~~Miller~~, Reede + ~~Staley~~

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FINAL REPORT ON COMBINED INITIAL PRODUCTION AND INSPECTION COMPARISON TEST OF M16A1 RIFLES

BY

ALLAN WILSON

MAY 1969

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FINAL REPORT

BY

ALLAN WILSON

MAY 1969

ABERDEEN PROVING GROUND
ABERDEEN PROVING GROUND, MARYLAND
21005

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ABSTRACT

A combined initial production and inspection comparison test of M16A1 rifles was conducted at Aberdeen Proving Ground by the Materiel Test Directorate between 25 January and 15 May 1969. Thirty-five rifles from each of two new producers as well as 35 rifles from the original producer were subjected to inspection, accuracy, endurance, displacement-time, and environmental tests. As functioning deficiencies were encountered with rifles from all producers, an endurance retest was conducted which demonstrated reliable performance and identified certain critical production problems which were primarily responsible for the earlier failures.

FOREWORD

The Materiel Test Directorate was responsible for conducting the test and preparing the test report. In order to complete all testing within a 90-day period, various test phases were assigned to a number of test directors as follows:

Inspection. Mr. George Hendricks

Accuracy and Endurance. 1LT James Cope, Mr. Franklin Miller, Mr. Walter Eller, and Mr. Eric Keele

Displacement-Time Study. Mr. Lloyd Staley

High Temperature. Mr. George Hendricks

High Humidity. Mr. Walter Eller

Salt-Water Immersion. Mr. Walter Eller

Dynamic Dust. Mr. George Hendricks

Water Spray. Mr. George Hendricks

Unlubricated. 1LT Robert Ballard

Low Temperature. Mr. Lloyd Staley and Mr. Franklin Miller

Endurance Retest. 1LT James Cope, Mr. Lloyd Staley, and Mr. Walter Eller

ABERDEEN PROVING GROUND
ABERDEEN PROVING GROUND, MARYLAND 21005

USATECOM PROJECT NOS. 8-9-0200-25 AND 8-9-0200-27

FINAL REPORT ON COMBINED INITIAL PRODUCTION AND INSPECTION COMPARISON TEST OF M16A1 RIFLES

25 JANUARY TO 15 MAY 1969

SECTION 1. INTRODUCTION

1.1 BACKGROUND

In 1966, the XM16E1 rifle was type-classified Standard A as the M16A1 rifle. From that year until 1968, all military procurement needs were met by a single contractor. In 1968 production was expanded to include two additional contractors and initial production lots were made available for test from both sources late in 1968.

In January 1969, 35 rifles from each of the two new producers were received at Aberdeen Proving Ground and initial production tests were initiated by the Materiel Test Directorate at the direction of US Army Test and Evaluation Command (USATECOM) (Reference 1). At the same time, 35 rifles from the original producer were also submitted for an inspection comparison test as requested by US Army Weapons Command (USAWECOM) and it was directed by USATECOM that the rifles from all three producers would be tested simultaneously and that the results of test would be combined in a single report (Reference 2).

1.2 DESCRIPTION OF MATERIEL

The M16A1 rifle is a lightweight, air-cooled, gas-operated weapon capable of either semiautomatic or automatic fire. The rifle employs a 20-round magazine and fires 5.56-mm ball (M193) and tracer (M196) cartridges. More detailed information may be found in TM 9-1005-249-12 and TM 9-1005-249-34 (References 7 and 8).

1.3 TEST OBJECTIVES

Test objectives for the Materiel Test Directorate were established at a meeting held at Aberdeen Proving Ground on 9 January 1969 attended by representatives from USATECOM, USAWECOM, and from the Office of

Project Manager for Rifles (AMCPM-RS). The test objectives were confirmed in Reference 3 and are extracted from the reference as follows: "To conduct, analyze and report the data necessary to permit evaluation by USAWECOM and USAMC of materiel requirements as stated in the objective paragraphs of the respective test plans, and to permit USATECOM to determine the degree of suitability of the initial production test items for issue to the user per AMCR 700-34."

1.4 SUMMARY OF RESULTS AND CONCLUSIONS

1.4.1 Deficiencies

Deficiencies were as follows:

a. Following initial inspection at APG, and a subsequent inspection at Rock Island Arsenal, the withdrawal from test by AMSWE-QA of two Code B rifles and six Code C rifles due to improper chamber finish and incorrect chamber and bolt dimensions was rated as a separate deficiency in each instance (ref par. 2.2.5a).

b. The improper staking of bolt-carrier key screws on one Code B rifle was rated as a deficiency as the weapon was rendered inoperable during firing and required repair at the direct- and general-support level. It was also observed that bolt-carrier screws on 15 other Code B rifles were improperly staked and did not meet the inspection requirements of item 47 of SAPD-253F, Reference 13 (ref pars. 2.2.4.2 and 2.6.4).

c. A defective bolt-catch casting found in one Code A rifle was rated as a deficiency as requested by AMSTE-BC in Reference 4 (ref par. 2.2.5a).

d. Due to excessive numbers of failures of the bolt to remain to the rear in the initial endurance test, 39 occurrences within the first 6000 rounds on four Code A rifles, these repetitive failures were classed as a Code A production deficiency[a] (ref par. 2.4.4).

e. Due to excessive numbers of double-feed malfunctions in the initial endurance test, 42 and 67 occurrences within the first 6000 rounds with four Code B and four Code C rifles respectively, these repetitive failures were classed as production deficiencies[a] against both producers (ref par. 2.4.4).

[a]Subsequent production rifles were tested in an endurance retest (par. 2.9) and demonstrated much improved performance for all producers; however, it is not known to what extent corrective action has been taken on the large numbers of earlier production rifles.

f. In six instances, rifle bolts were found to be cracked at the cam pin-hole position after 6000 rounds or less of firing, three with Code A rifle bolts, and three with Code B bolts. As complete bolt separation is considered potentially hazardous and has occurred in tests at Rock Island Arsenal, these failures were classed as production deficiencies against both producers (ref pars. 2.4.5.2, 2.6.4, 2.7.4.1, and 2.9.5.4).

Since the bolts produced by the Code C contractor experienced no similar failures any effort to evaluate the true risk to personnel when bolt failure occurs appears secondary to a firm requirement that bolts from all producers be durable.

g. Defective selector-lever castings were found in 11 of the original 35 Code B rifles. The defective selectors resulted in repetitive firing failures and the problem was classed as a Code B production deficiency as requested by AMSWE-QA in Reference 5 (ref par. 2.4.5.2).

h. The over-all performance of all M16A1 rifles at low temperature (-65°F) was unsatisfactory as evidenced by the following malfunction rates (malfunctions per 1000 rounds fired):

1) Code A, 31.3.

2) Code B, 23.8.

3) Code C, 32.0.

This level of performance is classed as an inherent deficiency of the present rifle-ammunition system and appears to be independent of variables which might be attributable to different production techniques or production sources. It should be emphasized, however, that exposure to these environmental conditions alone does not significantly degrade initial (clean) weapon performance. With weapons cleaned and lubricated prior to a minimum of six hours of low-temperature exposure, a malfunction rate of 2.4 per 1000 rounds fired was obtained during 49 initial 100-round cycles. The malfunction rate increased progressively and drastically as repeated cycles of firing were attempted without maintenance and with 2-hour conditioning periods between cycles. Such a schedule results in freezing of mechanism fouling which has accumulated on the cycling components and firing is often reinitiated only with great difficulty (ref par. 2.7.4).

1.4.2 Shortcomings

Shortcomings were as follows:

a. Automatic sear-assembly pins in Code A rifles failed to meet, or only marginally met, requirements for proper depth of taper which resulted, in some instances, in damage to the automatic sear assembly[a] (ref par. 2.2.4.1).

b. Improper swedging of bolt cam-pin holes on two Code B rifles is a shortcoming as this failure permits inadvertent reversed assembly (ref par. 2.2.4.2).

c. Defective and damaged extractor springs were received from the Code B contractor; this was rated as a shortcoming as many of the springs could not be used as spare parts (ref par. 2.2.4.2).

d. Failure of a rivet on the magazine floor-plate retaining clip and a defective magazine spring were encountered with two Code C magazines respectively in less than the minimum-life requirement of 250 rounds (ref pars. 2.4.4.3 and 2.9.5.4).

e. Excessive trigger pull (above 8.5 lbs) was noted with one Code A, three Code B and one Code C rifle (ref par. 2.2.4).

f. One Code A and two Code C rifles exceeded the initial cyclic rate requirement of 900 rounds per minute, however, no cyclic rate failures were recorded in either the endurance test or the endurance retest (ref par. 2.2.4).

g. The targeting requirements of SAPD-253F (Reference 13) were not met by two Code A and one Code C rifle, however, dispersion results with all rifles were judged to be acceptable[b] (ref par. 2.3.4).

h. Three Code A extractor springs failed the minimum-life requirement of 2000 rounds. In addition, 19 other Code A extractor springs broke beyond the minimum-life period, demonstrating much less durability than Code B or Code C springs. It appeared that the end coils were ground too "thin" as the end coils often split prior to actual spring breakage (ref pars. 2.4.5.2 and 2.9.5.4).

[a] It is understood that drawing specifications were to be changed to reduce the possibility of recurrence of this problem.

[b] It is the opinion of the test agency that certain targeting requirements of SAPD-253F are unrealistically stringent (ref par. 2.3.5c).

i. Bolt-lug cracks were detected by magnaglow inspection prior to 6000 rounds with the majority of the rifle bolts examined. While this failure, as observed in this test, is judged not to be hazardous, the problem appears to be due to improper machining of bolt-lug fillets and the practice should be corrected (ref pars. 2.4.5.2, 2.7.4, and 2.9.4).

j. In many instances, inspection and measurement of the configuration of bolt lugs and bolt catches revealed that drawing requirements were not met. These are extremely serious shortcomings as the proper configuration of both of these components is critical if reliable functioning is to be obtained (ref par. 2.9.4).

k. Broken bolt rings occurred in three Code C rifles in less than 3000 rounds. Although the effect on functioning of a broken bolt ring, or rings, has not been full evaluated, this component is considered a critical one and failure prior to 6000 rounds is not permitted in SAPD-253F (ref par. 2.9.5.4).

l. One defective trigger and trigger spring were found in one Code A rifle, which resulted in trigger return failures during firing (ref par. 2.9.5.4).

1.4.3 Other Significant Problems

As discussed in paragraph 2.5.5, certain current production specifications may require careful review, if reliable performance of the M16A1 rifle is to be maintained or improved. These areas of concern are as follows:

a. Bolt catch. The present policy of a gradual phase-out of bolt catches of original configuration is considered improper; all current bolt catches should be of the improved modified design and this design should be studied for further optimization.

b. Rifle bolt. Failure to meet bolt-lug dimensional specifications occurs too frequently, considering the critical nature of bolt-lug configuration. In addition, the presently permitted tolerances for lug chamfer, or radius (0.005 to 0.015 inch) appears excessive and the tolerance limits may permit unacceptable occurrences of double-feed and bolt-catch malfunctions as dimensions approach, respectively, either extreme.

c. Magazine spring. Current specifications for the magazine spring should be carefully studied since spring-force characteristics may be marginally low and the magazine spring plays a vital role in assuring proper bolt-catch operation as well as cartridge feeding.

SECTION 2. DETAILS OF TEST

2.1 INTRODUCTION

2.1.1 Malfunction Abbreviations

Abbreviations of malfunctions used in this report are identified below; a more detailed and illustrated explanation of malfunctions common to the M16A1 rifle is contained in Reference 6.

a. FF-1. A feeding malfunction which occurs when the bolt catch is released and the first round from a fully loaded magazine is not successfully and completely fed and chambered.

b. FF/BB. A feeding malfunction which occurs during firing with the rifle bolt positioned behind the base of the cartridge.

c. FF/BOB. Same as FF/BB except that the bolt has overridden the base of the cartridge.

d. FF/COEC. A feeding malfunction which results in the bolt closing on an empty chamber.

e. FF/DF. Similar to FF/BB, except that the bolt has also come in contact with a second live round and is often jammed against this round much in the manner of a FF/BOB. As this particular malfunction is not illustrated or described in Reference 6, it is shown here as Figure 2.1-1.

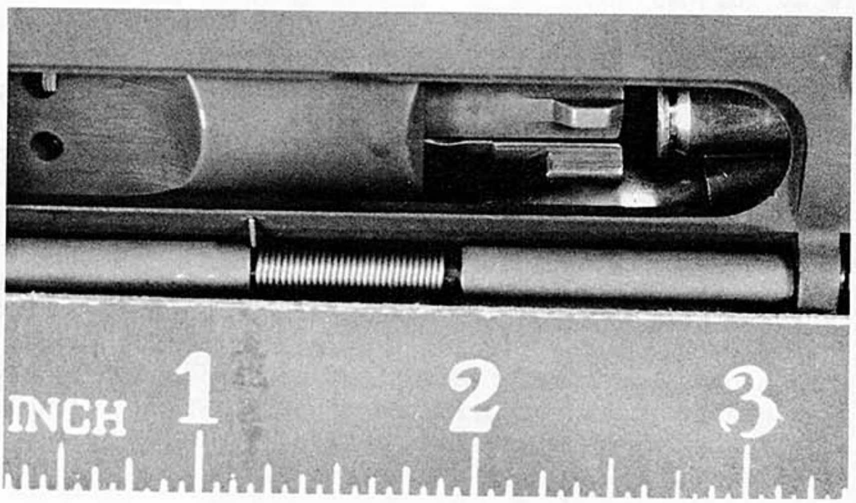


Figure 2.1-1: Close-Up View of Double-Feed Malfunction In the M16A1 Rifle as It Occurred in Various Subtests in this Report.

f. FBR. Failure of the bolt to be engaged and held open in a rearward position by the bolt catch after the last round in the magazine is fired.

g. FFR (Failure to Fire). While this failure usually appears to have occurred after a successful feeding cycle, it is often due to a final failure of the carrier to completely close. In such instances, the hammer strikes the carrier, completing closure, but only lightly indenting the cartridge primer. This malfunction also occurs when fouling buildup interferes with firing-pin travel, and occasionally, but rarely, may be due to an ammunition deficiency.

h. FJ. Failure of a fired case to be completely ejected from the rifle. Usually, this malfunction is indicative of a broken extractor spring.

i. FX. Failure of a fired case to be extracted from the chamber. This malfunction requires mechanical aid in clearing (cleaning rod, knife blade, etc.) or repeated attempts to re-engage the cartridge rim by hand cycling the bolt.

j. FTR. Failure of the trigger to return to a forward position when released; often caused by excessive fouling which cannot be overcome by trigger spring force.

2.1.2 Round-by-Round Data

Appendix I contains round-by-round data for the original endurance test (par. 2.4) and the low-temperature test (par. 2.7). Various subtypes of the malfunctions listed in par. 2.1.1 above are identified in these data and a supplementary malfunction abbreviation list is contained in Appendix I.

2.1.3 Malfunction Clearing Action

Firing performance data, which are given in the various subtests as well as in Appendix I, identify the clearing action that was required to overcome malfunctions in most instances. Abbreviations which are used to identify such action are as follows:

a. BA. The use of the bolt assist device cleared the stoppage.

b. CH. Only the charging handle was used to clear the stoppage.

c. M. It was necessary to remove the magazine in order to clear the stoppage; often the abbreviation CH/M is listed, indicating that the charging handle had to be held to the rear with one hand while the magazine was removed with the other.

d. ORG. The failure required corrective action (usually repair) at the operator and organizational level as identified in TM 9-1005-249-12 (Reference 7).

e. DSL. The failure required corrective action at the direct- and general-support level identified in TM 9-1005-249-34 (Reference 8).

f. FXT. A special tool was used to remove a fired case which had failed to extract; the tool is illustrated in Reference 6.

2.1.4 Round Count and Magazine Number

Depending on the particular subtest, all malfunctions are identified both by individual round number within a magazine (1 to 20) and by the individual magazine number. These data are contained either in the summarized data in Section 2 or in the round-by-round data in Appendix I.

The FF-1 and FBR malfunctions always occur on round Nos. 1 and 20 respectively. All other malfunctions are counted as occuring on whatever round number has been fired at the time of the malfunction; a FF/DF listed as round No. 17 indicates that, during the cycling operation following the firing of round No. 17, a double feed occurred which involved rounds No. 18 and 19. The only exception is for the FFR malfunction which identifies the round number which failed to fire and does not designate the previous successfully fired round.

2.1.5 Interchange Test

A parts interchange test was conducted at Rock Island Arsenal and the results of test were forwarded to USATECOM for inclusion in this report as directed in both the inspection comparison and initial production test plans (Reference 9 and 10 respectively). These data are contained in Appendix I.

2.1.6 Maintenance

Comments pertinent to maintenance of the M16A1 rifle and the suitability of maintenance manual TM 9-1005-249-12 are contained in par. 2.4.5.2c. It should be noted that this test was the first occasion when this test agency adhered exclusively with one exception, to the maintenance procedures specified for the organizational and operator level rather than the more detailed and rigorous maintenance typical of direct and general support. The single exception occurred during the initial inspection test when rifles were disassembled, inspected, and maintained following instructions in TM 9-1005-249-34 (Direct and General Support Manual, Reference 8).

This test also was the first occasion when this test agency employed bore cleaner (MIL-C-372B) as an all purpose cleaner rather than dry-cleaning solvent (Fed Spec 0-T-620A) during maintenance in a large-scale test of the M16A1 rifle.

2.1.7 Endurance Retest

The data in par. 2.9 report the results of testing an additional 36 rifles not originally programmed, but which was requested by AMSWE-QA (Reference 11) and directed by AMSTE-BC (Reference 12). All other subtest paragraphs contain data obtained from tests of the 105 rifles originally received.

2.1.8 Additional Reference Data

An addendum to this report, which is retained in Aberdeen Proving Ground library, contains additional test data not included in the general distribution copies of this report. The addendum is comprised of the individual bore measurements and round-by-round velocity data.

2.2 INSPECTION TEST

2.2.1 Objectives

The objectives were:

a. To determine that the test items and support materiel have been received in proper condition for test and are free from damage.

b. To inspect and to measure certain physical characteristics, and to test-fire each rifle.

2.2.2 Criteria

Criteria were as follow:

a. The test items shall be adequately and clearly marked and undamaged.

b. Each rifle shall be packed with those items specified as Basic Issue Items.

c. Trigger-pull force shall be 5.5 to 8.5 pounds and free of creep.

d. Headspace shall be 1.4646 to 1.4706 inches.

e. Firing-pin indent, from inertia force alone, shall not exceed 0.008 inch and shall not be less than 0.020 inch as a result of normal hammer fall. The indent shall not be off-center more than one-half the diameter of the firing-pin point.

f. Firing-pin protrusion shall be 0.028 to 0.036 inch.

g. The average cyclic rate of fire for a 20-round continuous burst shall be 700 to 900 rounds per minute (the applicability of this criterion is discussed in par. 2.2.5c).

h. The rifles shall meet the inspection requirements of Appendix J, par. 5.0, SAPD-253F (Reference 13).

2.2.3 Method

A thorough disassembly, inspection, and maintenance operation (per TM 9-1005-249-34) is performed on each rifle and physical characteristics are obtained as follows:

a. Trigger pull is determined by averaging three "dry-firing" trials as measured by a hand-held spring scale.

b. Headspace is determined by employing a graduated set of headspace gages (1.4646 to 1.4706 in.) to determine the longest gage which can be accepted in the rifle chamber with the bolt closed and locked.

c. Firing-pin protrusion is measured with a dial-indicator gage.

d. Bore measurements are obtained with the aid of an air gage.

e. The rifle and cycling-group components are weighed.

During inspection, each rifle is examined for complicance with the standards established in the various subparagraphs of par. 5.0, Appendix J, SAPD-253F. (Subpars. 13, 18, 54, 62, 78, 79, 82 to 87, and 90 to 93 were evaluated during the course of the endurance test; subpars. 58, 59, 60 and 72 to 75 were evaluated during the accuracy and targeting tests and subpars. 61, 67 and 68 were not evaluated as test gages were not available. Requirements in all other subparagraphs were evaluated in the initial inspection test.)

Each rifle is then fired 40 rounds (20 rounds in 5-round bursts immediately followed by a continuous 20-round burst) from a government-approved test stand. The cyclic rate of fire for each rifle is measured during the firing of each 20-round burst.

Following the cyclic-rate-of-fire test, firing-pin indent is measured employing copper-compression cyclinders and a special holding fixture inserted in the rifle chamber. The firing-pin indent test is conducted in two trials, first by measuring the depth of indent as a result of normal hammer fall against the firing pin, and then by measuring indent caused by inertia motion of the firing pin when the bolt carrier is freely released from the bolt catch position.

At the conclusion of firing in all other subtests, each rifle is again inspected and headspace and firing-pin protrusion are measured; in addition, the trigger pull, firing-pin indent, and barrel bores are also measured for the rifles which have been fired in the endurance test (par. 2.4).

2.2.4 Results

The results of test are contained in the following tables and paragraphs. The data from individual trigger-pull trials are contained in Appendix I and bore measurements are contained in the APG library file copy of this report.

Table 2.2-I. Physical Characteristics

Individual manufacturers are designated by code leters, A, B, and C.

