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FINAL REPORT ON

SPECIAL STUDY

OF

HIGH TEMPERATURE BORE FOULING OF 5.56-MM, M196 TRACER CARTRIDGE IN M16A1 RIFLE

BY

A. R. HANKINS

FEBRUARY 1968

ABERDEEN PROVING GROUND
ABERDEEN PROVING GROUND, MARYLAND

AMSTE-BC 5 MAR 1968

SUBJECT: Final Report on Special Study of High Temperature Bore Fouling of 5.56mm Tracer Cartridge in M16A1 Rifle, USATECOM Project 8-8-0200-08

(1) The M196 tracer cartridge assembled with WC 846 propellant and fired in the all-tracer mode is unsuitable for use in the M16A1 rifle at ambient temperature of 95°F, or higher.

(2) The use of GMCS bullet jackets with M196 cartridges loaded with WC 846 propellant and fired in the all-tracer mode constitutes an improvement but does not eliminate the performance difficulties experienced with this cartridge assembled with GM bullet jackets.

b. It is recommended that:

(1) The use of WC 846 propellant in the M196 all-tracer cartridge modes be discontinued where employment of the ammunition at ambient temperatures approaching 95°F can be expected.

(2) Investigation be conducted to identify the cause, and remedy, of the unsatisfactory performance given in this test by M196 all-tracer loading with WC 846 propellant.

(3) The mix of ball and tracer cartridges regardless of propellant be determined which will yield acceptable performance within useable temperature ranges and specified rates of fire.

FOR THE COMMANDER:

Robert B. Tully

ROBERT B. TULLY
Colonel, GS
Dir, Inf Mat Test Dir

1 Incl
APG Rpt No. DPS-2664

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ABERDEEN PROVING GROUND
ABERDEEN PROVING GROUND, MARYLAND
21005

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ABSTRACT

A special study was conducted at Aberdeen Proving Ground from November 1967 through January 1968 to investigate bore fouling when firing M196 tracer ammunition from the M16A1 rifle in a high-temperature environment. Seventeen lots of M196 tracer cartridges, representing several manufacturing "variables", were tested at 95°F and 155°F. It was concluded that the M196 tracer cartridge loaded with WC 846 (ball-type) propellant is incompatible with the M16A1 rifle when stored and fired at 95°F or higher; the tracer cartridges loaded with IMR 8208M propellant performed satisfactorily in the M16A1 rifle at the test temperatures.

FOREWORD

Development and Proof Services was responsible for preparation of the test plan outline, conducting the test, and preparing the test report.

ABERDEEN PROVING GROUND
ABERDEEN PROVING GROUND, MARYLAND 21005

USATECOM PROJECT NO. 8-8-0200-08

FINAL REPORT ON SPECIAL STUDY OF HIGH TEMPERATURE BORE FOULING OF 5.56-MM, M196 TRACER AMMUNITION IN M16A1 RIFLE

NOVEMBER 1967 THROUGH JANUARY 1968

SECTION 1. INTRODUCTION

1.1 BACKGROUND

Reported isolated instances of bore fouling in the 5.56-mm, M16A1 rifle when firing all-tracer ammunition and an occurrence of severe bore fouling with tracer ammunition in a current test at Aberdeen Proving Ground indicated the need for an investigation of this phenomenon. The bore fouling experienced at Aberdeen Proving Ground, in conjunction with jacket separations, excessive dispersion, and erratic bullet flight, occurred under a high-temperature environment (+155°F) with a tracer lot (LC-12081) assembled with ball propellant. A tracer lot (TW-18001) containing IMR propellant, tested similarly, performed satisfactorily. A test was therefore begun to learn whether the problem was associated with the particular lot, the manufacturer, or the propellant. Tracer cartridges assembled with gilding-metal-clad steel (GMCS) bullet jackets were also included in the test to learn whether these constituted an improvement over the standard gilding-metal (GM) jacket with respect to the bore fouling condition.

1.2 DESCRIPTION OF MATERIEL

Seventeen lots of cartridges, 5.56-mm, tracer, M196, representing several manufacturing "variables" in 5.56-mm tracer ammunition, were used in this test. These lots consisted of cartridges from two assembly plants (Lake City and Twin Cities) both IMR- and ball-propellant-loaded lots, and cartridges assembled with experimental GMCS bullet jackets and the standard GM jackets. Identification of components associated with each lot is contained in Table 2.2-I.

1.3 TEST OBJECTIVE

To determine the prevalence among variously assembled 5.56-mm tracer cartridge lots of an apparent incompatibility of tracer ammunition with the M16A1 rifle when used in a high-temperature environment.

1.4 SUMMARY OF RESULTS

Each of four lots of ball-propellant-loaded tracer cartridges assembled with GM jackets, each tested in a separate rifle, demonstrated severe bore fouling, excessive bullet yaw and jacket separations in the first or second 80-round cycle of firing in the 155°F environment. Representative witness-screen targets are shown in Appendix I. None of the six Lake City or five Twin Cities test lots (GM jackets) loaded with IMR propellant exhibited this condition when similarly fired to 1000 rounds on each rifle - lot combination.

Tests of the four ball-propellant-loaded lots were repeated with new rifles and with materiel conditioned to 95°F. The four lots demonstrated the same performance as encountered at 155°F within one to five 80-round cycles of firing.

The remaining quantities of the samples from three of the ball-propellant lots initially conditioned to 155°F were reconditioned to 95°F and fired from new rifles at that temperature. One lot repeated the performance initially encountered at 155°F in the first 80-round cycle, the remaining two lots demonstrated bore fouling and one bullet breakup but otherwise fired seven cycles successfully.

The ball-propellant-loaded lot with experimental GMCS bullet jackets showed some improvement at 155°F over the lots with ball propellant and standard GM jackets. Bore fouling and bullet yaw occurred only after 480 rounds and then to a lesser degree than with the standard jackets. The lot with GMCS jackets and IMR propellant gave performance comparable to that of the IMR-loaded lots with GM jackets.

Tests conducted with a combination of rifle and ball-propellant lot which had previously proven unsatisfactory at 155°F showed the combination would perform satisfactorily without removing the fouling from the bore when the ammunition was conditioned to range temperature (44°F) and the weapon remained at 155°F. Conversely, when 155°F ammunition was fired with the rifle at range temperature, bullet yaw and erratic flight occurred. A previously unfired rifle was successfully fired 400 rounds with one of the ball-propellant lots with both the rifle and ammunition at range temperature.

1.5 CONCLUSIONS

It is concluded that:

a. The M196 tracer cartridge assembled with WC 846 propellant is unsuitable for use in the M16A1 rifle at ambient temperature of 95°F, or higher (ref pars. 1.4 and 2.2.3).

b. The use of GMCS bullet jackets with M196 cartridges loaded with WC 846 propellant constitutes an improvement but does not eliminate the performance difficulties experienced with this cartridge assembled with GM bullet jackets (ref pars. 1.4 and 2.2.3).

1.6 RECOMMENDATIONS

It is recommended that:

a. The use of WC 846 propellant in the M196 tracer cartridge be discontinued where employment of the ammunition at ambient temperatures approaching 95°F can be expected.

b. Investigation be conducted to identify the cause, and remedy, of the unsatisfactory performance given in this test by M196 tracer loaded with WC 846 propellant.

SECTION 2. DETAILS OF TEST

2.1 INTRODUCTION

Testing was conducted with all test ammunition lots and associated weapons conditioned to 155°F. The four test lots containing WC 846 propellant were also tested at 95°F and, additionally, three of these lots were tested at 95°F after initially being conditioned to 155°F. Other firings were conducted with the rifles and one WC 846 propellant lot at range temperature.

2.2 HIGH TEMPERATURE

2.2.1 Objective

To examine the various test lots of M196 tracer for the occurrence of severe bore fouling, bullet yaw, and erratic bullet flight when fired from the M16A1 rifle under a high temperature environment.

2.2.2 Method

The bores of the M16A1 rifles used in the test were gaged and inspected prior to use.

The weapons and ammunition were stored and fired under environmental temperature conditions as given in Table 2.2-I.

The firing schedule consisted of 80-round cycles with the weapon returned to the ambient environmental temperature at the end of each cycle. Modes of fire were alternated (by magazine) between semiautomatic fire and automatic fire in short bursts. Repetitive cycles were fired with each weapon and cartridge-lot combination until definitive results were obtained.

All firing was directed through a paper witness-screen target located 25 meters forward of the firing point. A separate target (shot-group) was obtained for each 20 rounds.

Initially, firing was conducted with one weapon for each cartridge lot. Additional weapons were fired as indicated in Table 2.2-I.

The bores of the rifles were cleaned prior to beginning the test but were not cleaned at any time during the test.

To the extent possible, a count of downrange trace function was made during the firing of each lot.

Records of the number and type of malfunctions were maintained for each weapon and cartridge-lot combination.

2.2.3 Results

The results of the high-temperature test are shown in Table 2.2-I. Performance data for the M16A1 rifles used in the test, bore measurements and inspection data, photographs of representative witness screen targets, and tracer function data are given in Appendix I.

Table 2.2-I. Barrel Fouling Test Data

Rifle No. APG	Rifle No. Mfr	No. Cycles, 80 Rd/ cycle[a]	Total Rds Fired	Tracer, M196 Ammunition Lot	Prop. Type	Bullet Jacket	Proj Performance[b]	Barrel Cond
Weapons and ammunition conditioned at +155°F.								
1	613991	2	160	LC-12071	Ball	GM	Yaw after 60 rd	Fouled
2	749787	1	80	LC-12112	Ball	GM	Yaw after 7 rd	Fouled
3	803273	1	80	LC-12114	Ball	GM	Yaw after 10 rd	Fouled
4	807238	1	80	LC-12115	Ball	GM	Yaw after 10 rd	Fouled
5	809140	12	1000	LC-12119	IMR	GM	Satisfactory	Clean
6	654600X	12	1000	LC-12107	IMR	GM	Satisfactory	Clean
7	766198	12	1000	LC-12108	IMR	GM	Satisfactory	Clean
8	800219	12	1000	LC-SP-499	IMR	GMCS	Satisfactory	Clean
9	800686	12	1000	LC-12109	IMR	GM	Satisfactory	Clean
10	802960	12	1000	LC-SP-520	Ball	GMCS	Yaw after 480 rd	Fouled
11	804059	12	1000	TW-18018	IMR	GM	Satisfactory	Clean
12	805255	12	1000	TW-18027	IMR	GM	Satisfactory	Clean
14	808311	12	980	TW-18028	IMR	GM	Satisfactory	Clean
15	808411	12	1000	LC-12110	IMR	GM	Satisfactory	Clean
16	808565	12	1000	LC-12111	IMR	GM	Satisfactory	Clean
17	809705	12	998	TW-18045	IMR	GM	Satisfactory	Clean
18	813583	12	1000	TW-18047	IMR	GM	Satisfactory	Clean
19	813856	12	1000	LC-SP-499	IMR	GMCS	Satisfactory	Clean
20	813861	12	1000	LC-SP-520	Ball	GMCS	Yaw after 480 rd	Fouled

[a]An additional 20 to 40 rounds were fired following each 12th cycle (960 rounds) to complete the total number of rounds shown.

[b]Yaw indicates occurrence of bullet yaw, increased dispersion, erratic bullet flight, and evidence of bullet breakup after number of rounds indicated.

