPM	5.3
b. Impact Test - Apparatus and comparison values	JSSPM TB 700-2	4.2 5.2i
c. Electrostatic discharge test- Apparatus and comparison values	JSSPM	4.2
d. Auto ignition temperature	JSSPM	5.9
e. Explosive temperature (5 sec)	MIL-STD-650	506.1
f. Detonation test	TB 700-2	5.2f
g. Ignition and unconfined burning test	TB 700-2	5.2g
h. Thermal stability test	TB 700-2	5.2h
i. Card gap test	TB 700-2	5.2j

MIL-C-70725(AR)

5. PACKAGING.

5.1 Level A. Not applicable

5.2 Level B. The contractor shall apply his best effort to design, fabricate and test a package to transport and store any cartridge developed by this document. The design of the package shall use military or federal specifications as much as possible and shall meet the requirements of Method 1A of MIL-P-116 and the Code of Federal Regulations, Title 49, section 173.101. The contractor shall submit the packaging design to the Packaging Division, ARDEC, for approval prior to fabrication of the packaging and performance of engineering tests. Level 3 drawings of the packaging and marking shall be forwarded to the Packaging Division for review and, if necessary, comment.

5.2.1 Unit package. Thirty cartridges shall be packed in a unit package (i.e., fiberboard/paperboard box).

5.2.2 Intermediate packaging/packing. The development of the intermediate packaging/packing shall take into consideration the requirements listed in 5.2 and the requirements to pass the test listed in 5.2.3. The quantity of cartridges in the intermediate packing boxes shall be 1200. The intermediate packing boxes shall meet the requirements of PPP-B-636. Two intermediate packs shall be packed in a bag per method 1A of MIL-P-116 and placed in an outer package. The outer pack shall meet the requirements of PPP-B-636, class - Weather Resistant.

5.2.3 Tests. In order to insure packaging performance, tests as identified below from drawing 8837375 shall be performed on the outer package by the contractor and witnessed by the Government.

5.2.3.1 Temperature conditioning. Tests shall be performed at +160°F, +70°F (ambient) and -65°F. Except for +70°F, the packaged ammunition shall be conditioned for a minimum of 16 hours immediately prior to each test. During the performance of the test the temperature requirement shall be met by (a) using portable conditioning equipment where the ambient air temperature is maintained for the duration of the random vibration tests or (b) conditioning the items and testing as quickly as possible after removal from the conditioning chamber to maintain the specified temperature level as close as possible to the required level for the shock tests.

5.2.3.2 Test sample. Twelve loaded boxes (outer packages) shall be considered a test sample. Unless otherwise specified, at each temperature, two boxes will be subjected sequentially to random vibration tests (figures 1, 2 and 3 in Appendix A) on three

MIL-C-70725(AR)

mutually perpendicular axes, and tests 2 (free fall drop), 13 (seven foot drop) and 14 (loose cargo) in accordance with drawing 8837375. The remaining six boxes will be subjected to a forty foot drop test, test 12, in accordance with drawing 8837375 with two boxes dropped at each temperature. Orientation of the boxes for the test shall be as specified on drawing 8837375.

5.2.3.3 Criteria for passing tests.

5.2.3.3.1 Physical condition. At the conclusion of the random vibration tests, test 2, test 14 and test 13 the packaged ammunition should be safe to handle and operable. The decision that the ammunition has met or failed to meet "safe" and "operable" is based upon the firing of the ammunition in the applicable weapons. Mechanical or physical damage to the ammunition which precludes the normal function of the ammunition is cause for rejection. The package (container) shall not spill its contents, must be capable of being handled, stacked, stored and must not compromise ammunition protection. However, minor damage to the exterior container: loose nails, split wood, bent box hardware, dents in fiber/metal container, etc. are permissible and are not cause for container rejection.

5.2.3.3.2 Explosive elements. At the conclusion of test 12, no explosive element should have burned or detonated and ammunition should be safe to dispose of by applicable handling and disposal regulations without injury to personnel.

5.3 Level C. Packaging shall be same as for level B.

5.4 Marking. The boxes shall be marked per MIL-STD-129 and Code of Federal Regulations Title 49, Section 173.101 and United Nations - Transport of Dangerous Goods, Section 9.

5.5 Unitization. All ammunition must be unitized for shipment and storage. Packaging drawings shall be submitted to ARDEC for transmittal to the U.S. Army Defense Ammunition Center and School which will provide approved unitization drawings and procedures.