Rifle No.	Weight, lb: Rifle[a] A	B	C	Recoiling Parts: Buffer A	B	C	Bolt-Carrier Assembly[b] A	B	C	Action Spring A	B	C	Trigger Pull,[c] lb A	B	C	Measurements, in.: Firing-Pin Protrusion A	B	C	Headspace A	B	C
1	6.62	6.82	6.73	0.322	0.326	0.327	0.720	0.718	0.717	0.134	0.133	0.134	-	7.8	7.3	0.031	0.034	0.030	1.4666	[d]1.4646	[e] -
2	6.67	6.84	6.69	.321	.325	.325	.715	.716	.722	.134	.135	.133	7.6	7.6	7.8	.032	.034	.030	1.4646	1.4646	[e] -
3	6.63	6.79	6.76	.321	.325	.325	.717	.711	.714	.133	.135	.135	8.0	7.8	7.5	.032	.032	.030	1.4656	1.4656	1.4646
4	6.69	6.82	6.76	.321	.325	.324	.715	.716	.719	.133	.135	.133	6.8	8.0	7.4	.032	.035	.030	1.4656	1.4666	1.4646
5	6.64	6.80	6.76	.321	.326	.324	.716	.713	.722	.135	.133	.134	7.1	8.1	7.6	.031	.034	.030	1.4666	1.4686	[e] -
6	6.70	6.83	6.73	.321	.325	.324	.717	.715	.718	.133	.133	.134	8.2	7.5	7.7	.033	.033	.030	1.4656	[e] -	[e] -
7	6.66	6.83	6.77	.321	.325	.324	.715	.716	.718	.133	.134	.135	8.0	-	8.5	.031	.031	.031	1.4646	1.4686	[d]1.4646
8	6.68	6.78	6.75	.322	.325	.324	.717	.712	.714	.133	.135	.133	8.4	7.8	6.9	.031	.034	.030	1.4656	1.4646	1.4646
9	6.69	6.84	6.74	.322	.327	.322	.714	.715	.716	.133	.134	.134	7.9	8.2	7.6	.032	.035	.030	1.4656	1.4666	[d]1.4646
10	6.63	6.85	6.70	.321	.327	.322	.718	.717	.719	.133	.133	.134	8.4	7.1	7.6	.032	.033	.030	1.4646	1.4646	[d]1.4646
11	6.64	6.81	6.84	.321	.325	.324	.718	.716	.722	.138	.134	.136	7.8	-	7.9	.032	.033	.030	1.4656	1.4666	1.4646
12	6.71	6.85	6.79	.321	.325	.322	.717	.715	.719	.133	.135	.133	7.7	7.4	7.7	.032	.032	.031	1.4676	1.4676	[e] -
13	6.67	6.82	6.80	.320	.324	.326	.718	.714	.720	.133	.133	.134	7.8	8.3	7.3	.031	.034	.030	1.4646	1.4656	1.4646
14	6.66	6.82	6.76	.320	.326	.324	.717	.715	.721	.133	.133	.134	7.5	7.8	-	.032	.032	.030	1.4666	1.4676	1.4646
15	6.66	6.81	6.77	.321	.324	.325	.719	.715	.720	.133	.133	.134	6.7	7.9	8.4	.031	.036	.030	1.4656	1.4686	1.4656
16	6.70	6.83	6.76	.321	.325	.324	.719	.712	.712	.134	.133	.134	7.4	7.5	7.1	.032	.031	.035	1.4666	1.4676	1.4646
17	6.73	6.83	6.79	.322	.325	.323	.716	.717	.716	.134	.133	.134	7.7	7.9	7.7	.032	.035	.030	1.4656	1.4646	[e] -
18	6.68	6.87	6.75	.321	.323	.323	.716	.715	.718	.133	.135	.134	7.3	8.3	7.9	.031	.033	.030	1.4666	[d]1.4646	[e] -
19	6.66	6.81	6.73	.321	.325	.323	.717	.714	.719	.134	.134	.135	6.6	7.9	8.3	.031	.032	.030	1.4656	1.4656	[d]1.4646
20	6.72	6.81	6.78	.321	.326	.325	.718	.715	.711	.134	.135	.135	6.9	7.3	7.5	.031	.034	.030	1.4656	[d]1.4646	1.4646
21	6.66	6.80	6.88	.321	.325	.324	.719	.712	.725	.133	.133	.134	7.7	7.8	7.5	.032	.033	.032	1.4666	[e] -	[d]1.4646
22	6.65	6.83	6.77	.320	.324	.325	.717	.713	.714	.133	.132	.133	7.0	-	8.2	.032	.031	.030	1.4666	1.4676	[d]1.4646
23	6.72	6.80	6.72	.321	.326	.324	.716	.715	.719	.133	.134	.134	8.4	8.4	7.9	.032	.034	.030	1.4666	[e] -	1.4646
24	6.67	6.81	6.78	.321	.326	.324	.717	.717	.720	.133	.133	.134	7.7	7.5	7.5	.032	.031	.030	1.4666	1.4656	1.4646
25	6.65	6.85	6.75	.320	.324	.324	.720	.714	.719	.133	.134	.134	8.1	7.5	7.9	.032	.032	.030	1.4666	1.4646	1.4646
26	6.66	6.80	6.77	.319	.323	.324	.720	.715	.719	.133	.134	.134	8.2	8.4	8.5	.031	.031	.029	1.4666	1.4646	1.4646
27	6.65	6.83	6.75	.321	.324	.324	.717	.715	.718	.132	.134	.134	7.3	7.5	8.4	.030	.030	.030	1.4666	1.4666	1.4656
28	6.73	6.77	6.74	.321	.324	.325	.719	.715	.714	.132	.133	.134	8.4	7.5	8.2	.032	.032	.030	1.4666	[e] -	[d]1.4646
29	6.69	6.79	6.82	.321	.323	.324	.714	.715	.722	.133	.133	.134	8.0	7.7	8.3	.031	.034	.030	1.4656	1.4646	[d]1.4646

See footnotes on following page.

Table 2.2-I (Cont'd)

Rifle No.	Weight, lb: Rifle[a] A	Rifle[a] B	Rifle[a] C	Recoiling Parts: Buffer A	Buffer B	Buffer C	Bolt-Carrier Assembly[b] A	Bolt-Carrier Assembly[b] B	Bolt-Carrier Assembly[b] C	Action Spring A	Action Spring B	Action Spring C	Trigger Pull,[c] lb A	Trigger Pull,[c] lb B	Trigger Pull,[c] lb C	Measurements, in.: Firing-Pin Protrusion A	Firing-Pin Protrusion B	Firing-Pin Protrusion C	Headspace A	Headspace B	Headspace C
30	6.69	6.78	6.82	0.321	0.325	0.323	0.718	0.715	0.718	0.132	0.134	0.132	7.3	7.7	7.6	0.031	0.034	0.029	1.4656	1.4666	1.4646
31	6.69	6.80	6.76	.321	.325	.324	.719	.719	.713	.133	.132	.134	6.7	7.5	7.4	.032	.033	.029	1.4656	1.4666	[d]1.4646
32	6.68	6.77	6.78	.321	.326	.324	.719	.715	.714	.133	.133	.132	8.1	7.6	7.9	.032	.033	.030	1.4666	1.4646	1.4666
33	6.69	6.78	6.81	.320	.324	.324	.718	.714	.717	.132	.134	.134	7.9	7.6	7.9	.031	.035	.030	1.4656	1.4656	[d]1.4646
34	6.64	6.82	6.81	.321	.326	.324	.716	.715	.720	.132	.134	.133	7.5	7.6	7.4	.030	.034	.030	1.4666	1.4646	[e] -
35	6.64	6.83	6.80	.321	.326	.324	.718	.716	.707	.132	.134	.134	7.1	7.8	7.6	.031	.034	.030	1.4646	1.4656	[e] -
Avg	6.67	6.82	6.80	.321	.325	.324	.717	.715	.718	.133	.134	.134	7.7	7.9	7.8	.032	.033	.030	1.4659	1.4660	1.4648

[a]Rifle weight is without magazine or other accessories.
[b]Includes bolt assembly and firing pin.
[c]Trigger-pull is average of 3 trials.
[d]The gage was difficult to remove from the chamber.
[e]Headspace less than minimum gage 1.4646 inches.

Table 2.2-II. Initial Cyclic-Rate-of-Fire Measurements (Rds/Min)

Rifle No.	Weapon Code A	Weapon Code B	Weapon Code C
1	L743	794	794
2	802	825	802
3	808	818	781
4	778	802	895
5	776	796	H908
6	784	802	806
7	786	815	873
8	851	H853	869
9	813	791	808
10	849	831	838
11	799	829	815
12	834	834	811
13	799	834	829
14	H921	801	784
15	853	806	811
16	813	829	844
17	857	813	811
18	891	770	829
19	799	808	867
20	879	831	832
21	847	770	842
22	765	778	861
23	806	823	808
24	849	838	798
25	851	840	827
26	845	806	767
27	883	825	820
28	853	829	832
29	900	822	869
30	881	845	L744
31	873	L761	838
32	820	808	825
33	897	802	906
34	849	845	836
35	863	794	838
Avg	835	813	829
Std Dev	42.9	22.7	36.7

H = Highest initial rate per manufacturer.
L = Lowest initial rate per manufacturer.

Table 2.2-III. Firing-Pin Indent Measurements, In.

Rifle No.	Inertia Indent, Weapon Code A	Inertia Indent, Weapon Code B	Inertia Indent, Weapon Code C	Hammer-Fall Indent[a], Weapon Code A	Hammer-Fall Indent[a], Weapon Code B	Hammer-Fall Indent[a], Weapon Code C
1	0.007	0.006	0.006	0.023	0.023	0.022
2	.006	.006	.007	.022	.022	.022
3	.006	.005	.005	.023	.024	.023
4	.006	.005	.006	.022	.023	.025
5	.007	.006	.006	.023	.023	.023
6	.007	.006	.007	.023	.023	.023
7	.007	.007	.007	.023	.023	.023
8	.006	.006	.005	.023	.023	.022
9	.006	.006	.007	.023	.022	.022
10	.007	.006	.006	.024	.023	.022
11	.006	.006	.006	.023	.023	.022
12	.006	.006	.007	.023	.022	.022
13	.005	.007	.006	.021	.022	.023
14	.007	.006	.006	.023	.023	.023
15	.006	.006	.005	.022	.023	.022
16	.007	.006	.007	.021	.023	.023
17	.007	.006	[b] -	.024	.023	[b] -
18	[c] .006	.007	[d] .008	.022	.022	[d] .023
19	.007	.006	.006	.022	.024	.023
20	.006	.007	.005	.022	.023	.022
21	.006	.006	.006	.022	.022	.023
22	.006	.006	.006	.022	.023	.022
23	.006	.006	.007	.023	.023	.022
24	.006	.006	.006	.024	.022	.023
25	.007	.007	.005	.023	.023	.022
26	.007	.006	.006	.025	.022	.023
27	.007	.007	.007	.024	.022	.023
28	.006	.006	.006	.023	.023	.022
29	.006	.007	.007	.023	.024	.024
30	.006	.007	.005	.024	.024	.022
31	.008	.005	.007	.021	.022	.022
32	.005	.007	.006	.023	.024	.022
33	.006	.008	.007	.023	.024	.023
34	.006	.006	.006	.023	.023	.022
35	.006	.006	[e] .008	.021	.024	.023
Avg	.006	.006	.006	.023	.023	.023

[a]The firing-pin indent on all trials, all manufacturers, was not off center by more than one-half the diameter of the firing pin.
[b]The firing-pin indent fixture would not fit properly in the chamber; the bolt could not be closed.
[c]Two trials were conducted; the first measured 0.002 in., the second, 0.006 in..
[d]The bolt was difficult to close on the fixture.
[e]Two trials were conducted; the first measured 0.009 in., the second, 0.008 in..

Table 2.2-IV. After-Fire Measurements of Headspace and Firing-Pin Protrusion.

Measurements are in inches and were taken at the conclusion of firing in all other subtests; any change in measurements from the data given in Table 2.2-I is also noted (+ or -) following the after-fire measurement.

Rifle No.	Rounds Fired	Headspace Weapon Code A		B		C		Firing-Pin Protrusion Weapon Code A		B		C	
1	1000	1.4676	+0.0010	1.4656	+0.0010	NR		0.032	+0.001	0.034	NC	NR	
2	1000	1.4666	+0.0020	1.4656	+0.0010	NR		.032	NC	.035	+0.001	NR	
3	1000	1.4666	+0.0010	1.4656	NC	1.4666	+0.0020	.032	NC	.032	NC	0.030	NC
4	3000	1.4656	NC	NR		1.4646	NC	.032	NC	NR		.030	NC
5	3000	1.4666	NC	NR		NR		.032	+0.001	NR		NR	
6	3000	NR		NR		NR		NR		NR		NR	
7	3000	1.4656	NC	1.4686	NC	1.4646	NC	.030	-0.001	.030	+0.001	.030	-0.001
8	3000	NR		NR		1.4646	NC	NR		NR		.030	NC
9	3000	NR		NR		1.4656	+0.0010	NR		NR		.031	+0.001
10	1000	1.4656	+0.0010	1.4646	NC	1.4656	+0.0010	.031	-0.001	.033	NC	.031	+0.001
11	1000	1.4656	NC	1.4666	NC	1.4656	+0.0010	.031	-0.001	.033	NC	.030	NC
12	1000	1.4686	+0.0010	1.4686	+0.0010	NR		.033	+0.001	.032	NC	NR	
13	1000	1.4666	+0.0020	1.4666	+0.0010	1.4646	NC	.031	NC	.035	+0.001	.030	NC
14	1000	1.4676	+0.0010	1.4676	NC	1.4646	NC	.033	+0.001	.032	NC	.030	NC
15	1000	1.4656	NC	1.4686	NC	1.4656	NC	.032	+0.001	.035	+0.001	.031	+0.001
16	1000	1.4666	NC	1.4666	+0.0010	1.4656	+0.0010	.032	NC	.031	NC	.035	NC
17	1000	1.4656	NC	1.4646	NC	NR		.031	-0.001	.036	+0.001	NR	
18	120	1.4666	NC	1.4646	NC	NR		.031	NC	.032	-0.001	NR	
19	120	1.4646	-0.0010	1.4666	+0.0010	1.4646	NC	.030	-0.001	.032	NC	.029	-0.001
20	120	1.4656	NC	1.4646	NC	1.4656	+0.0010	.029	-0.002	.034	NC	.030	NC
21	120	1.4666	NC	NR		1.4646	NC	.028	-0.004	NR		.032	NC
22	120	1.4666	NC	1.4676	NC	1.4646	NC	.032	NC	.031	NC	.029	-0.001
23	1000	1.4666	NC	NR		NR		.031	-0.001	NR		NR	
24	1000	1.4666	NC	1.4656	NC	1.4666	+0.0020	.033	+0.001	.031	NC	.030	NC
25	1000	1.4666	NC	1.4646	NC	1.4646	NC	.033	+0.001	.032	NC	.030	NC
26		NR		NR		NR		NR		NR		NR	
27		NR		NR		NR		NR		NR		NR	
28		NR		NR		NR		NR		NR		NR	
29	10000	NR		1.4656	+0.0010	1.4646	NC	NR		.033	-0.001	.030	NC
30	10000	1.4666	+0.0010	1.4666	NC	1.4656	+0.0010	.032	+0.001	.034	NC	.028	-0.001
31	10000	NR		1.4676	+0.0010	1.4646	NC	NR		.033	NC	.030	+0.001
32	10000	NR		1.4656	+0.0010	1.4666	NC	NR		.031	-0.002	.030	NC
33	10000	1.4666	+0.0010	1.4676	+0.0020	1.4646	NC	.032	+0.001	.034	-0.001	.031	+0.001
34	10000	1.4666	NC	1.4646	NC	NR		.032	+0.002	.034	NC	NR	
35	10000	NR		NR		NR		NR		NR		NR	

a. The exact round count on each rifle must be determined by reference to the particular subtest in which the rifle was fired; round counts listed here are approximate. Rifles No. 26, 27, and 28 were kinematic test rifles and spare-parts rifles.

b. Measurements indicated by NR designate those rifles for which no prefire data were obtained in instances as the headspace was less than the minimum APG gage, and thus not measured; NR also denotes lack of meaningful before-and-after data due to bolt substitution in some rifles following initial inspection.

c. NC denotes no change in the before-and-after data.

Table 2.2-V. Firing-Pin Indent and Trigger-Pull Measurements for Endurance Test Rifles Only

Measurements were taken at the conclusion of firing the seven endurance test rifles 10,000 rounds each; any change in measurements from the data given in Table 2.2-I and 2.2-III is noted (+ or -) following the after-firing measurement. Individual manufacturers are designated by code leters, A, B, and C.

Rifle No.	Firing Pin Indent Measurements, in. — Inertia Indent A	Inertia Indent B	Inertia Indent C	Hammer Fall Indent A	Hammer Fall Indent B	Hammer Fall Indent C	Trigger Pull, lb A	Trigger Pull, lb B	Trigger Pull, lb C
28	[a]NF	NF	[b]0.006 [c]NC	NF	NF	[b]0.021 -0.001	NF	NF	7.5 -0.7
29	[b]0.007 +0.001	0.006 -0.001	.007 NC	[b]0.023 NC	0.022 -0.002	.024 NC	6.4 -1.6	6.5 -1.2	6.3 -2.0
30	.006 NC	.006 - .001	.006 +0.001	.023 -0.001	.022 - .002	.021 - .001	5.5 -1.8	7.2 -0.5	8.4 +0.8
31	[b].008 NC	.006 - .001	.006 - .001	[b].021 NC	.021 - .001	.022 NC	5.5 -1.2	6.3 -1.2	6.0 -1.4
32	[b].005 NC	.007 NC	.006 NC	[b].023 NC	.021 - .003	.021 - .001	5.5 -2.6	6.7 -0.9	6.4 -1.5
33	[d]NR	.005 - .003	NR	NR	.022 - .002	NR	5.6 -2.3	6.4 -1.2	6.4 -1.5
34	.006 NC	.007 - .001	.005 - .001	.023 NC	.022 - .001	.021 - .002	5.6 -1.9	7.1 -0.5	6.6 -0.8
35	[b].006 NC	[b].008 - .002	NF	[b].020 - .001	[b].023 - .001	NF	5.7 -1.4	7.8 -0.0	NF

[a]NF = Not fired in endurance test.
[b]After-fire data obtained with rifle equipped with replacement bolt.
[c]NC = No change in the before-and-after data.
[d]NR = Not recorded.

2.2.4.1 Initial Inspection Results for Code A Rifles. Results were as follow:

a. All Code A rifles were properly packed, not damaged in shipment, adequately and clearly marked, and the required basic issue items were included with each rifle.

b. Bore measurements for all Code A rifles were within specifications; **0.219 + 0.001 inch not with (land measurement) and 0.2235 + 0.0010 inch not with (groove measurement).**

c. Twenty-five firing pins and two barrel-bore gages were not included among the required spare parts and support equipment respectively.

d. The automatic sear assemblies from eight rifles were damaged (Figure 2.2-1). The sear assembly (Figure 2.2-2) is maintained in the rifle by a pin which passes through a sear bushing and both sides of the lower receiver. One short leg of the automatic sear spring is permitted to drop into a slot in the sear bushing in such a manner that it retains the sear-assembly pin by resting in a matching groove in the sear pin. During assembly, the tapered point of the sear-pin lifts the spring leg up and permits the sear pin to be fully positioned. Measurements indicated that some Code A sear pins marginally met, or failed to meet, the taper configuration specifications of D61615; the taper angle was correct, 45°, but the depth of taper varied from 0.012 to 0.020 inch (0.015 to 0.025 inch permitted). An inadequate or marginal taper on the sear pin could fail to lift the sear spring leg and an attempt to seat the pin could result in spring and bushing damage similar to that observed in the defective sears. The eight defective sears were replaced with new parts which were subsequently made available after initial cyclic-rate firings (40-rds), however, five of the eight new sear pins received also failed to meet taper specifications with taper depth varying from 0.0128 to 0.0146 inch.

The rifle numbers originally received with damaged sear assemblies were as follows:

A2, 6, 12, 20, 24, 28, 32, and 33.

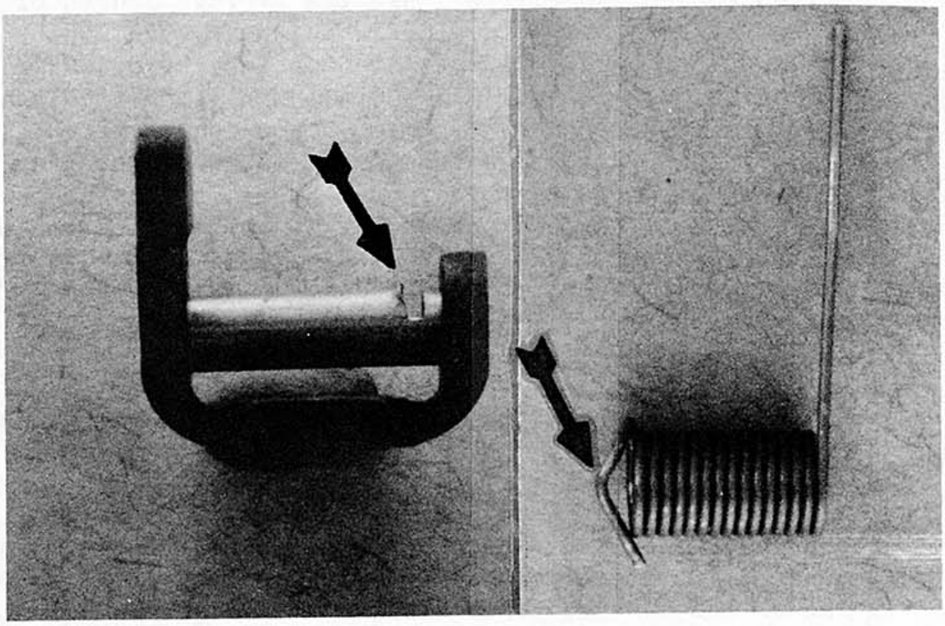


Figure 2.2-1: Damaged Sear Bushing (Left) and Damaged Sear Spring from Code A Rifle. Arrows Indicate Areas of Damage.

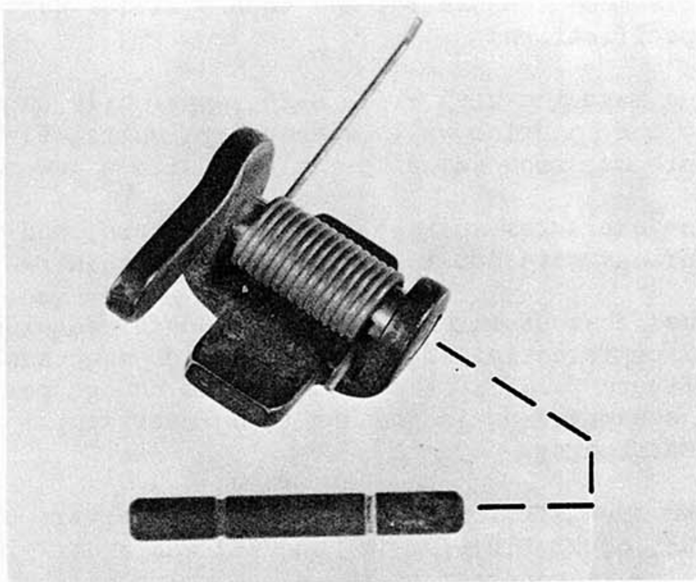


Figure 2.2-2: An Automatic Sear Assembly and Sear Pin are Shown.

e. All of the 30 extractor springs supplied as spare parts failed to meet specifications; the average length of the 30 springs was 0.293 in. (0.222 in. permitted, D61568); the average spring load of three springs at 0.175-in. height was 8.0 pounds (4.2 ± 0.4 pounds permitted) and at 0.135 in., 10.1 pounds (7.5 ± 0.9 pounds permitted). As no other Code A spare extractor springs were available, AMSWE-QA directed that the nonstandard springs be used whenever necessary in subsequent subtests. Due to the difficulty of removing assembled extractor springs from extractors the springs mounted in the test rifles were not measured.

2.2.4.2 Initial Inspection Results for Code B Rifles. Results were as follows:

a. All Code B rifles were properly packed, not damaged in shipment, adequately and clearly marked, and the required basic issue items were included with each rifle. However, 198 of the 245 magazines received for test were in a used condition as evidenced by characteristic wear marks on the top of the cartridge followers. Some magazines had rifle serial numbers and malfunction notes written on the sides of the magazines. The 198 magazines were replaced with new magazines following initial cyclic-rate trails.

b. Bore measurements for all Code B rifles were within specifications.

c. One magazine with rifle B-26, apparently unused, was coated on the interior walls with a dry, white, flaky substance. This magazine was also replaced with a new magazine.

d. One extractor spring, three extractors, and two ejector springs were not included among the required spare parts.

e. The faces of three buffers were deformed along the circumferential edge by a series of many small dents (Figure 2.2-3). The cause of the damage was unknown but the damage was judged not to be detrimental to rifle functioning.

f. The anodized finish on the upper receivers of seven rifles (B3, 6, 13, 16, 17, 18, and 35) was a dark reddish-brown/ color in contrast to the black color of the lower receivers and the usual black color of other upper receivers. Occasional black spots on these upper receivers suggested that the anodizing process had not been carefully controlled.