Table 2.2-I (Cont'd)

Rifle No. APG	Rifle No. Mfr	No. Cycles, 80 Rd/ cycle[a]	Total Rds Fired	Tracer, M196 Ammunition Lot	Prop. Type	Bullet Jacket	Proj Performance[b]	Barrel Cond
Weapon conditioned at +155°F. Ammunition conditioned at +44°F (previously conditioned at +155°F).								
2	749787	1	80	LC-12112	Ball	GM	Satisfactory	Fouled
Weapon conditioned at +44°F. Ammunition conditioned at +155°F.								
2	749787	1	80	LC-12112	Ball	GM	Yaw after 60 rd	Fouled
Weapon and ammunition reconditioned from +155°F to +44°F.								
13	808300	5	400	LC-12112	Ball	GM	Satisfactory	Fouled
Weapons and ammunition reconditioned from +155°F to +95°F.								
21	813908	7	557	LC-12071	Ball	GM	Satisfactory	Fouled
22	814152	7	560	LC-12114	Ball	GM	Satisfactory	Fouled
24	814328	1	80	LC-12115	Ball	GM	Yaw after 60 rd	Fouled
Weapons and ammunition conditioned at +95°F.								
25	814451	5	400	LC-12071	Ball	GM	Yaw on target	Fouled
26	814589	4	320	LC-12112	Ball	GM	Yaw on target	Fouled
27	814599	1	80	LC-12115	Ball	GM	Yaw after 60 rd	Fouled
28	814808	1	80	LC-12114	Ball	GM	Yaw after 60 rd	Fouled

[a]An additional 20 to 40 rounds were fired following each 12th cycle (960 rounds) to complete the total number of rounds shown.
[b]Yaw indicates occurrence of bullet yaw, increased dispersion, erratic bullet flight, and evidence of bullet breakup after number of rounds indicated.

GM = Gilding metal.
GMCS = Gilding-metal-clad-steel.

The following observations were made during the test:

a. Cartridge lots loaded with WC 846 propellant were observed under daylight conditions, to give visible display of trace upon bullet exit from the muzzle whereas lots loaded with IMR 8208 propellant gave visible trace only after the projectile had traveled 5 to 10 feet from the muzzle.

b. In many instances, ejected tracer closure disks were noted on the ground forward of the gun position. The proximity of some of these to the muzzle poses the possibility that some are being ejected and burned in the bore, and may contribute to fouling of the bore.

c. During the firing of GMCS lots loaded with ball propellant, unique fouling deposits were observed on interior and exterior surfaces of the weapon. The fouling was rust-colored and appeared to be vaporized gilding metal. Some "drying" of the lubricant on the gun parts was associated with the fouling; however, gun functioning was not affected. The IMR-loaded GMCS lot did not exhibit this peculiar type of fouling.

d. The excessive fouling in the bore after firing the ball-propellant-loaded lots was from the gas port forward. The remainder of the barrel showed relatively little fouling. The fouling build-up was sufficiently severe to prevent gaging the barrels after firing.

e. One instance of bullet breakup was detected during the firing of 2000 rounds of the IMR-loaded GMCS lot. The breakup was evidenced by a fragment hole in the witness-screen target.

2.2.4 Analysis

It is apparent from results of this test that the combination of elevated temperature and ball propellant produces unsatisfactory performance of the M196 tracer cartridge; however, the fact that IMR-loaded cartridges performed satisfactorily does not necessarily indicate that the origin of the problem rests with the propellant. The probabilities must be considered that some unidentified characteristic(s) of the M196 bullet design, component materials, or the technique of assembly provides a marginal condition which is revealed when the bullet is subjected to the interior ballistics generated with WC 846 propellant. This consideration dictates that the cause of the failure be identified and eliminated, not only to secure compatibility with WC 846 propellant but to assure that the M196 bullet, as assembled, is reliable.

SECTION 3. APPENDICES

APPENDIX I - TEST DATA

Performance Data, M16A1 Rifle

No. Rds Fired	Total Rds Fired	Stoppages	Remarks
Weapons and ammunition conditioned at +155°F.			
Rifle Serial No.: 613991. Ammunition: Cartridge, 5.56-mm, tracer, M196, lot LC-12071 (ball propellant WC 846), GM bullet jacket.			
160	160	None	
Rifle Serial No.: 749787. Ammunition: Cartridge, 5.56-mm, tracer, M196, lot LC-12112 (ball propellant WC 846), GM bullet jacket.			
80	80	None	
Rifle Serial No.: 803273. Ammunition: Cartridge, 5.56-mm, tracer, M196, lot 12114 (ball propellant WC 846), GM bullet jacket.			
80	80	None	
Rifle Serial No.: 807238. Ammunition: Cartridge, 5.56-mm, tracer, M196, lot 12115 (ball propellant WC 846), GM bullet jacket.			
80	80	None	
Rifle Serial No.: 809140. Ammunition: Cartridge, 5.56-mm, tracer, M196, lot LC-12119 (IMR propellant 8208M), GM bullet jacket.			
160	160	None	
80	240	2-FF	Occurred during 2nd round of first and fourth magazines. Both rounds damaged during chambering.
80	320	1-FF	Same as above (5th round of 4th magazine).
80	400	1-FF	Same as above (5th round of 2nd magazine).
80	480	1-FF	Same as above (3rd round of 3rd magazine).

No. Rds Fired	Total Rds Fired	Stoppages	Remarks
80	560	1-FF	Same as above (20th round of 2nd magazine).
80	640	4-FF	Same as above (4th and 17th round of 2nd magazine, third round of 3rd magazine, and 16th round of 4th magazine).
80	720	6-FF	Same as above (9th, 11th, and 15th round of 1st magazine, 7th round of 3rd magazine, and 14th and 17th round of 4th magazine).
80	800	8-FF	Same as above (2nd, 7th and 15th round of 1st magazine, 4th and 14th round of 2nd magazine, 2nd and 4th round of 3rd magazine, and 6th round of 4th magazine).
80	880	13-FF	Rounds damaged during chambering.
120	1000	7-FF	Rounds damaged during chambering.
Rifle Serial No.: 654600X. Ammunition: Cartridge, 5.56-mm, tracer, M196, lot LC-12107 (IMR propellant 8208M), GM bullet jacket.			
1000	1000	None	
Rifle Serial No.: 766198. Ammunition: Cartridge, 5.56-mm, tracer, M196, lot LC-12108 (IMR propellant 8208M), GM bullet jacket.			
80	80	2-BOB	Occurred with 3rd and 11th round of first magazine.
720	800	None	
80	880	1-BOB	Occurred with 5th round of first magazine.
120	1000	None	
Rifle Serial No.: 800219. Ammunition: Cartridge, 5.56-mm, tracer, M196, lot LC-SP-499 (IMR propellant 8208M), GMCS bullets.			
240	240	None	
80	320	None	
680	1000	None	

No. Rds Fired	Total Rds Fired	Stoppages	Remarks
Rifle Serial No.: 800686. Ammunition: Cartridge, 5.56-mm, tracer, M196, lot LC-12109 (IMR propellant 8208M), GM bullet jacket.			
1000	1000	None	
Rifle Serial No.: 802960. Ammunition: Cartridge, 5.56-mm, tracer M196, lot LC-SP-520 (ball propellant WC 846), GMCS bullets.			
80	80	None	
80	160	None	
840	1000	None	
Rifle Serial No.: 804059. Ammunition: Cartridge, 5.56-mm, tracer, M196, lot TW-18018 (IMR propellant 8208M), GM bullet jacket.			
1000	1000	None	
Rifle Serial No.: 805255. Ammunition: Cartridge, 5.56-mm, tracer, M196, lot TW-18027 (IMR propellant 8208M), GM bullet jacket.			
1000	1000	None	
Rifle Serial No.: 808311. Ammunition: Cartridge, 5.56-mm, tracer, M196, lot TW-18028 (IMR propellant 8208M), GM bullet jacket.			
1000	1000	None	
Rifle Serial No.: 808411. Ammunition: Cartridge, 5.56-mm, tracer, M196, lot LC-12110 (IMR propellant 8208M), GM bullet jacket.			
80	80	1-BOB	Occurred with the 2nd round of first magazine.
920	1000	None	
Rifle Serial No.: 808565. Ammunition: Cartridge, 5.56-mm, tracer, M196, lot LC-12111 (IMR propellant 8208M), GM bullet jacket.			
720	720	None	
80	800	1-FF	Occurred with 1st round of second magazine.
200	1000	None	

No. Rds Fired	Total Rds Fired	Stoppages	Remarks
Rifle Serial No.: 809705. Ammunition: Cartridge, 5.56-mm, tracer, M196, lot TW-18045 (IMR propellant 8208M), GM bullet jacket.			
998	998	None	
Rifle Serial No.: 813583. Ammunition: Cartridge, 5.56-mm, tracer, M196, lot TW-18047 (IMR propellant 8208M), GM bullet jacket.			
480	480	None	
80	560	1-FJ	Occurred with fourth magazine. Next round was in the chamber.
80	640	1-FJ	Occurred with 11th round of second magazine. Both empty case and next round were trying to feed into chamber.
80	720	None	
80	800	1-FJ	Occurred with 6th round of second magazine. Both empty case and next round were trying to feed into chamber.
		1-FX	Occurred with third magazine. The next round was being fed from magazine.
		1-FJ	Occurred with 14th round of fourth magazine. Next round was in the chamber.
80	880	1-FX	Occurred with 16th round of fourth magazine. The next round was being fed from the magazine.
120	1000	None	
Rifle Serial No.: 813856. Ammunition: Cartridge, 5.56-mm, tracer, M196, lot LC-SP-499 (IMR propellant 8208M), GMCS bullets.			
1000	1000	None	

No. Rds Fired	Total Rds Fired	Stoppages	Remarks
Rifle Serial No.: 813861. Ammunition: Cartridge, 5.56-mm, tracer, M196, lot LC-SP-520 (ball propellant WC 846), GMCS bullets.			
400	400	None	
80	480	None	
520	1000	None	
Weapon conditioned at +155°F. Ammunition conditioned at +44°F (reconditioned from +155°F). Rifle Serial No.: 749787. Ammunition : Cartridge, 5.56-mm, tracer, M196, lot LC-12112 (ball propellant WC 846), GM bullet jacket.			
80	80	None	
Weapon conditioned at +44°F. Ammunition conditioned at +155°F. Rifle Serial No.: 749787. Ammunition: Cartridge, 5.56-mm, tracer, M196, lot LC-12112 (ball propellant WC 846), GM bullet jacket.			
80	80	None	
Weapon and Ammunition reconditioned from +155°F to +44°F. Rifle Serial No.: 808300. Ammunition: Cartridge, 5.56-mm, tracer, M196, lot LC-12112 (ball propellant WC 846), GM bullet jacket.			
400	400	None	
Weapons and ammunition reconditioned from +155°F to +95°F. Rifle Serial No.: 813908. Ammunition: Cartridge, 5.56-mm, tracer, M196, lot LC-12071 (ball propellant WC 846), GM bullet jacket.			
557	557	None	
Rifle Serial No.: 814152. Ammunition: Cartridge, 5.56-mm, tracer, M196, lot LC-12114 (ball propellant WC 846), GM bullet jacket.			
240	240	None	
80	320	1-Failure to extract.	Occurred with 4th round of first magazine. The next round was being fed to the chamber.

No. Rds Fired	Total Rds Fired	Stoppages	Remarks
80	400	1-FX	Occurred with 19th round of first magazine. The next round was being fed to the chamber.
160	560	None	

Rifle Serial No.: 814328.
Ammunition: Cartridge, 5.56-mm, tracer, M196, lot LC-12115 (ball propellant WC 846), GM bullet jacket.

80	80	None	

Weapons and ammunition conditioned at +95°F.
Rifle Serial No.: 814451.
Ammunition: Cartridge, 5.56-mm, tracer, M196, lot LC-12071 (ball propellant WC 846), GM bullet jacket.

400	400	None	

Rifle Serial No.: 814589.
Ammunition: Cartridge, 5.56-mm, tracer, M196, lot LC-12112 (ball propellant WC 846), GM bullet jacket.

320	320	None	

Rifle Serial No.: 814599.
Ammunition: Cartridge, 5.56-mm, tracer, M196, lot LC-12115 (ball propellant WC 846), GM bullet jacket.

80	80	None	

Rifle Serial No.: 814808.
Ammunition: Cartridge, 5.56-mm, tracer, M196, lot LC-12114 (ball propellant WC 846), GM bullet jacket.

80	80	None	

BOB = Bolt overrode base.
FF = Failure to feed.
FJ = Failure to eject.
FX = Failure to extract.