6. NOTES

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

6.1 Intended use. This cartridge is intended for use in the M16 series rifles for training.

MIL-C-70725(AR)

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 and 2.2).
- c. Type and level of packing of this specification.
- d. Provision for submission of Inspection Equipment Designs (DI-R-1714).
- e. Provisions for submission of acceptance inspection results for each lot of ammunition presented to the Government (See 6.6).

6.3 Submission of inspection equipment designs for approval. See (MIL-A-48078). Equipment designs shall be submitted as required to: Commander, US Army Armament Research, Development and Engineering Center, ATTN: SMCAR-QAF-I (D), Picatinny Arsenal, NJ 07806-5000. Request letter of submittal should state contractor, contract number, specification number, item nomenclature, and classification of defects and tests paragraph number. This address will be specified on the Contract Data Requirements Lists, DD Form 1423 in the contract.

6.4 Data cards. (See MIL-A-48078). Distribution of data cards shall include the following: Commander, US Army Armament Research, Development and Engineering Center, ATTN: SMCAR-QAF-S, Picatinny Arsenal, NJ 07806-5000.

6.5 Drawings. Documents listed in Section 2 of this specification under the heading US Army Armament Research, Development and Engineering Center may also include documents prepared by, and identified as, US Army Armament Research and Development Command, Edgewood Arsenal, Frankford Arsenal, Rock Island Arsenal and Picatinny Arsenal documents. Technical data originally prepared by these activities are now under cognizance of ARDEC.

6.6 Data submission. Results of all tests performed by the contractor shall be submitted in accordance with Data Item DI-QCIC-80736 on the DD Form 1423 for the contract. Distribution shall include the address specified in 6.3.

6.6.1 Charge level data. The contractor is required to submit an analysis that establishes the minimum propellant charge required to preclude the possibility of a bullet-in-bore. The contractor is also responsible for providing a method of charge level verification.

MIL-C-70725(AR)

6.7 Data items. Data required by this specification are cited in the paragraphs listed below. The Form DD 1423 should include distribution of data cards as specified in 6.3.

<u>Paragraph</u>	<u>Data requirement</u>	<u>Applicable DID</u>
4.5	Quality Inspection, Quality Deficiency Report	DI-QCIC-80736

6.8 Definitions.

6.8.1 Interfix. A commodity made to one unchanged design which encompasses unchanged drawings(s), material(s) and specification(s), manufactured by a specific manufacturing process by a single manufacturer at a single location.

6.8.2 Reliability. For the purpose of this specification the following measure of reliability shall be used.

$$\text{reliability} = 1 - \frac{\text{number of stoppages (ammunition related)}}{\text{number of rounds fired}}$$

6.9 Subject term (key word)listing.

Small Arms
Testing
Bullet

Custodian
Army-AR

Preparing activity:
Army-AR

(Project 1305-AE22)

MIL-C-70725(AR)

APPENDIX A

PACKAGING TESTS

10.0 SCOPE

10.1 Scope. This appendix gives the values that the random vibration is tested for.

20.0 APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

30.0 TESTS

30.1 Random vibration test. The boxes shall be tested sequentially to the test requirements listed in figures 1,2, and 3.

MIL-C-70725(AR)

APPENDIX AFigures for packaging tests

<u>Vertical Axis*</u>		<u>Transverse Axis*</u>		<u>Longitudinal Axis*</u>	
<u>Freq.</u>	<u>PSD Value**</u>	<u>Freq.</u>	<u>PSD Value**</u>	<u>Freq.</u>	<u>PSD Value**</u>
5	.2300	5	.1373	5	.0605
17	.0154	9	.0900	15	.0241
20	.0235	14	.0427	16	.0350
22	.0109	16	.0496	19	.0092
24	.0109	18	.0229	37	.0029
26	.0154	119	.0008	41	.0060
69	.0018	146	.0013	49	.0017
79	.0048	166	.0009	105	.0006
87	.0028	201	.0009	125	.0004
123	.0063	273	.0053	143	.0013
161	.0043	298	.0021	187	.0013
209	.0057	371	.0104	219	.0028
224	.0150	382	.0019	221	.0068
247	.0031	402	.0077	247	.0325
278	.0139	422	.0027	249	.0096
293	.0037	500	.0016	270	.0026
357	.0028			293	.0094
375	.0052			336	.0120
500	.0011			353	.0247
				379	.0085
				431	.0224
				433	.0092
				500	.0014

