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AUTHORITY

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TECHNICAL NOTE TN-1131

INVESTIGATION OF 5.56MM,
CARTRIDGE LOT LC-12387 IN STANDARD 5.56MM, M16A1
RIFLES

by

ANDREW J. GRANDY

Each transmittal of this document outside the Department of Defense must have prior approval of the Commanding Officer, Frankford Arsenal, Philadelphia, Pa., 19137 Attn: SMUFA-J8000.

December 1968



DEPARTMENT OF THE ARMY
FRANKFORD ARSENAL
Philadelphia, Pa. 19137

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AD 847697

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TECHNICAL NOTE TN-1131

INVESTIGATION OF 5.56MM,
CARTRIDGE LOT LC-12387 IN STANDARD 5.56MM, M16A1
RIFLES

by

ANDREW J. GRANDY

AMCMS Code 4810.16.0229.1.22

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of Defense must have prior approval of the Commanding Officer,
Frankford Arsenal, Philadelphia, Pa. 19137 Attn: SMUFA-J8000.

Ammunition Development & Engineering Laboratories
FRANKFORD ARSENAL
Philadelphia, Pa. 19137

December 1968

ABSTRACT

This report is concerned with a limited investigation of the 5.56mm cartridge, lot LC-12387, fired from M16A1 rifles using the standard flash suppressor, FSN-1005-933-8089.

Two 5000-round confirmatory tests were fired in M16A1 rifles at Frankford Arsenal using ammunition lot LC-12387. These tests have indicated the adequacy of this ammunition when fired in standard rifles with standard flash suppressors. There was no significant accumulation of cartridge residue in the bolt-carrier group of either of the rifles. Residue accumulation in the gas tube appeared normal as indicated by air flow readings and weight measurements.

Review of test data contained in U.S. Army Human Engineering Laboratories (USAHEL) Letter Report No. 88 has indicated that the use of noise suppressing muzzle attachments can seriously affect gas tube life in the M16A1 rifles.

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INTRODUCTION

During July 1968, the USAHEL, Aberdeen Proving Ground, conducted noise level and cyclic rate tests on the M16A1 rifle fitted with various designs of noise suppressors. Ammunition used for these tests was Cartridge, 5.56mm, Ball, M193, lot LC-12387. Results of these tests were reported in USAHEL Letter Report No. 88¹ which noted: "The ammunition (M193, Lot LC-12387) is dirty ammunition."

At the request of the Project Manager, Rifles, WECOM, Rock Island, Illinois (see Appendix A), a limited firing test was conducted at Frankford Arsenal to determine whether subject lot (LC-12387) of ammunition should be suspended or restricted in use. This limited test was also to determine "fouling" characteristics of this ammunition lot in M16A1 rifles using the standard muzzle attachment, flash suppressor FSN-1005-933-8089.

Data contained in USAHEL Letter Report No. 88 which related to residue deposits were based on visual observation. Comparison procedures such as measuring barrel lands and grooves, weighing gas tubes and bolt components (prior and during testing), and obtaining periodic flow meter measurements through the gas tube, were absent from the report.

USAMUCOM Indorsement (Appendix A) requested investigation of the USAHEL Report considering the following points as a minimum:

"a. The comparability of the tests of lot LC-12387 and Lot RA-5276 (reported to be superior to lot LC-12387), particularly as concerns lubrication and cleaning procedures, rounds fired per day, length of test, and specific non-standard muzzle devices used.

b. The criteria applied by USAHEL in comparing "dirtiness" of different lots, e.g., visual, weight of fouling deposits, weapon malfunction rates, etc.

¹Letter Report No. 88 "Noise Measurements and Cyclic Rates for the M16 Rifle Equipped with Various Noise Suppressors," F.A. Spellman, D. L. Lince, Engineering Research Laboratory, USAHEL, Aberdeen Proving Ground Md., July 1968.

c. Correlation observed by USAHEL between "dirtiness" and progressive restriction of air flow through gas tube of M16A1 rifle, if the latter was measured.

d. The controls used in the tests to distinguish phenomena occurring in the standard M16A1 rifle from those occurring in M16A1 rifles modified by the addition of non-standard muzzle devices.

The USAHEL Letter Report No. 88 noted that the "ammunition used in the tests (lot LC-12387) is not comparable to ammunition used in previous testing such as lot RA-5276." Contact with the USAHEL disclosed that no direct comparison could be made between the two lots of ammunition because test conditions were different.

Frankford Arsenal plans called for the comparative firings of lot RA-5276 in addition to lot LC-12387, but ammunition from Lot RA-5276 could not be obtained.

DESCRIPTION OF TESTS

A total of 10,000 rounds of ammunition lot LC-12387 was obtained for this evaluation. Two firing tests were conducted consisting of 5000 rounds each in two separate rifles. Rifle A (SN 848305) was fitted with a new barrel (less than 70 rounds) and a new gas tube. Receiver history for Rifle A was 11,300 rounds prior to the test. Rifle B (SN 856760) had a barrel history of 20,000 rounds prior to this test. A new gas tube was also fitted to this rifle. Receiver history for Rifle B was 31,300 rounds prior to the test. Both rifles were inspected for bore characteristics and gas port location. These measurements are shown in Figures 1 and 2.