Note: In these firings, the issue complement of new magazines provided with each rifle was used only in the rifle to which assigned.

MULTIPLE STARGAGE MEASUREMENT & INSPECTION DATA FORM

5.56 MM Barrel

CASTING NUMBER	[illegible]
MANUFACTURER	
PROOF OFFICER	[illegible]
MODEL	M16A1
NUMBER OF ROUNDS	B.F. APG
NUMBER	613771
FIRING STATUS (Check One)	BEFORE ✓ / AFTER
	APG # 1
5.56 MM Barrel	
DATE OF GAUGING	14 NOV. '67

Dist. (inches) From Rear Face of Barrel	Dist. (inches) From Face of Flash Suppressor ✓	Meas. indicated in .0001 of an inch. LANDS .2190" Vert.	LANDS .2190" Hor.	Grooves .2235" Vert.	Grooves .2235" Hor.
20.	1.25	+.0004	+.0004	+.0005	+.0007
19.70	2.00	2	4	8	7
18.70	3.00	2	4	9	8
17.70	4.00	3	3	9	8
16.70	5.00	3	3	8	8
15.70	6.00	3	4	8	9
14.70	7.00	2	2	6	8
13.70	8.00	0	2	6	6
12.70	9.00	1	4	8	7
11.70	10.00	0	2	9	7
10.70	11.00	2	3	10	7
9.70	12.00	2	2	10	8
8.70	13.00	2	3	10	8
7.70	14.00	1	3	9	8
6.70	15.00	2	3	9	8
5.70	16.00	2	3	9	8
4.70	17.00	3	3	9	8
3.70	18.00	2	3	9	7
3.35	18.35	2	3	9	8
2.85	18.85	2	3	10	7
2.60	19.10	+.0002	+.0003	+.0009	+.0007

BORESCOPE REMARKS:
HEAVY CIRCUMFERENTIAL TOOL MARKS BEGINNING IN STRAIGHT OF CHAMBER AND EXTENDING THROUGHOUT ENTIRE DRIVING EDGES OF LANDS CHIPPED ON FORCING CONE. FOR WORD EDGE OF GAS PORT LIGHTLY ERODED.

BY: SCHANTZ - MONK

MULTIPLE STARGAGE MEASUREMENT & INSPECTION DATA FORM

Item	Entry
Casting Number	X
Manufacturer	
Model	M16A1
Number	749787
5.56 MM Barrel	APG #2
Proof Officer	HAWKINS W.O. 324-633-70
Number of Rounds	B.F. APG
Firing Status (Check One)	Before: ✓ After:
Date of Gauging	14 NOV. 67

5.56 MM Barrel

Dist. (inches) From		Meas. indicated in .0001 of an inch.			
Rear Face of Barrel	Face of Flash Suppressor	LANDS .2190" Vert.	LANDS .2190" Hor.	Grooves .2235" Vert.	Grooves .2235" Hor.
20.	1.25 ✓	+.0004	+.0005	+.0003	+.0004
19.70	2.00	4	4	3	3
18.70	3.00	5	4	3	2
17.70	4.00	4	4	3	3
16.70	5.00	4	4	3	5
15.70	6.00	5	4	4	4
14.70	7.00	4	5	3	4
13.70	8.00	4	4	4	4
12.70	9.00	4	3	4	4
11.70	10.00	2	2	4	5
10.70	11.00	2	4	2	4
9.70	12.00	4	5	3	2
8.70	13.00	2	2	1	1
7.70	14.00	3	2	1	1
6.70	15.00	2	1	3	4
5.70	16.00	3	4	3	5
4.70	17.00	3	2	4	5
3.70	18.00	3	3	5	5
3.35	18.35	4	5	5	6
2.85	18.85	5	3	5	5
2.60	19.10	+.0004	+.0005	+.0005	+.0005

BORESCOPE REMARKS:
LIGHT. CIRCUMFERENTIAL TOOL MARKS BEGINING IN STRAIGHT OF CHAMBER AND EXTENDING THROUGHOUT BORE. HEAVY TO LIGHT PITTING BEGINNING AT ORIGIN OF RIFLING AND EXTENDING FORWARD APPROX 12.0 INCHES. DRIVING EDGES OF LANDS CHIPPED AT COMMENCEMENT OF RIFLING. FORWARD EDGE OF [illegible] LIGHTLY ERODED.

BY: SCHANTZ

MULTIPLE STARGAGE MEASUREMENT & INSPECTION DATA FORM

CASTING NUMBER	X
MANUFACTURER	
MODEL	M16A1
NUMBER	203273
(item)	5.56 MM Barrel
PROOF OFFICER	W.O. 324-633-80 H.D. Hawkins
NUMBER OF ROUNDS	B.F. APG
FIRING STATUS (Check One)	APG # 3 — BEFORE ✓ / AFTER
DATE OF GAUGING	14 Nov. 67

5.56 MM Barrel

Dist. (inches) From Rear Face of Barrel	Dist. (inches) From Face of Flash Suppressor ✓	Meas. indicated in .0001 of an inch. LANDS .2190" Vert.	LANDS .2190" Hor.	Grooves .2235" Vert.	Grooves .2235" Hor.
20.	1.25	+.0004	+.0004	+.0003	+.0003
19.70	2.00	3	2	3	3
18.70	3.00	4	2	5	4
17.70	4.00	3	3	4	3
16.70	5.00	3	1	3	4
15.70	6.00	4	1	2	4
14.70	7.00	3	1	3	4
13.70	8.00	1	2	3	3
12.70	9.00	2	1	3	4
11.70	10.00	1	2	3	4
10.70	11.00	2	2	4	4
9.70	12.00	3	2	4	4
8.70	13.00	2	2	5	4
7.70	14.00	0	2	4	4
6.70	15.00	2	2	5	5
5.70	16.00	4	2	5	5
4.70	17.00	4	3	5	5
3.70	18.00	4	4	5	5
3.35	18.35	4	3	5	5
2.85	18.85	4	4	5	5
2.60	19.10	+.0005	+.0004	+.0005	+.0005

BORESCOPE REMARKS: Heavy circumferential tool marks beginning in straight of chamber and extending through throat of bore. Forward ledge of gas port lightly eroded.

BY: SCHANTZ - NIAK

MULTIPLE STARGAGE MEASUREMENT & INSPECTION DATA FORM

5.56 MM Barrel

Field	Entry
5.56 MM Barrel	
Date of Gauging	14 NOV. 67
Number	807238
Firing Status (Check One)	Before ✓ / After
	APG # 4
Model	M16A1
Number of Rounds	B.F 1,226
Manufacturer	
Proof Officer	HANKINS
Casting Number	
	W.O. 324-633-80

5.56 MM Barrel

Dist. (inches) From		Meas. indicated in .0001 of an inch.			
Rear Face of Barrel	Face of Flash Suppressor ✓	LANDS .2190" Vert.	LANDS .2190" Hor.	Grooves .2235" Vert.	Grooves .2235" Hor.
20.	1.25	±.0005	±.0004	±.0004	±.0004
19.70	2.00	5	4	5	5
18.70	3.00	5	4	6	6
17.70	4.00	4	5	5	5
16.70	5.00	4	4	4	5
15.70	6.00	5	4	4	5
14.70	7.00	2	4	3	5
13.70	8.00	1	2	3	6
12.70	9.00	2	2	4	4
11.70	10.00	2	2	3	4
10.70	11.00	2	2	2	3
9.70	12.00	1	2	4	3
8.70	13.00	2	3	4	3
7.70	14.00	2	2	4	4
6.70	15.00	3	2	4	4
5.70	16.00	3	2	4	4
4.70	17.00	4	3	4	4
3.70	18.00	4	3	4	5
3.35	18.35	4	3	5	5
2.85	18.85	5	4	5	5
2.60	19.10	±.0004	±.0003	±.0005	±.0005

BORESCOPE REMARKS: Light circumferential tool marks beginning in straight of chamber and extending throughout bore. Driving edges of lands chipped in forcing cone. Forward edge of gas port slightly eroded.

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MULTIPLE STARGAGE MEASUREMENT & INSPECTION DATA FORM

5.56 MM Barrel

Dist. (inches) From: Rear Face of Barrel	Face of Flash Suppressor	Meas. indicated in .0001 of an inch. LANDS .2190" Vert.	LANDS .2190" Hor.	Grooves .2235" Vert.	Grooves .2235" Hor.
20.	1.25	+.0004	+.0003	+.0005	+.0004
19.70	2.00	3	2	6	7
18.70	3.00	4	3	8	9
17.70	4.00	3	3	9	9
16.70	5.00	3	2	8	7
15.70	6.00	3	3	8	7
14.70	7.00	1	2	7	9
13.70	8.00	1	1	7	8
12.70	9.00	2	1	8	8
11.70	10.00	3	1	9	9
10.70	11.00	2	2	9	8
9.70	12.00	2	3	7	8
8.70	13.00	1	3	7	8
7.70	14.00	2	3	8	8
6.70	15.00	3	3	9	9
5.70	16.00	2	3	10	9
4.70	17.00	2	3	10	9
3.70	18.00	2	3	9	8
3.35	18.35	3	2	8	8
2.85	18.85	3	2	9	9
2.60	19.10	+.0003	+.0003	+.0009	+.0009

BORESCOPE REMARKS: Light circumferential tool marks extending throughout bore, more pronounced in straight of chamber. Driving edges of lands chipped in leading cone area. Forward edge of gas port lightly eroded.

BY: SCHANTZ-MONK

- 5.56 MM Barrel
- NUMBER: 809140 APG#5
- FIRING STATUS (Check One): BEFORE ✓ AFTER
- DATE OF GAUGING: 14 NOV. 67
- MODEL: M16A1
- NUMBER OF ROUNDS: B.F. APG
- MANUFACTURER:
- PROOF OFFICER: HAWKINS W.O. 324-633-70
- CASTING NUMBER: X

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MULTIPLE STARGAGE MEASUREMENT & INSPECTION DATA FORM

5.56 MM Barrel M16A1

CASTING NUMBER	X	
MANUFACTURER		
PROOF OFFICER	HAWKINS W.O. 324-633-80	
MODEL	M16A1	
NUMBER OF ROUNDS	B.E. APG	
NUMBER	654600X APG # 6	
FIRING STATUS (Check One)	BEFORE ✓	AFTER
5.56 MM Barrel		
DATE OF GAUGING	15 NOV. 67	

Dist. (inches) From		Meas. indicated in .0001 of an inch.			
Rear Face of Barrel	Face of Flash Suppressor	LANDS .2190" Vert.	LANDS .2190" Hor.	Grooves .2235" Vert.	Grooves .2235" Hor.
20.	1.[illegible]	+.0008	+.0002	+.0009	+.0005
19.70	2.00	4	2	4	5
18.70	3.00	4	2	5	5
17.70	4.00	4	3	5	6
16.70	5.00	4	3	5	6
15.70	6.00	3	3	4	6
14.70	7.00	2	3	5	5
13.70	8.00	2	2	6	4
12.70	9.00	3	4	5	5
11.70	10.00	3	4	6	6
10.70	11.00	3	4	5	7
9.70	12.00	3	3	5	6
8.70	13.00	4	3	6	6
7.70	14.00	4	3	7	6
6.70	15.00	4	4	6	7
5.70	16.00	4	4	7	7
4.70	17.00	5	4	7	7
3.70	18.00	5	4	7	6
3.35	18.35	4	4	7	6
2.85	18.85	5	5	7	7
2.60	19.10	+.0005	+.0005	+.0007	+.0007

BORESCOPE REMARKS: Light circumferential tool marks beginning in shoulder of chamber and extending forward throughout bore. Lands lightly chipped on driving edges in forcing cone area. Forward edge of gas port eroded slightly. Light metallic build up throughout bore, more pronounced at muzzle end.