* TEST DURATION 120 MINUTES PER AXIS

** PSD-POWER SPECTRAL DENSITY--G SQ. PER HZ

Figure A1. Random Vibration Schedule-Wheeled Vehicle

Figure A2. Narrowband Random-On-Random Vibration - Tracked Vehicle

5-500 HZ Test Threshold No. Phase (g ² /Hz) Sweeps	NARROWBAND 1			NARROWBAND 2			NARROWBAND 3			NARROWBAND 4			NARROWBAND 5			
	BW (Hz)	PSD (g/Hz)	Sweep BW (Hz)													
VERTICAL AXIS (12 minutes per test phase)																
V1	0.0030	30-35	0.0649	3	60-70	0.0300	6	90-105	0.0236	9	120-140	0.0097	12	150-175	0.0128	15
V2	0.0018	41-47	0.0508	3	82-94	0.0562	6	123-141	0.0054	9	164-188	0.0067	12	205-235	0.0128	15
V3	0.0044	53-65	0.1096	6	106-130	0.0067	12	159-195	0.0531	18	212-260	0.0269	24	265-325	0.0485	30
V4	0.0032	71-88	0.1029	9	142-176	0.0698	18	213-264	0.0647	27	284-352	0.0280	36	335-440	0.0058	45
V5	0.0050	94-112	0.2065	9	188-224	0.5690	18	282-336	0.0583	27	376-448	0.0169	36	---	---	---
TRANSVERSE AXIS (12 minutes per test phase)																
T1	0.0015	30-35	0.0163	3	60-70	0.0222	6	90-105	0.0122	9	120-140	0.0054	12	150-175	0.0037	15
T2	0.0012	41-47	0.0165	3	82-94	0.0157	6	123-141	0.0078	9	164-188	0.0066	12	205-235	0.0129	15
T3	0.0040	53-65	0.0530	6	106-130	0.0241	12	159-195	0.0176	18	212-260	0.0091	24	265-325	0.0113	30
T4	0.0029	71-88	0.0535	9	142-176	0.1096	18	213-264	0.0358	27	284-352	0.0072	36	---	---	---
T5	0.0024	94-112	0.2093	9	188-224	0.1296	18	282-336	0.0267	27	376-448	0.0094	36	---	---	---
LONGITUDINAL AXIS (12 minutes per test phase)																
L1	0.0023	30-35	0.0190	3	60-70	0.0135	6	90-105	0.0055	9	120-140	0.0086	12	150-175	0.0062	15
L2	0.0012	41-47	0.0074	3	82-94	0.0115	6	---	---	---	---	---	---	---	---	---
L3	0.0038	53-65	0.414	6	106-130	0.0227	12	159-195	0.0131	18	212-260	0.0165	24	265-325	0.0151	30
L4	0.0028	71-88	0.0886	9	142-176	0.0095	18	213-264	0.0296	27	284-352	0.0210	36	355-440	0.0098	40
L5	0.0035	94-112	0.0985	9	188-224	0.1112	18	282-336	0.0431	27	376-448	0.0154	36	---	---	---

MIL-C-70725(AR)

APPENDIX AFigures for packaging tests

<u>Vertical Axis*</u>		<u>Transverse Axis*</u>		<u>Longitudinal Axis*</u>	
<u>Freq.</u>	<u>PSD Value**</u>	<u>Freq.</u>	<u>PSD Value**</u>	<u>Freq.</u>	<u>PSD Value**</u>
5	.2252	5	.0474	5	.0536
8	.5508	6	.0303	5	.0536
10	.0437	7	.0761	8	.1102
13	.0253	13	.0130	13	.0140
15	.0735	15	.0335	16	.0303
19	.0143	16	.0137	20	.0130
23	.0358	21	.0102	23	.0378
27	.0123	23	.0268	27	.0079
30	.0286	25	.0090	30	.0208
34	.0133	28	.0090	33	.0068
36	.0416	30	.0137	95	.0019
41	.0103	34	.0055	121	.0214
45	.0241	37	.0081	146	.0450
51	.0114	46	.0039	153	.0236
95	.0266	51	.0068	158	.0549
111	.0166	55	.0042	164	.0261
136	.0683	158	.0029	185	.0577
147	.0266	235	.0013	314	.0015
185	.0603	257	.0027	353	.0096
262	.0634	317	.0016	398	.0009
330	.0083	326	.0057	444	.0027
360	.0253	343	.0009	500	.0014
500	.0017	384	.0018		
		410	.0008		
		462	.0020		
		500	.0007		

* TEST DURATION 96 MINUTES PER AXIS

** PSD-POWER SPECTRAL DENSITY--G SQ. PER HZ

Figure A3. Random Vibration Schedule--Two-Wheeled Trailer

MIL-C-70725(AR)

APPENDIX B

RESIDUAL STRESS TEST PROCEDURE

10.0 SCOPE

10.1 Scope. This appendix gives test procedure for performing the residual stress test.

20.0 APPLICABLE DOCUMENTS.

This section is not applicable to this appendix.