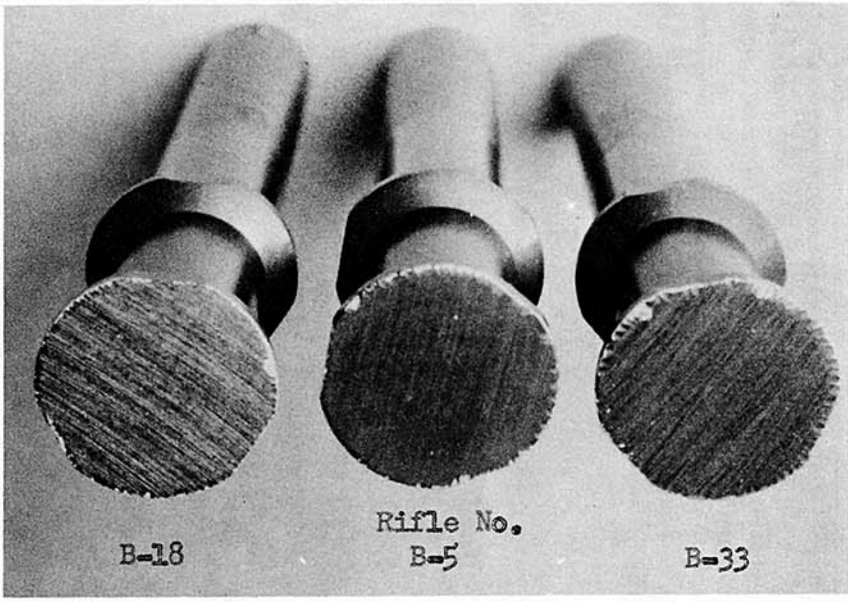


Figure 2.2-3: Damaged Code B Buffers. Note Series of Dents And Abrasions Along Circumferential Edges of Buffer Faces.

g. Among a total of 29 extractor springs received as spare parts, 19 appeared to be damaged from previous use (Figure 2.2-4). Three of the damaged springs were measured for load at 0.135 and 0.175-in. heights; the average spring force at these heights was 6.4 and 3.2 pounds respectively (see par. 2.2.4.1e for spring load specifications at these spring heights). Due to the difficulty of removing assembled extractor springs from extractors, the springs mounted in the test rifles were not measured.

h. Nine of the remaining ten extractor springs received as spare parts and not discussed in the preceding paragraph are shown in Figure 2.2-5. These springs were more severely damaged and appeared to have been forcibly removed from previous assembly in extractors. Thirty new extractor springs were subsequently received for test as spare parts; all of these springs were measured and met the specifications of D61568.

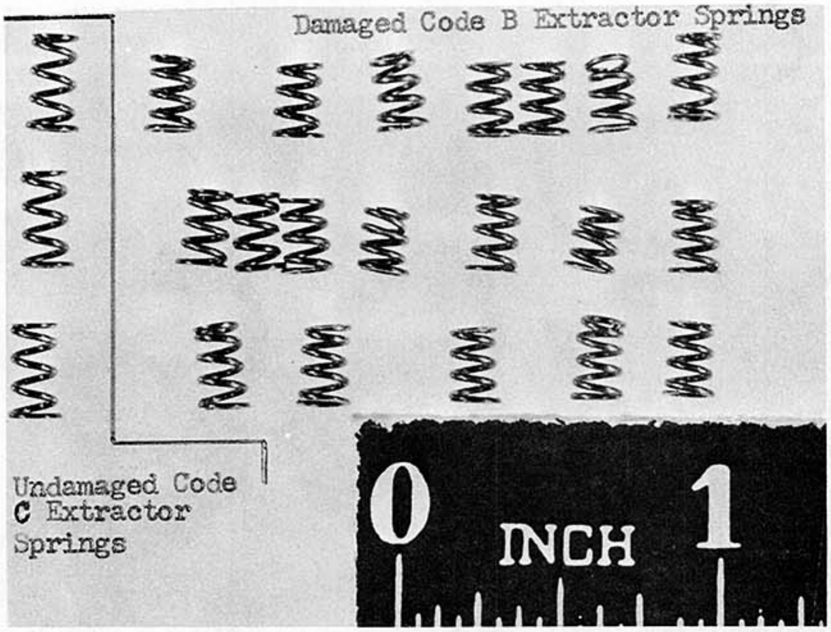


Figure 2.2-4: Damaged Code B Spare Parts Extractor Springs. Three Undamaged Code C Springs Are Shown at Left for Comparison.

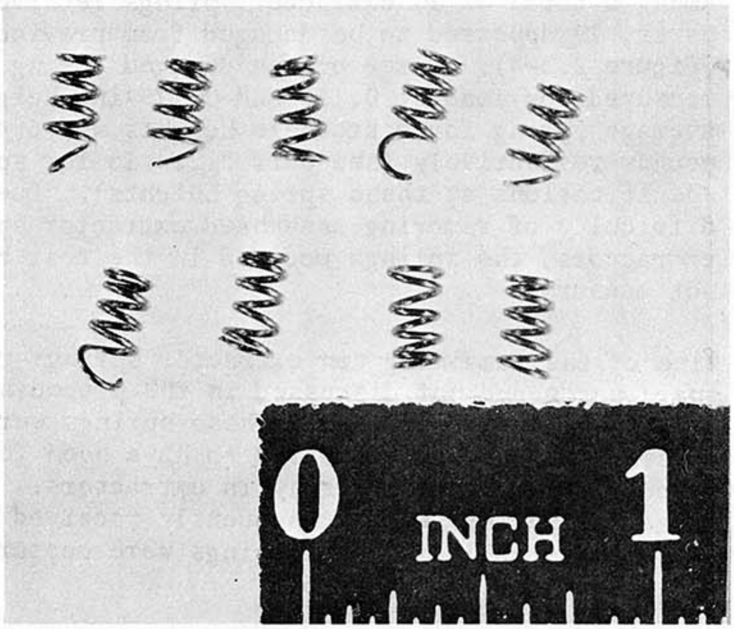


Figure 2.2-5: Damaged and Bent Code B Spare Parts Extractor Springs.

i. During inspection, it was noted that the bolt-cam pins on rifles B9 and B12 would enter either side of the cam-pin holes on the respective bolts. In order to preclude incorrect assembly of the bolt and cam pin, D61538 specifies that the bottom cam-pin hole will be swedged to a 0.307-in. no-go diameter. Measurements indicated that the bottom cam-pin hole diameters were 0.308 to 0.309 inch and that the cam-pin diameters were also 0.308 to 0.309 inch (D61704 specifies that the cam pin diameter should be 0.3105-.0005 but the pins showed definite wear marks which may have accounted in part for the small pin diameter). While the problem involved the interrelationship between the diameters of both the pin and the staked hole, insufficient staking appeared to be the primary cause of the shortcoming.

j. The required inspection marks, "M" for magnetic-particle inspection and "P" for proof firing, could not be detected on the bolt from rifle B26 without the aid of a magnifying glass and, even then, only faint traces of the proof marks could be seen.

k. Inspection of the required staking of the bolt carrier key and the bolt-carrier key screws indicated that the staking was improperly done on 16 rifles. In some instances, multiple staking strikes were observed; in others, staking was faint or improperly located. The rifle numbers were as follows:

B2, 3, 5, 6, 8, 10, 12, 14, 15, 17, 19, 20, 22, 26, 30, and 33.

l. Initial headspace measurements (Table 2.2-I) indicated that the bolt and chamber dimensions of rifles B6, 21, 23, and 28 were less than the minimum permitted as measured with an APG gage. As the APG gage was not a government standard gage for the M16A1 rifle, three of the Code B rifles were returned to AMSWE-QA for further measurement (B6 was inadvertently omitted from shipment). Measurements by AMSWE-QA indicated that rifles B21 and B23 were not within specifications and the rifles were withdrawn from test. Inspection observations made by AMSWE-QA are contained in Appendix I.

m. During initial maintenance following the preliminary cyclic-rate and accuracy firings, the selector-lever detent springs in rifles B3 and B12 were found to be incorrect. In each case, a detent take-down pin spring had been incorrectly assembled in place of the much stronger selector-lever detent spring. The incorrect assembly appeared to have occurred during original assembly at the manufacturing site.

2.2.4.3 Initial Inspection Results for Code C Rifles. Results were as follows:

a. All Code C rifles were properly packed, not damaged in shipment, adequately and clearly marked, and the required basic issue items were included with each rifle with the exception that no magazines were packed with rifle C28; seven new magazines were subsequently received.

b. Bore measurements for Code C rifles were considered to be only marginally within specifications; occasional undersize dimensions were recorded at some positions in the barrel bores of rifles C10, 13, 14, 21, 33, and 35. Individual barrel measurement data for these rifles are contained in Appendix I.

c. All of the 30 extractor springs supplied as spare parts failed to meet specifications; the average length of the 30 springs was 0.285-inch; the average spring load of three springs at 0.175-inch height was 7.4 pounds and at 0.135-inch, 9.6 pounds. (Spring load specifications are stated in par. 2.2.4.1e.) Due to the difficulty of removing assembled extractor springs from extractors, the springs mounted in the test rifles were not measured. As no other Code C spare extractor springs were available, AMSWE-QA directed that the nonstandard springs be used whenever necessary in subsequent subtests.

d. Initial headspace measurements (Table 2.2-I) indicated that the bolt and chamber dimensions of rifles C1, 2, 5, 6, 12, 17, 18, 34, and 35 were less than the minimum permitted as measured with an APG gage. As the APG gage was not a government standard gage for the M16A1 rifle, eight of the Code C rifles were returned to AMSWE-QA for further measurement (C5 was being fired in the low-temperature test and was not removed from the climatic chamber for shipment). Measurements obtained by AMSWE-QA indicated that the rifles C1, 6, 12, 17, 18, and 35 were not within specifications and the rifles were withdrawn from test (with the exception of C1 which was not originally cited as a defective rifle in time to be withdrawn from dust and rain tests).

Subsequently, rifle C17 was resubmitted for test by exchanging the bolt from C18 with the original bolt in C17. This was done by direction of AMSWE-QA and with assurance from AMSWE-QA that the bolt exchange restored C17 to full and correct serviceability.

Inspection observations made by AMSWE-QA are contained in Appendix I.

2.2.4.4 Special Gages. Special headspace and firing-pin protrusion gages intended for direct- and general-support use were also received as test items. The headspace gage was intended to be used to reject rifles which, through wear, exceed a headspace length of 1.4730 inch. (Note: This gage could not be used to check the headspace problems discussed in pars. 2.2.4.21 and 2.2.4.3d as the gage was a maximum gage only.) The firing-pin protrusion gage was a double-end gage intended to reject either insufficient or excessive firing pin protrusion at 0.028 and 0.036 inch respectively. Each gage was calibrated at APG; the headspace gage measured 1.4730 inch and the firing pin protrusion gage 0.0280 and 0.0352 inch. Both gages were considered suitable and were employed, in addition to APG gages, throughout all inspection tests of headspace and firing-pin protrusion.

2.2.4.5 Malfunctions During Initial Cyclic-Rate-of-Fire Trials. Results were as follows:

a. Two failures to fire occurred during the cyclic-rate trials with rifle A2 and magazine A2-1. Since this rifle was fired with a defective sear assembly (ref par. 2.2.4.1d) the malfunctions were attributed to a failure of the sear assembly to engage the hammer during automatic fire, permitting the hammer to "ride" forward with the bolt carrier. These malfunctions were not charged against the rifle as the defective sear had already been cited as a production shortcoming in an equipment performance report to AMSWE-QA. (Firing of the initial cyclic-rate trial prior to sear-assembly replacement was requested by APG, and concurred in by SWERI-QA, in order not to unduly delay test progress awaiting receipt of spare parts.) The rifle was subsequently fitted with new sear components and a successful 40-round cyclic-rate trial was conducted.

b. During the firing of rifle A30, magazine A30-2 and rifle B12, magazine B12-2, the first round in the magazine failed to be stripped from the magazine when the bolt was manually released from the bolt stop. The magazine did not appear to be improperly loaded and the rifles were each charged with a failure-to-feed the first round (FF-1).

c. On two other occasions, failures-to-feed occurred during the firing of Code B rifles; one failure each with rifle B7, magazine B7-1, and rifle B17, magazine B17-7. In each instance the failures appeared to be a double feed of two rounds and were attributed to improper stacking of the rounds in the magazine, i.e., one round stacked directly on top of another round. The magazines had been loaded employing the Code D magazine filler (stripper-clip loading guide) packed with the bandoliers of ammunition.

As the malfunctions could have been caused either by improper loading or from employing a defective magazine filler, the stoppages were not initially charged against the weapons. Test personnel were advised to be especially alert during subsequent magazine loading operations to identify, if possible, the existence of defective mazazine fillers (further information concerning the problem of defective magazine fillers can be found in Reference 14).

Shortly after initiation of the low-temperature test, the first full-scale firing test, personnel again noted that double-stacking of rounds would occur occasionally while using Code D magazine fillers. From that point on, all magazines for all firings were individually hand-loaded and the magazine fillers packed with the ammunition were not used. However, as firing was initiated and progressed in other subtests, the double feed malfunction continued to occur despite the most careful hand-loading of magazines and the two feeding failures cited above were judged not to have been caused by use of the Code D magazine filler.

d. During initial cyclic-rate firings, the bottom rivet, which secures the magazine floor-plate retaining spring, failed on rifle B30, magazine B30-2 (Figure 2.2-6). This failure permitted the floor plate to move rearward and partially disassemble. Firing was completed with the magazine without failure as the problem was noted before complete disassembly of the magazine occurred. The magazine was removed from test. Note that this problem should be charged against the Code C manufacturer, the supplier of all test magazines.

e. Two failures of the bolt to remain to the rear (FBR) after the last round in the magazine is fired, occurred with rifle C3, magazines C3-1 and C3-2. Inspection of the magazines failed to reveal the cause of the malfunction and the magazines were reloaded and fired in rifle C28 without failure. However, subsequent inspection of the bolt catch mechanism during the next maintenance period showed that the bolt catch, a casting, had been improperly made. The defective bolt catch is shown in Figure 2.2-7.

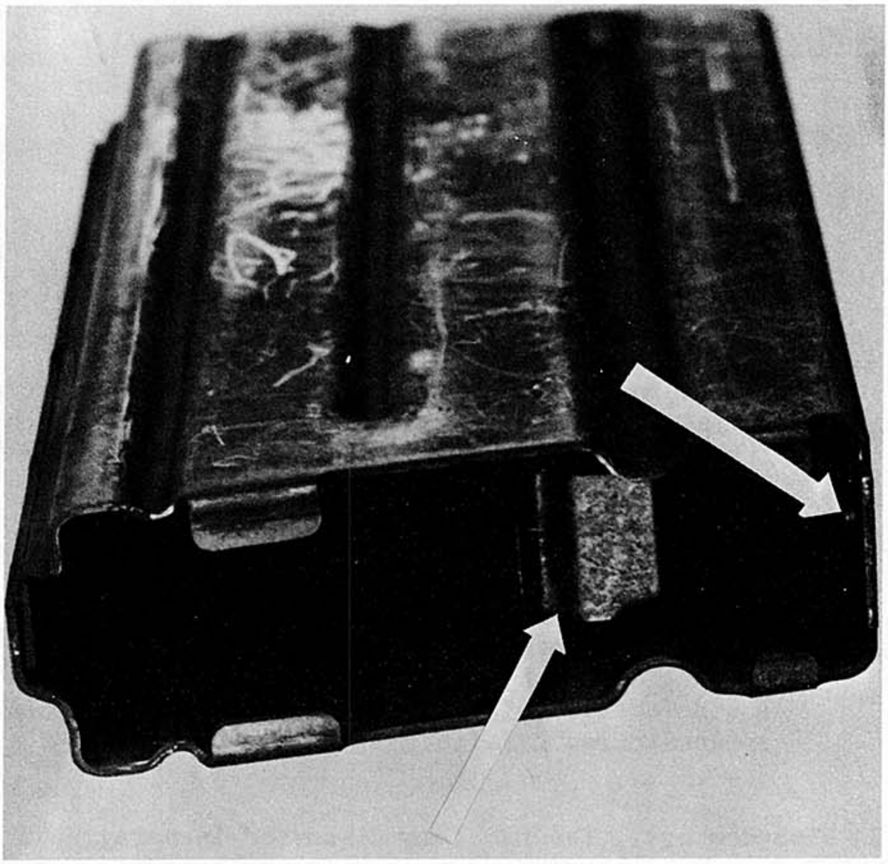


Figure 2.2-6: The Magazine Floor Plate Retaining Spring, Left Arrow, Has Pulled Free from the Retaining Rivet, Right Arrow; Magazine B30-2.

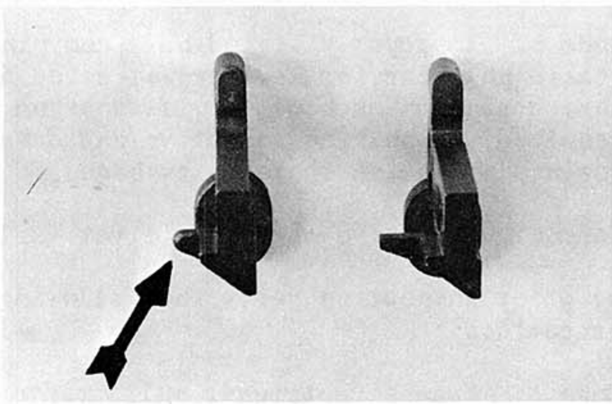


Figure 2.2-7: The Defective Bolt Catch from Rifle C3 Is Shown at Left and a Correctly Manufactured Catch Is Shown at Right.

2.2.5 Analysis

2.2.5.1 Deficiencies. Deficiencies were as follow:

a. Code A, none.

b. Code B, the withdrawal from test by AMSWE-QA of two Code B rifles due to improper chamber finish is rated as a separate deficiency in both instances.

The improper staking of the bolt carrier key screws on rifle B17 is also rated as a deficiency based on the firing failures discussed in Table 2.6-III (see Code B shortcomings below).

c. Code C, the withdrawal from test by AMSWE-QA of six Code C rifles due to improper chamber finish and incorrect chamber and bolt dimensions is rated as a separate deficiency in each instance.

The defective bolt catch discussed in paragraph 2.2.4.5e is considered a deficiency[a].

2.2.5.2 Shortcomings. The problems discussed in paragraphs 2.2.4.1 through 2.2.4.3 were reported by equipment performance report as soon as detected. Among the problems encountered the following were classified as shortcomings:

a. Code A. Defective automatic sear assemblies and new sear pins which failed to meet specifications.

b. Code B. Improperly staked bolt cam pin holes. Improperly staked bolt-carrier key screws; rated as an individual shortcoming on each of 15 rifles as no firing failures resulted. Supplying defective and damaged extractor springs in sealed spare-parts bags.

c. Code C. Defective magazine (rivet failure).

During other inspection tests the following failures were also charged as shortcomings:

a. Code A. Excessive trigger pull, rifle A1.

[a]This failure was initially rated as a shortcoming by equipment performance report but was subsequently reclassified as a deficiency, again by equipment performance report, as directed by AMSTE-BC (Reference 4).

b. Code B. Excessive trigger pull, rifles B7, 11, and 22.

c. Code C. Excessive trigger pull, rifle C14.

2.2.5.3 Initial Cyclic-Rate Performance. Purchase description SAPD-253F cites two cyclic-rate-of-fire requirements; one pertaining to rifles in new condition (700 to 900 rds per min permitted) and the other to rifles subjected to a 6000-round endurance test (700 to 940 rds per min permitted). The first criterion is judged to be applicable to rifles in this subtest and the latter criterion to rifles tested in paragraph 2.4. On this basis, one Code A rifle, A14, and two Code C rifles, C5 and C33, exceeded the permissible upper limit of 900 rds per min in this subtest (ref Table 2.2-II). These failures are judged to be shortcomings.

2.2.5.4 Inspection Requirements of SAPD-253F. No shortcomings or deficiencies, other than those already discussed, were detected during the visual and manual inspections as specified in the applicable subparagraphs of paragraph 5.0, Appendix J, SAPD-253F.

2.3 ACCURACY TEST

2.3.1 Objective

The objective was to determine the accuracy and dispersion characteristics of the test rifles.

2.3.2 Criteria

Criteria are as follows:

a. The extreme spread of a 10-shot group shall not exceed 4.8 inches at a range of 100 yards.

b. All impacts in each 10-shot group at 100 yards shall be within a rectangle outline as specified in Figure 1 of SAPD-253F (17.4 inches vertically by 11.8 inches horizontally as measured on targets supplied by AMCPM-RS).

c. Sight adjustments may be made in order to place the 10-shot group within the rectangular outline cited above but the sight adjustments shall not exceed the following:

1) The front sight shall be no higher than flush, nor below flush by more than 0.030 inch.

2) The rear sight shall be within two clicks right or left of mechanical zero.

d. The rear sight drum shall be capable of six complete revolutions and the rear sight shall be capable of pivoting to the "normal" and "long" positions throughout this range of travel.

e. The front sight shall have 20 clicks of downward travel remaining at 0.030 inch below flush position.

f. Sight markings shall be clear and legible and the sights shall be free of burrs or deformations.

2.3.3 Method

Seven rifles from each of the three manufacturers are fired employing ammunition lot TW-18399 (M193, ball projectile) which is fired in this test only.

It was necessary to employ lot TW-18399 for accuracy testing since lot TW-18301, the basic testfunctioning lot, was rated "too accurate" to meet the specifications of par. 3.3.6 of SAPD-253F, i.e., accuracy characteristics of the test lot must be within a mean radius range of 1.2 to 1.4 inches at 200 yards. The ammunition data sheets (Appendix I) for lot TW-18399 report a mean radius of 1.2 inch, and for lot TW-18301, a mean radius of 0.88 inch.

Prior to the first record target, three sighting shots are fired with the sights centrally located (rear sight at mechanical zero, front sight at 0.015 inch below flush position). The sights are then adjusted, if necessary, within the limits cited in 2.3.2c and the sight settings noted.

Five 10-round targets are then fired semiautomatically with each rifle from a bench-rest position in an enclosed 100-yard range by a rifleman holding a current NRA Master Classification.

Without any further sight change, the test is repeated but with an M7 bayonet attached to each test rifle; the test is again repeated, but from the prone firing position using the M3 bipod without bayonet. In addition to the target data, projectile velocities are measured on a minimum of 20 rounds at a distance of 15 feet from the muzzle.

Targets are fired no faster than at a rate of approximately 10 to 30 rounds per minute and complete cooling is observed between each set of five targets.

Subsequent targeting and projectile velocity exercises are also conducted by firing five 10-round targets from bench rest at 2000-round intervals during the conduct of the endurance test (par. 2.4). These firings are conducted by two riflemen with each man firing the same set of rifles. Additional sight corrections are made prior to the first 2000-round targeting to bring the center of impact as near as possible to the aiming point without regard to the sight-setting restrictions of par. 2.3.2c. These new sight settings are noted and all subsequent targets are then fired without further sight adjustment. While this procedure permits center-of-impact changes attributable to the weapon to be evaluated at each 2000-round interval during endurance test firing any center-of-impact shift between the initial accuracy test and the first 2000-round endurance test interval may be due to the change in firers and to the use of the new sight setting. The use of two master riflemen and changes in sight adjustments were considered essential if test conduct and data reduction were to be expedited; agreement to this procedure was obtained from SWERI-QA and AMCPM-RS.

2.3.4 Results

Target and velocity data are summarized in Tables 2.3-I through 2.3-IX: individual target data are contained in Appendix I and individual velocity data are contained in the APG library file copy of this report.

Each rifle was fired a total of approximately 400 rounds during all accuracy and velocity tests and the following malfunctions occurred:

a. Five FBR's with rifle A29.

b. Five FBR's with rifle A30.

c. One FBR with rifle A31.

d. Two FBR's with rifle A32.

e. One FF/DF with rifle B32.

f. One FF/DF with rifle C30.

g. One FBR with rifle C34.