BY: HOYLE & WILMOTH

MULTIPLE STARGAGE MEASUREMENT & INSPECTION DATA FORM

5.56 MM Barrel — M16A1

- CASTING NUMBER: X
- MANUFACTURER:
- PROOF OFFICER: HINKINS W.O. 324-633-80
- MODEL: M16A1
- NUMBER OF ROUNDS: 3.F. APG
- NUMBER: 766198 APG# 7
- FIRING STATUS (Check One): BEFORE ✓ AFTER
- DATE OF GAUGING: 15 NOV. 67
- 5.56 MM Barrel

Dist. (inches) From Rear Face of Barrel	Face of Flash Suppressor	Meas. indicated in .0001 of an inch. LANDS .2190" Vert.	Hor.	Grooves .2235" Vert.	Hor.
20.	1.25	+.0006	+.0006	+.0004	+.0005
19.70	2.00	6	5	5	5
18.70	3.00	5	5	6	6
17.70	4.00	6	4	6	4
16.70	5.00	6	4	5	4
15.70	6.00	6	6	6	4
14.70	7.00	4	4	4	4
13.70	8.00	5	3	5	2
12.70	9.00	3	3	4	4
11.70	10.00	2	3	4	4
10.70	11.00	3	3	5	4
9.70	12.00	3	4	5	4
8.70	13.00	2	2	4	4
7.70	14.00	3	2	5	5
6.70	15.00	4	3	5	5
5.70	16.00	2	2	5	5
4.70	17.00	4	4	5	5
3.70	18.00	4	4	5	6
3.35	18.35	4	4	5	6
2.85	18.85	4	4	5	6
2.60	19.10	+.0004	+.0005	+.0005	+.000[illegible]

BORESCOPE REMARKS: Light to moderate circumferential and [illegible] erosion in straight of chamber and extending [illegible] throughout bore. Driving edges of lands chipped in forcing cone and commencement of rifling. Light [illegible] on forward edge of gas port.

BY: MONK & WILKINSON

5.56 MM Barrel M16A1

Dist. (inches) From		Meas. indicated in .0001 of an inch.			
		LANDS .2190"		Grooves .2235"	
Rear Face of Barrel	Face of Flash Suppressor	Vert.	Hor.	Vert.	Hor.
20.	1.25	+.0005	+.0005	+.0008	+.0009
19.70	2.00	5	5	8	9
18.70	3.00	4	4	10	10
17.70	4.00	4	5	10	10
16.70	5.00	4	4	9	10
15.70	6.00	4	5	9	9
14.70	7.00	3	4	7	8
13.70	8.00	3	3	7	7
12.70	9.00	3	3	9	9
11.70	10.00	2	4	10	10
10.70	11.00	4	3	8	10
9.70	12.00	3	2	8	9
8.70	13.00	3	3	8	9
7.70	14.00	2	3	9	8
6.70	15.00	3	3	7	9
5.70	16.00	3	4	8	8
4.70	17.00	4	4	9	8
3.70	18.00	4	3	9	8
3.35	18.35	3	3	9	8
2.85	18.85	3	3	9	8
2.60	19.10	+.0003	+.0004	+.0008	+.0008

BORESCOPE REMARKS: Light longitudinal scratches in main powder chamber. Circumferential tool marks beginning in straight of chamber and extending forward thru-out bore. Driving edges of lands chipped in forcing cone area. Forward edge of gas port slightly eroded. Very light metallic deposits thru-out bore.

BY: [illegible]-WILMOTH

MULTIPLE STARGAGE MEASUREMENT & INSPECTION DATA FORM

5.56 MM Barrel		
NUMBER	800219 APG # 8	FIRING STATUS (Check One): BEFORE ✓ / AFTER
MODEL	M16A1	NUMBER OF ROUNDS: B.F.@ MP.
MANUFACTURER		PROOF OFFICER: Hawkins WO: 374-(?)-80
CASTING NUMBER	X	
		DATE OF GAUGING: 15 NOV. 67

MULTIPLE STARGAGE MEASUREMENT & INSPECTION DATA FORM

5.56 MM Barrel	
NUMBER	800686
	APG # 9
MODEL	M16A1
MANUFACTURER	
CASTING NUMBER	X
DATE OF GAUGING	15 NOV. 65
FIRING STATUS (Check One)	✓ BEFORE / AFTER
NUMBER OF ROUNDS	B. F. @ APG
PROOF OFFICER	HAWKINS
	W.O.: 371-652-80

5.56 MM Barrel *M16A1*

Dist. (inches) From			Meas. indicated in .0001 of an inch.			
	Rear Face of Barrel	Face of Flash Suppressor	LANDS .2190" Vert.	LANDS .2190" Hor.	Grooves .2235" Vert.	Grooves .2235" Hor.
	20.	1.25	+.0006	+.0006	+.0009	+.0009
	19.70	2.00	6	6	9	8
	18.70	3.00	5	4	10	8
	17.70	4.00	4	2	7	7
	16.70	5.00	5	4	6	7
	15.70	6.00	5	3	6	8
	14.70	7.00	4	3	6	8
	13.70	8.00	3	2	7	9
	12.70	9.00	4	4	8	8
	11.70	10.00	4	3	9	8
	10.70	11.00	3	4	7	8
	9.70	12.00	3	3	9	9
	8.70	13.00	2	2	9	9
	7.70	14.00	3	3	9	9
	6.70	15.00	2	2	9	9
	5.70	16.00	4	3	8	8
	4.70	17.00	4	4	9	9
	3.70	18.00	4	4	9	9
	3.35	18.35	3	4	8	8
	2.85	18.85	4	5	9	9
	2.60	19.10	+.0004	+.0005	+.0008	+.0008

BORESCOPE REMARKS: *Light circumferential tool marks beginning in straight of chamber and extending forward thru-out bore. Driving edges of lands lightly [illegible] in throat area. Forward edge of [illegible] and slightly [illegible], light metallic [illegible] thru-out bore.*

BY: [illegible]

MULTIPLE STARGAGE MEASUREMENT & INSPECTION DATA FORM

5.56 MM Barrel	
CASTING NUMBER	X
MANUFACTURER	
MODEL	M16A1
NUMBER	802960 APG# 10
PROOF OFFICER	HAWKINS W.O. 3011-653-80
NUMBER OF ROUNDS	B.F.@ APG
FIRING STATUS (Check One)	BEFORE ✓ / AFTER
DATE OF GAUGING	15 NOV. '71

5.56 MM Barrel M16A1

Dist. (inches) From Rear Face of Barrel	Face of Flash Suppressor	Meas. indicated in .0001 of an inch. LANDS .2190" Vert.	LANDS .2190" Hor.	Grooves .2235" Vert.	Grooves .2235" Hor.
20.	1.25	+.0004	+.0003	+.0005	+.0005
19.70	2.00	3	4	6	6
18.70	3.00	4	3	7	6
17.70	4.00	3	4	6	6
16.70	5.00	3	2	5	6
15.70	6.00	3	3	5	6
14.70	7.00	2	2	6	6
13.70	8.00	2	1	6	5
12.70	9.00	2	2	6	5
11.70	10.00	1	2	7	6
10.70	11.00	2	1	6	6
9.70	12.00	2	1	6	6
8.70	13.00	2	2	6	6
7.70	14.00	2	2	6	5
6.70	15.00	2	2	6	6
5.70	16.00	2	2	6	6
4.70	17.00	3	3	6	6
3.70	18.00	3	3	7	6
3.35	18.35	4	3	7	6
2.85	18.85	4	3	7	7
2.60	19.10	+.0004	+.0004	+.0007	+.0007

BORESCOPE REMARKS: Light circumferential tool marks beginning in straight of chamber and extending forward thru-out bore. Driving edges of lands chipped in forcing cone area. Light wiped edge on rear of [illegible]. Forward [illegible] lightly [illegible]. Light metallic deposits thru-out bore.

BY: MONK & WILMOTH

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MULTIPLE STARGAGE MEASUREMENT & INSPECTION DATA FORM

5.56 MM Barrel

NUMBER: 804057

MODEL: M16A1

MANUFACTURER:

CASTING NUMBER: X

FIRING STATUS (Check One): BEFORE ✓ AFTER — APG # 11

NUMBER OF ROUNDS: B.F.@ A[illegible]

PROOF OFFICER: HAWKINS W.O. 324-653-80

DATE OF GAUGING: 15 Nov '67

5.56 MM Barrel M16A1

Dist. (inches) From		Meas. indicated in .0001 of an inch.			
		LANDS .2190"		Grooves .2235"	
Rear Face of Barrel	Face of Flash Suppressor	Vert.	Hor.	Vert.	Hor.
20.	1.25	+.0005	+.0006	+.0007	+.0009
19.70	2.00	5	5	8	8
18.70	3.00	6	5	9	9
17.70	4.00	6	6	9	9
16.70	5.00	6	5	8	8
15.70	6.00	5	5	7	9
14.70	7.00	3	4	5	7
13.70	8.00	3	3	4	5
12.70	9.00	5	3	6	7
11.70	10.00	4	4	6	7
10.70	11.00	4	4	5	6
9.70	12.00	3	3	6	6
8.70	13.00	2	3	6	7
7.70	14.00	3	3	7	8
6.70	15.00	3	7	7	8
5.70	16.00	4	5	8	8
4.70	17.00	5	5	7	7
3.70	18.00	4	5	7	7
3.35	18.35	4	4	6	7
2.85	18.85	4	5	7	7
2.60	19.10	+.0005	+.0005	+.0006	+.0006

BORESCOPE REMARKS: Light longitudinal scratches in main rifle chamber. Circumferential tool marks beginning in straight of chamber and extending forward thru-out bore. Rough wire edge on rear of gas port. Forward edge slightly eroded.

By: [illegible]

MULTIPLE STARGAGE MEASUREMENT & INSPECTION DATA FORM

5.56 MM Barrel	
NUMBER	805255 / APG # 12
MODEL	[illegible]
MANUFACTURER	
CASTING NUMBER	X
DATE OF GAUGING	15 Nov. '67
FIRING STATUS (Check One)	BEFORE ✓ / AFTER
NUMBER OF ROUNDS	B.F. @ [illegible]
PROOF OFFICER	[illegible] W.O. 524-C53-80

5.56 MM Barrel

Dist. (inches) From		Meas. indicated in .0001 of an inch.			
Rear Face of Barrel	Face of Flash Suppressor	LANDS .2190" Vert.	LANDS .2190" Hor.	Grooves .2235" Vert.	Grooves .2235" Hor.
20.	1.25	+.0005	+.0006	+.0006	+.0006
19.70	2.00	4	6	7	7
18.70	3.00	5	5	8	8
17.70	4.00	5	4	6	7
16.70	5.00	4	4	6	7
15.70	6.00	3	3	4	6
14.70	7.00	3	3	4	4
13.70	8.00	4	3	4	4
12.70	9.00	3	3	4	5
11.70	10.00	4	2	5	4
10.70	11.00	3	3	5	4
9.70	12.00	2	3	5	4
8.70	13.00	3	3	6	5
7.70	14.00	4	3	6	6
6.70	15.00	3	4	6	6
5.70	16.00	4	4	6	6
4.70	17.00	4	4	6	6
3.70	18.00	3	4	6	6
3.35	18.35	4	5	7	6
2.85	18.85	4	4	6	7
2.60	19.10	+.0005	+.0004	+.0005	+.0006

BORESCOPE REMARKS: Light pits and scratches in origin part of chamber, light to moderate circumferential tool marks beginning in straight of chamber and [illegible], [illegible] throughout bore. Driving edges of lands chipped. Wired [illegible]. [illegible] of gas port [illegible] edges lightly eroded. Very slight metallic deposits throughout bore.