30.0 PURPOSE

30.1 Purpose. The residual stress test is performed to determine if the residual stress in polyethylene cases is great enough to cause splits or cracks in service or during long term storage.

40.0 EQUIPMENT

40.1 Equipment. Equipment used in this test shall be approved by the Government prior to testing.

40.2 Material. Detergent, Nonylphenoxy Poly, (Ethyleneoxy) Ethanol is required for this test.

40.3 Test samples. Test samples shall consist of complete sets of the quantity of parts specified with the exception of propellant and primer (inert cartridge). Process the components on the production line and assemble to meet all final assembly dimensional requirements.

40.4 Safety Requirements. Heat resistant gloves shall be worn when handling heated test samples and trays.

50.0 TEST PROCEDURES.

50.1 Test Procedures. The following test procedure shall be followed:

a. Immerse the test samples in the detergent. Seal the detergent coated samples in a polyethylene bag to minimize evaporation and place them in an aluminum tray. Place the tray with the sealed bags of test samples in an oven set at $160^{\circ}\text{F} \pm 5^{\circ}\text{F}$ for seven days.

MIL-C-70725(AR)

b. After seven days remove the tray from the oven and cool for one hour. Rinse the inert test samples in running water to remove the detergent. Dry with clean rags or paper towels. Coat the surfaces with machinist's dye and wipe with rags or towels, removing all excess dye from the surfaces.

c. Examine the surfaces for cracks, splits and crazing using a 7 power eye loop or magnifying glass.

60.0 RECORDING OF DATA

60.1 Data. Record the following:

- a. Date of test.
- b. Test ammunition lot number and specification number.
- c. Cracks - Number, size and location (Dwg. 7643674).
- d. Splits - Number, size and location (Dwg. 7643674).
- e. Crazing - Number, size and location (Dwg. 7643674).
- f. Technician.
- g. Foreman.

MIL-C-70725(AR)

APPENDIX C

Function and Casualty Test Procedure

10.0 SCOPE

10.1 Scope. This appendix gives test procedures for performing the function and casualty test.

20.0 APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

30.0 PURPOSE

30.1 Purpose. The purpose of Function and Casualty tests is to demonstrate, whether or not the ammunition undergoing acceptance can be expected to perform satisfactorily, under conditions of field usage, in the service weapons for which it has been designed.

Casualties and malfunctions can be caused either by the ammunition or by the weapon in which it is fired, so that, to a certain extent, these two factors are interdependent. A faulty or poorly adjusted weapon can cause casualties in normal ammunition, but if the weapon is in proper condition when the casualties are encountered the fault lies with the ammunition.

40.0 EQUIPMENT

40.1 Equipment. Equipment used in this test shall be approved by the Government prior to testing (see 6.2).

40.2 Cyclic-Rate Timer. Suitable recording instrument that will permit measurements within ± 25 of the true rate of fire.

50.0 TEST PROCEDURE

50.1 Pre-firing (Preparation for test). The following procedure shall be followed:

a. Weapons shall be of the latest design and shall conform to the applicable specification. The barrels of the weapons shall be thoroughly cleaned and carefully examined using a borescope. The condition of the barrel shall be recorded.

b. The weapons to be used need not be temperature conditioned to the test temperature prior to use unless required by the specification (see 4.6.8.1).

MIL-C-70725(AR)

c. The test cartridges being loaded into 30 round magazines shall be examined for obvious defects. If visual defects are found, the defective cartridge(s) shall be replaced and the defects shall be noted on the test sheet form.

d. After the cartridges have been loaded into magazines, they shall be conditioned at the required temperature for not less than two hours.

50.2 Firing. The following procedure shall be followed:

a. Upon completion of storage, high or low temperature, the cartridges shall be placed in an insulated box which has also been conditioned at the specified temperature. The insulated box containing the cartridges is then placed at a point convenient to the technician. The cartridges are removed from the insulated box and fired.

b. Firing shall be conducted in 500-round segments in accordance with the firing schedules of Table C1. The 500-round segments shall be repeated until the required test quantity is fired.

c. When the required test quantity for each weapon is less than 500 rounds (lot acceptance test) the firing schedule will be followed until the required number of rounds have been fired, after which the weapons will be cleaned and inspected.

d. When the required test quantity for each weapon is greater than, but not an even multiple of 500 (lot acceptance retest), the following procedure is to be followed:

(1) The 500 round cycle is repeated until less than 500 rounds remain.