Table 2.3-I. Summary of Initial Accuracy Firings (Benchrest)

Target measurements are in inches and the data are the average or total respectively of five 10-round targets for each rifle.

Rifle No.	CI from AP[a] H	CI from AP[a] V	Extreme Spread	Mean Radius	No. of Rounds Outside Rectangular Outline[b]	No. of Fliers[c]
A29	-0.2	-1.8	4.3	1.2	0	1
A30	+0.8	-0.5	3.6	1.1	0	0
A31	+2.4	+8.9	4.2	1.1	30	0
A32	-0.1	-0.8	3.2	1.0	0	0
A33	+2.0	+1.6	2.8	0.9	0	0
A34	+0.1	-0.6	3.3	1.0	0	0
A35	+5.0	-3.0	3.0	1.0	11	0
Avg	+1.4	+0.5	3.5	1.0	Total 41	1
B29	-2.0	+2.9	3.7	1.0	0	0
B30	+1.4	-1.6	2.9	0.9	0	1
B31	+0.1	-0.3	4.2	1.3	0	0
B32	-1.2	-0.6	3.2	1.0	0	0
B33	-0.3	-1.2	3.5	1.1	0	0
B34	-0.8	-0.9	3.3	1.0	0	0
B35	+3.6	-0.1	4.1	1.1	1	0
Avg	+0.1	-0.4	3.6	1.1	Total 1	1
C28	+0.3	+6.3	3.3	1.1	0	0
C29	-7.0	+4.9	2.8	0.9	42	0
C30	+0.6	+2.1	3.8	1.1	0	0
C31	-0.7	+5.9	3.2	1.0	0	0
C32	-2.9	-0.4	3.0	1.0	1	1
C33	-1.4	+1.3	3.8	1.1	0	1
C34	-0.2	+3.7	3.2	1.0	0	0
Avg	+1.6	+3.4	3.3	1.0	Total 43	2

See footnotes on next page.

[a]Center of impact from aiming point; the aiming point was at the 6 o'clock position on an 8-inch black bull's-eye. The aiming point was located midway vertically and horizontally within a rectangular outline measuring 17.4 inches vertically by 11.8 inches horizontally. The targets were supplied for test by AMCPM-RS.
[b]Outside the rectangular outline is defined as any shot outside the outline or whose center intersects the inside edge of the outline. The corners of the outline were circular with a 2.8-inch radius.
[c]A flyer is defined as a shot hole which is a greater distance from the nearest shot hole than the extreme spread of the other nine holes.

Table 2.3-II. Summary of Initial Accuracy Firings (Benchrest with Bayonet)

Target measurements are in inches and the data are the average or total respectively of five 10-round targets for each rifle.

Rifle No.	CI from AP[a] H	CI from AP[a] V	Extreme Spread	Mean Radius	No. of Rounds Outside Rectangular Outline[b]	No. of Fliers[c]
A29	-0.9	-2.1	3.4	1.1	0	0
A30	+1.6	-0.5	3.5	1.1	0	0
A31	+3.8	+8.1	4.3	1.4	23	0
A32	+0.8	-1.3	3.6	1.1	0	0
A33	+1.7	+1.6	4.1	1.2	0	0
A34	+1.3	+0.2	3.5	1.1	0	0
A35	+5.7	-3.8	5.1	1.3	21	1
Avg	+2.0	+0.3	3.9	1.2	Total 44	1
B29	-1.1	+1.8	3.7	1.1	0	1
B30	+2.2	-2.0	3.7	1.2	0	0
B31	+0.8	-2.0	4.4	1.3	0	0
B32	-0.6	-1.5	3.6	1.0	0	0
B33	+0.3	-2.3	4.2	1.2	0	0
B34	+0.1	-1.7	3.8	1.1	0	0
B35	+4.6	-1.1	3.7	1.0	4	0
Avg	+0.9	-1.3	3.9	1.1	Total 4	1
C28	+0.4	+4.9	3.3	1.1	0	0
C29	-6.9	+4.3	3.7	1.1	43	0
C30	+0.8	+1.2	4.2	1.3	0	0
C31	-1.0	+3.7	3.8	1.1	0	1
C32	-2.0	+0.3	3.8	1.1	0	0
C33	-1.3	+1.1	3.3	1.1	0	0
C34	-0.6	+2.6	3.2	1.0	0	0
Avg	-1.5	+2.6	3.6	1.1	Total 43	1

Footnotes on next page.

[a]Center of impact from aiming point; the aiming point was at the 6 o'clock position on an 8-inch black bull's-eye. The aiming point was located midway vertically and horizontally within a rectangular outline measuring 17.4 inches vertically by 11.8 inches horizontally. The targets were supplied for test by AMCPM-RS.
[b]Outside the rectangular outline is defined as any shot outside the outline or whose center intersects the inside edge of the outline. The corners of the outline were circular with a 2.8-inch radius.
[c]A flyer is defined as a shot hole which is a greater distance from the nearest shot hole than the extreme spread of the other nine holes.

Table 2.3-III. Summary of Initial Accuracy Firings (Prone with Bipod)

Target measurements are in inches and the data are the average or total respectively of five 10-round targets for each rifle.

Rifle No.	CI from AP[a] H	CI from AP[a] V	Extreme Spread	Mean Radius	No. of Rounds Outside Rectangular Outline[b]	No. of Fliers[c]
A29	-0.6	-7.4	3.3	0.9	8	0
A30	+1.2	-4.2	3.5	1.1	0	0
A31	+3.6	+4.5	3.1	1.0	5	0
A32	+0.3	-5.9	3.2	0.9	0	0
A33	+1.7	-2.4	2.6	0.8	0	0
A34	+0.8	-4.6	2.7	0.8	0	0
A35	+5.4	-7.5	3.4	1.0	29	0
Avg	+1.8	-3.9	3.1	0.9	Total 42	0
B29	-1.4	0.0	3.8	1.1	0	0
B30	+2.3	-5.5	4.0	1.2	0	1
B31	+2.3	-5.4	4.1	1.3	3	0
B32	-0.6	-4.6	3.6	1.0	4	0
B33	-0.5	-4.3	4.3	1.4	0	0
B34	0.0	-4.3	4.4	1.1	0	0
B35	+4.1	-3.2	3.8	1.3	0	0
Avg	+0.9	-3.9	4.0	1.2	Total 7	1
C28	+0.3	+3.1	3.5	1.2	0	0
C29	-7.0	+0.7	4.9	1.4	39	0
C30	+1.2	-3.3	4.8	1.5	0	0
C31	-0.5	+1.9	4.1	1.1	0	0
C32	-2.5	-4.9	3.5	1.0	3	0
C33	-1.1	-1.6	3.3	1.0	0	0
C34	-0.7	-0.7	3.6	1.0	0	0
Avg	-1.5	-0.7	4.0	1.2	Total 42	0

Footnotes on next page.

[a]Center of impact from aiming point; the aiming point was at the 6 o'clock position on an 8-inch black bull's-eye. The aiming point was located midway vertically and horizontally within a rectangular outline measuring 17.4 inches vertically by 11.8 inches horizontally. The targets were supplied for test by AMCPM-RS.
[b]Outside the rectangular outline is defined as any shot outside the outline or whose center intersects the inside edge of the outline. The corners of the outline were circular with a 2.8-inch radius.
[c]A flyer is defined as a shot hole which is a greater distance from the nearest shot hole than the extreme spread of the other nine holes.

Table 2.3-IV. Summary of Accuracy Test Firings After 2000 Rounds

Target measurements are in inches and the data are the average **of five 10-round targets fired from benchrest for each rifle.**

Rifle No.	CI from AP[a] H	CI from AP[a] V	Extreme Spread	Mean Radius
A29	+1.6	-1.8	4.0	1.2
A30	+2.4	+0.7	4.2	1.3
A31	+4.1	+4.3	3.2	0.9
A32	+1.9	-1.9	4.0	1.1
A33	+3.1	+0.3	3.8	1.2
A34	+1.2	-2.2	3.9	1.1
A35	+5.8	-3.5	4.3	1.3
Avg	+2.9	-0.6	3.9	1.2
B29	-1.2	+1.2	4.4	1.2
B30	+2.4	-2.9	4.0	1.2
B31	-0.8	-2.9	4.4	1.3
B32	-0.4	-0.6	5.3	1.3
B33	+0.2	-1.2	4.1	1.2
B34	-3.2	-2.2	3.7	1.2
B35	+1.8	-1.6	3.7	1.2
Avg	-0.2	-1.5	4.2	1.2
C28	+1.1	+5.7	3.8	1.2
C29	-4.1	+5.1	3.8	1.2
C30	+2.4	+2.0	4.5	1.3
C31	-0.3	+5.7	3.2	1.0
C32	-3.2	+1.6	4.0	1.2
C33	-1.7	+3.5	3.2	1.0
C34	-1.1	+5.6	2.6	0.8
Avg	-1.0	+4.2	3.6	1.1

Foot note on next page.

[a]Center of impact from aiming point; the aiming point was at the 6 o'clock position on an 8-inch black bull's-eye. The aiming point was located midway vertically and horizontally within a rectangular outline measuring 17.4 inches vertically by 11.8 inches horizontally. The targets were supplied for test by AMCPM-RS.

Table 2.3-V. Summary of Accuracy Test Firings After 4000 Rounds

Target measurements are in inches and the data are the average **of five 10-round targets fired from benchrest for each rifle.**

Rifle No.	CI from AP[a] H	CI from AP[a] V	Extreme Spread	Mean Radius
A29	+1.4	-2.2	4.6	1.4
A30	+2.1	-0.2	4.1	1.2
A31	+4.6	+3.6	3.5	1.2
A32	+1.9	-2.3	4.1	1.1
A33	+3.4	+0.4	3.3	0.9
A34	+1.3	-1.1	4.1	1.2
A35	+6.3	-3.5	2.8	1.1
Avg	+3.0	-0.8	3.8	1.2
B29	-1.1	-0.2	4.2	1.3
B30	+3.2	-1.8	4.5	1.3
B31	+0.3	-1.7	4.5	1.3
B32	+0.2	+2.5	4.4	1.3
B33	-0.5	+4.9	3.8	1.2
B34	-3.1	-2.0	3.2	1.0
B35	+1.3	-1.3	3.4	1.1
Avg	0.0	+0.1	4.0	1.2
C28	+1.1	+6.4	3.4	1.0
C29	-3.4	+6.7	3.0	1.0
C30	+3.2	+3.6	4.0	1.1
C31	-0.5	+6.3	4.3	1.3
C32	-2.9	+2.2	4.2	1.2
C33	-0.4	+4.7	3.1	1.0
C34	-0.3	+6.5	2.8	0.8
Avg	-0.6	+5.7	3.5	1.1

[a]Center of impact from aiming point; the aiming point was at the 6 o'clock position on an 8-inch black bull's-eye. The aiming point was located midway vertically and horizontally within a rectangular outline measuring 17.4 inches vertically by 11.8 inches horizontally. The targets were supplied for test by AMCPM-RS.

Table 2.3-VI. Summary of Accuracy Test Firings
After 6000 Rounds

Target measurements are in inches and the data are the average **of five 10-round targets fired from benchrest for each rifle.**

Rifle No.	CI from AP[a] H	V	Extreme Spread	Mean Radius
A29	+0.5	-1.4	3.4	1.0
A30	+2.1	-0.1	4.6	1.2
A31	+3.8	+6.1	4.4	1.2
A32	+1.0	-0.8	3.0	0.9
A33	+2.8	+1.6	4.3	1.1
A34	+0.2	-1.0	2.7	0.8
A35	+3.6	-2.3	3.5	1.0
Avg	+2.0	+0.3	3.7	1.0
B29	-0.7	+3.9	4.8	1.4
B30	+1.9	+0.1	3.7	1.2
B31	-0.8	-1.0	3.8	1.2
B32	-0.6	+2.1	3.9	1.2
B33	-1.5	+1.1	4.0	1.2
B34	-4.1	+0.7	3.8	1.1
B35	+0.7	-0.4	3.9	1.2
Avg	-0.7	+0.9	4.0	1.2
C28	+0.5	+6.7	3.2	1.0
C29	-3.5	+6.0	4.0	1.3
C30	+1.9	+2.6	3.3	1.0
C31	-0.8	+6.4	4.2	1.3
C32	-3.4	+1.4	2.9	1.0
C33	-1.4	+1.6	2.9	0.9
C34	-0.5	+3.4	2.9	1.0
Avg	-1.0	+4.0	3.3	1.1

[a]Center of impact from aiming point; the aiming point was at the 6 o'clock position on an 8-inch black bull's-eye. The aiming point was located midway vertically and horizontally within a rectangular outline measuring 17.4 inches vertically by 11.8 inches horizontally. The targets were supplied for test by AMCPM-RS.

Table 2.3-VII. Summary of Accuracy Test Firings After 8000 Rounds

Target measurements are in inches and the data are the average **of five 10-round targets fired from benchrest for each rifle.**

Rifle No.	CP from AP[a] H	CP from AP[a] V	Extreme Spread	Mean Radius
A29	+1.0	-2.4	3.3	1.0
A30	+2.0	+0.3	5.2	1.4
A31	+4.0	+6.5	4.0	1.1
A32	+1.0	+0.4	2.4	0.7
A33	+2.7	+2.3	4.1	1.2
A34	-0.7	+0.0	3.1	1.0
A35	+4.5	-0.1	3.5	1.1
Avg	+2.1	+1.0	3.7	1.1
B29	-1.2	-0.1	4.0	1.2
B30	+2.4	-1.6	4.3	1.3
B31	-0.3	+0.4	4.0	1.2
B32	-0.1	+1.3	3.9	1.1
B33	-1.0	-1.9	3.8	1.2
B34	-2.9	-1.3	3.0	0.9
B35	+1.6	-0.3	3.6	1.1
Avg	-0.2	-0.5	3.8	1.1
C28	+0.6	+5.2	3.5	1.2
C29	-3.4	+5.1	3.5	1.1
C30	+1.4	+1.7	3.3	1.1
C31	-0.5	+6.1	4.4	1.3
C32	-3.2	+0.3	3.9	1.3
C33	-1.0	+1.9	2.8	0.9
C34	-0.9	+4.0	3.2	1.0
Avg	-1.0	+3.5	3.5	1.1

[a] Center of impact for aiming point; the aiming point was at the 6 o'clock position on an 8-inch black bull's-eye. The aiming point was located midway vertically and horizontally within a rectangular outline measuring 17.4 inches vertically by 11.8 inches horizontally. The targets were supplied for test by AMCPM-RS.

Table 2.3-VIII. Summary of Accuracy Test Firings
After 10,000 Rounds

Target measurements are in inches and the data are the average **of five 10-round targets fired from benchrest for each rifle.**

Rifle No.	CI from AP[a] H	CI from AP[a] V	Extreme Spread	Mean Radius
A29	+0.9	+2.1	4.1	1.2
A30	+2.3	+0.4	4.3	1.3
A31	+3.2	+6.7	3.7	1.1
A32	+0.5	-0.9	3.6	1.0
A33	+1.3	+2.6	4.4	1.1
A34	+0.0	-0.2	2.7	0.9
A35	+5.1	-1.0	3.5	1.1
Avg	+1.9	+1.4	3.8	1.1
B29	+0.3	+3.4	5.9	1.6
B30	+2.9	+1.2	4.0	1.2
B31	+0.5	-1.8	4.4	1.2
B32	-1.1	+4.0	3.0	0.9
B33	-0.9	+0.5	4.2	1.3
B34	-4.1	-2.3	2.6	0.8
B35	+2.0	+0.7	3.1	1.0
Avg	-0.1	+0.8	3.9	1.1
C28	+1.2	+5.8	3.8	1.1
C29	-3.3	+5.2	3.0	0.9
C30	+2.0	+3.9	2.6	0.8
C31	-0.4	+5.5	4.0	1.2
C32	-2.2	+0.5	3.7	0.9
C33	-1.4	+2.2	3.2	0.9
C34	-0.4	+4.4	2.8	0.8
Avg	-0.6	+3.9	3.3	0.9

[a]Center of impact from aiming point; the aiming point was at the 6 o'clock position on an 8-inch black bull's-eye. The aiming point was located midway vertically and horizontally within a rectangular outline measuring 17.4 inches vertically by 11.8 inches horizontally. The targets were supplied for test by AMCPM-RS.

Table 2.3-IX. Summary of Projectile Velocity Data

Figures are the average of 20-50 individual velocities at 15 feet from the weapon muzzle.

	Velocity, fps					
Rifle No.	Initial	After 2000 Rounds	After 4000 Rounds	After 6000 Rounds	After 8000 Rounds	After 10000 Rounds
A29	3147	3165	3187	3171	3223	3196
A30	3183	3174	3191	3186	3195	3199
A31	3171	3183	3201	3182	3206	3192
A32	3169	3176	3198	3182	3233	3219
A33	3168	3175	3195	3181	3218	3224
A34	3161	3183	3202	3159	3177	3173
A35	3156	3192	3210	3185	3181	3181
Avg	3165	3178	3198	3178	3205	3198
B29	3167	3184	3183	3193	3199	3201
B30	3159	3188	3189	3198	3193	3192
B31	3176	3202	3202	3117	3181	3203
B32	3167	3188	3197	3199	3195	3193
B33	3166	3173	3195	3209	3190	3176
B34	3163	3157	3187	3180	3189	3174
B35	3158	3159	3174	3174	3184	3131
Avg	3165	3179	3190	3196	3190	3181
C28	NR	3171	3186	3207	3187	3187
C29	3157	3148	3187	3191	3194	3176
C30	3160	3154	3192	3180	3189	3190
C31	3156	3150	3189	3211	3197	3200
C32	3145	3152	3177	3180	3180	3190
C33	3137	3128	3142	3150	3165	3105
C34	3137	3157	3153	3166	3171	3112
Avg	3149	3151	3175	3184	3183	3166

2.3.5 Analysis

2.3.5.1 Average Dispersion and Velocity. Summarized data in Table 2.3-X show that the average dispersion and velocity performance of rifles from all three producers is not only well within acceptable limits but is not degraded as a result of extended firing (a 4.8-inch extreme spread is permitted in SAPD 253-F and although no velocity criteria are cited, a level of 3100-3200 fps is judged to be satisfactory).

Table 2.3-X. Summary of Endurance Test Dispersion and Velocity Data

Weapon Code	Average Extreme Spread, in., at 100 Yards	Average Projectile Velocity, fps, at 15 Feet
	New Condition	
A	3.5	3165
B	3.6	3165
C	3.3	3149
	6000 Rounds	
A	3.7	3178
B	4.0	3196
C	3.3	3184
	10,000 Rounds	
A	3.8	3198
B	3.9	3181
C	3.3	3166

2.3.5.2 Individual Weapon Dispersion. An examination of the individual target data in Appendix I indicates that two rifles, A29 and A30, would have failed the initial targeting test required of each rifle at the production site; extreme spread measurements were 6.1 and 5.0-inches respectively. However, each rifle would have been subjected to retest and the subsequently fired targets (recorded in Appendix I) show that both rifles would then have met the 4.8-inch requirement.

Other rifles occasionally exceeded the 4.8-inch maximum after initial targeting, but since these instances were rare, and since the individual averages were well below the permitted limit, dispersion performance of all rifles in this test is rated as satisfactory.

2.3.5.3 Center-of-Impact versus Sight-Setting. Table 2.3-I shows that impacts on targets from five rifles fell outside the required targeting outline. Only three of these rifles, A31, A35, and C29 are judged to have failed the targeting requirement of SAPD 253-F since only one "outside" hit was recorded for the other two rifles during five consecutive targets. Targeting failure of the three rifles cited is rated as a shortcoming in each instance. However, it is the opinion of the test agency that the sight adjustment requirements may be unrealistically stringent. Small additional changes in sight settings, beyond those permitted in the SAPD, would have brought all impacts well within the targeting outline with ample remaining sight adjustment.

2.3.5.4 Bayonet and Bipod Firings. Some degradation in dispersion and a detectable shift in center-of-impact can be noted by comparing data in Tables 2.3-I through 2.3-III for the benchrest, bayonet, and bipod firings. However, the average extreme spread measurements were well below the 4.8-inch benchrest requirement and the center-of-impact changes are not considered significant.

2.3.5.5 Comparison With Acceptance Results. Aberdeen Proving Ground had been advised that a copy of the original targeting results obtained at the three production sites would be forwarded by AMSWE-QA for inclusion in the report. However, only reports for the Code A and Code B rifles were received (Appendix I). A comparison of these data with initial target data obtained at APG is shown in Table 2.3-XI.

Table 2.3-XI. Comparison of Defense Contract Administrative Services (DCAS) and Aberdeen Proving Ground (APG) Extreme Spread Target Data, in.

Rifle No.	Code A Rifles DCAS[a]	Code A Rifles APG	Code B Rifles DCAS[a]	Code B Rifles APG
29	4.6	[b]6.1	4.0	2.6
30	2.8	[c]5.0	2.4	3.8
31	3.2	4.2	4.0	4.7
32	3.0	2.7	4.0	2.3
33	3.6	3.0	3.6	4.2
34	3.0	3.6	3.6	3.3
35	3.0	2.6	3.4	3.9
Avg	3.3	3.9	3.6	3.5

[a]DCAS data were obtained from a machine rest at a range of 50 yards and have been multiplied by two for comparison with APG 100-yard benchrest data.
[b]Extreme spread on next target was 4.3 inches.
[c]Extreme spread on next target was 4.6 inches.

2.3.5.6 Projectile-Yaw Observations. All targets were examined for evidence of projectile yaw. While some slight tipping of projectiles was noted on some targets, and the incidence of tipping increased somewhat as firing progressed, no projectile imprints exceeded 15° of yaw.

2.3.5.7 Inspection Requirements. The visual and manual inspection requirements of the applicable subparagraphs of par. 5.0, Appendix J, SAPD-253F, including those stated in pars. 2.3.2d, e, and f of this report, were all judged to have been adequately fulfilled by the rifles employed in this subtest.

2.4 ENDURANCE TEST

2.4.1 Objective

The objective was to determine the reliability and durability of the test weapons.

2.4.2 Criteria

Criteria were as follows:

a. During an endurance test of 6000 rounds, the cyclic rate of fire for each rifle shall be within 700 to 940 rds per min as measured at 1000-round intervals.

b. The reliability and durability of the test rifles during 6000 rounds of firing shall not exceed the limits of SAPD-253F as cited in Appendix I in this report (the applicability of this criterion is discussed in par. 2.4.5.1).

2.4.3 Method

Seven rifles from each manufacturer are each fired 10,000 rounds (6000 for criteria evaluation and 4000 for information purposes). Five of the rifles from each manufacturer are fired with M193, ball projectile ammunition only, and two rifles are fired with a 4-to-1 mix of M193 and M196 tracer ammunition. The ball-tracer mix is loaded in each magazine so that the first four rounds fired are M193 cartridges followed by one M196 cartridge, etc. The M193 lot was TW18301 and the M196 lot, TW18077.

Rifles A29 through 33, B29 through 33, and C28 through 32 fire M193 ammunition only; rifles A34, A35, B34, B35, C33, and C34 fire the 4 to 1 mix.

A maintenance period (per TM 9-1005-249-12) is observed following each 1000 rounds of firing and all rifles are fired in increments of full 1000-round complements in any firing day with the exception noted in the following paragraph.