BY: Monk & Wilmoth

MULTIPLE STARGAGE MEASUREMENT & INSPECTION DATA FORM

5.56 MM Barrel	
NUMBER	808300
	APG# 13
MODEL	M16A1
MANUFACTURER	
CASTING NUMBER	X
PROOF OFFICER	W.O. [illegible]
NUMBER OF ROUNDS	B.F. @ [illegible]
FIRING STATUS (Check One)	BEFORE ✓ / AFTER
DATE OF GAUGING	15 Nov. '67

5.56 MM Barrel

Dist. (inches) From Rear Face of Barrel	Face of Flash Suppressor ✓	Meas. indicated in .0001 of an inch. LANDS .2190" Vert.	LANDS .2190" Hor.	Grooves .2235" Vert.	Grooves .2235" Hor.
20.	1.25	+.0003	+.0004	+.0005	+.0004
19.70	2.00	3	2	6	5
18.70	3.00	2	2	6	6
17.70	4.00	3	2	6	5
16.70	5.00	3	2	5	6
15.70	6.00	3	4	5	7
14.70	7.00	2	3	5	7
13.70	8.00	2	3	4	6
12.70	9.00	3	3	6	7
11.70	10.00	3	2	8	8
10.70	11.00	3	3	8	8
9.70	12.00	4	3	8	9
8.70	13.00	4	2	7	9
7.70	14.00	3	3	8	8
6.70	15.00	3	3	9	8
5.70	16.00	4	3	7	8
4.70	17.00	4	4	7	8
3.70	18.00	3	4	7	7
3.35	18.35	4	4	8	7
2.85	18.85	4	3	8	7
2.60	19.10	+.0004	+.0004	+.0007	+.0008

BORESCOPE REMARKS: Light circumferential tool marks beginning in vicinity of chamber and extending forward entire length of bore. Driving edges of lands lightly chipped in [illegible] area. Light [illegible] [illegible], bend intersecting gas port at forward edge is chipped.

By: Monk & Wilmoth

MULTIPLE STARGAGE MEASUREMENT & INSPECTION DATA FORM

5.56 MM Barrel M16A1

Dist. (inches) From Rear Face of Barrel	Face of Flash Suppressor ✓	Meas. indicated in .0001 of an inch. LANDS .2190" Vert.	LANDS Hor.	Grooves .2235" Vert.	Grooves Hor.
20.	1.25	+.0008	+.0007	+.0009	+.0009
19.70	2.00	8	7	8	8
18.70	3.00	7	6	8	6
17.70	4.00	6	7	7	6
16.70	5.00	7	6	6	6
15.70	6.00	5	6	6	7
14.70	7.00	5	6	7	8
13.70	8.00	6	4	7	7
12.70	9.00	7	6	5	5
11.70	10.00	4	4	5	5
10.70	11.00	5	4	5	5
9.70	12.00	5	4	6	6
8.70	13.00	5	4	7	7
7.70	14.00	5	5	7	7
6.70	15.00	6	5	7	7
5.70	16.00	6	5	7	7
4.70	17.00	5	5	7	7
3.70	18.00	5	6	7	7
3.35	18.35	6	6	7	6
2.85	18.85	6	6	7	6
2.60	19.10	+.0006	+.0006	+.0007	+.0007

BORESCOPE REMARKS: Light circumferential tool marks beginning at start of chamber and extending forward throughout bore. Lands lightly chipped on driving edges in forcing cone area. Forward edges of [illegible] very lightly eroded. Very light [illegible] throughout bore.

BY: MONK - WILMOTH

CASTING NUMBER	X
MANUFACTURER	
PROOF OFFICER	W.O. [illegible]
MODEL	M16A1
NUMBER OF ROUNDS	
NUMBER	808311
	APG# 14
FIRING STATUS (Check One)	BEFORE ✓ / AFTER
5.56 MM Barrel	
DATE OF GAUGING	15/Nov/67

MULTIPLE STARGAGE MEASUREMENT & INSPECTION DATA FORM

5.56 MM Barrel	NUMBER	MODEL	MANUFACTURER	CASTING NUMBER
	808411	M16A1		X
DATE OF GAUGING: 15 NOV. 67	FIRING STATUS (Check One): APG# 15 — BEFORE ✓ / AFTER	NUMBER OF ROUNDS: B.F.D. [illegible]	PROOF OFFICER: HARKINS [illegible] -80	

5.56 MM Barrel M16A1

Dist. (inches) From			Meas. indicated in .0001 of an inch.			
	Rear Face of Barrel	Face of Flash Suppressor	LANDS .2190" Vert.	LANDS .2190" Hor.	Grooves .2235" Vert.	Grooves .2235" Hor.
	20.	1.25	+.0005	+.0003	+.0001	+.0002
	19.70	2.00	3	3	2	3
	18.70	3.00	4	4	4	4
	17.70	4.00	3	3	4	4
	16.70	5.00	3	1	3	4
	15.70	6.00	3	2	3	4
	14.70	7.00	2	2	1	4
	13.70	8.00	2	1	3	3
	12.70	9.00	2	1	3	3
	11.70	10.00	1	2	3	3
	10.70	11.00	1	1	4	3
	9.70	12.00	2	2	3	3
	8.70	13.00	1	1	3	3
	7.70	14.00	1	2	3	3
	6.70	15.00	2	2	4	4
	5.70	16.00	1	2	3	3
	4.70	17.00	1	2	2	3
	3.70	18.00	2	3	2	3
	3.35	18.35	2	3	2	3
	2.85	18.85	2	3	3	3
	2.60	19.10	+.0003	+.0004	+.0003	+.0003

BORESCOPE REMARKS: Light to moderate circumferential tool marks indicating bore was straightened at chamber through bore. Driving edges of lands lightly chipped and flattened in forcing cone area. Light erosion on forward edge of gas port.

BY: MONK & WILMOTH

STEAP-DS Form 106 (Part I) 17 JUNE 64

MULTIPLE STARGAGE MEASUREMENT & INSPECTION DATA FORM

5.56 MM Barrel M16A1

- CASTING NUMBER: X
- MANUFACTURER: X
- MODEL: M16A1
- NUMBER: 808565 APG# 16
- 5.56 MM Barrel
- PROOF OFFICER: W.O. HAWKINS [illegible]-20
- NUMBER OF ROUNDS: [illegible]
- FIRING STATUS (Check One): BEFORE ✓ AFTER
- DATE OF GAUGING: 15 NOV 67

Dist. (inches) From Rear Face of Barrel	Face of Flash Suppressor	Meas. indicated in .0001 of an inch. LANDS .2190" Vert.	LANDS .2190" Hor.	Grooves .2235" Vert.	Grooves .2235" Hor.
20.	1.25	+.0004	+.0004	+.0005	+.0006
19.70	2.00	2	2	5	6
18.70	3.00	.0000	1	5	6
17.70	4.00	+.0001	3	5	6
16.70	5.00	1	2	5	5
15.70	6.00	2	1	3	5
14.70	7.00	.0000	1	3	4
13.70	8.00	0	.0000	6	4
12.70	9.00	0	0	4	4
11.70	10.00	0	0	5	4
10.70	11.00	-.0001	0	4	4
9.70	12.00	.0000	0	4	4
8.70	13.00	-.0001	-.0001	5	4
7.70	14.00	.0000	1	4	4
6.70	15.00	0	.0000	4	5
5.70	16.00	+.0001	+.0001	5	6
4.70	17.00	.0000	2	6	6
3.70	18.00	+.0002	3	6	7
3.35	18.35	2	4	6	6
2.85	18.85	3	2	6	6
2.60	19.10	+.0002	+.0004	+.0005	+.0006

BORESCOPE REMARKS: Light circumferential tool marks beginning in straight of chamber and extends [illegible] forward throat area. Driving edge of lands chipped in forcing cone area. Two lands in 12 o'clock position heavily chipped and flattened, metal appears to be pushed forward. [illegible] edge on rear of one land with light erosion on driving edge. Light metallic deposits thru-out bore.

BY: Hank E. [illegible]

STEAP-DS Form 106 (Part I) 17 JUNE 64 I-22

MULTIPLE STARGAGE MEASUREMENT & INSPECTION DATA FORM

5.56 MM Barrel	NUMBER	MODEL	MANUFACTURER	CASTING NUMBER
	809705 APG# 17	M16A1		X

DATE OF GAUGING	FIRING STATUS (Check One)	NUMBER OF ROUNDS	PROOF OFFICER
15 Nov. '67	BEFORE ✓ / AFTER	B.F. @ [illegible]	HARRIS W.O. [illegible]-80

5.56 MM Barrel M16A1

Dist. (inches) From Rear Face of Barrel	Face of Flash Suppressor	Meas. indicated in .0001 of an inch. LANDS .2190" Vert.	LANDS .2190" Hor.	Grooves .2235" Vert.	Grooves .2235" Hor.
20.	1.25	+.0004	+.0004	+.0006	+.0003
19.70	2.00	3	4	5	4
18.70	3.00	3	4	4	4
17.70	4.00	2	2	4	4
16.70	5.00	1	3	3	4
15.70	6.00	1	4	3	3
14.70	7.00	1	3	3	3
13.70	8.00	1	1	3	3
12.70	9.00	1	2	3	3
11.70	10.00	1	2	3	4
10.70	11.00	2	1	3	3
9.70	12.00	2	1	4	4
8.70	13.00	1	2	5	4
7.70	14.00	1	1	5	4
6.70	15.00	2	2	4	5
5.70	16.00	3	3	4	5
4.70	17.00	4	3	5	4
3.70	18.00	4	3	5	4
3.35	18.35	3	2	5	4
2.85	18.85	4	3	5	5
2.60	19.10	+.0003	+.0003	+.0005	+.0005

BORESCOPE REMARKS: Light to moderate circumferential tool marks beginning in straight of chamber and extending forward thru-out bore. Driving edges of lands [illegible] chipped forming [illegible] zone. Light metallic deposits thru-out bore. Light erosion on forward edge of gas port with wired edge on rear.

BY: [illegible] & [illegible]

MULTIPLE STARGAGE MEASUREMENT & INSPECTION DATA FORM

5.56 MM Barrel	
CASTING NUMBER	X
MANUFACTURER	
PROOF OFFICER	HANKINS W.O. 324-633-80
MODEL	M16A1
NUMBER OF ROUNDS	B.F. [illegible]
NUMBER	813583
FIRING STATUS (Check One)	BEFORE ✓ / AFTER — RPC # [illegible]
DATE OF GAUGING	24 NOV. 67

5.56 MM Barrel

Dist. (inches) From		Meas. indicated in .0001 of an inch.			
		LANDS .2190"		Grooves .2235"	
Rear Face of Barrel	Face of Flash Suppressor	Vert.	Hor.	Vert.	Hor.
20.	1.25	+.0006	+.0007	+.0008	+.0009
19.70	2.00	6	7	8	9
18.70	3.00	6	7	8	9
17.70	4.00	6	7	9	8
16.70	5.00	5	5	8	9
15.70	6.00	5	5	8	9
14.70	7.00	4	4	6	9
13.70	8.00	5	5	5	8
12.70	9.00	5	6	7	7
11.70	10.00	5	5	7	7
10.70	11.00	5	5	8	7
9.70	12.00	5	5	9	8
8.70	13.00	4	5	8	9
7.70	14.00	5	4	8	7
6.70	15.00	5	5	7	7
5.70	16.00	6	5	8	7
4.70	17.00	6	6	9	8
3.70	18.00	6	6	9	9
3.35	18.35	7	6	8	9
2.85	18.85	7	7	9	9
2.60	19.10	+.0007	+.0007	+.0009	+.0009

BORESCOPE REMARKS:

Light to moderate longitudinal scratches in various portions chamber. Slope and straight of chamber noticeably [illegible]. Circumferential [illegible] beginning at [illegible] slope and [illegible] [illegible] bore. [illegible] slightly [illegible] [illegible] throughout bore.