(2) The remaining rounds are fired in accordance with the firing schedule until the required quantity is fired. The weapon is then cleaned and inspected.

e. No more than 30 seconds delay is permitted between magazines.

f. Cooling of the weapon to ambient temperature with forced air shall be performed as required by the firing schedule.

g. Fired cases shall be visually examined by the technician for possible case casualties.

50.3 Cyclic rate.

MIL-C-70725(AR)

50.3.1 Cyclic rate measurements. Cyclic rate measurements shall be taken in pairs as indicated in the firing schedule. To determine compliance with the cyclic rate requirements, cyclic rate values shall be averaged together as follows:

a. Starting average - The first three cyclic rate values taken at the start of all 500-round segments, from the same weapon type, at the same temperature, shall be averaged together.

b. Ending average- The last three cyclic rate values taken at the end of all 500-round segments, from the same weapon type, at the same temperature, shall be averaged together.

c. Overall average- The average of all cyclic rates recorded throughout the 500-round segments, as indicated on the firing schedule for each weapon type at each temperature condition.

d. The starting, ending, and overall average must meet the requirement for cyclic rate as specified for that weapon type.

MIL-C-70725(AR)

TABLE CI. FIRING SCHEDULES

<u>M16A1</u>	<u>M16A2</u>
30 C - CR	30 B - CR
30 C - CR	30 B - CR
30 S	30 S
30 B	30 B - CR
30 C - CR	30 S
Cool	Cool
30 S	30 B - CR
30 B	30 S
30 C - CR	30 B - CR
30 S	30 S
30 B	30 B - CR
Cool	Cool
30 C - CR	30 S
30 S	30 B - CR
30 B	30 S
30 C - CR	30 B - CR
20 S	20 S
Cool	Cool
30 C - CR	30 B - CR
30 C - CR	30 B - CR
<u>clean/inspect</u>	<u>clean/inspect</u>
500 Total	500 Total

Key:

S = Single shot
 B = Bursts of 3 to 5 rounds each
 C = Continuous fire
 CR = Cyclic rate taken

MIL-C-70725(AR)

50.4 Bullet integrity. As part of the Function and Casualty firings, a quantity of rounds (as specified in Tables I, II, and 4.5.3.1) shall be evaluated in accordance with the following procedure. A paper sheet (6' x 6' minimum) shall be stretched tightly over a rigid frame of the same size. The sheet shall be placed perpendicular to the barrel of the weapon, 15 feet from the muzzle. The sheet shall be replaced as necessary to facilitate observation. Any evidence of bullet fragmentation indicated by irregular perforations or by the number of perforations exceeding the number of rounds fired shall be noted. All irregular perforations shall be measured. All irregular perforations greater than 1/10" shall be classed as defects.

50.5 Breech flash. During all Function and Casualty firings the breech of the weapons shall be observed for breech flash. Any instance of breech flash shall be noted, as well as the relative magnitude of each occurrence. The criteria shall be considered met if the number of breech flash defects meets the acceptable levels as called out in Table I. The observer shall classify all occurrences of breech flash as follows:

- a. Critical - Any instance of breech flash that will cause hazardous or unsafe conditions for a shooter (right or left handed).
- b. Major - Any instance of flame in the breech area that is not critical.
- c. Minor - Any instance of breech sparks which do not eject into the area of a shooter.

50.6 Fouling. The following procedure shall be followed:

a. Cleaning or lubrication of the barrel or any part of the weapon is only permitted in between 1000-round segments, after observation for fouling has been made. Should stoppages or malfunctions occur at a rate greater than that allowed by Table IV, the weapon shall be examined for evidence of propellant fouling or particle/shavings fouling as a possible cause. The results of the examination shall be noted.

b. To evaluate the effect of fouling on cyclic rate, the "ending average" cyclic rate shall be compared to the "starting average" cyclic rate (see cyclic rate procedure). The difference shall be checked for compliance with the requirement.

60.0 RECORDING OF DATA

60.1 Casualties. Casualties shall be reported in accordance with the terminology specified in the applicable specification. All weapon stoppages shall be reported and classed in accordance with

MIL-C-70725(AR)

the firing defect definitions listed in Section 90.0. For each defect in the "other" category, a description of the particular defect will be provided.

60.2 Misfires. Misfires shall be recorded and the cause described.

60.3 Function and Casualty. The function and casualty test requires careful attention and alertness, and any unusual occurrence in gun function or appearance of fired cases shall be noted. Suspected trends and patterns should also be noted.