At the conclusion of each even-numbered 1000-round cycle, but immediately following the maintenance period, five 10-round targets are fired semiautomatically at a range of 100 yards from a benchrest and a minimum of 20 projectile velocities is also obtained. These accuracy and velocity firings are conducted with lot TW18399. In the event that the next firing cycle of 1000 rounds cannot be fully completed in the same firing day as the accuracy firing, the rifle is cleaned after accuracy testing and stored until the next firing day.

All firing is done from the shoulder except as noted in the following paragraph.

At the conclusion of each odd-numbered 1000-round cycle, but immediately following the maintenance period, the cyclic rate of fire for each rifle is measured by firing a 20-round automatic burst with the rifle installed in a government-approved test stand. The cyclic rate of fire is also obtained on every 20-round automatic burst during shoulder firing.

For round-count purposes, none of the accuracy and velocity firings are included in the 1000-round cycles nor in the test totals of 10,000 rounds per rifle, and any malfunctions which occur during the accuracy and velocity firings are listed in par. 2.3.4. However, parts breakages, if any, which may occur during accuracy and velocity firings are included in the durability record reported in par. 2.4.4.

Each rifle is ambient air-cooled after each 100 rounds and each 100-round cycle is fired as follows:

a. Twenty rounds in bursts of approximately five rounds each.

b. Twenty rounds in a single continuous burst.

c. Twenty rounds fired semiautomatically.

d. Twenty rounds in bursts of approximately five rounds each.

e. Twenty rounds fired semiautomatically.

Sufficient new magazines are employed so that no magazine is fired more than 600 rounds. Each magazine is numbered and magazine Nos. 1 to 5 are fired during the first 3000 rounds with each rifle, Nos. 6 to 10 during the firing of rounds 3001 to 6000, Nos. 11 to 15 during the firing of rounds 6001 to 9000, and magazine Nos. 16 to 20 during the firing of the final 1000 rounds.

Magnetic-particle inspection of the rifle bolts is periodically conducted. (Note: On 13 February 1969, AMSWE-QA requested that all rifle bolts be inspected at each 1000-round interval as of that date.)

2.4.4 <u>Results</u>

The target and velocity data have been previously reported in par. 2.3. Reliability and durability data are reported in Tables 2.4-I through 2.4-III, and in Appendix I, and are also discussed in subsequent paragraphs. Magnaglow inspection results of the rifle bolts are summarized in Table 2.4-IV, illustrated in Figure 2.4-1, and detailed inspection results are contained in Appendix I.

Table 2.4-I. Summary of Endurance and Reliability Data

Round Count	Malfunctions								Defective, Damaged, or Broken Parts[a]		
	FF-1	FBR	FF/BB	FJ	FF/BOB	FFR	FF/DF	Total	Extractor Spring	Cracked Bolt[b]	Other
					Rifle No. A29						
1 to 6000	8	[c] 7	0	0	0	0	0	15	1 (3709)	1	0
6001 to 10000	2	[d]29	0	0	0	0	0	31	1 (3291)	0	0
Total	10	36	0	0	0	0	0	46	2	1	0
					Rifle No. A30						
1 to 6000	9	15	1	0	0	0	0	25	0	1	0
6001 to 10000	4	[e]60	0	0	0	0	0	64	1 (9000)	0	0
Total	13	75	1	0	0	0	0	89	1	1	0
					Rifle No. A31						
1 to 6000	2	4	0	1	0	0	0	7	0	1	0
6001 to 10000	0	[c] 7	0	0	0	4	0	11	0	1	0
Total	2	11	0	1	0	4	0	18	0	2	0
					Rifle No. A32						
1 to 6000	1	[f]13	1	1	0	0	0	16	1 (5649)	1	0
6001 to 10000	6	21	0	1	0	0	0	28	0	0	0
Total	7	34	1	2	0	0	0	44	1	1	0

See footnotes at end of table.

Table 2.4-I (Cont'd)

Round Count	Malfunctions								Defective, Damaged, or Broken Parts[a]		
	FF-1	FBR	FF/BB	FJ	FF/BOB	FFR	FF/DF	Total	Extractor Spring	Cracked Bolt[b]	Other
Rifle No. A33											
1 to 6000	0	1	0	0	1	0	0	2	1 (3965)	0	0
6001 to 10000	3	0	0	0	0	0	0	3	1 (3035)	1	0
Total	3	1	0	0	1	0	0	5	2	1	0
Rifle No. A34											
1 to 6000	0	0	0	0	0	0	0	0	1 (3230)	0	0
6001 to 10000	3	5	0	0	0	0	0	8	3 (2973, 2130, 1720)	1	0
Total	3	5	0	0	0	0	0	8	4	1	0
Rifle No. A35											
1 to 6000	0	0	0	0	0	0	0	0	0	0	0
6001 to 10000	2	2	0	0	0	8	0	12	1 (10000+)	2	0
Total	2	2	0	0	0	8	0	12	1	2	0
All Code A Rifles											
Total	40	164	2	3	1	12	0	222	11	9	0

See footnotes at end of table.

Table 2.4-I (Cont'd)

Round Count	Malfunctions								Defective, Damaged, or Broken Parts[a]		
	FF-1	FBR	FF/BB	FJ	FF/BOB	FFR	FF/DF	Total	Extractor Spring	Cracked Bolt[b]	Other
Rifle No. B29											
1 to 6000	0	0	0	0	0	0	0	0	0	1	SL
6001 to 10000	0	0	0	0	0	0	1	1	0	0	0
Total	0	0	0	0	0	0	1	1	0	1	1
Rifle No. B30											
1 to 6000	0	0	0	0	0	0	5	5	0	1	0
6001 to 10000	0	1	0	0	0	1	3	5	0	0	0
Total	0	1	0	0	0	1	8	10	0	1	0
Rifle No. B31											
1 to 6000	0	0	0	0	0	0	1	1	0	1	SL
6001 to 10000	0	0	0	0	0	1	3	4	0	0	0
Total	0	0	0	0	0	1	4	5	0	1	1
Rifle No. B32											
1 to 6000	2	0	0	0	0	1	13	16	0	1	SL
6001 to 10000	0	0	0	0	0	0	[g]15	15	1 (8000)	0	[h] 1
Total	2	0	0	0	0	1	28	31	1	1	[i] 2

See footnotes at end of table.

Table 2.4-I (Cont'd)

Round Count	Malfunctions								Defective, Damaged, or Broken Parts[a]		
	FF-1	FBR	FF/BB	FJ	FF/BOB	FFR	FF/DF	Total	Extractor Spring	Cracked Bolt[b]	Other
					Rifle No. B33						
1 to 6000	0	0	0	0	0	0	13	13	0	1	0
6001 to 10000	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	13	13	0	1	0
					Rifle No. B34						
1 to 6000	0	0	0	0	0	0	11	11	0	1	0
6001 to 10000	3	0	0	0	0	0	5	8	1 (7000)	0	0
Total	3	0	0	0	0	0	16	19	1	1	0
					Rifle No. B35						
1 to 6000	0	0	0	0	0	0	2	2	1 (5592)	2	0
6001 to 10000	1	1	0	0	0	0	1	3	1 (4400)	0	0
Total	1	1	0	0	0	0	3	5	2	2	0
					All Code B Rifles						
Total	6	2	0	0	0	3	73	84	4	8	4

See footnotes at end of table.

Table 2.4-I (Cont'd)

Round Count	Malfunctions								Defective, Damaged, or Broken Parts[a]		
	FF-1	FBR	FF/BB	FJ	FF/BOB	FFR	FF/DF	Total	Extractor Spring	Cracked Bolt[b]	Other
Rifle No. C28											
1 to 6000	0	1	0	0	0	1	3	5	0	1	0
6001 to 10000	0	4	0	0	0	1	0	5	0	0	0
Total	0	5	0	0	0	2	3	10	0	1	0
Rifle No. C29											
1 to 6000	0	1	0	0	0	0	2	3	0	1	0
6001 to 10000	0	0	0	0	0	0	0	0	1 (9000)	0	0
Total	0	1	0	0	0	0	2	3	1	1	0
Rifle No. C30											
1 to 6000	0	0	0	0	0	0	21	21	0	0	0
6001 to 10000	0	1	0	0	0	5	[g]25	31	0	1	0
Total	0	1	0	0	0	5	46	52	0	1	0
Rifle No. C31											
1 to 6000	4	0	0	0	0	2	[j]26	32	0	0	[k]1
6001 to 10000	2	0	2	0	0	1	24	29	0	1	0
Total	6	0	2	0	0	3	50	61	0	1	1

See footnotes at end of table.

Table 2.4-I (Cont'd)

Round Count	Malfunctions: FF-1	FBR	FF/BB	FJ	FF/BOB	FFR	FF/DF	Total	Defective, Damaged, or Broken Parts[a]: Extractor Spring	Cracked Bolt[b]	Other
					Rifle No. C32						
1 to 6000	1	0	0	0	0	0	1	2	0	1	0
6001 to 10000	0	0	0	0	0	0	0	0	1 (8000)	0	0
Total	1	0	0	0	0	0	1	2	1	1	0
					Rifle No. C33						
1 to 6000	1	0	0	0	0	1	14	16	0	1	0
6001 to 10000	8	3	0	0	0	0	1	12	0	0	[k] 1
Total	9	3	0	0	0	1	15	28	0	1	1
					Rifle No. C34						
1 to 6000	1	9	0	0	0	0	6	16	0	1	0
6001 to 10000	2	[c] 7	0	0	0	0	0	9	0	0	0
Total	3	16	0	0	0	0	6	25	0	1	0
					All Code C Rifles						
	19	26	2	0	0	11	123	181	2	7	2

See footnotes on following page.

Table 2.4-I (Cont'd)

[a]Numbers appearing in parenthesis indicate the life of the broken part in rounds fired.
[b]See Table 2.4-IV for further information concerning bolt durability.
[c]An additional FBR occurred during accuracy tests.
[d]Four additional FBR's occurred during accuracy tests.
[e]Five additional FBR's occurred during accuracy tests.
[f]Two additional FBR's occurred during accuracy tests.
[g]An additional FF/DF occurred during accuracy tests.
[h]The dust-cover pin-retaining ring disassembled during firing.
[i]Total does not include a defective Code C magazine (the floor plate-retainer spring failed to properly engage and retain the magazine floor plate).
[j]Total includes one triple-feed, i.e., two rounds were loose forward of the bolt and the bolt was jammed against a third round.
[k]The front sling swivel retaining pin disassembled.

SL = Selector level.

Table 2.4-II. Summary of Cyclic Rate of Fire Data during Endurance Test

Averages are, in most instances, for ten trials during each of the 1000-round intervals.

	Round Count Interval									
Cyclic Rate	1 to 1000	1001 to 2000	2001 to 3000	3001 to 4000	4001 to 5000	5001 to 6000	6001 to 7000	7001 to 8000	8001 to 9000	9001 to 10000
					Rifle No. A29					
Min	832	811	799	772	767	753	719	683	683	741
Max	849	935	853	861	842	857	789	759	775	823
Avg	840	846	826	808	792	790	737	705	728	773
					Rifle No. A30					
Min	829	806	786	818	768	780	729	719	702	707
Max	871	904	849	891	853	844	827	836	780	747
Avg	849	857	821	840	802	796	760	746	728	731

Table 2.4-II (Cont'd)

Cyclic Rate	1 to 1000	1001 to 2000	2001 to 3000	3001 to 4000	4001 to 5000	5001 to 6000	6001 to 7000	7001 to 8000	8001 to 9000	9001 to 10000
	Round Count Interval									
Rifle No. A31										
Min	765	825	809	778	783	778	731	746	730	734
Max	851	887	844	865	815	818	780	811	750	784
Avg	822	848	828	810	800	797	760	770	740	766
Rifle No. A32										
Min	823	845	823	799	789	792	776	711	703	700
Max	871	897	853	893	853	883	861	789	753	756
Avg	854	868	839	838	822	816	805	734	730	723
Rifle No. A33										
Min	829	832	836	802	759	761	784	746	746	749
Max	883	895	863	871	822	836	840	811	801	788
Avg	850	859	852	831	788	802	802	774	768	776
Rifle No. A34										
Min	759	772	772	755	734	759	729	731	747	755
Max	823	855	802	827	822	825	786	818	809	[a]912
Avg	804	795	784	773	764	773	754	767	764	795
Rifle No. A35										
Min	801	802	794	773	765	784	746	741	755	750
Max	838	849	816	825	832	887	823	820	801	832
Avg	818	812	803	790	786	802	773	770	772	771
Rifle Nos. A29 through A33										
Grand Avg	843	856	833	826	801	800	773	746	739	753

[a]The rate tape for this burst was rechecked and the rate was confirmed.

Table 2.4-II (Cont'd)

Cyclic Rate	Round Count Interval 1 to 1000	1001 to 2000	2001 to 3000	3001 to 4000	4001 to 5000	5001 to 6000	6001 to 7000	7001 to 8000	8001 to 9000	9001 to 10000
					Rifle No. B29					
Min	840	822	823	804	808	730	786	804	778	801
Max	865	851	853	865	844	853	801	823	809	834
Avg	853	838	838	839	817	781	793	812	795	809
					Rifle No. B30					
Min	836	853	865	823	851	820	838	836	836	849
Max	869	889	910	891	889	873	863	883	849	871
Avg	853	875	884	852	877	843	850	855	825	862
					Rifle No. B31					
Min	786	801	804	776	802	762	752	755	755	792
Max	808	838	853	863	855	829	799	788	783	809
Avg	795	823	822	810	823	784	774	774	765	800
					Rifle No. B32					
Min	799	844	831	851	838	796	801	780	784	759
Max	851	875	851	879	887	863	836	838	822	791
Avg	831	859	842	871	859	829	819	806	798	778
					Rifle No. B33					
Min	784	815	813	861	825	778	799	784	776	794
Max	816	893	834	881	859	867	836	840	818	808
Avg	799	847	824	870	842	803	813	804	801	802
					Rifle No. B34					
Min	802	788	820	776	813	816	825	772	832	851
Max	825	883	851	842	851	897	859	883	849	869
Avg	816	812	838	810	835	837	841	807	841	857

Table 2.4-II (Cont'd)

Cyclic Rate	1 to 1000	1001 to 2000	2001 to 3000	3001 to 4000	4001 to 5000	5001 to 6000	6001 to 7000	7001 to 8000	8001 to 9000	9001 to 10000
	Round Count Interval									
Rifle No. B35										
Min	789	794	808	781	791	798	816	772	825	815
Max	818	855	851	845	831	863	859	883	867	913
Avg	798	815	820	810	810	815	835	807	847	846
Rifles No. B29 through B33										
Grand Avg	826	848	842	857	844	813	818	809	810	822
Rifle No. C28										
Min	792	762	743	736	715	703	702	672	683	619
Max	838	844	806	783	808	775	737	773	720	727
Avg	808	795	774	761	742	733	717	707	698	690
Rifle No. C29										
Min	832	776	755	779	758	759	737	706	723	702
Max	863	855	816	859	827	842	798	838	786	773
Avg	848	807	777	814	773	779	760	752	748	733
Rifle No. C30										
Min	747	778	737	765	737	740	724	710	679	688
Max	792	813	778	827	775	806	778	764	727	762
Avg	778	794	763	795	750	770	757	740	710	714
Rifle No. C31										
Min	801	809	801	840	781	802	796	767	778	781
Max	822	881	840	921	886	831	820	857	822	840
Avg	814	832	827	863	819	812	808	801	800	800
Rifle No. C32										
Min	768	786	778	788	759	768	747	743	756	714
Max	829	842	822	855	844	825	827	829	792	808
Avg	792	803	799	798	782	794	771	763	776	746

Table 2.4-II (Cont'd)

Cyclic Rate	1 to 1000	1001 to 2000	2001 to 3000	3001 to 4000	4001 to 5000	5001 to 6000	6001 to 7000	7001 to 8000	8001 to 9000	9001 to 10000
					Rifle No. C33					
Min	786	791	806	762	761	758	756	753	749	776
Max	869	885	859	853	823	849	825	857	825	863
Avg	811	814	819	791	790	784	795	779	788	800
					Rifle No. C34					
Min	755	762	758	747	740	747	767	762	758	773
Max	791	815	786	832	784	895	799	825	813	883
Avg	770	782	775	771	760	780	788	781	791	799
					Rifle Nos. C28 through C32					
Grand Avg	808	806	788	806	774	779	771	760	759	755

Table 2.4-III. Comparison of Cyclic Rates of Fire, Government-Approved Test Stand versus Shoulder Firing

	A29	A30	A31	A32	A33	A34	A35	Avg[a]
				At 1000 Rounds				
Test stand[b]	935	904	887	897	895	855	849	888
Shoulder	849	832	861	879	NR	772	816	835
Variation	+ 86	+ 72	+ 26	+ 18	-	+ 83	+ 33	+ 53
				At 5000 Rounds				
Test stand[b]	NR	NR	788	883	836	825	887	844
Shoulder	792	796	802	838	829	781	808	812
Variation	-	-	- 14	+ 45	+ 7	+ 44	+ 79	+ 32

See footnotes at end of table.

Table 2.4-III (Cont'd)

	Rifle No.							
	A29	A30	A31	A32	A33	A34	A35	Avg[a]
				At 9000 Rounds				
Test stand[b]	823	747	755	726	784	912	832	797
Shoulder	791	737	734	708	778	815	778	763
Variation	+ 32	+ 10	+ 21	+ 18	+ 6	+ 97	+ 54	+ 34

	Rifle No.							
	B29	B30	B31	B32	B33	B34	B35	Avg[a]
				At 1000 Rounds				
Test stand[b]	822	853	NR	844	893	883	855	858
Shoulder	838	881	831	857	842	801	802	837
Variation	- 16	- 28	-	- 13	+ 51	+ 82	+ 53	+ 21
				At 5000 Rounds				
Test stand[b]	853	873	829	863	867	897	863	864
Shoulder	813	853	816	834	816	836	NR	828
Variation	+ 40	+ 20	+ 13	+ 29	+ 51	+ 61	-	+ 36
				At 9000 Rounds				
Test stand[b]	NR	863	792	791	801	869	913	848
Shoulder	804	849	794	NR	806	853	853	831
Variation	-	+ 14	- 2	-	- 5	+ 16	+ 60	+ 17

	Rifle No.							
	C28	C29	C30	C31	C32	C33	C34	Avg[a]
				At 1000 Rounds				
Test stand[b]	844	855	784	881	842	885	815	844
Shoulder	794	829	778	811	796	802	784	799
Variation	+ 50	+ 26	+ 6	+ 70	+ 46	+ 83	+ 31	+ 45

See footnotes at end of table.

Table 2.4-III (Cont'd)

	Rifle No.							
	C28	C29	C30	C31	C32	C33	C34	Avg[a]
				At 5000 Rounds				
Test stand[b]	775	842	806	831	825	849	895	832
Shoulder	749	773	781	NR	809	772	804	781
Variation	+ 26	+ 69	+ 25	-	+ 16	+ 77	+ 91	+ 51
				At 9000 Rounds				
Test stand[b]	727	773	762	840	808	863	883	808
Shoulder	707	723	731	804	759	781	794	757
Variation	+ 20	+ 50	+ 31	+ 36	+ 49	+ 82	+ 89	+ 51

[a]Averages include only those data where both a test-stand rate and a shoulder rate are reported.

[b]Following each odd-numbered 1000-round maintenance, 20 rounds were fired in short bursts followed immediately by a continuous 20-round burst with the rifle mounted in the test stand. The test-stand rates are the cyclic rates of fire for these continuous bursts at the 1000-, 5000-, and 9000-round intervals. Sixty additional rounds are then fired in each rifle, the rifle cooled, then 20 rounds fired in short bursts followed by a continuous 20-round burst fired from the shoulder; this latter rate is the shoulder rate.

Note: A plus (+), in the variation, indicates that the test-stand rate exceeded the shoulder rate and a minus (-) indicates the opposite in rate variation.

Table 2.4-IV. Summary of Magnaglow Inspection of Rifle Bolts

Rifle No.	Inspection Results at 1000-Round Intervals[a]										
	New	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A29							[b]L/R/CP				
[c]A29A	OK	OK	OK	OK	OK						
A30							OK	L/R	[d]NC	NC	[e]L+/R
A31							OK	L/R	L+/R+	L/R/CP	
[c]A31A	OK	OK									
A32							L/R				
[c]A32A	OK	OK	L	NC	L/R						
A33							OK	R	NC	R+	R++
A34								L/R	L+/R	NC	NC
A35								L/R			
[c]A35A	OK	L	NC	NC							
B29				OK	L/R	NC	L+/R+	NC	L/R+	NC	NC
B30				L/R	NC	L+/R	L+/R+	L++/R++	NC	L+++/R++	Not recorded
B31				L	L+/R	L++/R	NC	NC	NC	NC	L++/R+
B32				OK	OK	R	R+	NC	NC	NC	L/R+
B33				L/R	NC	L+/R+	NC	NC	NC	NC	L+/R++
B34					OK	L	L/R	NC	L+/R+	L++/R+	L+++/R+
B35					R						
[c]B35A	OK	L/R	NC	L/R+	L+/R++	NC	L++/R++				
C28				R	R+	NC	NC	NC	NC	L/R+	L+/R+
C29				OK	OK	L	NC	L/R	L/R+	NC	NC
C30				OK	OK	OK	OK	OK	OK	R	R+
C31				OK	OK	OK	OK	OK	R	NC	NC
C32				OK	R	NC	R+	R++	NC	NC	R++/L
C33					R	R+	R++	NC	NC	NC	NC
C34					R						
[c]C34A	OK	OK	OK	OK	OK	OK	OK				

See following page for notes.

[a]The first entry in each instance indicates the round count on the rifle bolt when the first magnaglow inspection was conducted.

[b] L = magnaglow inspection revealed a crack at the base of the bolt lug immediately left of the extractor slot.

R = magnaglow inspection revealed a crack at the base of the bolt lug immediately right of the extractor slot.

CP = magnaglow inspection revealed a crack in the wall of the bolt cam pin hole.

[c]In some instances, a cracked bolt was replaced with a new (A) bolt.

[d]NC = no change from the previous inspection.

[e]+ = a previously noted crack has lengthened.