B.F. [illegible]

MULTIPLE STARGAGE MEASUREMENT & INSPECTION DATA FORM

5.56 MM Barrel

Item	Entry
CASTING NUMBER	X
MANUFACTURER	
PROOF OFFICER	HANKINS W.O. 324-633-80
MODEL	M16A1
NUMBER OF ROUNDS	B.F. [illegible]
NUMBER	813856 APG # 19
FIRING STATUS (Check One)	BEFORE ✓ / AFTER
DATE OF GAUGING	24 NOV. '67
	5.56 MM Barrel

Dist. (inches) From		Meas. indicated in .0001 of an inch.			
Rear Face of Barrel	Face of Flash Suppressor	LANDS .2190" Vert.	LANDS .2190" Hor.	Grooves .2235" Vert.	Grooves .2235" Hor.
20.	1.25	+.0002	+.0001	+.0001	+.0001
19.70	2.00	1	1	2	2
18.70	3.00	2	2	3	2
17.70	4.00	0	2	2	3
16.70	5.00	+.0001	2	2	2
15.70	6.00	0	1	1	2
14.70	7.00	-.0001	0	0	2
13.70	8.00	0	-.0001	-.0001	2
12.70	9.00	-.0001	1	+.0001	1
11.70	10.00	1	2	1	1
10.70	11.00	2	1	1	1
9.70	12.00	2	2	0	1
8.70	13.00	1	2	-.0001	1
7.70	14.00	1	2	0	1
6.70	15.00	1	1	0	0
5.70	16.00	1	0	0	0
4.70	17.00	1	0	0	1
3.70	18.00	1	-.0001	0	1
3.35	18.35	2	0	0	0
2.85	18.85	1	0	0	0
2.60	19.10	-.0001	.0000	+.0001	.0000

BORESCOPE REMARKS:

LIGHT LONGITUDINAL SCRATCHES IN MAIN POWDER CHAMBER. LIGHT CIRCUMFERENTIAL TOOL MARKS BEGINNING IN STRAIGHT OF CHAMBER AND EXTENDING THRUOUT BORE. DRIVING EDGE OF LANDS LIGHTLY CHIPPED AT COMMENCEMENT OF RIFLING. VERY LIGHT EROSION ON FORWARD EDGE OF GAS PORT. Light deposits thruout bore.

Marks - Schantz

STEAP-DS Form 106 (Part I) 17 JUNE 64

MULTIPLE STARGAGE MEASUREMENT & INSPECTION DATA FORM

Field	Entry
Item	5.56 MM Barrel
NUMBER	813861 / APG # 20
MODEL	M16A1
MANUFACTURER	
CASTING NUMBER	X
PROOF OFFICER	HANKINS / W.O. 324-633-50
NUMBER OF ROUNDS	B.F. APG
FIRING STATUS (Check One)	BEFORE ✓ / AFTER
DATE OF GAUGING	21 NOV 67

5.56 MM Barrel

Dist. (inches) From Rear Face of Barrel	Face of Flash Suppressor	Meas. indicated in .0001 of an inch. LANDS .2190" Vert.	LANDS Hor.	Grooves .2235" Vert.	Grooves Hor.
20.	1.25	+.0004	+.0003	+.0007	+.0006
19.70	2.00	3	3	6	5
18.70	3.00	1	2	5	4
17.70	4.00	1	0	5	3
16.70	5.00	2	1	3	3
15.70	6.00	1	1	4	4
14.70	7.00	− 2	0	2	5
13.70	8.00	− 1	− 2	4	3
12.70	9.00	0	0	4	3
11.70	10.00	0	+ 1	4	3
10.70	11.00	+ 1	0	3	3
9.70	12.00	1	1	3	3
8.70	13.00	1	0	3	3
7.70	14.00	1	0	4	3
6.70	15.00	1	1	4	3
5.70	16.00	2	2	4	3
4.70	17.00	1	2	4	4
3.70	18.00	1	2	4	4
3.35	18.35	1	1	4	4
2.85	18.85	2	1	4	4
2.60	19.10	+.0002	+.0001	+.0005	+.0004

BORESCOPE REMARKS:

Light to moderate longitudinal [illegible] in main [illegible] chamber. [illegible] circumferential tool marks [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] bore. Edges of lands [illegible] [illegible] at commencement of rifling. [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] deposits throughout bore.

BY [illegible]

MULTIPLE STARGAGE MEASUREMENT & INSPECTION DATA FORM

Item	5.56 MM Barrel
Date of Gauging	24 NOV. 67
Firing Status (Check One)	Before: ✓ After:
Number	813908 APG #2
Number of Rounds	R.F. APG
Model	M16A1
Proof Officer	HAWKINS W.O. 321-632-80
Manufacturer	
Casting Number	X

5.56 MM Barrel

Dist. (inches) From: Rear Face of Barrel	Face of Flash Suppressor	Meas. indicated in .0001 of an inch. LANDS .2190" Vert.	LANDS .2190" Hor.	Grooves .2235" Vert.	Grooves .2235" Hor.
20.	1.25	+.0002	+.0002	+.0005	+.0005
19.70	2.00	1	1	5	5
18.70	3.00	0	-.0001	5	5
17.70	4.00	0	0	5	5
16.70	5.00	0	-.0001	4	4
15.70	6.00	-.0001	2	4	4
14.70	7.00	3	3	3	5
13.70	8.00	4	3	3	3
12.70	9.00	2	1	3	4
11.70	10.00	2	1	3	4
10.70	11.00	2	2	3	3
9.70	12.00	1	1	3	3
8.70	13.00	2	3	3	3
7.70	14.00	4	2	3	3
6.70	15.00	2	2	3	2
5.70	16.00	1	1	3	3
4.70	17.00	-.0001	0	3	3
3.70	18.00	0	-.0002	3	3
3.35	18.35	0	0	3	3
2.85	18.85	+.0001	0	3	3
2.60	19.10	.0000	.0000	+.0003	+.0003

BORESCOPE REMARKS:

Light longitudinal scratches and [illegible] ... Drilling [illegible] ... commencing [illegible] forward [illegible] ... bore.

BY: [illegible]

STEAP-DS Form 106 (Part I) 17 JUNE 64

MULTIPLE STARGAGE MEASUREMENT & INSPECTION DATA FORM

Casting Number	Manufacturer	Proof Officer	Model	Number of Rounds	Number	Firing Status (Check One)	Date of Gauging
X		HANKINS W.O. 324-633-80	M16A1	B.F. MPG	814152	MPG #22 — Before: ✓ / After:	21 NOV. 67

5.56 MM Barrel

5.56 MM Barrel

Dist. (inches) From Rear Face of Barrel	Dist. (inches) From Face of Flash Suppressor	Meas. indicated in .0001 of an inch. LANDS .2190" Vert.	LANDS .2190" Hor.	Grooves .2235" Vert.	Grooves .2235" Hor.
20.	1.25	+.0011	+.0011	+.0013	+.0013
19.70	2.00	9	8	14	13
18.70	3.00	9	9	13	13
17.70	4.00	8	8	12	12
16.70	5.00	8	7	10	10
15.70	6.00	7	6	10	11
14.70	7.00	6	6	9	11
13.70	8.00	2	6	9	10
12.70	9.00	6	6	12	10
11.70	10.00	6	6	10	10
10.70	11.00	6	6	10	10
9.70	12.00	6	6	10	10
8.70	13.00	6	5	10	10
7.70	14.00	4	5	9	9
6.70	15.00	5	5	10	9
5.70	16.00	6	5	10	9
4.70	17.00	6	5	9	9
3.70	18.00	7	7	8	9
3.35	18.35	5	6	8	9
2.85	18.85	7	7	10	9
2.60	19.10	+.0007	+.0007	+.0009	+.0009

BORESCOPE REMARKS:

Light longitudinal scratches [illegible] chamber. Light [illegible] chamber [illegible] lands [illegible] width [illegible] Light [illegible]

BY: MANK

MULTIPLE STARGAGE MEASUREMENT & INSPECTION DATA FORM

CASTING NUMBER	X
MANUFACTURER	
PROOF OFFICER	HAWKINS W.O. 324-633-80
MODEL	M16A1
NUMBER OF ROUNDS	[illegible]
NUMBER	214328
FIRING STATUS (Check One)	AFTER / BEFORE — [illegible]
DATE OF GAUGING	27 NOV. '67
	5.56 MM Barrel

5.56 MM Barrel

Dist. (inches) From: Rear Face of Barrel	Face of Flash Suppressor	Meas. indicated in .0001 of an inch. LANDS .2190" Vert.	LANDS .2190" Hor.	Grooves .2235" Vert.	Grooves .2235" Hor.
20.	1.25	+.0006	+.0006	+.0008	+.0009
19.70	2.00	07	06	09	11
18.70	3.00	06	07	12	12
17.70	4.00	06	07	11	11
16.70	5.00	07	05	10	11
15.70	6.00	07	04	10	11
14.70	7.00	05	05	10	11
13.70	8.00	05	05	11	11
12.70	9.00	06	08	12	11
11.70	10.00	07	07	11	12
10.70	11.00	06	05	10	11
9.70	12.00	04	04	11	11
8.70	13.00	04	05	12	12
7.70	14.00	05	05	10	09
6.70	15.00	06	06	10	10
5.70	16.00	06	07	10	11
4.70	17.00	06	07	12	12
3.70	18.00	07	07	12	12
3.35	18.35	07	07	12	12
2.85	18.85	07	08	12	12
2.60	19.10	+.0008	+.0011	+.0011	+.0010

BORESCOPE REMARKS:

Circumferential tool marks beginning at chamber slope and extending throughout bore. Driving edge of lands lightly chipped at commencement of rifling. Forward edge of gas port lightly eroded. Light erosion throughout bore.

[illegible signature]

MULTIPLE STARGAGE MEASUREMENT & INSPECTION DATA FORM

CASTING NUMBER	X
MANUFACTURER	
PROOF OFFICER	HAWKINS W.O. 324-633-80
MODEL	M16A1
NUMBER OF ROUNDS	B.F. [illegible]
NUMBER	8114451
FIRING STATUS (Check One)	AFTER / BEFORE ✓ — Nov [illegible]
5.56 MM Barrel	
DATE OF GAUGING	27 NOV. 67

5.56 MM Barrel

Dist. (inches) From Rear Face of Barrel	Face of Flash Suppressor	Meas. indicated in .0001 of an inch. LANDS .2190" Vert.	LANDS Hor.	Grooves .2235" Vert.	Grooves Hor.
20.	1.25	+.0003	+.0003	+.0004	+.0004
19.70	2.00	03	03	03	02
18.70	3.00	01	02	03	03
17.70	4.00	01	01	04	03
16.70	5.00	01	01	04	04
15.70	6.00	03	01	03	04
14.70	7.00	00	00	03	03
13.70	8.00	+ 01	01	01	03
12.70	9.00	02	01	04	04
11.70	10.00	00	01	03	03
10.70	11.00	+ 01	00	03	03
9.70	12.00	01	00	03	03
8.70	13.00	00	00	03	04
7.70	14.00	00	00	03	04
6.70	15.00	00	00	03	04
5.70	16.00	+ 03	+ 01	03	04
4.70	17.00	01	02	04	04
3.70	18.00	03	02	04	04
3.35	18.35	02	02	04	05
2.85	18.85	02	02	04	05
2.60	19.10	+.0002	+.0002	+.0004	+.0004

BORESCOPE REMARKS:

Light to moderate longitudinal scratches in main powder chamber. Circumferential tool marks beginning at start of chamber and extending throughout bore. Driving edge of lands lightly chipped at commencement of rifling. Very light erosion in forward edge of gas port. Very light deposits throughout bore.

Mark Schantz

MULTIPLE STARGAGE MEASUREMENT & INSPECTION DATA FORM

CASTING NUMBER	MANUFACTURER	MODEL	NUMBER	
X		M16A1	814589	5.56 MM Barrel

PROOF OFFICER: HANKINS W.O. 324-633-80

NUMBER OF ROUNDS: BF AT AP6

APG #26

FIRING STATUS (Check One): BEFORE ✓ AFTER

DATE OF GAUGING: 27 Nov. 67

5.56 MM Barrel

Dist. (inches) From: Rear Face of Barrel	Face of Flash Suppressor	Meas. indicated in .0001 of an inch. LANDS .2190" Vert.	Hor.	Grooves .2235" Vert.	Hor.
20.	1.25	+.0005	+.0005	+.0007	+.0008
19.70	2.00	05	05	09	08
18.70	3.00	04	03	08	07
17.70	4.00	04	03	07	08
16.70	5.00	02	02	07	07
15.70	6.00	01	03	06	07
14.70	7.00	− 01	02	04	06
13.70	8.00	+ 01	02	06	06
12.70	9.00	01	02	06	05
11.70	10.00	− 01	02	06	05
10.70	11.00	+ 01	01	07	06
9.70	12.00	02	01	06	05
8.70	13.00	01	00	05	05
7.70	14.00	02	00	06	07
6.70	15.00	03	+ 02	07	06
5.70	16.00	03	03	06	06
4.70	17.00	03	03	07	06
3.70	18.00	04	04	07	07
3.35	18.35	03	03	07	07
2.85	18.85	03	04	07	07
2.60	19.10	+.0004	+.0003	+.0007	+.0008

BORESCOPE REMARKS:

Light longitudinal scratches in main powder chamber. Circumferential tool marks in forward portion of main chamber and extending thru bell line. Driving edge of lands lightly chipped at commencement of rifling. Forward edge of gas port very lightly eroded. Light deposits thruout bore.