60.4 Failures. Failures of gun parts shall be shown on the ammunition report.

60.5 Time. The time required to clear any jams or stoppages shall be recorded for each incident.

60.6 Weapon. The following shall be recorded:

- a. Serial number.
- b. Total number of cartridges fired in weapon.
- c. Headspace measurement.
- d. Cyclic rate.

70.0 OPERATIONAL NOTES

70.1 Stoppages. In the event of stoppages occurring at a rate greater than that allowed by Table IV during firing of the test, a detailed check shall be made to determine whether the ammunition or the equipment is at fault. If the stoppage was caused by a misfire, the check of the weapon shall include measurement of the firing-pin protrusion and firing-pin indent. To assist in determining whether ammunition or equipment is responsible for a stoppage, it is good practice to test the weapon in question using ammunition of known characteristics, and to test the ammunition in question by firing in another weapon of the same type. If it is established that some faulty condition of the weapon is responsible for the stoppage, then the test shall be disregarded, the weapon shall be corrected or replaced, and the tests with that type weapon shall be re-fired. If it cannot be established that the weapon or other equipment is at fault, then the stoppage shall be charged against the ammunition.

70.2 Misfires. If misfires are encountered at a rate greater than that allowed by Table IV, the weapons shall be examined carefully to determine if the cause is attributable to the gun. In any ballistic acceptance test where a misfire occurs, a second attempt to fire a primer is not made. It is mandatory that a period of at least fifteen (15) minutes elapse after the misfire occurs before the action of the weapon is opened, whereupon the misfire

MIL-C-70725(AR)

cartridge is carefully removed in accordance with existing safety regulations, and preserved for further examination. All handling and examinations of misfired cartridges shall be conducted with due regard for the hazards involved. The weapon in which a misfire occurs shall be thoroughly checked; it shall be disassembled and all component parts critically scrutinized. Results of such examinations shall be included on the test report as a matter of information.

70.2.1 Examination. Laboratory examination of the misfired cartridges shall be made to determine the specific cause. The result of the investigation is to be included on the test report.

70.3 Firing defects. Upon completion of firing, all cartridge cases from the test ammunition shall be carefully examined for firing defects. If any defect is found, a detailed check of the equipment shall be made to determine whether the ammunition or the equipment is at fault. If it is established that a faulty weapon is responsible for the firing defect, then the test shall be disregarded, the weapon shall be corrected or replaced, and the test shall be refired. If it cannot be established that the weapon or other equipment is at fault, then the stoppage shall be charged against the ammunition.

80.0 DEFINITIONS

80.1 Misfire. Failure of a round of ammunition to fire after initiating action is taken. There are two categories of misfires:

- a. The primer fails to fire when struck by the firing pin.
- b. The propellant does not ignite when the primer fires normally.

80.2 Perforated primer. A perforated primer is one in which the indent in the primer cup, made by the firing pin, is entirely perforated. It can be identified by a visible hole through the primer, or if the perforation be minute, by discoloration of the indent caused by gas burning.

80.3 Primer leak. Discoloration caused by gas leakage around the junction between the primer cup and the primer pocket wall. It is termed a large leak if the gas escapes around more than 50% of the periphery of the primer cup; or a small leak if the gas escapes around 50% or less of the periphery.

80.4 Loose primer. Looseness, but not so as to permit the fired primer to fall from the primer pocket after the cartridge is fired without distortion to primer pocket.

MIL-C-70725(AR)

80.5 Blown Primer or a dropped primer which falls out of the primer pocket. A blown primer is a primer which, when the cartridge is fired, is separated completely from the head of the cartridge case, and both the head of the case and the pocket are enlarged and deformed. A dropped primer is in the same category as a blown primer but the distortion to the primer pocket is less obvious.

80.6 Ruptured Body. A circumferential separation of the case wall produced by firing. Ruptures are divided into two categories, partial and complete. A partial rupture is one which extends less than 360° around the case; a complete rupture is one which extends entirely around the case, separating the case in two parts. Ruptures are designated according to position, as indicated on Drawing 7643674.

80.7 Split Body or Case. A longitudinal separation of the metal in the case wall produced by firing. Splits shall be classified as shown in the specification.

90.0 FIRING DEFECT DEFINITIONS

90.1 Bolt override base (BOB). During the feeding process of the next cartridge, the bolt passes over the rim and pushes on the body of the cartridge causing an angular feed which will jam the weapon.