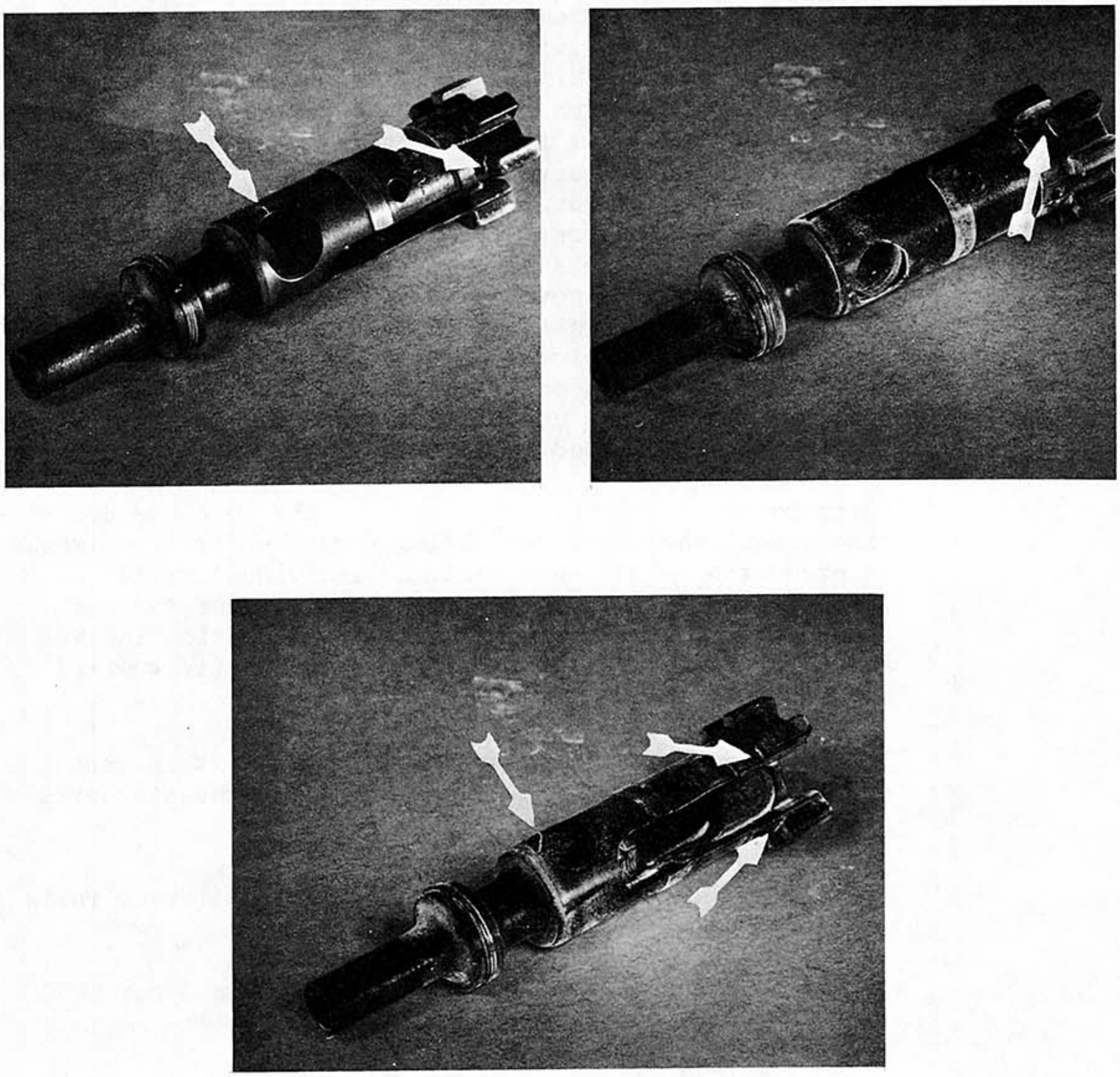


Figure 2.4-1: Black Light Views of the Magnetic Particle Crack Patterns at the Base of the Two Lugs and in the Cam Pin Hole of Bolt No. A29 after Firing 6000 Rounds.

2.4.5 Analysis

2.4.5.1 Reliability. Reliability is discussed as follows:

a. Purchase Description No. SAPD-253F establishes a detailed malfunction record among various malfunction categories against which M16A1 rifles are tested at the individual production sites. This reliability standard has been extracted in full from the purchase description and is contained in Appendix I. This standard appears appropriate and well suited to serve as firm criteria for analysis of the endurance test results, for the first 6000 rounds only, as reported in the previous tables. The fact that the APG test rifles were shoulder-fired (all production-site firings utilize the government-approved test stand) and that some rifles were fired with a 4-to-1 mix of ball and tracer ammunition (production site firings are conducted with ball ammunition only) does not, in the test agency's opinion, justify the use of criteria any less restrictive than those established in SAPD-253F.

Furthermore, for initial production, the purchase description establishes that ten rifles from the first two weeks of production shall each meet the individual rifle criteria and failure by any rifle shall cause the producer to "institute necessary corrective action in the manufacturing processes and associated quality control procedures".

Therefore, the following reliability analysis is made considering each individual rifle against the standards of SAPD-253F.

1) Rifles which failed to meet the reliability criteria of SAPD-253F:

a) Due to excessive FBR's (no more than 3 per 6000 rounds permitted).

1 Code A, Nos. 29, 30, 31, and 32.

2 Code C, No. 34.

b) Due to excessive feeding failures (no more than 4 per 6000 rounds permitted).

1 Code B, Nos. 30, 32, 33, and 34.

2 Code C, Nos. 30, 31, 33, and 34[a].

[a]Note that some rifles failed criteria in two different malfunction categories.

c) Due to excessive failures of the bolt to lock (no more than 2 per 6000 rounds permitted; scored as FF-1's in Table 2.4-I).

1 Code A, Nos. 29[a] and 30[a].

2 Code C, No. 31[a].

2) Rifles which met all of the reliability criteria of SAPD-253F:

a) Code A, Nos. 33, 34, and 35.

b) Code B, Nos. 29, 31, and 35.

c) Code C, Nos. 28. 29, and 32.

3) Malfunction rates per 1000 rounds fired were as shown in Table 2.4-V (number at the left of each slash mark is the rate for the first 6000 rounds; number at the right is for the entire 10,000 rounds).

Table 2.4-V. Malfunction Rates

Rifle No.[a]	Code A	Code B	Code C
29	2.50/4.60	0.00/0.10	0.83/1.00
30	4.17/8.90	0.83/1.00	0.50/0.30
31	1.17/1.80	0.17/0.50	3.50/5.20
32	2.67/4.40	2.67/3.10	5.33/6.10
33	0.33/0.50	2.17/1.30	0.33/0.20
34	0.00/0.80	1.83/1.90	2.67/2.80
35	0.00/1.20	0.33/0.50	2.67/2.50
Avg	1.55/3.17	1.14/1.20	2.26/2.59

[a]Rifle numbers for Code C rifles are 28 through 34, in order

[a]Note that some rifles failed criteria in two different malfunction categories.

b. The data in Table 2.4-I clearly indicate that elimination of FBR's with Code A rifles and elimination of double-feeds with both Code B and C rifles would provide extremely high reliability levels for all three contractors. As these data were being transmitted to AMSWE-QA on a daily basis, and also as a result of a limited firing exercise conducted at APG (par. 2.8), an endurance retest of 36 rifles was directed and initiated on 3 April 1969. The rifles submitted for retest were expected to overcome both major problem areas by incorporation of a new bolt-catch configuration and by closely adhering to bolt-lug configuration specifications. The results of the retest are reported in paragraph 2.9.

2.4.5.2 **Durability. Durability is discussed as follows:**

a. SAPD-253F also cites specific durability levels for certain components in terms of number of permitted parts failures as well as establishing minimum-life requirements for individual parts. The following durability analysis is made considering each individual rifle against the durability standards of SAPD-253F:

1) One magazine failure occurred, but beyond the 250-round minimum life requirement (Appendix I).

2) No ejector-spring failures occurred.

3) Within the first 6000 rounds on each rifle, no more than one extractor-spring failure occurred per rifle and none of these occurred in less than the specified 2000-round minimum life. **However, Code A extractor** springs, both original and those from spare parts, were significantly less durable than either Code B or Code C springs.

4) No "other-parts" failures occurred (limited to trigger spring, disconnect spring, hammer spring, extractor pin, and extractor). However, parts failures occurred beyond those permitted in the limitation as follows:

a) Rifle A29, bolt cracked at cam-pin hole, 6000 rounds.

b) Rifles B29, 31 and 32; defective selector lever.

c) Rifle C31, front sling swivel retaining pin.

Only the latter failure of a non-functioning part is considered not critical and not within the intent of SAPD-253F.

b. Parts Failure Discussion.

1) Magnaglow results for the bolts from endurance test rifles have been summarized in Table 2.4-IV. Because a bolt lug failure was believed to be a critical and a potentially hazardous defect, additional firings were conducted to further investigate the apparent problem. Bolt lugs were progressively removed from one Code A bolt until only two of the original seven lugs remained. A total of 380 rounds was then fired in the full automatic mode with only the 2-lug support and no failures or malfunctions occurred. When the sixth lug

was removed, a bolt failure did occur; the cartridge case ruptured and the magazine floor plate blew out.

It was judged that bolt-lug cracking, as observed in this endurance test (no more than two lugs cracked on any single bolt in 10,000 rounds), was not hazardous and did not degrade weapon functioning. However, it is the opinion of the test agency that this problem should be corrected, since it is not an inherent problem, and since improper machining at the rear fillet on each lug is primarily responsible for these failures. Further detailed information on the problem is contained in Appendix I.

2) Bolt cracks also occurred with Code A rifle bolts at the bolt cam-pin hole in this endurance test as well as in the retest of 36 rifles (par. 2.9). This problem is rated **as a critical defect and should be overcome.** Complete failure of the bolt at the cam-pin hole is regarded as potentially hazardous to the firer and renders the rifle unserviceable except **at direct and general** support level. It should also be noted that the problem occurred with Code B rifles in **the high and low** temperature test (pars. 2.6 and 2.7) and in the endurance retest, but that no cam-pin hole cracks occurred with any Code C rifles. This problem is discussed further in par. 2.9.5.

3) A Code B defective selector lever is shown in Figure 2.4-2. The arrow indicates where a slight burr or protrusion exists at the bottom of one of the selector lever detent cavities. This condition was noted on 11 of the 35 Code B rifles submitted for test, including three of the endurance test rifles and resulted in repeated firing failures in this subtest. The detent obstruction in the cavity permitted the lever to become positioned too far to the right side of the receiver and the trigger would become blocked. This problem was first reported by equipment performance report as a shortcoming, but was later reclassified as a deficiency as requested by AMSWE-QA (Reference 5).

c. Maintenance Inspection Notes. The following problem areas were noted during the various maintenance operations performed at 1000-round intervals:

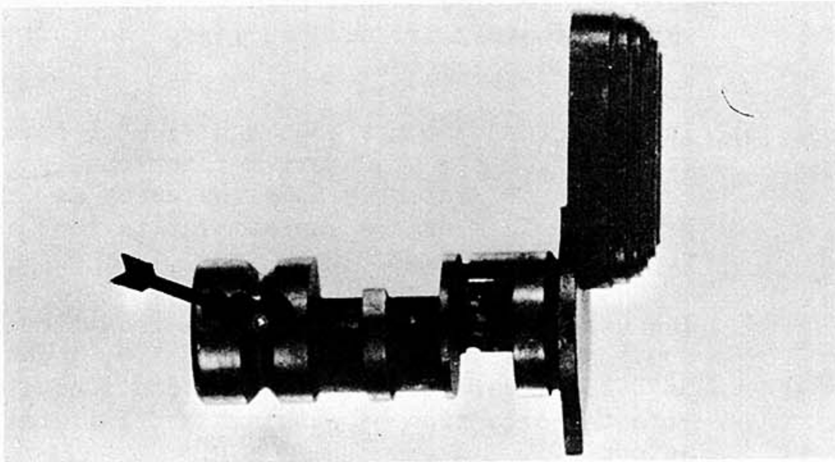


Figure 2.4-2: Arrow Indicates a Protrusion at the Bottom of a Code B Selector-Lever Cavity.

1) The use of bore cleaner (MIL-C-372B) as a general-purpose cleaner for the rifle mechanism in all sub-tests in this report was specifically requested by AMSWE-QA to be used in place of dry-cleaning solvent (Fed. Spec O-T-620A). Dry-cleaning solvent has been the standard cleaner for M16A1 rifles in previous tests at APG and is specified in TM9-1005-249-34 as a cleaner to be used at direct and general support level while bore cleaner is specified in TM9-1005-249-12 to be used at the operator and organizational level.

   It was the opinion of experienced maintenance personnel that bore cleaner was not as effective in removing fouling from the rifle mechanism as was dry-cleaning solvent. Hard deposits of fouling were not always successfully or completely removed from such components as the firing pin and bolt and the interior of the bolt carrier. As testing progressed it was often noted that the firing pin, bolt cam pin, and the bolt itself, all presumably freely-moving parts, could only be dis-assembled with some difficulty due to accumulations of hard, dry fouling.

2) Maintenance personnel also noted that Code A extractor springs, the least durable of the three production samples, would often become split for a short distance on the exposed end of the extractor spring. While these springs were considered serviceable, and usually not replaced, this initial failure was often followed by complete coil breakage in subsequent firings. It appeared most likely that Code A extractor springs

were either ground too "thin" on the end coil or were improperly hardened springs. No further investigation was conducted.

3) It was noted that the edge and **face** of some buffers in weapons from all producers became rough and appeared corroded and dented in some instances as firing progressed. This damage was similar to that shown in Figure 2.2-3.

4) The visual and manual inspection requirements of the applicable subparagraphs of par. 5.0, Appendix J, SAPD-253F, were judged to have been adequately fulfilled with the exception of problems and failures already noted.

2.4.5.3 Cyclic Rate of Fire. Throughout 6000 rounds of firing, all 21 test rifles met the requirement of 700 to 940 rounds per minute for every rate obtained, both from the shoulder and during the occasional government-approved test stand firings. Table 2.4-III compares test-stand and shoulder-fired rates. While the data do not afford a precise evaluation of the difference in rate levels as a function of rigid versus "soft" mounting, the data in Table 2.4-III do tend to confirm that cyclic-rate levels in the man-supported mode are, as expected, somewhat lower than acceptance-test cyclic-rate data would indicate.

It should also be noted that Code B rifles evidenced somewhat less variation between "soft" and rigid mounting, and that the level of cyclic rate was maintained more consistently with less **rate reduction** with Code B rifles as firing progressed.

2.4.5.4 Summary. Of the 21 rifles tested, all met the cyclic-rate-of-fire requirements, 17 met the durability requirements and 9 met the reliability requirements; only seven rifles met requirements in all three of these categories (A33, 34, and 35; B35; and C28, C29, and C32).

2.5 DISPLACEMENT-TIME STUDY

2.5.1 Objectives

The objectives were:

a. To determine the cyclic characteristics of the weapons when firing the test lots of ammunition.

b. To compare cyclic performance of rifles from the three different producers.

c. To provide definitive cyclic data which would aid in more specific analysis of the firings in other subtests.

2.5.2 Criteria

The test is conducted primarily for information purposes, however, the displacement-time records obtained in this test with rifles from all producers were expected to be comparable to similar records previously obtained in a basic study of the M16A1 rifle and reported in Reference 15.

2.5.3 Method

A displacement-time camera, incorporating a special light-sensitive paper attached to a revolving drum, is operated in conjunction with a sequence timer and a rigid mechanical firing mount to obtain traces of the motion of various components in the M16A1 rifle during firing. Small, highly polished, light-reflecting surfaces, either attached to or fabricated on the essential components, provide a tracking capability by which traces are recorded on the light-sensitive paper. Wherever necessary, portions of the receiver and magazine of the test rifles are cut away to permit full viewing of the components.

The following determinations were made:

a. A characteristic displacement-time curve for the bolt carrier was established.

b. Response times for the hammer, cartridge follower (magazine), and bolt catch were obtained and measured.

c. Cyclic-time intervals were recorded for bolt carrier and buffer travel during single-shot and burst fire while employing ball, tracer, and a 4-to-1 mix loading of ball and tracer ammunition, and bolt carrier velocities were measured for the singly-fired rounds.

2.5.4 Results

Both results and analysis of the above determinations are contained in the following subparagraphs and a brief summary is presented in par. 2.5.5.

2.5.4.1 Characteristic Displacement-Time Curve. In an original displacement-time study of the M16A1 rifle (Reference 15), a characteristic displacement-time curve for the bolt carrier was presented. A similar curve was obtained in this exercise and is illustrated in Figure 2.5-1. Some minor corrections from the originally established trace appear on the curve in Figure 2.5-1 and, in addition, accurate measurements of both displacement and time are presented for each of the displacement intervals. The displacement measurements were obtained from test rifle C27, but should be applicable to any M16A1 rifle with little variation. However, the time values are based on a total cycle time of 80 milliseconds, or a cyclic rate of 750 rds per min, and these values can be expected to vary in comparison to other curves obtained with M16A1 rifles depending on the total cycle time.

2.5.4.2 Hammer Characteristics. An examination of 20-round continuous burst records, three records each for rifles A27, B27, and C27, revealed no significant difference in hammer displacement characteristics between the three rifle producers. Rounds No. 1, 5, 10, 15 and 20 were individually measured and the data recorded in Table 2.5-I.

Figure 2.5-2 illustrates a redrawn displacement-time trace for the motion of the hammer in the M16A1 rifle. The intervals, A to F, in Figure 2.5-2 illustrate and identify the time measurements given in Table 2.5-I. The measurements of interval A, hammer fall time, correspond closely (approximately 10 milliseconds) to values established in an earlier study of the M16A1 rifle (Reference 15). The original study concluded that hammer characteristics were entirely adequate and the displacement-time records in this test reaffirm this judgement.

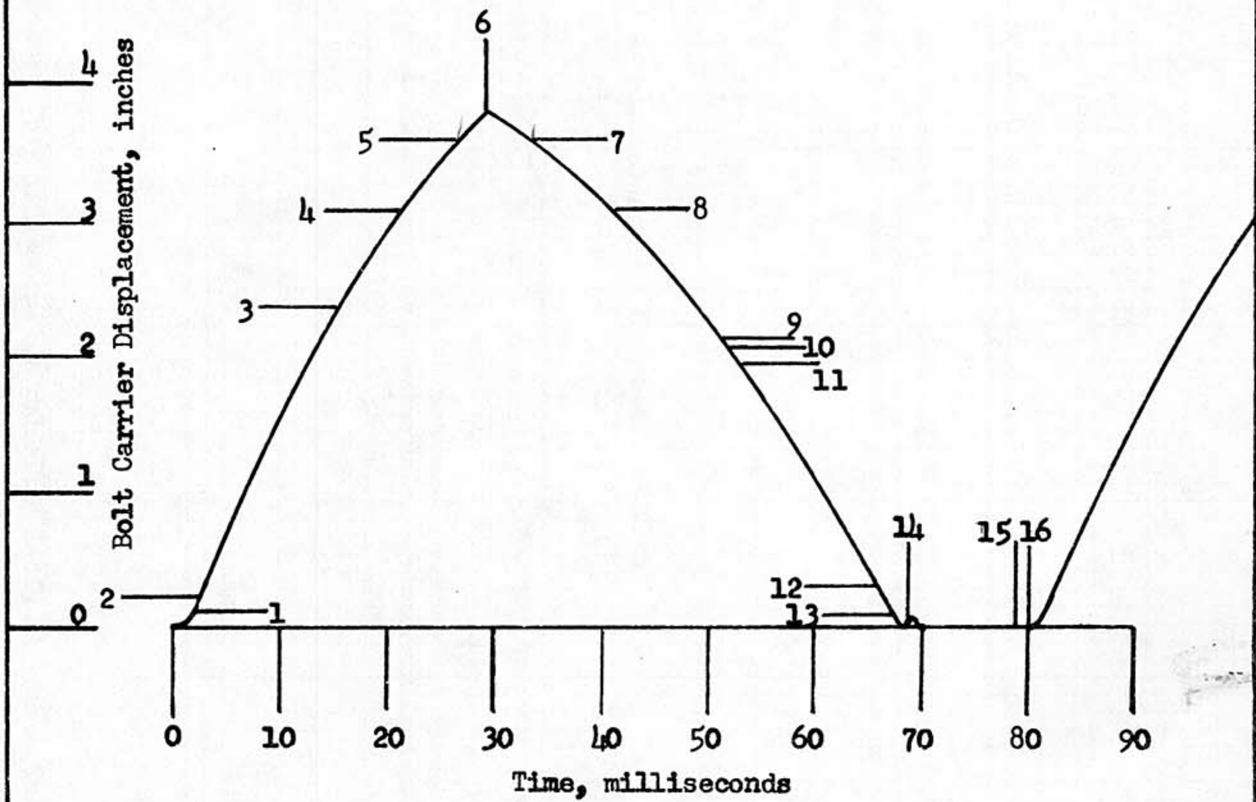


Figure 2.5-1: Characteristic Displacement-Time Curve, M16A1 Rifle Bolt Carrier.

Legend[a]

1. Initial carrier travel prior to unlocking of the bolt (.10/2).
2. Bolt fully unlocked (.22/3).
3. Fired case ejected (2.43/15).
4. Bolt lug face clears base of next live round in the magazine (3.11/22).
5. Bolt lug face clears bolt catch position (3.60/27).
6. Buffer impact (3.80/29).
7. Bolt stripping lugs engaged by bolt catch after last round only (3.60/33).
8. Bolt lug face contacts base of next live round in the magazine (3.11/41).
9. Hammer engaged by disconnector in semiautomatic fire (2.09/51).
10. Bolt lug face clears retaining lips of the magazine (2.05/52).
11. Hammer engaged by automatic sear in automatic fire (1.93/53).
12. Bolt lug face contacts barrel extension (.28/66).
13. Bolt locked, automatic sear releases hammer during automatic fire (.07/67).
14. Carrier rebound after initial closure (.03/69).
15. Hammer impacts the firing pin (-/78).
16. Carrier starts rearward in recoil (-/80).

a. Numbers in parenthesis indicate displacement of bolt carrier in inches from the fully closed position and the time of the event in milliseconds from time zero when the round fires.