Mark Schantz

MULTIPLE STARGAGE MEASUREMENT & INSPECTION DATA FORM

CASTING NUMBER	MANUFACTURER	MODEL	NUMBER	
X		M16A1	814599	5.56 MM Barrel

PROOF OFFICER: Hankins WO 324-633-80

NUMBER OF ROUNDS: BF AT APG

FIRING STATUS (Check One): BEFORE ✓ AFTER

APG-#27

DATE OF GAUGING: 27 Nov. 67

5.56 MM Barrel

Dist. (inches) From Rear Face of Barrel	Face of Flash Suppressor	Meas. indicated in .0001 of an inch. LANDS .2190" Vert.	Hor.	Grooves .2235" Vert.	Hor.
20.	1.25	+.0001	+.0001	+.0001	+.0001
19.70	2.00	00	-01	00	00
18.70	3.00	00	02	-01	-01
17.70	4.00	-02	01	02	01
16.70	5.00	01	01	02	01
15.70	6.00	01	02	02	02
14.70	7.00	03	02	02	01
13.70	8.00	04	02	01	01
12.70	9.00	03	02	01	01
11.70	10.00	03	02	01	01
10.70	11.00	02	03	02	01
9.70	12.00	03	02	02	01
8.70	13.00	03	02	01	02
7.70	14.00	02	03	01	02
6.70	15.00	02	03	02	02
5.70	16.00	02	02	02	02
4.70	17.00	01	02	02	01
3.70	18.00	01	01	02	02
3.35	18.35	02	01	02	01
2.85	18.85	02	01	02	01
2.60	19.10	-.0001	.0000	-.0002	-.0001

BORESCOPE REMARKS:

Light to moderate longitudinal scratches in main powder chamber. Circumferential tool marks beginning in straight of chamber and extend into thruout bore. Forward edge of gas port slightly eroded. Light deposits intermittently thruout bore.

Mark Schantz

STEAP-DS Form 106 (Part I) 17 JUNE 64

MULTIPLE STARGAGE MEASUREMENT & INSPECTION DATA FORM

CASTING NUMBER	MANUFACTURER	MODEL	NUMBER	DATE OF GAUGING
X		M16A1	814808	27 Nov. 67

PROOF OFFICER: HANKINS W.O. 324-633-90

NUMBER OF ROUNDS: 135 BT A06

APG #28

FIRING STATUS (Check One): BEFORE ✓ AFTER

5.56 MM Barrel

5.56 MM Barrel

Dist. (Inches) From Rear Face of Barrel	Face of Flash Suppressor	LANDS .2190" Vert.	LANDS .2190" Hor.	Grooves .2235" Vert.	Grooves .2235" Hor.
		Meas. indicated in .0001 of an inch.			
20.	1.25	+.0001	+.0000	+.0004	+.0001
19.70	2.00	00	-02	02	01
18.70	3.00	-01	01	02	01
17.70	4.00	01	02	02	01
16.70	5.00	02	02	01	00
15.70	6.00	03	02	01	+01
14.70	7.00	03	03	00	02
13.70	8.00	03	04	-02	01
12.70	9.00	01	03	00	00
11.70	10.00	03	03	+01	00
10.70	11.00	04	03	01	00
9.70	12.00	03	03	01	00
8.70	13.00	04	03	01	00
7.70	14.00	03	02	01	00
6.70	15.00	04	04	01	00
5.70	16.00	04	03	01	00
4.70	17.00	01	02	01	00
3.70	18.00	02	02	01	+01
3.35	18.35	02	02	01	01
2.85	18.85	01	02	01	01
2.60	19.10	-.0001	-.0002	+.0001	+.0001

BORESCOPE REMARKS:

Light to moderate longitudinal scratches in main powder chamber. Slope and straight of chamber roughly machined. Light circumferential tool marks beginning in centering slope and extending throughout land. Light indents on lands and grooves beginning at origin of rifling and extending (approx) 2.00" forward. More pronounced in twelve o'clock area. Light erosion on forward edge of gas port. Light deposits throughout bore.

Marie Schantz

Observed Trace Count for Firings at 155°F

Trial No.[a]	No. Traces
Lot: LC-12071.	
Gun: No. 1.	
Propellant: Ball.	
1	40
2	45
Lot: LC-12112.	
Gun: No. 2.	
1	10
Lot: LC-12114.	
Gun: No. 3.	
1	15
Lot: LC-12115.	
Gun: No. 4.	
1	19
Lot: LC-12119.	
Gun: No. 5.	
Propellant: IMR.	
1	49
2	47
3	43
4	54
5	39
6	47
7	62
8	51
9	55
10	55
11	60
12	47
Lot: LC-12107.	
Gun: No. 6.	
1	47
2	68
3	72
4	72
5	76
6	75
7	75
8	75
9	79
10	74
11	74
12	72
Lot: LC-12108.	
Gun: No. 7.	
1	75
2	78
3	74
4	77
5	78
6	76
7	79
8	78
9	79
10	78
11	78
12	77
Lot: LC-SP-499.	
Gun: No. 8.	
1	56
2	54
3	59
4	60
5	61
6	68
7	73
8	64
9	59
10	60
11	61
12	68
Lot: LC-12109.	
Gun: No. 9.	
1	75
2	77
3	76
4	76
5	74
6	77
7	74
8	76
9	74
10	78
11	76
12	75
Lot: LC-SP-520.	
Gun: No. 10.	
Propellant: Ball.	
1	55
2	59
3	57
4	60
5	53
6	62
7	62
8	52
9	53
10	51
11	53
12	59
Lot: TW-18018.	
Gun: No. 11.	
Propellant: IMR.	
1	65
2	57
3	52
4	55
5	64
6	52
7	38
8	51
9	60
10	59
11	59
12	50
Lot: TW-18027.	
Gun: No. 12.	
1	54
2	37
3	37
4	42
5	49
6	45
7	41
8	43
9	55
10	50
11	52
12	51
Lot: LC-12112.	
Gun: No. 13[b].	
Propellant: Ball.	
1	73
2	75
3	74
4	78
5	77
Lot: TW-18028.	
Gun: No. 14.	
Propellant: IMR.	
1	53
2	44
3	43
4	54
5	43
6	42
7	32
8	41

[a]Each trial consisted of an 80-round cycle. A tracer count was not maintained on the final 20 to 40 rounds fired on some lots after the 12th cycle (960 rounds).

[b]Weapon and 400 rounds of ammunition were removed from the 155°F temperature and reconditioned and fired at range temperature (44°F).

Trial No.[a]	No. Traces
9	35
10	48
11	34
12	39
Lot:	LC-12110.
Gun:	No. 15.
Propellant:	IMR.
1	71
2	71
3	71
4	78
5	75
6	74
7	77
8	76
9	73
10	80
11	78
12	74
Lot:	LC-12111.
Gun:	No. 16.
1	76
2	75
3	78
4	76
5	77
6	79
7	77
8	73
9	77
10	78
11	76
12	76

Trial No.[a]	No. Traces
Lot:	TW-18045.
Gun:	No. 17.
1	39
2	46
3	35
4	43
5	43
6	38
7	42
8	43
9	30
10	34
11	32
12	48
Lot:	TW-18047.
Gun:	No. 18.
1	31
2	30
3	34
4	34
5	25
6	33
7	50
8	41
9	39
10	32
11	36
12	31
Lot:	LS-SP-499.
Gun:	No. 19.
1	56
2	53

Trial No.[a]	No. Traces
3	54
4	54
5	57
6	59
7	61
8	59
9	73
10	75
11	73
12	66
Lot:	LC-SP-520.
Gun:	No. 20.
Propellant:	Ball.
1	40
2	43
3	47
4	53
5	50
6	51
7	53
8	54
9	47
10	53
11	54
12	59

[a]Each trial consisted of an 80-round cycle. A tracer count was not maintained on the final 20 to 40 rounds fired on some lots after the 12th cycle (960 rounds).

[b]Weapon and 400 rounds of ammunition were removed from the 155°F temperature and reconditioned and fired at range temperature (44°F).

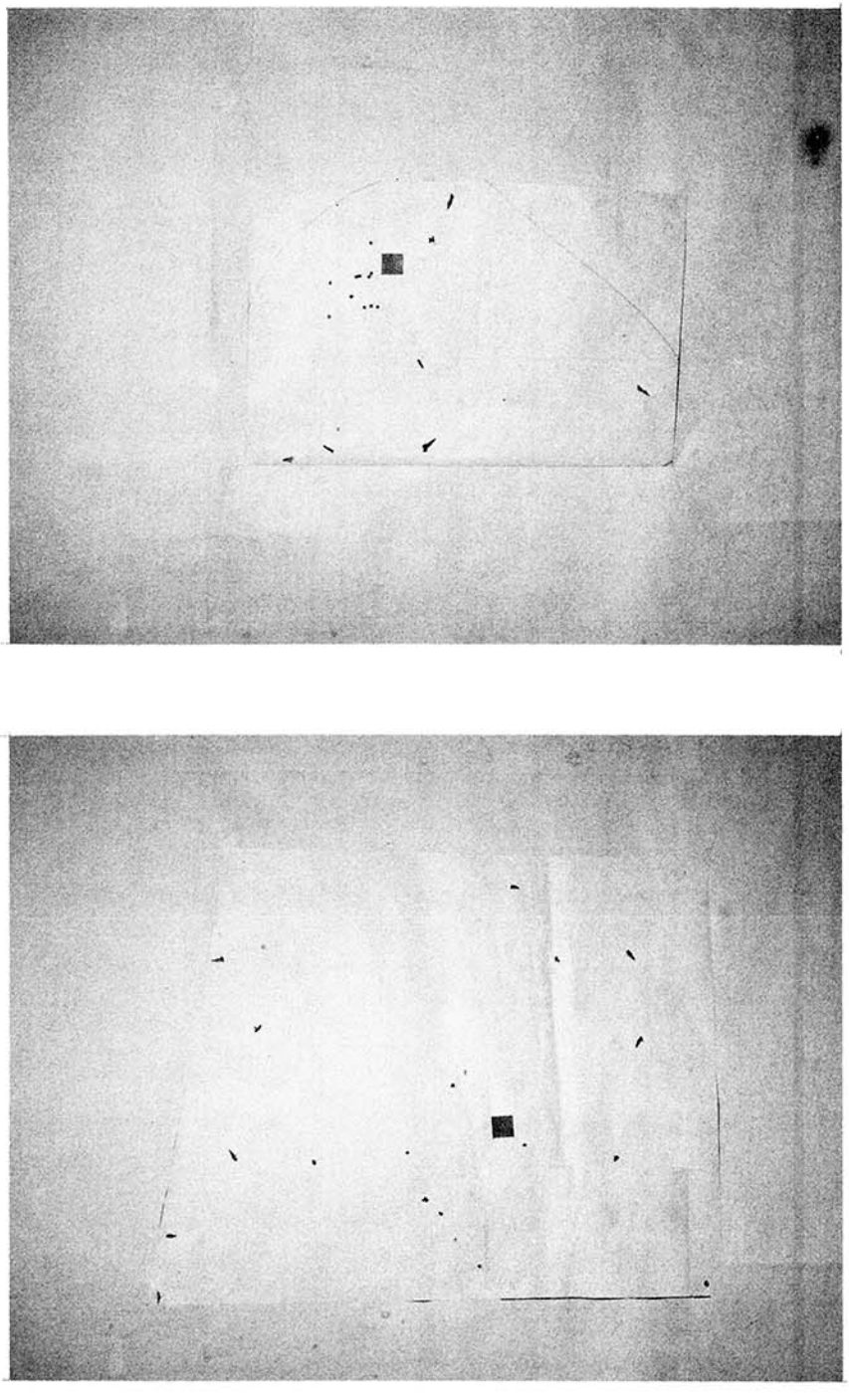

Figure I-1: Typical Bullet Yaw and Fragment Imprints on 25-Meter Witness Screen when Firing M196 Cartridge Lots with WC 846 Propellant and GM Jackets at 155°F. TOP: Rounds 1 to 20. BOTTOM: Rounds 41 to 60.