90.2 Close on empty chamber (COEC). The bolt fails to pick-up the next round and closes into position on the empty chamber.

90.3 Failure to eject (FEJ). The cartridge is removed from the chamber but is not ejected from the weapon, causing the spent case to become jammed between the bolt and the chamber face.

90.4 Failure to extract (FEX). The bolt moves to the rear with the spent cartridge case remaining in the chamber.

90.5 Double feed (DF). Two cartridges are stripped from the magazine and the bolt attempts to simultaneously feed both into the chamber. A weapon stoppage results from this defect.

90.6 Failure to feed (FFD). The fired cartridge case is ejected, but the next cartridge is not successfully fed into the chamber. This may result from a variety of causes.

90.7 Failure to fire (FFR). The fired cartridge case is ejected and the next cartridge is fed properly into the chamber, but due to any number of situations, the cartridge does not fire. A misfire would fall under this category.

MIL-C-70725(AR)

90.8 Uncontrolled fire. Any occasion where more shots are fired than that which was demanded: in semi-automatic fire, one trigger pull producing two or more rounds to fire; in the M16A1's fully automatic mode, a failure to promptly stop when the trigger is released; in the M16A2's 3-round burst mode, one trigger pull producing four or more rounds to fire.

90.9 Other. Any other weapon stoppage or defect encountered during firing.

MIL-C-70725(AR)

APPENDIX D

Chemical Compatibility Test Procedure

10.0 SCOPE

10.1 Scope. This appendix gives test procedures for performing the Chemical Compatibility test.

20.0 APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

30.0 PURPOSE

30.1 Purpose. To determine the durability of cartridges when brought into contact with various lubricants, cleaners and solvents used or available for use, in weapon and military vehicle maintenance.

40.0 EQUIPMENT

40.1 Equipment. Equipment used in this test shall be approved by the Government (See 6.2) prior to testing.

40.2 Weapons. Weapons shall conform to the dimensions shown on the applicable drawings.

40.3 Lubricants. The lubricants, solvents and chemicals to be used are as indicated in Section 3.

50.0 TEST PROCEDURES

50.1 Pre-firing. The following procedure shall be followed:

a. The weapon containing an M2 training bolt shall be assembled in the test fixture.

b. One thousand cartridges shall be divided equally among the required chemicals. The cartridges shall be immersed in the assigned chemical for one minute at a depth of 2.54 cm (1 inch) above the case rim with the cartridge laid horizontally to the chemical. After one minute the cartridges are removed, set base down in a storage rack and allowed to drain naturally for 24 hours.

c. After the 24 hour dripping period, the cartridges shall be wiped of the assigned chemical, and inspected for abnormalities.

50.2 Firing. The following procedure shall be followed:

MIL-C-70725(AR)

a. Each cartridge shall be fired as designated from an M16A2, and observed for functioning. The firing shall take place as follows: 100 rounds of control ammunition (not exposed to chemicals) shall be fired in accordance with the below firing schedule. The weapon shall be cleaned and 100 rounds of ammunition from one test condition shall then be fired in accordance with the below schedule. The fired cases shall be inspected, and all ammunition related stoppages shall be recorded. The weapon shall then be cleaned, and the firing sequence will be repeated with 100 rounds from the next test condition. If functioning problems are encountered with any conditioned rounds, the weapon will be cleaned, and an additional 100 control rounds will be fired before continuing the test.

b. Firing schedule

30 rounds (3rd burst mode)
 30 rounds (3rd burst mode)
 20 rounds (single shot)
 20 rounds (3rd burst mode)

100 rounds total

50.3 Criteria. The criteria will be considered met if no critical defects are observed, and if the Reliability (see 6.7.2) of the test cartridges does not degrade by more than 0.10 from the control firings for each individual test chemical.

60.0 RECORDING OF DATA

60.1 Data. Record the following:

- a. Date of test
- b. Test ammunition lot number and specification number
- c. Ammunition temperature
- d. Gun room temperature
- e. Machine gun type and serial number
- f. Number of shots through gun
- g. Machine gun headspace
- g. Firing pin protrusion
- i. Firing pin indent
- j. Number of cartridges fired
- k. Case casualties
- l. Ammunition related stoppages
- m. Any abnormality
- n. Test Personnel

MIL-C-70725(AR)

APPENDIX E

Noise Level Test Procedure

10.0 SCOPE

10.1 Scope. This appendix gives test procedures for performing the Noise Level Test.

20.0 APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

30.0 PURPOSE

30.1 Purpose. To compare the noise level of test cartridges with the noise produced by control cartridges and to measure the noise level at the gunner's head position.