Fifty cycles of 100 rounds each were fired in each of the test rifles. A cycle consisted of five 20-round magazines loaded and fired as follows:

20 rounds semiautomatic, 1 shot per second

20 rounds semiautomatic, 1 shot per second

DATE: 11 September 1968

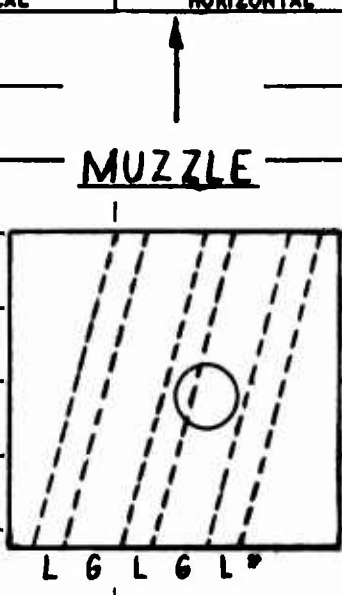
CAL. 5.56MM

MODEL: M16A1

SERIAL NO: 848305 (A)

(Barrel #8 New)

DISTANCE MUZZLE INCHES	LAND DIAMETER INCHES		GROOVE DIAMETER INCHES	
	VERTICAL	HORIZONTAL	VERTICAL	HORIZONTAL
0.05	.2195		.2242	
1	.2195		.2241	
2	.2195		.2241	
3	.2195		.2240	
4	.2195		.2241	
5	.2195		.2241	
6	.2195		.2242	
7	.2195		.2243	
8	.2195		.2241	
9	.2196		.2242	
10	.2194		.2241	
11	.2195		.2241	
12	.2194		.2241	
13	.2193		.2241	
14	.2193		.2241	
15	.2193		.2240	
16	.2193		.2241	
17	.2194		.2241	
18 17.5	.2193		.2241	
19				
20				
21				
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27	Rifling Pitch - 12.00 inches. Gas Port Orientation shown above. Gas Port located 70% in groove and 30% on land. Gas Port exit relatively free of burrs.			
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SMUPA-J Form 25, 26 Sep 67
(Formerly SMUPA-U Form 12)

Figure 1. Bore Gaging Record, SN 848305, Rifle A

DATE: 10 September 1968

CAL. 5.56MM

MODEL: M16A1

SERIAL NO: 856760 (B)

(Barrel #6 Fired 20,000 Rds.)

DISTANCE MUZZLE INCHES	LAND DIAMETER INCHES		GROOVE DIAMETER INCHES	
	VERTICAL	HORIZONTAL	VERTICAL	HORIZONTAL
0.5	.2197		.2244	
1	.2197		.2244	
2	.2197		.2242	
3	.2197		.2242	
4	.2198		.2243	
5	.2198		.2245	
6	.2197		.2245	
7	.2192		.2245	
8	.2195		.2243	
9	.2194		.2242	
10	.2194		.2243	
11	.2195		.2244	
12	.2196		.2245	
13	.2195		.2243	
14	.2197		.2243	
15	.2202		.2241	
16	*		.2242	
17	*		.2246	
18				
19				
20				
21		L G L G L		
22				
23				
24	* Greater than .2210			
25				
26				
27	Rifling Pitch 12.05 inches. Gas Port Orientation and erosion shown above. Gas Port to right of land, 70% in groove and 30% on land. Light deposits of metal fouling from gas port vicinity (not sufficient to obstruct passage of gaging spindles). Little erosion at forward edge of gas port exit.			
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SHUPA-J Form 23, 25 Sep 67
(Formerly SHUPA-U Form 12)

Figure 2. Bore Gaging Record, SN 856760, Rifle B

20 rounds semiautomatic, 1 shot per second

20 rounds automatic, 2 to 3 round bursts

20 rounds automatic, single burst of 20 shots during which the cyclic rate was recorded.

The rifles were air-cooled to ambient after each cycle. After five cycles, the complete bolt assemblies were lubricated using Lubricating Oil, Semifluid, MIL-L-46000.

After ten cycles, the flash suppressors were removed and gas tube flow meter measurements were recorded. The gas tubes were removed from the rifle and weighed. The rifles were then cleaned and lubricated in accordance with SAPD-253E, dated 5 July 1968.

Reassembled rifles were then fired and cleaned as scheduled above until completion of the tests.

TEST RESULTS

Lake City Army Ammunition Plant Inspection Report for lot LC12387 is shown in Appendix B. The 1000-round fouling test referred to in "Remarks" of Appendix B indicated only light fouling characteristics for this ammunition lot. Appendix C shows Ammunition Lot Inspection Report for lot RA-5276.

Acceptance history and criteria for ammunition lots LC-12387 and RA-5276 indicate that these cartridge lots met ballistic, mechanical, environmental and rifle functioning requirements for acceptance. Supplementary chemical and physical tests of ten sample bullet jackets from the cartridge lot LC-12387 show that they compared to physical and chemical acceptance requirements. Results of these analyses are shown in Frankford Arsenal Laboratory Report, see Figure 3.

Cyclic rate and flow meter data generated for each of the two test rifles are contained in Table I (Rifle A) and Table II (Rifle B).

Rifle A displayed a tendency to gain weight in the gas tube as firing progressed with an increase in flow meter readings and a decrease of cyclic rate, see Figure 4. The rifle barrel on this weapon had less than 70 rounds fired prior to this test.