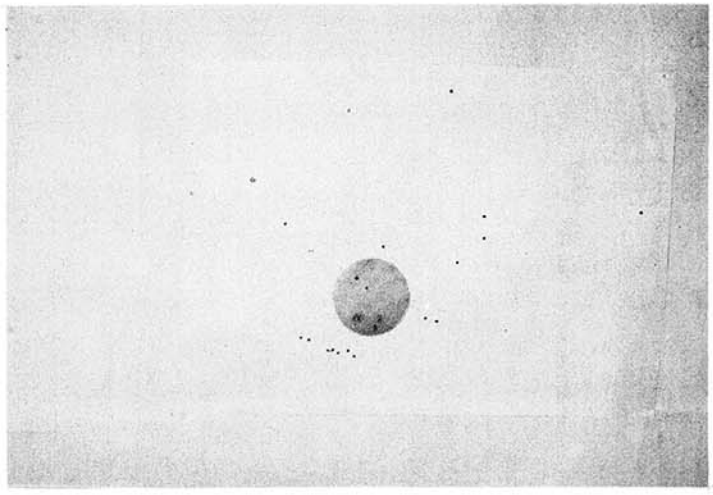

Figure I-2: Typical Bullet Holes in 25-Meter Witness Screen when Firing M196 Cartridge Lots with IMR 8208 Propellant at 155°F. Group Shown for Rounds 981 to 1000, Fired in 3-Round Bursts is Representative of Both GM and GMCS Bullet Jackets.

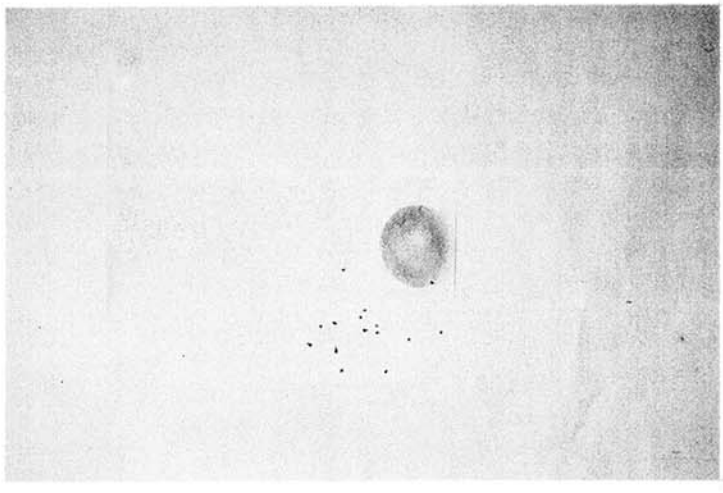

Figure I-3: Witness Screen for Rounds 981 to 1000 Fired in 3-Round Bursts with M196 Cartridge Lot Assembled with WC 846 Propellant and GMCS Bullet Jackets.

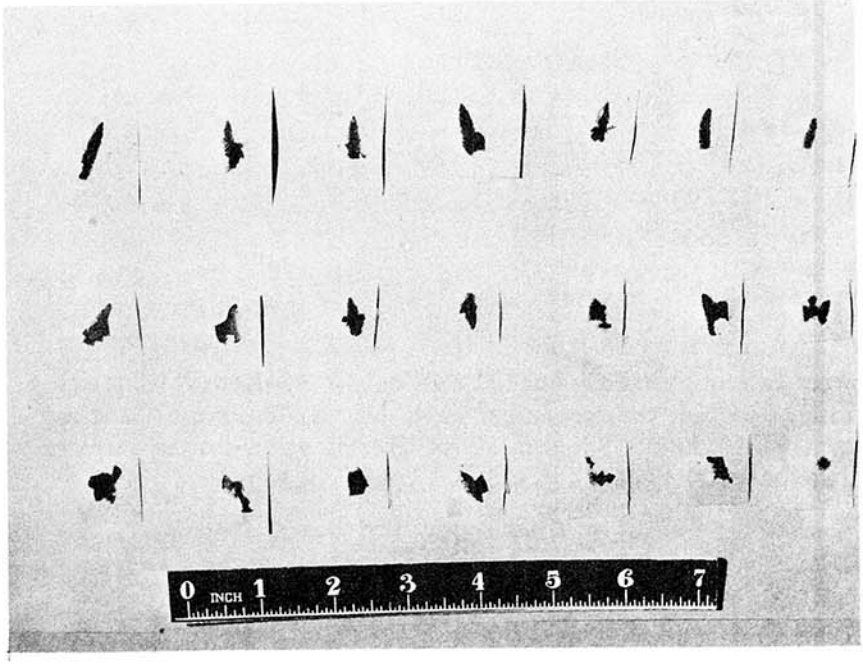

Figure I-4: Typical Witness Screen Imprints of Fragments Observed with M196 Cartridge Lots Loaded with WC 846 Propellant.

APPENDIX II - CORRESPONDENCE

DEPARTMENT OF THE ARMY
HEADQUARTERS, U. S. ARMY TEST AND EVALUATION COMMAND
ABERDEEN PROVING GROUND, MARYLAND 21005

S: 9 Nov 67

AMSTE-BC

3 NOV 67

SUBJECT: Test Directive for Special Study of High Temperature Bore Fouling of 5.56mm Tracer Ammunition in M16A1 Rifle, USATECOM Project No. 8-8-0200-08

TO: Commanding Officer
Aberdeen Proving Ground
ATTN: STEAP-CO-P
Aberdeen Proving Ground, Md 21005

1. References:

a. Message, APG 12742, dated 171346Z Oct 67, subject: Firing of M196 Tracer Cartridges in M16A1 Rifles.

b. Planning Meeting held at HQ USATECOM, 24 October 1967, to discuss Tests of M16A1 Rifle and Associated Ammunition.

2. As a result of reference a, the Project Manager, Rifles (AMCPM-RS), verbally requested that this command meet (reference 1b) to discuss plans to further evaluate the degree of incompatibility of tracer ammunition when fired from the M16A1 Rifle. Messrs Doilney, Hankins, Wilson and Staley, STEAP-DS-TI, were present.

3. The following was established:

a. The Project Manager, Rifles would provide 45 weapons and $15,000 by 9 November 1967.

b. The US Army Munitions Command would provide 6,000 rounds each of 17 tracer lots. Two lots are to be gilding metal clad steel (GMCS) projectiles; the remainder are to be standard gilding metal (GM) projectiles. Twelve lots will be produced by Lake City Arsenal, of which four lots (2 GM and 2 GMCS), will contain otherwise identical components. The remaining five lots will be produced by Twin Cities Arsenal.

c. The US Army Test and Evaluation Command will initiate tests on 9 November 1967, complete tests on 15 December 1967 and provide report to AMCPM-RS by 20 January 1968.

AMSTE-BC 3 NOV 1967

SUBJECT: Test Directive for Special Study of High Temperature Bore Fouling of 5.56mm Tracer Ammunition in M16A1 Rifle, USATECOM Project No. 8-8-0200-08

4. It is requested that CO, APG implement test program as outlined in para 3c, except the report will be provided to this headquarters by 10 January 1968. Test plan outline is required by 9 November 1967.

5. This is a category 1, SEA related, USATECOM Priority 1 activity. USATECOM Project No. 8-8-0200-08 is assigned.

6. Test plan outline and an interim report in letter form to meet the deadline are acceptable, to be followed by a final report.

7. Distribution will be in accordance with inclosure 1.

8. This is an unclassified task.

FOR THE COMMANDER:

GOODWIN MORROW
Act Dir
Inf Mat Test Dir

2 Incl w/d
1. Dist List
2. TSRS

Copies furnished:
CG AMC ATTN: AMCPM-RS
CO APG ATTN: STEAP-DS-TI

APPENDIX III - REFERENCE

1. Test Plan Outline for Special Study of High Temperature Bore Fouling of 5.56-MM Tracer Ammunition in M16A1 Rifle, 15 November 1967.

APPENDIX IV - DISTRIBUTION LIST

USATECOM Project No. 8-8-0200-08

Addressee	Final Report
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AD Accession No.

Development and Proof Services, Aberdeen Proving Ground, Md.
Final Report of USATECOM Project No. 8-8-0200-08, Special Study of High Temperature Bore Fouling of 5.56-MM, M196 Tracer Cartridge in M16A1 Rifle, February 1968
AMCMS Code No. 4420.25.0132.2.136, Report No. DPS-2664
Author A. R. Hankins
Secondary distribution controlled by US Army Materiel Command
58 pages, 5 illustrations

Unclassified Report

A special study was conducted at Aberdeen Proving Ground from November 1967 through January 1968 to investigate bore fouling when firing M196 tracer ammunition from the M16A1 rifle in a high-temperature environment. Seventeen lots of M196 tracer cartridges, representing several manufacturing "variables", were tested at 95°F and 155°F. It was concluded that the M196 tracer cartridge loaded with WC 846 (ball-type) propellant is incompatible with the M16A1 rifle when stored and fired at 95°F or higher; the tracer cartridges loaded with IMR 8208M propellant performed satisfactorily in the M16A1 rifle at the test temperatures.

AD Accession No.

Development and Proof Services, Aberdeen Proving Ground, Md.
Final Report of USATECOM Project No. 8-8-0200-08, Special Study of High Temperature Bore Fouling of 5.56-MM, M196 Tracer Cartridge in M16A1 Rifle, February 1968
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Unclassified

Security Classification

DOCUMENT CONTROL DATA - R&D

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1. ORIGINATING ACTIVITY *(Corporate author)*

Development and Proof Services
Aberdeen Proving Ground, Maryland

2a. REPORT SECURITY CLASSIFICATION
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2b. GROUP

3. REPORT TITLE

SPECIAL STUDY OF HIGH TEMPERATURE BORE FOULING OF 5.26-MM, M196 TRACER CARTRIDGE IN M16A1 RIFLE

4. DESCRIPTIVE NOTES *(Type of report and inclusive dates)*

Final Report November 1967 through January 1968

5. AUTHOR(S) *(Last name, first name, initial)*

Hankins, A. R.

6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
February 1968	58	1

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b. PROJECT NO.
USATECOM Project No. 8-8-0200-08

c.

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DPS-2664

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11. SUPPLEMENTARY NOTES
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12. SPONSORING MILITARY ACTIVITY
USAMC

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A special study was conducted at Aberdeen Proving Ground from November 1967 through January 1968 to investigate bore fouling when firing M196 tracer ammunition from the M16A1 rifle in a high-temperature environment. Seventeen lots of M196 tracer cartridges, representing several manufacturing "variables", were tested at 95°F and 155°F. It was concluded that the M196 tracer cartridge loaded with WC 846 (ball-type) propellant is incompatible with the M16A1 rifle when stored and fired at 95°F or higher; the tracer cartridges loaded with IMR 8208M propellant performed satisfactorily in the M16A1 rifle at the test temperatures.

DD FORM 1 JAN 64 1473

Unclassified

Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Rifle, 5.56-mm, M16A1 Cartridge, Tracer, M196 Bore Fouling Tracer Performance						

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