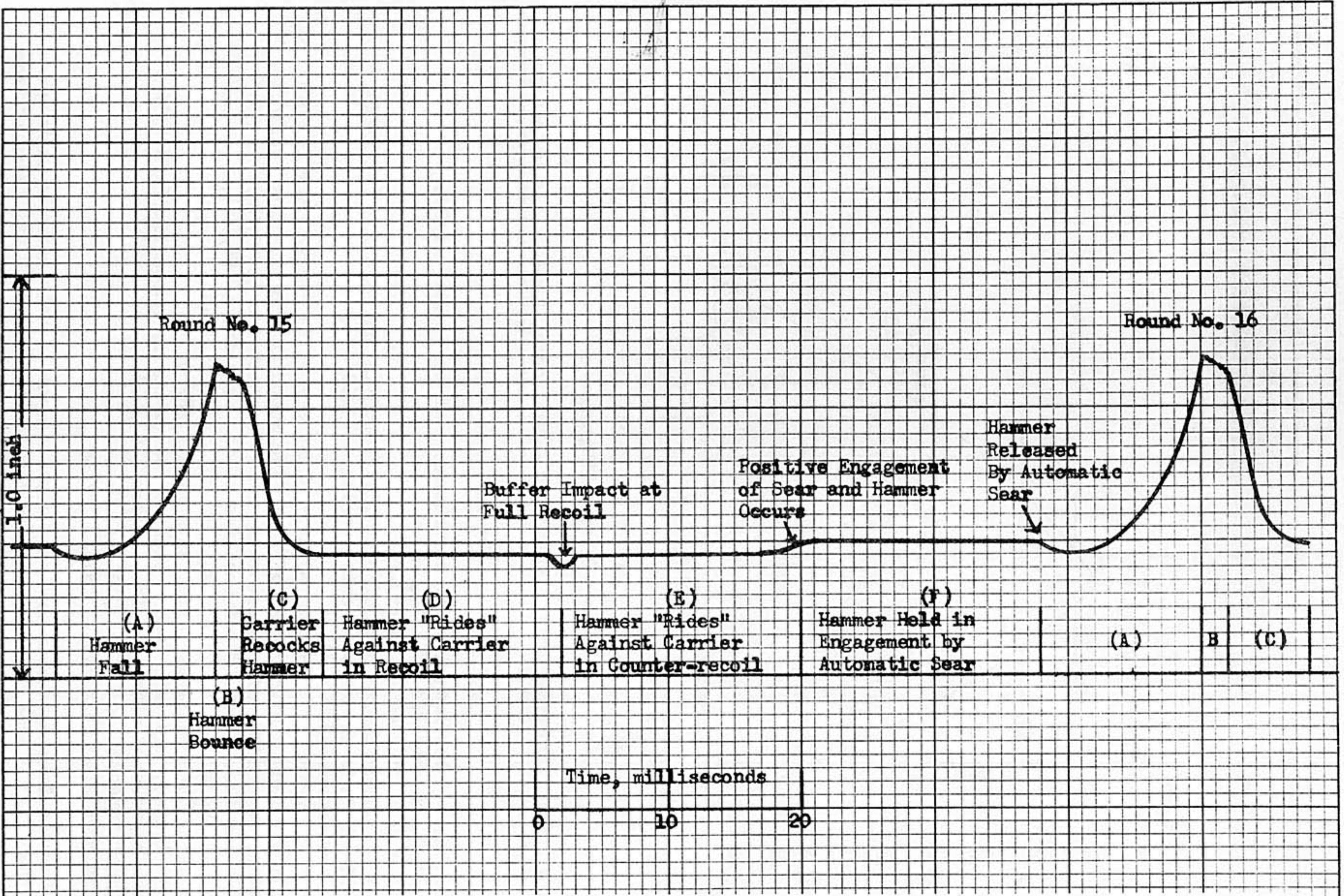


Figure 2.5-2: Redrawn Displacement-Time Trace of Hammer in M16A1 Rifle During Automatic Fire; Record No. B27-16

Table 2.5-I. Time Measurements for Various Intervals of Hammer Displacement in the M16A1 Rifle

Round No.	Total Cycle Time, ms	Interval Time, ms A	B	C	D	E	F	Record No.
1	68	[a] 9	2	4	17	17	19	A27-16
5	66	11	2	4	16	18	15	
10	64	11	2	4	16	16	15	
15	62	11	2	5	15	15	14	
20	[b] -	10	2	4	15	18	[b] -	
1	76	[a] 10	2	5	20	23	16	A27-17
5	69	11	2	5	17	16	18	
10	67	11	2	4	16	17	17	
15	66	11	2	5	16	17	15	
20	[b] -	11	2	4	15	18	[b] -	
1	68	[a] 8	2	3	19	17	19	A27-18
5	66	11	2	4	16	16	17	
10	72	11	2	4	20	22	13	
15	67	10	2	4	17	16	18	
20	[b] -	10	2	4	16	17	[b] -	
1	90	[a] 12	2	6	24	24	22	B27-16
5	82	12	2	6	20	18	24	
10	79	12	2	5	20	22	18	
15	74	12	2	6	18	18	18	
20	[b] -	12	2	5	19	16	[b] -	
1	74	[a] 11	2	5	20	22	14	B27-17
5	71	10	2	5	19	22	13	
10	66	11	2	5	16	20	12	
15	68	10	2	5	17	20	14	
20	[b] -	11	2	4	17	16	[b] -	
1	78	[a] 10	2	5	22	22	17	B27-18
5	83	11	2	6	22	27	15	
10	73	11	2	5	19	21	15	
15	71	11	2	5	18	18	17	
20	[b] -	11	2	5	18	17	[b] -	
1	74	[a] 9	2	4	21	23	15	C27-16
5	70	10	3	4	18	17	18	
10	68	11	3	4	16	17	17	
15	65	10	3	4	16	19	13	
20	[b] -	10	2	4	15	16	[b] -	

[a]The hammer is engaged and is released by the trigger on the first round; but for subsequent rounds in an automatic burst, engagement and release occurs from the automatic sear.

[b]The bolt catch interrupts a full cycle on the final round.

Table 2.5-I (Cont'd)

Round No.	Total Cycle Time, ms	Interval Time, ms A	B	C	D	E	F	Record No.
1	80	[a] 9	3	4	23	23	18	C27-17
5	72	10	3	5	19	15	20	
10	71	11	3	4	18	20	15	
15	64	10	3	4	16	15	16	
20	[b] -	10	2	3	16	15	[b] -	
1	77	[a] 9	2	4	21	25	16	C27-18
5	73	11	3	5	19	21	14	
10	71	11	2	5	17	18	18	
15	70	11	3	4	17	19	16	
20	[b] -	11	3	4	16	18	[b] -	

[a]The hammer is engaged and is released by the trigger on the first round; but for subsequent rounds in an automatic burst, engagement and release occurs from the automatic sear.
[b]The bolt catch interrupts a full cycle on the final round.

2.5.4.3 Magazine Characteristics. Three displacement-time records were obtained showing response characteristics of the cartridge follower in the magazine during a 20-round burst for each of the three test rifles A27, B27, and C27. Records were also obtained in greater detail for final rounds in a continuous burst. Although a different magazine was used with each rifle it should be noted that all M16A1 rifle magazines are of Code C manufacture.

Examination of all the records revealed similar response characteristics, but in one particular segment of each record there appeared to be evidence of undesirable performance with a definite potential for rifle malfunctioning. Figure 2.5-3 illustrates typical records for the final four rounds in a continuous 20-round burst from each test rifle. Also shown, for comparison, is a typical record of the first four rounds fired in a continuous 20-round burst. The circled portions of each trace of final rounds in Figure 2.5-3 show a distinct and sharp downward motion of the rear of the cartridge follower approximately at the feeding position during each cycle. However, this characteristic does not occur to any noticeable degree until the magazine is nearly empty and the circled portions on the record of round Nos. 1 through 4 show stable and desirable cartridge-follower response motion.

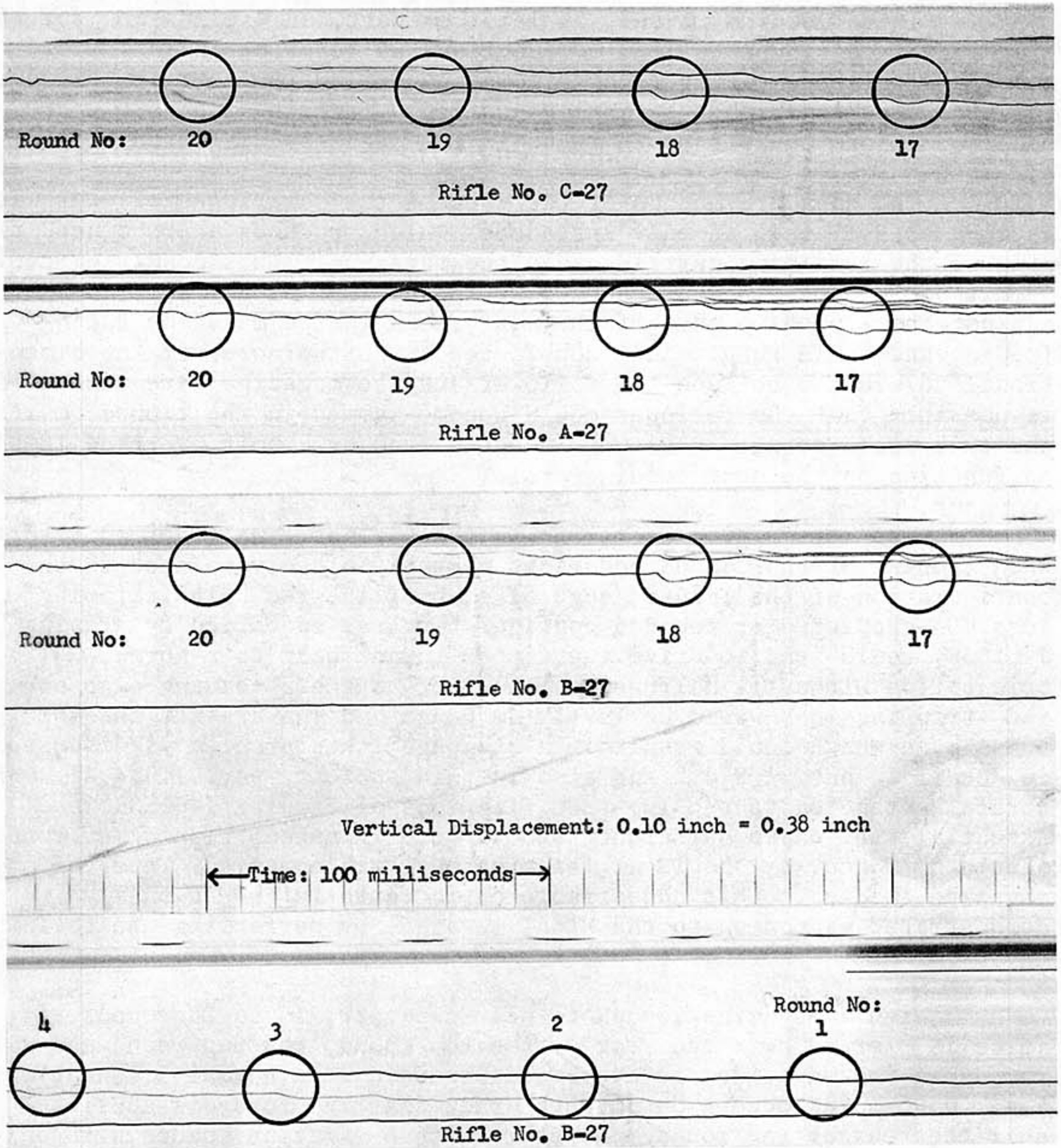


Figure 2.5-3: Cartridge Follower Response Characteristics In the M16A1 Rifle Magazine Are Shown during Automatic Fire. Explanation Is Contained In the Text.

These records reveal, at least in part, an explanation for the high incidence of double-feed malfunctions as reported in par. 2.4.4, and the displacement-time records coincide well with the fact that double feeds occurred only on the final rounds in a magazine (no double feed was reported before the fifteenth round in the magazine was fired).

The downward motion of the rear of the cartridge follower was as much as 0.15 inch in many instances, which produces a pronounced tipping of the remaining cartridges in the magazine. This condition could permit one or the other of the two stripping lugs of the bolt to jam against the tipped-up nose of the next round in the magazine during feeding and could result in a double feed. Furthermore, if the dimensional tolerances between the follower and the magazine were minimal it is possible that the follower could become jammed in the tipped position and this could result in either a double feed or a bolt override (BOB) malfunction on the next feeding cycle.

The determining factor in whether or not a malfunction results when tipping of the rounds occurs is probably closely related to the configuration of the leading edge of each of the two bolt stripping lugs. A chamfered or rounded configuration, as specified by drawing J-61538, would tend to drive the tipped rounds back to a normal orientation without a malfunction; however, a sharp leading edge on the stripping lugs would be likely to gouge and jam against the soft brass case which could result in a stoppage (this problem is discussed in detail in par. 2.9.4.2 and also in this subtest, par. 2.5.4.4). While careful attention to the lug specifications of drawing J-61538 is essential, the basic deficiency should be eliminated; tipping of rounds should not occur or should at least be negligible, at any level of magazine loading. This undesirable characteristic can be easily demonstrated as common to the M16A1 magazine by performing the following exercise:

With a magazine loaded to near capacity, 15 to 18 rounds, if force is exerted near the rear of the top round, the top round and all rounds in the magazine are depressed downward in a normal orientation; i.e., no tipping occurs despite the fact that the force is applied near the rear of the round. However, with a magazine loaded with only four rounds, and with force applied at the same position, all of the rounds will now tip down at the base rather than being depressed in a level attitude as shown in Figure 2.5-4.

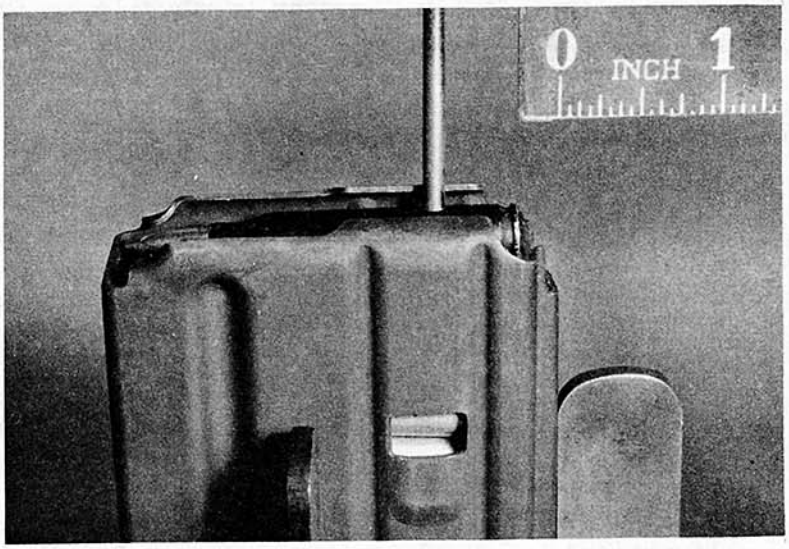


Figure 2.5-4: Upper Magazine Contains 18 Rounds, Lower Magazine Contains 4 Rounds. Note Tipping of Rounds Which Occurs in the Lower Magazine when Force Is Applied Near the Base of the Round.

While this tipping characteristic probably cannot be completely eliminated in the magazine, it would appear worthwhile to investigate the possibility of using a magazine spring of greater force characteristics than the one presently employed so that spring force against the follower in an empty magazine is increased and so that the base of the cartridge follower would be more adequately supported throughout its travel.

Seventeen magazines, selected from the endurance test and the retest, were measured for initial spring force. All magazines had been fired 600 rounds each and six of the magazines had experienced double-feed malfunctions. The results were as follows:

a. Magazines from initial endurance test experiencing double feeds: 2.9, 2.6, 2.8, 2.6, 2.9, and 2.9 lb; average of 2.8 lb.

b. Magazines from initial endurance test experiencing no malfunctions: 2.9, 2.8, 2.9, 2.9, and 2.9 lb; average of 2.9 lb.

c. Magazines from retest experiencing no malfunctions: 2.6, 2.6, 2.9, 2.8, 2.9, and 3.2 lb; average of 2.8 lb.

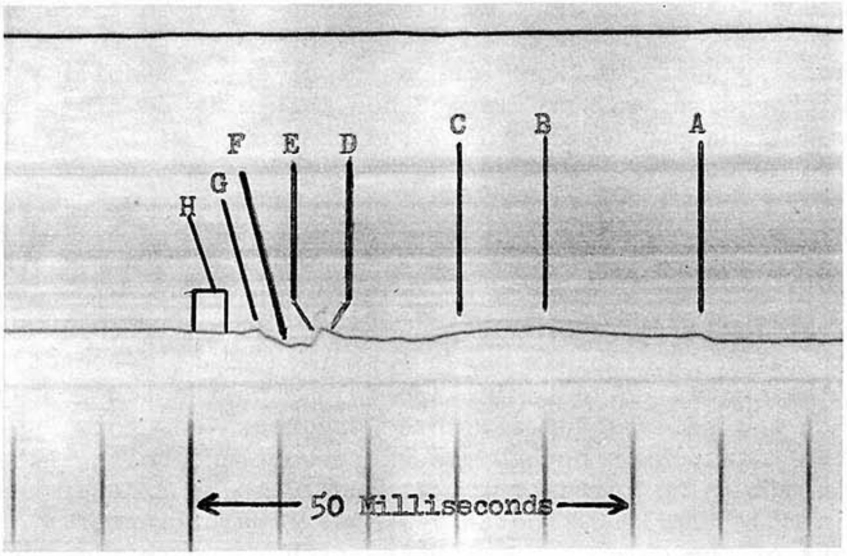
While the preceding measurements show no correlation between magazines associated with malfunctions and those which fired satisfactorily, all measured magazines were on the low side of spring-force tolerance; measurements were taken at 0.25 inch of follower deflection and drawing C62103 specifies that spring force should be 3.0 ± 0.5 lb. at this point.

Other magazines were also measured for comparison purposes and the results are shown in Table 2.5-II.

Table 2.5-II. Comparison Data

Magazine Type	Spring Force, lb
M14, 20-round	5.7
AK-47, 30-round	3.8
Browning auto. rifle, 20 round	3.7
Code C, 30-round (exp)	3.2
Code E, 30-round	3.1
Average of 17 Code C, 20-round magazines	2.8

2.5.4.4 Bolt-Catch Characteristics. Three displacement-time records were obtained showing bolt-catch response characteristics during the firing of the final round in a 20-round burst for each of the three test rifles; A27, B27, and C27. Figure 2.5-5 identifies the more important segments of bolt catch response characteristics.



Legend

A = Last round is removed from the magazine.
A-B = Bolt catch, elevated by the cartridge follower, rides against the carrier as carrier closes.
B = Bolt locked and carrier closed.
B-C = Dwell period of final cycle; bolt is locked, hammer has been released.
C = Last round is fired.
C-D = Bolt catch elevated by the cartridge follower, rides against the carrier as the carrier moves rearward in recoil.
D = Bolt catch rises in space between carrier and rear edge of bolt lug.
E = Bolt catch is driven back down as the rear edge of the bolt lug strikes the catch.
F = Bolt face clears the catch and catch is free to rise to the full catch position; bolt carrier is still in recoil (rearward) motion.
G = Bolt catch is fully elevated in front of bolt.
H = Bolt contacts the bolt catch in this area, exact location depends on velocity of the final cycle.
G-H = Bolt catch may exhibit some instability in this area and minor downward "bounce" may occur immediately prior to engagement of the bolt by the catch.

Figure 2.5-5: Displacement-Time Record of the Bolt Catch in Rifle A27, Record No. A27/20.

With reference to Figure 2.5-5, it can be seen that two critical areas of displacement versus time exist; the catch must respond and arrive at the full upward position (G) prior to the return of the counterrecoiling bolt, and once in position, any instability or bounce must be quickly dampened, or else be negligible in downward displacement, so that even if dampening is protracted the catch will remain sufficiently displaced to successfully engage the bolt.

All of the displacement-time records in this evaluation show that the catch was in the fully raised position within 2.4 to 3.9 milliseconds; a time interval entirely adequate to provide a safe margin before the bolt returns in counterrecoil (bolt turn-around time at the bolt catch is probably never less than 6 milliseconds). However, following the initial rise to full position, bolt-catch instability was noted on the records for all three producers and this unstable period often extended into the area where bolt and bolt catch engagement occur, although in no instance was it judged to be excessive either by extending the total bolt-catch response time or in terms of downward displacement of the catch. Total bolt-catch response time was 5 to 6 milliseconds including the final dampening motion.

Similar records of bolt-catch performance, obtained by the Code A manufacturer and forwarded to APG, were compared to the APG records. The manufacturer's records coincided well with the records obtained in this test except in the critical area of catch return time and catch instability. The manufacturer's records indicated that the catch often required as much as 5 milliseconds to rise to the full catch position and instability and downward bounce were often significantly more severe than in the APG records.

As failure of the bolt catch (FBR) was the predominant malfunction with Code A rifles in both the original endurance test and in the retest (par. 2.4 and par. 2.9), a further investigation and inspection of critical components was conducted. This investigation led to the following analysis of both possible and probable causes of recurring FBR's.

a. Cyclic Rate. A cyclic rate of fire, either less than 500 rds per min or in excessive of 975 rds per min for the twentieth round, sufficiently shortens the bolt turn-around time so that the catch has insufficient time to become fully positioned (Reference 15, par. 4.2.2.3). However, few if any Code A average cyclic rates of fire in the two endurance tests indicated that final rounds might have cycled at these extreme rates.

b. Bolt-Catch Configuration. Two different bolt-catch configurations are presently permitted in the M16A1 rifle. This subject is discussed in detail in par. 2.9.4.1, but essentially the most recently introduced catch, or modified catch insures full pivoting of the catch and permits a somewhat higher bolt-catch contact surface. The modified catch was installed in all Code A rifles during the endurance retest while the earlier catch was present in the initial endurance test (displacement-time records were obtained only with rifles equipped with the earlier catch). However. as Code B rifles employed the earlier catch in both endurance tests with extremely few FBR's occurring, and as FBR's continued to be the leading malfunction in Code A rifles in the endurance retest (although drastically reduced in number in the retest), the modified catch configuration alone does not completely and satisfactorily eliminate the occurrence of FBR's.

c. Bolt-Lug Configuration. Two bolt-lug configurations are permitted in the M16A1 rifle (this subject is discussed in detail in par. 2.9.4.2) and the option permits the leading edge of the bolt lugs to be formed by a 0.010 ± 0.005 in. radius, or by a 0.010 ± 0.005 in. by 45° chamfer. Code A rifles incorporated the radius configuration, while the bolt lugs on Code B and C rifles appeared to be chamfered. It should also be noted that two of the seven Code A initial endurance test rifles exceeded the maximum permitted radius of 0.015 in. while all Code B and C bolt lugs were less than the minimum permitted chamfer depth, varying from 0.001 to 0.004 in.

At the critical point of bolt and bolt-catch engagement it is possible for the catch, if fully elevated, to engage the lower portion of two of the bolt lugs (the two cartridge stripping lugs). In a marginal situation, only one lug is engaged and, as a failure condition approaches, engagement occurs on or near the leading edge of the right-hand stripping lug. In such instances, if the configuration of the leading edge of the engagement lug is broken by either a full radius or chamfer, there would then exist a significant potential for a bolt override to occur; however, if the leading edge of the lug was more sharply configured, then a successful engagement rather than an override would be more likely to occur. This presumed relationship between bolt-lug configuration and the incidence of FBR's is supported by the data reported in both par. 2.4.4 and par. 2.9.4. Code A bolt lugs incorporating a radius configuration were associated with a high incidence of FBR's in the initial endurance test and with a much reduced incidence, although still significant, during the retest when modified bolt catches were employed. On the other hand, Code B and C bolt lugs incorporated the relatively sharp (and out of specification) lug configuration in the original test and extremely few FBR's occurred within the first 6000 rounds of firing while there was an increase in this malfunction with both manufacturers during the retest with chamfered bolt lugs.

d. Magazine Spring. The cartridge follower in the magazine elevates the bolt catch to the upward position after the last round in the magazine has been fired. The time required for the catch to move upward and the ability of the catch to remain in the upward position are primarily dependent upon the degree of force exerted by the magazine spring against the rear of the cartridge follower. With reference to proper cartridge positioning, concern has already been expressed that magazine spring force is inadequate, particularly as the magazine becomes emptied. This concern should be given added emphasis as it is entirely possible that both FBR malfunctions and feeding malfunctions would be reduced if a spring of greater force characteristics were employed.

2.5.4.5 Single-Shot Records. Expanded single-shot records were obtained with rifles A26 and A27, B26 and B27, and C26 and C27. Three single rounds were fired with ball ammunition, lot TW18301, and three single rounds with tracer ammunition, lot TW18077, with each of the six test rifles. All records were examined and bolt carrier velocities were measured for A27, B27, and C27 at four different positions, two during recoil and two during counterrecoil, and the cyclic rate of fire computed for each round. These data are contained in Table 2.5-III.

Table 2.5-III. Bolt Carrier Velocity in the M16A1 Rifle

Rifle No.	Bolt Carrier Velocity, fps at Position No.[a] Recoil 1	Recoil 2	Counterrecoil 3	Counterrecoil 4	Single Round Cyclic Rate, rd per min
Ammunition Lot: TW18301 (M193 ball).					
A27	16.2	10.4	6.4	11.4	822
A27	14.4	8.3	4.9	10.4	779
A27	14.0	8.1	5.3	11.4	779
Avg	14.9	8.9	5.5	11.1	793

See footnotes on following page.