Rifle B displayed the same tendencies as Rifle A. This rifle barrel had a previous history of 20,000 rounds, see Figure 5.

USAHEL reported rifle stoppages after firing approximately 300 rounds. In the Frankford Arsenal tests, four weapon stoppages were encountered in rifle A. These occurred at round numbers 2052, 4397, 4701, and 4975. Minimal malfunctions encountered during test of this rifle cannot be attributed wholly to gas tube clogging, but to mechanical problems normally associated with the bolt-chamber area of the weapon. Rifle B continued firing without mishap to the end of the 5000-round test.

Results of this limited test show that ammunition lot LC-12387 behaved markedly different than in the USAHEL tests of noise suppressors reported in Letter Report No. 88. Data indicate that restrictions to the gun muzzle presented by the various types of noise suppressors studied by the USAHEL, caused rapid or abnormal buildup of residue in the suppressors being tested, the gas tube, the bolt assembly, and the rifle bore.

Tabulated data abstracted from the USAHEL report are shown in Table III. These data include cyclic rate information up to the 700-round cleaning point where the USAHEL reported maximum difficulties in the bolt areas of the test rifles.

CONCLUSIONS

It is concluded that:

1. The 5.56mm, Ball, M193 ammunition lot LC-12387 is suitable for use in the standard 5.56mm, M16A1 Rifle with standard flash suppressor, FSN-1005-933-8089.

U S ARMY FRANKFORD ARSENAL
BASIC MATERIALS EVALUATION LABORATORY (Q6100)
QUALITY ASSURANCE DIRECTORATE

NO 156406 DATE 3 October 1968
MATERIAL 5.56MM Ball Bullets
REPRESENTING _____ LOT NO. LC12387 P. O. _____
FROM _____ TO Mr. A. Grandy, J8200-110-3
SPECIFICATION & DATE _____ x.o. 83828-10

Vickers 2½ Kg Load

HARDNESS TESTS

BULLET JACKETS

Lot LC12387

	Test Made on Exterior		Surface, Front and Rear of Cannelure							
	0°	180°	0°	180°	0°	180°	0°	180°	0°	180°
Nose End	133	134	136	143	130	131	126	127	136	138
Base End	130	143	136	145	126	133	124	124	134	137
Test Made on Longitudinal Section (Mounted)										
	148		150		159		148		148	
	166	203	148	150	160	175	155	153	155	150
	148	160	146	150	151	159	140	140	153	146
	138	137	134	137	138	137	137	131	137	136
Cannelure										
	140	140	134	140	134	131	134	131	136	136
	142	143	140	138	136	137	138	133	136	137

CHEMICAL ANALYSES

BULLET JACKET

LC12387

Copper	89.87%
Lead	0.01%
Iron	0.02%
Zinc	10.0%
Tin	0.002%
Nickel	0.002%
Aluminum	None Detected
Manganese	0.002%
Bismuth	None Detected
Silver	0.002%
Silicon	0.001%
Antimony	None Detected

All conform to MIL-C-21768 Bullet Jacket.

REPORT APPROVED: _____

SAMUEL SITELMAN
Chief, Basic Material Evaluation Lab.

GEORGE NORWITZ
Chemist

SMUPA-Q Form 10, Rev 3 May 67 (Supersedes edition of 15 Feb 66)