40.0 Equipment

40.1 Equipment. Equipment used in this test shall be approved by the Government (see 6.2) prior to testing.

40.2 Weapons. Weapons shall conform to the dimensions shown on the applicable drawings.

50.0 TEST PROCEDURES

50.1 Pre-firing (preparation for test). The following procedure shall be followed:

a. Test and control cartridges shall be loaded into magazines, and conditioned at $70 \pm 2^{\circ}\text{F}$ for a minimum of four hours.

b. The weapon shall be assembled in the test fixture on the mount.

c. A noise level meter is set up outside the firing room with a microphone placed inside the firing room.

d. A second microphone is placed at the right handed gunner's head position.

e. The first microphone shall be placed in such a location in the firing room that the noise level produced by a burst of control cartridges is within the range specified in the requirement. This may entail firing more than one burst of control ammunition, with the microphone being moved to a new position for each burst fired, until the results comply with the requirement.

MIL-C-70725(AR)

When firing the test cartridges it is imperative that the microphone remain in the exact position as was used to obtain the specified level for the control cartridges.

50.2 During firing. The following procedure shall be followed:

- a. An observer is stationed at the noise level meter.
- b. The magazine containing the control cartridges shall be inserted into the weapon and fired full automatic.
- c. The noise levels are recorded.
- d. Without moving the microphones, the weapon bolt is replaced with an M2 training bolt. The magazines containing the test cartridges shall be loaded into the weapon and fired.
- e. The noise levels are recorded.
- f. If the noise level at the right handed gunner's head position exceeds 135 decibels, the test shall be repeated with the microphone located at the left handed gunner's head position.
- g. Fired cases shall be visually examined by the technician for possible case casualties.

60.0 RECORDING OF DATA

60.1 Data. Record the following:

- a. Date of test
- b. Test ammunition lot number and specification number
- c. Ammunition temperature
- d. Gun room temperature
- e. Firing range temperature
- f. Outdoor temperature
- g. Gun type and serial number
- h. Number of times the barrel has been fired
- i. Gun headspace
- j. Firing pin protrusion
- k. Firing pin indent
- l. Case casualties
- m. Any abnormality
- n. Gunner
- o. Foreman
- p. Location of microphones

60.2 Computations. Calculate the difference in noise levels between control and test cartridges.

60.3 Results. Show all the information on the data sheets plus the calculated noise level difference.

MIL-C-70725(AR)

APPENDIX F

Muzzle Flash Test Procedure

10.0 SCOPE

10.1 Scope. This appendix gives test procedures for performing the Muzzle Flash Test.

20.0 APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

30.0 PURPOSE

30.1 Purpose. To determine if the flash produced at the muzzle of the weapon is visible at a specified distance from the weapon under conditions of darkness.

40.0 EQUIPMENT

40.1 Equipment. Equipment used in this test shall be approved by the Government (see 6.2) prior to testing.

40.2 Range. Indoor firing range of adequate design to permit an observer to be stationed, behind protecting shield, at the distance of 100 meters from the muzzle of the weapon or an outdoor range under conditions of darkness.

40.3 Weapons. Weapons shall conform to the dimensions shown on the applicable drawings.

50.0 TEST PROCEDURES

50.1 Pre-firing (preparation for test). The following procedure shall be followed:

- a. The weapon is assembled in the test fixture on the mount.
- b. The observer is stationed down-range at a distance of 100 meters.
- c. The firing range shall be darkened.
- d. The test cartridge shall be conditioned at 20°C for a minimum of two hours after temperature has been reached.

50.2 During firing. The following procedure shall be followed:

MIL-C-70725(AR)

a. The cartridges shall be fired in short bursts with a time interval of 30 seconds between bursts.

b. The observer shall record the results of each burst of cartridges fired.

60.0 RECORDING OF DATA

60.1 Data. Record the following:

- a. Date of test
- b. Test ammunition lot number and specification number.
- c. Ammunition temperature
- d. Gun room temperature
- e. Firing range temperature
- f. Outdoor temperature
- g. Gun type and serial number
- h. Number of times the barrel has been fired
- i. Weapons headspace
- j. Firing pin protrusion
- k. Firing pin indent
- l. Case casualties
- m. Any abnormalities
- n. Gunner
- o. Foreman

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2. DOCUMENT DATE (YYMMDD)

92/07/02

3. DOCUMENT TITLE **CARTRIDGE, 5.56MM, M862 SHORT RANGE TRAINING AMMUNITION**

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

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