Figure 3. Laboratory Report, LC-12387, Bullet Jackets

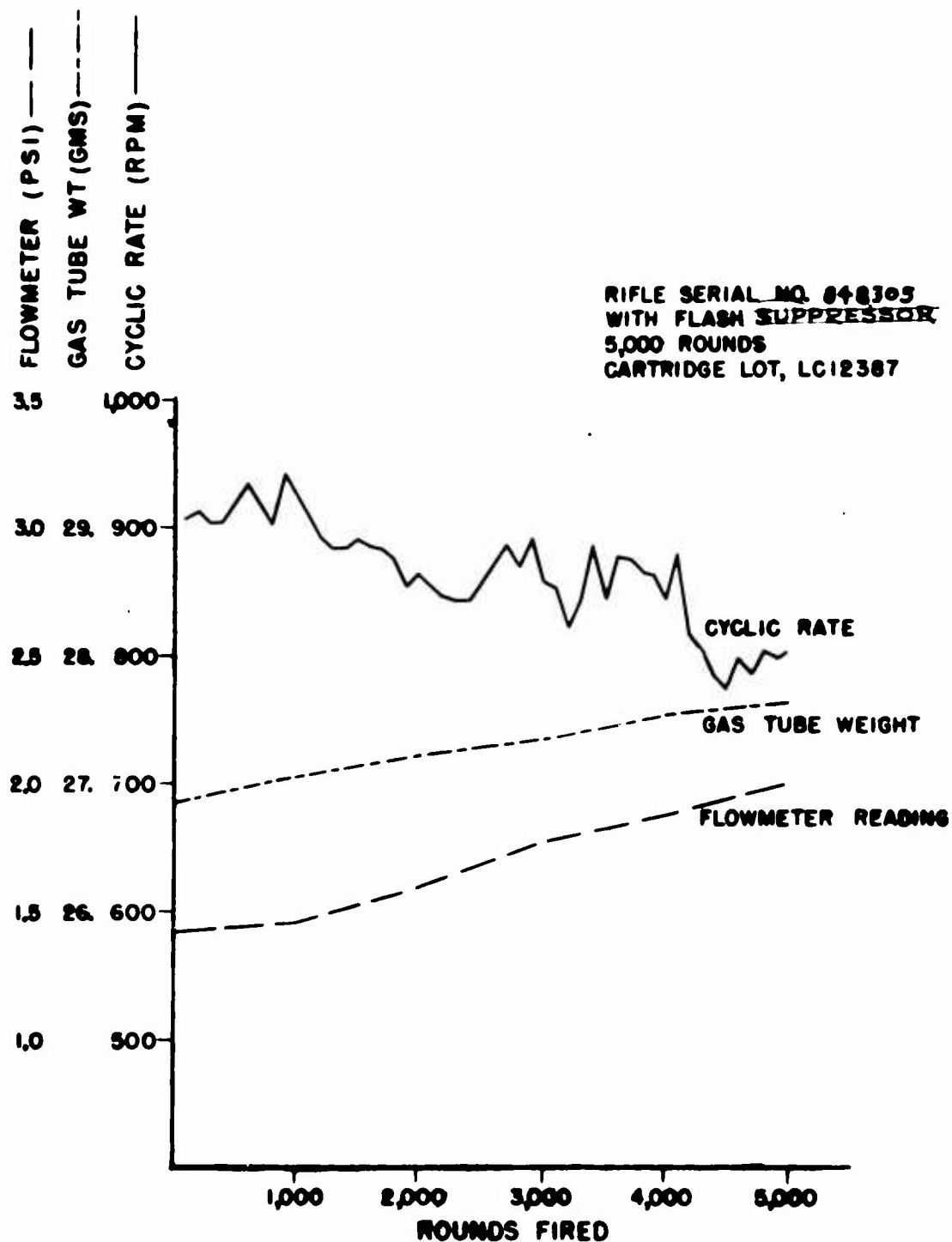


Figure 4. Curve, Test 23, Rifle A

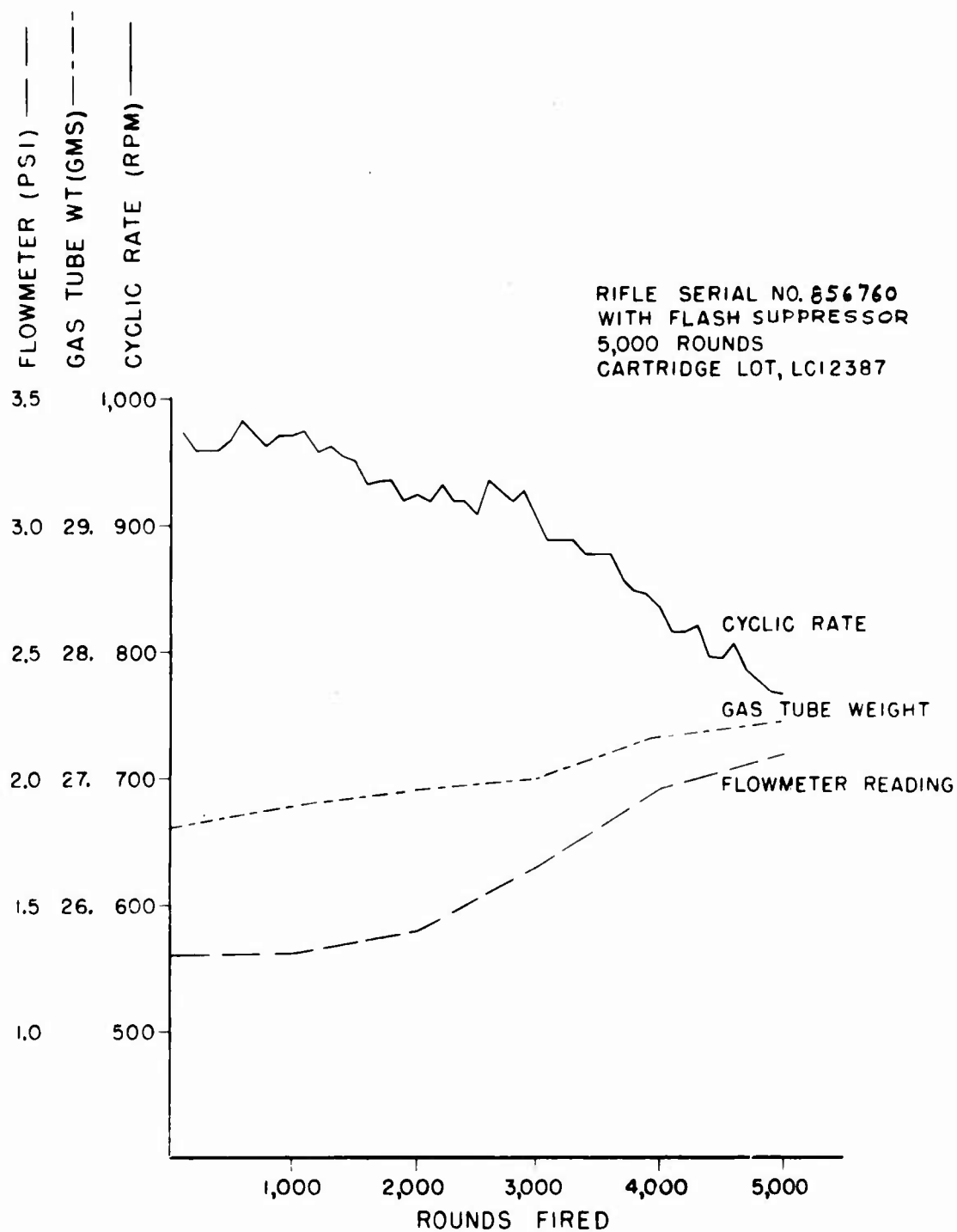


Figure 5. Curve, Test 24, Rifle B

TABLE I. Test Results

RIFLE A. SN848305

Lot LC 12387, Ball, M193		Number of Rounds in Barrel at Start of Test: Less Than 70					
ROUNDS	CR	ROUNDS	CR	ROUNDS	CR	ROUNDS	CR
100	908	1100	908	2100	857 **	3100	857
200	912	1200	891	2200	848	3200	823
300	905	1300	884	2300	844	3300	844
400	905	1400	884	2400	844	3400	888
500	919	1500	891	2500	860	3500	848
600	934	1600	887	2600	877	3600	880
700	919	1700	884	2700	887	3700	877
800	901	1800	877	2800	870	3800	867
900	942	1900	854	2900	894	3900	864
1000	923 *	2000	864	3000	860	4000	844

GAS TUBE WEIGHT (#23)

FLOW METER

ROUNDS	FLOW METER	GAS TUBE WEIGHT (#23)
New	1.43	26.8604
1000	1.46	27.0582
2000	1.60	27.2262
3000	1.78	27.3722
4000	1.88	27.5680
5000	2.02	27.6712

REMARKS:

Rifle fired with Standard Flash Suppressor.

* Replaced Hammer and Spring.

** One (1) stoppage due to broken bolt assembly at 2052 rounds; bolt assembly replaced.

*** Three (3) failures to extract (Rounds 4397, 4701 and 4975).

TABLE II. Test Results

RIFLE B. SN856760

Number of Rounds in Barrel at Start of Test: 20,000

Lot LC 12387, Ball, M193

<u>ROUNDS</u>	<u>CR</u>	<u>ROUNDS</u>	<u>CR</u>	<u>ROUNDS</u>	<u>CR</u>	<u>ROUNDS</u>	<u>CR</u>	<u>ROUNDS</u>	<u>CR</u>
100	974	1100	974	2100	919	3100	887	4100	814
200	958	1200	958	2200	931	3200	887	4200	814
300	958	1300	962	2300	919	3300	887	4300	820
400	958	1400	954	2400	919	3400	877	4400	797
500	966	1500	950	2500	908	3500	877	4500	795
600	983	1600	931	2600	934	3600	877	4600	806
700	970	1700	934	2700	927	3700	857	4700	784
800	962	1800	934	2800	919	3800	848	4800	778
900	970	1900	919	2900	927	3900	844	4900	768
1000	970	2000	923	3000	905	4000	835	5000	765

GAS TUBE WEIGHT (#24)

FLOW METER

New	1.30	26.6034
1000	1.31	26.7992
2000	1.40	26.9184
3000	1.65	27.0100
4000	1.96	27.3252
5000	2.18	27.4654

REMARKS.

Rifle fired with Standard Flash Suppressor.

TABLE III. Noise Measurements and Cyclic rates for the
M16 Rifle Equipped with Various Noise Suppressors
Excerpted from Letter Report No. 88, July 1968,
USARHEL

Serial Number	Suppressor Type	Pressure Level	Attenuation	Cyclic Rate Start 100 Rounds (RPM)*	Cyclic Rate (RPM) (Approx.)	Cyclic Rate Differences (RPM)
827684	HEL M4	124 (1)	37.	900	710	190
830696	HEL M4	124 (2)	37.	880	640	240
832494	HEL M4	124.5 (3)	36.5	890	760	130
1039993	SIONICS (648)	146	15	935	915 ¹	20
1077716	SIONICS (649)	147.5	13.5	930	890	40
1089795	SIONICS (650)	147	14.	960	920	40
1093436	FA/XM-1	124.5	36.5	895	725 ²	170
1095131	FA/XM-2	129	32.	870	640 ³	230
89153	HEL-Shorty	134.5	26.5	980	940 ⁴	40

*RPM - Rounds Per Minute

- ¹Test ended after 500 rounds
- ²Rifle cleaned after 500 rounds
- ³Rifle cleaned after 600 rounds
- ⁴Not cleaned during entire test

2. Use of the standard flash suppressors instead of the non-standard noise suppressors tested by USAHEL, resulted in decreased fouling in the M16A1 rifle.

RECOMMENDATIONS

It is recommended that:

1. No restrictive measures be taken on the 5.56mm, Ball, M193 ammunition lot LC-12387.

2. Future testing and evaluation of non-standard muzzle attachments for the 5.56mm M16A1 rifle should include:

a. Use of standard reference rifle with standard flash suppressor.

b. Complete dimensional control of test barrels

c. Flowmeter readings through the rifle gas tube

d. Recording the weight of the gas tube prior to and during test

e. Recording the weight and dimension of the standard flash suppressor or non-standard muzzle attachment prior to and during the test

f. Recording the cyclic rate

3. Close surveillance of field use of M16A1 rifles with noise suppressors be initiated and maintained.

APPENDIX A



DEPARTMENT OF THE ARMY
UNITED STATES ARMY MATERIEL COMMAND
PROJECT MANAGER - RIFLES
ROCK ISLAND ARSENAL
ROCK ISLAND, ILLINOIS 61201

AMCPM - RS

30 JUL 1968

SUBJECT: 5.56mm M193 Ammunition, Lot LC12387

Commanding General
U. S. Army Munitions Command
ATTN: AMSMU-RE
Dover, New Jersey 07801

1. Reference: USAHEL Letter Report No. 88, dated July 1968, Title: Noise Measurements and Cyclic Rates for the M16 Rifle Equipped with Various Noise Suppressors.

2. The Reference report contains the following statements concerning ammunition:

"REMARKS"

"All weapons were excessively dirty after firing. The ammunition used in the test (Lot LC12387) is not comparable to ammunition used in previous testing, such as Lot RA5276".

"CONCLUSION"

"It is concluded that:

1. The ammunition (M193, Lot LC12387) is dirty ammunition".

3. It is requested that an investigation be made to determine whether the subject lot of ammunition should be suspended or restricted in use, and the Project Manager be notified at the earliest possible time of the action taken so that he can be responsive to inquiries which are expected in consequence of these statements in the Reference report. It is requested that you communicate directly with USAHEL for further information which will be required in your investigation.

FOR THE PROJECT MANAGER:

A handwritten signature in dark ink, appearing to read "Wm. C. Davis, Jr.".

WM. C. DAVIS, JR.
Chief, Tech Management Division

S-19 Aug 68

AMSMU-RE-M (30 Jul 68) 1st Ind
SUBJECT: 5.56mm M193 Ammunition, Lot LC12387

7 AUG 1968

HQ, US Army Munitions Command, Dover, New Jersey 07801

TO: Commanding Officer, Frankford Arsenal, ATTN: SMUFA-J1000,
Philadelphia, Pennsylvania 19137

1. The basic letter asks for an early determination of action required, if any, as a result of USAHEL report that lot LC 12387 (Cartridge 5.56mm Ball, M193) "is dirty ammunition." It is requested that you initiate an investigation of this USAHEL report and advise the Project Manager-Rifles and this headquarters by 19 Aug 68 what date your determination of appropriate action will be completed.

2. It is suggested that your investigation consider the following points as a minimum:

a. The comparability of the tests of lot LC 12387 and lot RA 5276 (reported to be superior to lot LC 12387), particularly as concerns lubrication and cleaning procedures, rounds fired per day, length of test, and specific non-standard muzzle devices used.

b. The criteria applied by USAHEL in comparing "dirtiness" of different lots e.g., visual, weight of fouling deposits, weapon malfunction rates, etc.

c. Correlation observed by USAHEL between "dirtiness" and progressive restriction of air flow through gas tube of M16A1 rifle, if the latter was measured.

d. The controls used in the tests to distinguish phenomena occurring in the standard M16A1 rifle from those occurring in M16A1 rifles modified by the addition of non-standard muzzle devices.

FOR THE COMMANDER:



IRVING R. MOLLEN
Colonel, GS
Director of Rsch, Dev & Engr

Cy Furn:
CG USAWECOM, ATTN: AMCPM-RS

UNCLASSIFIED

DHS

X

ROUTINE
ROUTINE

COFA Phila Pa

CG, USAWECOM, ATTN: Project
Manager - Rifles Rock Island Ill.

CG, USAMUCOM, ATTN: AMSMU-RE,
Colonel Mullen; AMSMU-RE-M Dover,
New Jersey

Subject: 5.56mm M193 Ammunition, Lot LC12387

Unclassified from B2000.

1. Reference: Letter: dated 7 August 1968,
same subject: from Hq, USArmy Munitions Command,
to Commanding Officer, Frankford Arsenal.
2. Determination of action required, if any, as a
result of USAHEL report that lot LC12387 (Cartridge
5.56mm Ball, M193) "is dirty ammunition", will be
forwarded to your command by 19 September 1968.

19

AUG 68

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D. H. JOHNSON, LTC, OrdC, Ch, SCA
Comm Mgmt & Cust Rel Office

Unclas

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Unclassified

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Routine
Routine

COFA, Phila Pa

CG, USAMUCOM, ATTN: A RE-M,
Dover, New Jersey

CG, USAFECOM, ATTN: AMCPM-RS,
Rock Island, Illinois

Unclas TT from H2000 Signed D. H. Johnson, LTC, OrdC.
SUBJECT: 5.56mm M193 Ammunition Lot LC12387.

1. Reference: a. Letter AMCPM-RS 30 July 1968
b. 1st Indorsement AMSMU-RE-M
7 August 1968
c. TT, SNUFA-H2000 19 August 1968

2. Investigation of ammunition lot LC12387 was conducted as noted in reference 1 and 2. No compatibility data exists between USAHKL tests of LC 12387 and RA5276. Only visual observation was made by USAHKL during tests which led to conclusion that LC12387 "dirty" ammunition. In addition, standard rifle controls were not employed during USAHKL tests. I.E. Bore measurements, weighing gas tubes and bolt components and use of flowmeter

18	1700"R"
SEPT	68
1	2

21249

A. Grandy

D. H. JOHNSON, LTC, OrdC, Ch, SCA, Comm
Mgmt & Cost Rel Office

Unclassified

Unclassified

routine
routine

D.M. Johnson, LTC, OrdC A. Grandy

21249

data to monitor build-up of gas tube residue.

3. 10,000 rounds of LC12387 were fired at FA in two control rifles. (5000 rounds each). These tests fired under controlled conditions clearly indicate adequacy of ammunition LC12387 when fired in standard rifles with standard muzzle attachment. Indication also exists that use of non-standard muzzle attachments seriously effects gas tube life in the M16A1 Rifle. USANGL letter report No. 88 records rifle malfunctions as early as 300 rounds after start of tests using non-standard muzzle attachments. (NOISE SUPPRESSORS) FA tests in one control rifle yielded evidence of gas tube clogging after 4397 rounds although the rifle completed the 5000 rounds, while the other control rifle continued to fire without malfunction to 5000 rounds.

4. Complete report being prepared and will be forwarded on 23 September 1968.

Unclassified

APPENDIX B

QUANTITY PACKED: 2,007,600						LAKE CITY ARMY AMMUNITION PLANT						CONTRACT NO. DA-49-G10-AMC-3(A)					
FSN 1305-92b-3930-(A071)						INSPECTION REPORT - 5.56MM						PRIMER NO. 41 MIX FA956					
						ITEM CER., Ball, M193						PRIMER LOT NOS. 10-347, 346, 34					
FUNCTIONAL LOT NOS.						LOT NO. LC 12387						348, 335					
ARMED CODE 4810.10.0229.2.05.FY68						ACCEPTED ☒ 1ST TEST ☒						PROPELLANT TYPE WC 846					
						REJECTED ☐ RETEST ☐						A.L. NO. 45259, 45463					
						WAIVER ☐						CNS (GHS) 28.3, 28.0					
SPEC. NO. MIL-C-99B3D REV. A/4												CASE - STEEL ☐ BRASS ☒					
ECO DATE 2-16-68												HEADSTAMP (VH) LG 68					
CNS NO. D-10523632												BULLET JACKET Gilding Metal.					
REV E DATE 8-11-68						ACCEPTANCE DATE 10 May 1968											

FIRING TESTS					TRACE		NO. RDS.	RECORD	LIMIT
CHAMBER PRESSURE (PSI)	AMB	125°	160°	-65°	NO. TRACING @ 500 YDS				
RDS FIRED	20	10	10	20	NO. BULLET HURSTS				
RECORD	50000	+3090	-710	-4225	NO. ERRATIC FLIGHTS				
LIMIT - MAX	52,000	+5,000	+5,000	+5,000	NO. MUZZLE FLASHES				
AVG ± 3 SD	54000				WATERPROOF TEST				
LIMIT - MAX	58,000				NO. TESTED	NO. FAILED	SPEC. LIMIT		
PORT PRESSURE (PSI)					50	0	3		
RDS FIRED	20	10	10	20	DESCRIPTION OF DEFECTS				
RECORD	14800	-40	+140	-450	None				
LIMIT	15,000	+2,000	+2,000	+2,000	BULLET EXTRACTION TEST (LBS)				
VELOCITY ± 15 FT (FS)					NO. TESTED	SPEC. MIN.	NO. FAILED	MAX. MIN. MEAN	
RDS FIRED	20	10	10	20	25	35	0	104 74 82	
RECORD	3255	+67	+19	-172	MERCURIOUS NITRATE TEST				
LIMIT	3250+40	-250	-250	-250	NO. TESTED	NO. FAILED	SPEC. LIMIT		
STD DEV	26.0				50	0	0		
MEAN	40				BASE CLOSURE SEAL TEST				
ACCURACY (INCHES)	RDS FIRED	RECORD	LIMIT		NO. TESTED	NO. FAILED	SPEC. LIMIT		
WEAR RADII @ 200 YDS	90	1.6	2.0				3		
BURN TIME (SS)	50	1.21	4.00		VISUAL, GAGE & WEIGH INSPECTION				
FUNCTION & CASUALTY	RDS FIRED	RECORD	LIMIT		1ST SAMPLE	DATE			
RIFLE, 5.56MM, XM:6E1	720	OK			2ND SAMPLE	CRITICAL	MAJOR	MINOR	
CASUALTIES					AQL %	.04	.25	1.5%	
NONE					% DEFECTIVE	DEFECT NO. & DESCRIPTION			
					TOTAL				
					PACKING INSPECTION - CONTAINER CONTENT				
					MAJOR	MINOR			
					% DEFECTIVE	AQL %	% DEFECTIVE	AQL %	
						1.0		2.5	
					TOTAL AUTHORIZED RDS EXPENDED IN TESTS: * 2115				

REMARKS: *1000 rounds expended in Ballistics in accordance with 1050 Message AM-LC-14-67,
dated 12/5/67 - Fouling Test,
Diamond Pyramid Hardness Test - OK.

APPENDIX C

RD 1598 Rev. 4

REMINGTON ARMS COMPANY, INC.

BRIDGEPORT, CONNECTICUT

Quantity Packed: 1,036,800

BRIDGEPORT, CONNECTICUT
AMMUNITION LOT INSPECTION REPORT

LOT NO.: RA-5276

ITEM: CARTRIDGE, BALL, 5.56 MM M193

CONTRACT NO. DA-36-038-AMC-3694 (A)

Spec. No.: MIL-C-9963D Date: 1 June 1964

Amend No.: Date:

Drawing No.: D-10523632 Date: 26 June 1963

Rev. No.: C Date: 23 October 1964

Case: Steel ☐ Brass ☒ Head Stamp: (Year) 1967 Fed. Stock No.: 1305-067-0369-A066

Primer: 921 Mix: 5067 Primer Lot Nos.: RA2-1037, 1038, 1040 thru 1047

Propellant: Western Ball WC-546 MAX MAX LOT NO.: 943 & 952 Charge: See below

21
Loading Dates: Lot 943 - 26.73 ers. - March 16, 17, 20, 22, Bull. Jkt. GM ☒ GMCS ☐

Net 952-27.60 grs. - March 22, 23, 27, 1967 23

23:

BALLISTIC TESTS

OTHER TESTS

	ROUNDS	RECORD	LIMIT	BULLET EXTRACTION	ROUNDS	RECORD	LIMIT
VELOCITY (fps)					25	60	35 min
Normal - Temp. 70° ± 2°F.	20			MERCURY CRACK	50	0	0
Corr. Mean @ 15 ft.		3253	3250±40	WATERPROOF	50	0	3
Standard Deviation		25'	40' Max.				
High Temperature							
125°F. - 4 hrs.	10	+15	-250				
160°F-4 hrs.then 70°-6 hrs.	10	-1	-250				
Low Temperature							
-65° - 6 hrs.	20	-200	-250				
PRESSURE (CHAMBER)(psi)				VISUAL, GAGE & WEIGH INSPECTION			
Normal-Temp. 70°±2°F.	20			Sample Size			
Max. Ave.		15,300	52,000 Max.	17,375	Crit.	MAJOR	MINOR
Max. Ave. + 3s		52,755	58,000 Max.	Accept.Qual.Level	0.0	0.25	1.5
High Temperature				% Defective	0.0	0.0	0.05
125° - 4 hrs.	10	+600	+5,000	DEFECTS			
160°F-4hrs.then 70°F.-6 hrs.	10	+500	+5,000	Dented case			1
Low Temperature				Ring on bullet			1
-65°F. - 6 hrs.	20	-6400	+5,000	Small ext. groove			1
PRESSURE PORT (psi)	20	15,325	15,000 ±2,000	TOTAL			8
ACTION TIME (milliseconds)	50	2.31	4 max.				
ACCURACY - (M.R. @ 200 yds.)	20	1.35"	2.00" max.	PACKING INSPECTION			
FUNCTION & CASUALTY				720 crates	MAJOR	MINOR	
AR 15 Rifle Ambient	240	OK		Container Contents	Def.	AQL	% Def.
" " " -High	240	OK		Packed Container	0.0	1.0	0.0
" " " -Low	240	OK		Leak Test	0.0	1.0	0.0
CASUALTIES = None				Overpack	0.0	1.0	0.0
				Overpack-telescope	---	4.0	---
				Port Pressure Variation			
				125°F. + 185			
				160°F. - 65			
				-65°F. - 160			

20 rds/ctn
Packed: 720 rds/M2A1 box
1440 rds/wirebound crate
43200 rds/pallet

Primer Sensitivity

10.86-10.53-10.68-10.03-10.64-10.46-9.96-9.29

$$\bar{H} + 3s = \frac{10.00 - 10.17}{9.89 - 10.17}$$

3.78-3.63-3.24-3.24-3.56-3.86-3.36-3.59-

K - 3s - 3.59-3.51

This Lot of Ammunition Has Met All Requirements For Acceptance.

J. L. Williamson
Contractor Representative

9/9/67
Date

Joseph J. Lelli
Ordnance Representative

Apr-16
Date

Unclassified
Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

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		2b. GROUP	
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4. DESCRIPTIVE NOTES (Type of report and inclusive dates) Technical Note			
5. AUTHOR(S) (First name, middle initial, last name) ANDREW J. GRANDY			
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11. SUPPLEMENTARY NOTES		12. SPONSORING MILITARY ACTIVITY USAMUCOM	
13. ABSTRACT This report is concerned with a limited investigation of the 5.56mm cartridge, lot LC-12387, fired from M16A1 rifles using the standard flash suppressor, FSN-1005-933-8089. Two 5000-round confirmatory tests were fired in M16A1 rifles at Frankford Arsenal using ammunition lot LC-12387. These tests have indicated the adequacy of this ammunition when fired in standard rifles with standard flash suppressors. There was no significant accumulation of cartridge residue in the bolt-carrier group of either of the test rifles. Residue accumulation in the gas tube appeared normal as indicated by air flow readings and weight measurements. Review of test data contained in U.S. Army Human Engineering Laboratories (USAHEL) Letter Report No. 88 has indicated that the use of noise suppressing muzzle attachments can seriously affect gas tube life in the M16A1 rifles.			

DD FORM 1473 REPLACES DD FORM 1473, 1 JAN 64, WHICH IS OBSOLETE FOR ARMY USE.

Unclassified
Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
gas tube fouling M16A1 rifle M193 ball cartridge						