Table 2.5-III (Cont'd)

Rifle No.	Bolt Carrier Velocity, fps at Position No.[a] Recoil 1	2	Counterrecoil 3	4	Single Round Cyclic Rate, rd per min
B27	13.6	8.0	5.0	11.1	741
B27	13.3	7.8	5.1	11.1	741
B27	13.6	7.7	4.8	10.6	732
Avg	13.5	7.8	5.0	10.9	738
C27	13.7	7.0	4.6	10.6	723
C27	14.4	6.8	4.7	10.8	732
C27	13.4	6.5	4.1	10.8	714
Avg	13.8	6.8	4.5	10.7	723
Ammunition Lot[b]: TW18077 (M196 tracer).					
A27	12.6	7.4	5.9	10.2	588
A27	12.6	7.6	6.1	10.2	588
A27	13.0	7.6	6.4	10.5	588
Avg	12.7	7.5	6.1	10.3	588
B27	11.8	7.2	6.0	10.2	582
B27	12.0	5.6	4.4	9.7	588
B27	11.4	6.5	5.2	10.0	582
Avg	11.7	6.4	5.2	10.0	584
C27	11.8	4.9	3.7	8.9	612
[c]C27	11.8	4.3	3.1	6.0	-
[c]C27	11.4	3.3	2.6	7.5	606
Avg	11.7	4.2	3.1	-	-

[a]The carrier is in the same location, relative to the rifle receiver, in positions No. 1 and 4 but position No. 1 is after approximately 0.3 inch of initial recoil travel while position No. 4 is approximately 0.3 inch prior to final closure on counterrecoil. Similarly, position No. 2 is 0.3 inch before final buffer impact during recoil while position No. 3 is 0.3 inch after buffer impact in counterrecoil.
[b]Due to less than 3.8 inches of full recoil travel on tracer rounds, position No. 2 is measured at approximately 2.8 inches of recoil travel and position No. 3 is with the carrier in the same position in counterrecoil relative to the receiver.
[c]Malfunctions occurred on these two rounds; see par. 2.5.4.5.

While somewhat higher carrier velocities were measured for rifle A27 than for either B27 or C27, it would require examination of a large sample of weapons from each producer to determine whether the noted differences in velocities are characteristic of Code A production or if it is within the normal rifle-to-rifle variation common to all producers.

Perhaps the most significant data comparison is between carrier velocity levels for all test rifles when firing M193 ball cartridges as opposed to velocities measured when firing M196 tracer cartridges. All of the tracer records indicated an incomplete recoil travel without buffer impact. In two instances (footnote c in Table 2.5-III) recoil travel was shortened to the extent that the rifle malfunctioned. A bolt override (FF/BOB) occurred and the bolt closed on an empty chamber (FF/COEC) on the last two record rounds respectively for rifle C27 (although these were singly-fired rounds, a dummy round was loaded in the magazine to permit a normal feeding cycle during the counterrecoil motion).

The bolt carrier velocity data in Table 2.5-III further support marginal time measurements for tracer rounds, as recorded in Table 2.5-IV and as discussed in par. 2.5.4.6.

2.5.4.6 Burst-Fire Records. Continuous 20-round burst-fire records were obtained for rifles A26 and A27, B26 and B27, and C26 and C27. Three records were obtained for each rifle with ball ammunition, lot TW18301, and three records with tracer ammunition, lot TW18077. In addition, three records for each rifle were also obtained while firing a 4-to-1 mix of ball and tracer ammunition. All records were inspected and measured and the following time measurements in milliseconds were obtained for each round on each record: recoil, counterrecoil, dwell, and total cycle time. The cyclic rate-of-fire for each individual round was also computed in rounds per minute. Each of the individual record data sheets are contained in Appendix I and a summary of the data is contained in Table 2.5-IV.

In general, there did not appear to be any significant difference between producers and the recorded differences that were observed were judged to be attributable to normal rifle-to-rifle variation. The test, however, demonstrated again that M196 tracer cartridges often provide only marginal cyclic impulse characteristics, as shown in Figure 2.5-6, and this problem is discussed briefly following Table 2.5-IV and Figure 2.5-6.

Table 2.5-IV. Total Cycle Times of Selected Rounds from Records of 20-Round Continuous Bursts

All Measurements are in milliseconds.

Ammunition; TW18301, M193 ball					TW18077, M196 tracer					4-1, ball and tracer				
Record No.	Round No. 1	5	10	19	Record No.	Round No. 1	5	10	19	Record No.	Round No.[a] 1	5	10	19
					Rifle A26									
A26-7	79	84	72	69	A26-10	85	104	91	101	A26-13	78	108	89	70
A26-8	81	74	71	69	A26-11	105	104	104	105	A26-14	78	86	81	71
A26-9	80	78	72	74	A26-12	109	106	107	92	A26-15	74	89	87	70
Avg	80	79	72	71		100	105	101	99		77	94	86	70
					Rifle A27									
A27-7	84	82	75	69	A27-10	107	99	106	[b]103	A27-13	76	105	102	74
A27-8	86	86	77	74	A27-11	106	105	107	[b]103	A27-14	81	105	92	73
A27-9	80	78	76	70	A27-12	106	105	106	[b]101	A27-15	81	92	93	71
Avg	83	82	76	71		106	103	106	102		79	101	96	73
					Rifle B26									
B26-7	90	99	81	74	B26-10	108	106	105	[b]103	B26-12	87	104	89	72
B26-8	87	97	82	74	B26-11	[c]109	-	-	-	B26-13	84	105	90	75
B26-9	92	96	81	75	B26-11A [d]	-	-	-	-	B26-14	86	106	96	73
Avg	90	97	81	74							86	105	92	73
					Rifle B27									
B27-7	82	80	73	72	B27-10	91	99	87	89	B27-13	78	107	91	73
B27-8	83	83	76	72	B27-11	118	116	97	86	B27-14	77	95	86	72
B27-9	84	81	73	74	B27-12	110	108	99	90	B27-15	76	96	92	71
Avg	83	81	74	73		106	108	94	88		77	99	90	72

[a]Rounds No. 5 and 10 were tracers, 1 and 19 were ball cartridges.
[b]An FBR occurred when the twentieth round fired; see text.
[c]The bolt closed on an empty chamber (FF/COEC) after the second round fired; see text.
[d]The bolt closed on an empty chamber (FF/COEC) after the first round fired; see text.

Table 2.5-IV (Cont'd)

Ammunition: TW18301, M193 ball					TW18077, M196 tracer					4-1, ball and tracer				
Record No.	Round No. 1	5	10	19	Record No.	Round No. 1	5	10	19	Record No.	Round No.[a] 1	5	10	19
						Rifle C26								
C26-7	101	86	80	73	C26-10	[e]104	-	-	-	C26-13	93	105	103	74
C26-8	94	86	80	75	C26-11	[d]-	-	-	-	C26-14	85	103	105	70
C26-9	87	90	81	74	C26-12	[d]-	-	-	-	C26-15	83	99	105	77
Avg	94	87	80	74							87	102	104	74
						Rifle C27								
C27-7	97	87	77	73	C27-10	106	105	105	[b]99	C27-13	93	106	101	75
C27-8	99	80	87	72	C27-11	[d]-	-	-	-	C27-14	97	106	107	74
C27-9	89	81	76	79	C27-12	[d]-	-	-	-	C27-15	83	104	105	73
Avg	95	83	80	75							91	105	104	74

[a]Rounds No. 5 and 10 were tracers, 1 and 19 were ball cartridges.
[b]AN FBR occurred when the twentieth round fired; see text.
[d]The bolt closed on an empty chamber (FF/COEC) after the first round fired; see text.
[e]The bolt overrode the base (FF/BOB) of the third round; see text.

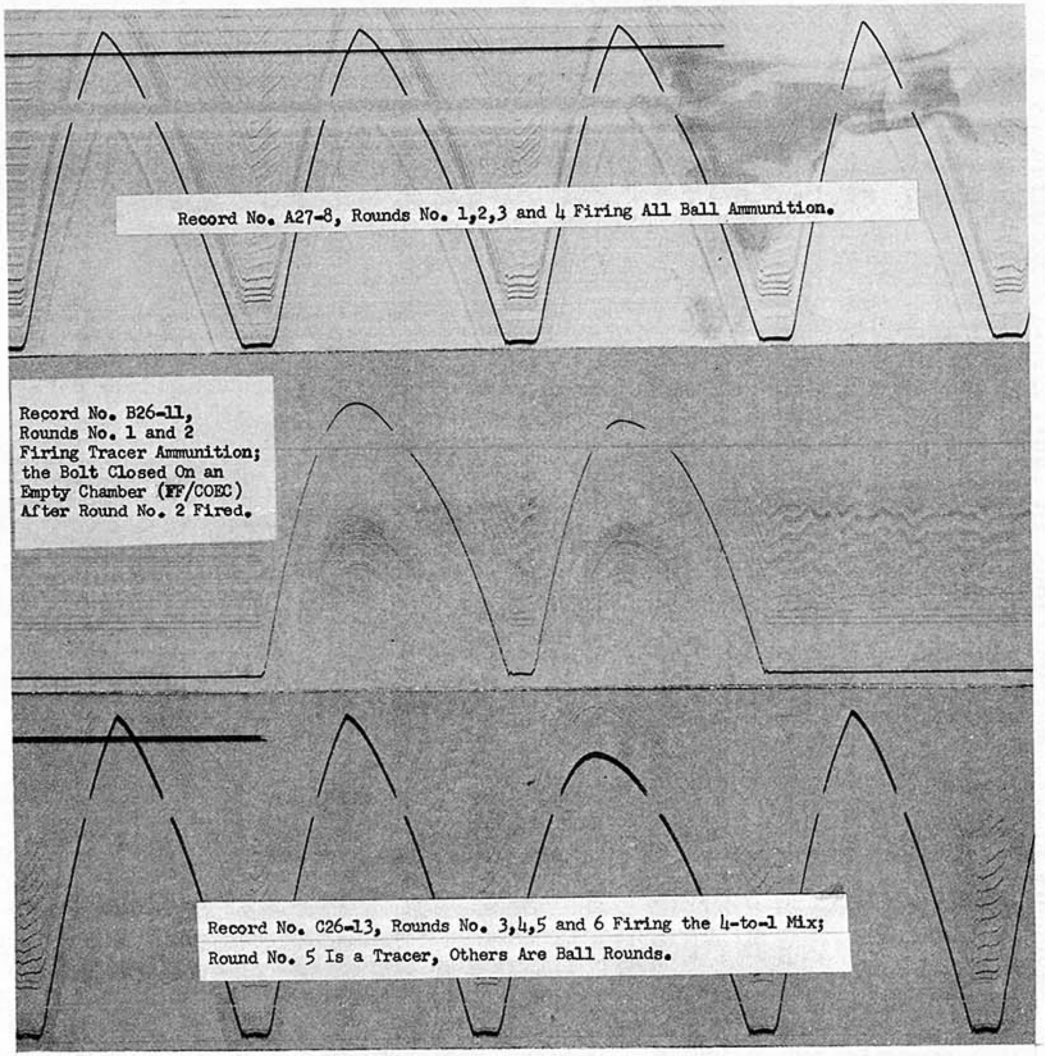


Figure 2.5-6: Displacement-Time Traces of Portions of Three Records Are Shown. Refer to Table 2.5-III and Appendix I for Measurements of These Particular Records. The Motion of the Buffer Is Shown in Each Instance.

During the firing of this exercise, 12 malfunctions occurred which are identified by footnote in Table 2.5-IV. Examination of the records of these twelve rounds indicated that bolt carrier travel was from 0.12 to 0.93 inch short of a full cycle. All of these malfunctions occurred while attempting to fire a 20-round continuous burst of tracer ammunition. This level of performance is typical of the M16A1 rifle when firing all M196 tracer ammunition loaded with IMR8208 propellant, and has been encountered and reported previously (Reference 16).

Seven of the 12 malfunctions in Table 2.5-IV occurred as a result of incomplete or short recoil on initially fired rounds and even when tracer rounds were preceded by ball rounds, as in the 4-to-1 mix firings, the cyclic level of subsequent tracers was often marginal. The data in Table 2.5-IV for the 4-to-1 firings show that tracer rounds No. 5 and 10 often exceeded 100 milliseconds in total cycle time, and times in excess of 100 milliseconds produce individual round cyclic rates in the 500 to 600 rounds per minute range. Furthermore, there should be little confidence that firing a 4-to-1 mix in a tactical situation would provide the reliability shown in this test for the mix firings reported in paragraph 2.4 and paragraph 2.9. All magazine complements in these tests were fired rapidly and rarely, if ever, was there an interruption which left a tracer to be subsequently fired in a "cool" rifle. However, there would certainly be many occasions in tactical usage when fire would be intentionally interrupted for several minutes and if a tracer round were to be fired as the next round this condition would be similar to the first-round, "cool" rifle results of the all-tracer firings in this subtest.

2.5.4.7 Buffer Characteristics. Both single shot and burst-fire records obtained in previously discussed exercises included traces of the buffer as well as the bolt carrier. These records were inspected and there appeared to be no separation of carrier and buffer throughout the firing cycles with the exception of a minor "bounce" separation on closure.

While the current standard buffer plays an important and complex role in cyclic-rate characteristics, the buffer assemblies in the displacement-time study rifles all appeared comparable and similar to buffers previously examined. However, measurements of elasticity, density, and recovery time of the polyurethane end cap on the buffer were not made (they were considered beyond the scope of this test) and these characteristics may require stringent specification in the future as the number of participating subcontractors for this item increases.

2.5.5 Summary

Differences in weapon performance, as observed in this subtest, are judged to be attributable to rifle-to-rifle variation rather than being endemic to a particular producer. However, the displacement-time records obtained in this test, in conjunction with the firing data in other subtests, show that certain current production specifications should be carefully reviewed if further optimization of the M16A1 rifle is to be achieved by all producers. Specifically, these areas of concern are as follows:

a. The option of employing bolt catches of two different configurations should be terminated without delay, retaining only the modified catch in production.

b. Bolt lug configuration must be held within current specifications and, if practicable, the specification tolerance reduced. The present permitted minimum chamfer or radius of 0.005 inch is considered marginal, if double-feed malfunctions are to be eliminated and the permitted maximum of 0.015 inch appears marginal with regard to the FBR malfunction. An alternative, but less desirable action, would be to abandon the chamfer or radius option in favor of the radius configuration only, in order to gain control of the double-feed malfunction even at the risk of increasing the liklihood of FBR's.

c. Further study of the bolt and bolt-catch configuration and of the magazine spring should be undertaken in an attempt to desensitize the apparently critical interface dimensional requirements of the bolt-catch, bolt, and magazine.

2.6 ENVIRONMENTAL TESTS

2.6.1 Objective

The objective was to determine the reliability and durability of the test weapons when fired in various adverse environments.

2.6.2 Criteria

The reliability and durability of the test weapons shall not be adversely affected to any significant degree when subjected to, and fired in, various adverse environments.

2.6.3 Method

Rifles are tested under conditions of high temperature (+155°F), high humidity, high humidity following salt-water immersion, dynamic dust, water spray, and in a normal ambient environment while in an unlubricated condition (low temperature tests were also conducted and are reported in par. 2.7).

2.6.3.1 Maintenance. All rifles are cleaned and lubricated in accordance with TM 9-1005-249-12 prior to testing. A set of rifles in new condition from each producer is employed in each environmental phase except that the same rifles are fired in the dynamic dust test and then in the water spray test.

2.6.3.2 Sample Size. The number of rifles from each producer tested under each condition is as follows:

a. High Temperature. Five rifles; three are fired with ball ammunition and two are fired with the 4-to-1 mixture of ball and tracer ammunition.

b. High Humidity. Three rifles, firing ball ammunition only.

c. High Humidity - Salt-Water Immersion. Five rifles, firing ball ammunition only.

d. Dynamic Dust. Three rifles, firing ball ammunition only.

e. Water Spray. The same three rifles are fired as are fired in the dynamic dust test.

f. Unlubricated. Three rifles, firing ball ammunition only.

2.6.3.3 Environmental Conditions. Testing under each condition was as follows:

a. High Temperature. The weapons and ammunition are initially conditioned at +155°F for a minimum of four hours and a 2-hour conditioning period is then observed between each 100-round cycle (fired as described in par. 2.4.3h) on each rifle during each firing day. The test is conducted on two firing days for each rifle, 500 rounds fired per day. Five magazines, numbered 1 through 5, are employed with each rifle. At the conclusion of high temperature testing, all rifle bolts are magnetic particle inspected for cracks.

b. High Humidity. The temperature and humidity schedule is in accordance with par. 3.3.1.c of Reference 17. Firing is conducted on four days, during a 10-day continuous environmental exposure, by firing 250 rounds per day on the third, fifth, eighth, and tenth days. Each weapon is permitted to return to the environmental temperature after firing 125 rounds before firing the final 125 rounds each day. The 125-round complement is fired as follows:

1) 20 rounds fired in short bursts.

2) 20 rounds fired in a continuous burst (cyclic rate measured).

3) 20 rounds fired semiautomatically.

4) 20 rounds fired in short bursts.

5) 20 rounds fired in a continuous burst.

6) 20 rounds fired semiautomatically.

7) 5 rounds fired semiautomatically.

c. High Humidity - Salt-Water Immersion. The environmental exposure time is ten days with high humidity conditions the same as in the high-humidity test except that loaded weapons are initially subjected to salt-water immersion and firing is attempted on the first, third, fifth, eighth, and tenth days in accordance with par. 3.3.5 of Reference 17. A sufficient number of loaded magazines to complete the test are also initially immersed in the salt-water solution. Sixty rounds of firing is attempted on each firing day with a loaded cartridge stored in the weapon chamber during the conditioning cycles.

c. Dynamic Dust. Each test weapon, with a fully loaded magazine inserted, and six additional magazines inclosed in plastic bags, is placed in a dynamic dust chamber. The 140-mesh silica flour dust used for this test is specified on page 510-1, par. 2.1 of MIL-STD-810B. Dust is introduced in the dust chamber through a pour hole located above and rearward of the test item at a rate of two pounds per minute and is circulated by a 12-inch blower operating at 60 rpm. The mode of fire for each of three 140-round trials (seven 20-round magazines) per rifle is a sequence of 20-round bursts, semi-automatic fire, and three to five round bursts with the first, fourth, and seventh cycles fired in 20-round bursts. The test is discontinued with any weapon that incurs a stoppage that is not readily clearable by immediate action during any of the three trials.

d. Water Spray. The rifles from the dynamic dust test are subjected to a water-spray test in accordance with par. 3.3.4 of Reference 17. (Note: Due to seasonal low temperatures at the time of this test, the water-spray test was conducted in a climatic chamber with air temperature maintained at +70°F ± 2°; the water temperature was 42° ± 1°.)

e. Unlubricated. The rifles were cleaned using bore cleaner (MIL-C-372B) and not lubricated before firing. It should be noted that this procedure does not leave the rifle in a "dry" condition as a preservative film is deposited on the cycling components when bore cleaner is used. Each rifle was fired 1000 rounds in 100-round cycles as specified in par. 2.4.3h.

2.6.4 Results

Test results are summarized in Tables 2.6-I through 2.6-XII.

Table 2.6-I. Summary of High Temperature (+155°F) Test

Rifle No.	Malfunction Type[a]	Round Count	Round No.[b]	Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	Remarks
A10	FBR	460	20	S/5	None	CH	
A11	FBR	500	20	S/7	None	CH	
A12	FF/BB	382	2	S/7	None	CH	The bolt failed to close completely on the third round. The round was bent and damaged and the damage appeared to have occurred during cycling after round No. 2 fired.
	FF/BB	664	4	B/6	None	CH	Same as at round No. 382.
	FBR	780	20	B/6	None	CH	
	FF/BB	965	5	B/6	None	CH	
A13	None				None		Fired with ball/tracer mix.
A14	None				None		Fired with ball/tracer mix.
Total	6				0		
B10	None				None		
B11	None				None		
B12	None				None		
B13	FF/BB	264	4	B/6	None	CH	Fired with ball/tracer mix.
B14	BDP				Bolt[e]	DSL	Fired with ball/tracer mix.
Total	1				1		
C10	None				None		
C11	None				None		
C12	None				None		
C13	None				None		Fired with ball/tracer mix.
C14	None				None		Fired with ball/tracer mix.
Total	0				0		

[a]As identified in par. 2.1.
[b]The round number is the round count within a 20-round magazine (see par. 2.1 for detailed explanation).
[c]Mode of Fire: B=Fired in short bursts; A=Fired in a continuous burst; S=Fired semiautomatically.
[d]As identified in par. 2.1.
[e]Magnaglow inspection after test revealed that the bolt was cracked at the cam pin hole.

Table 2.6-II. Cyclic Rates of Fire During High Temperature (+155°F) Test

Cycle No.[a]	A10	A11	A12	A13[b]	A14[b]	B10	B11	B12	B13[b]	B14[b]	C10	C11	C12	C13[b]	C14[b]
	Rifle No.														
1	875	891	881	822	877	906	847	889	883	873	871	869	889	849	827
2	930	924	940	845	906	944	895	944	915	944	904	906	926	883	887
3	937	919	917	853	921	949	895	947	935	910	906	900	921	912	893
4	949	926	933	867	904	961	910	949	930	919	900	887	919	919	889
5	951	928	942	838	915	968	908	954	908	897	910	915	889	926	873
6	933	926	949	844	924	964	904	949	915	910	924	926	915	924	902
7	944	926	930	867	910	951	891	933	919	910	912	928	910	902	887
8	942	919	926	829	902	943	881	930	908	917	910	921	883	900	873
9	942	904	919	844	919	930	865	935	904	935	900	893	861	859	871
10	933	902	919	829	904	964	889	904	895	904	906	908	853	873	861
Average	934	916	926	844	908	948	888	933	911	912	904	905	897	895	876

[a]Each cycle was composed of 100 rounds of firing as follows: 20 rounds in short bursts; 20 rounds in a continuous burst (cyclic rate measured); 20 rounds semiautomatic; 20 rounds in short bursts and 20 rounds semiautomatic.

[b]Fired with ball-tracer mix.

Table 2.6-III. Summary of High-Humidity Test

Rifle No.	Malfunction Type[a]	Round Count	Round No.[b]	Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	Remarks
A15	FF/BOB	210	5	A/11	None	CH/M	
	FF/BOB	227	2	S/12	None	CH/M	
	FF/BB	228	3	S/12	None	CH	
	FJ	467	17	S/9	None	CH	
	FBR	560	20	S/3	None	CH	
	FBR	620	20	S/6	None	CH	
	FBR	850	20	A/5	None	CH	
A16	FF/BB	103	3	S/6	None	CH	
A17	FF/BOB	104	4	S/6	None	CH/M	
	FF/BB	206	1	A/11	None	BA	
	FF/BOB	208	3	A/11	None	CH/M	
	FF/BB	313	3	B/4	None	BA	
	FF/BOB	353	3	S/6	None	CH/M	
	FF/BB	897	2	A/8	None	CH	The round was damaged and the damage appeared to have occurred during cycling after round No. 2 fired.
	FF/BB	937	2	B/10	None	CH	Same as round No. 897.
Total	15				0		
B15	FBR	270	20	B/1	None	CH	
	FBR	620	20	S/6	None	CH	
	FF-1	876	1	B/7	None	BA	
B16	None				None		
B17	FBR	475	20	A/11	None	CH	

[a] As identified in par. 2.1.
[b] The round number is the round count within a 20-round magazine (see par. 2.1 for detailed explanation).
[c] Mode of Fire: B = Fired in short bursts; A = Fired in a continuous burst; S = Fired semiautomatically.
[d] As identified in par. 2.1.

Table 2.6-III (Cont'd)

Rifle No.	Malfunction Type[a]	Round Count	Round No.[b]	Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	Remarks
	BDP	476			See remark	DSL	The bolt carrier key was loose due to improper staking of the carrier key screws and repeated malfunctions occurred. See par. 2.2.5a. The screws were properly staked and testing resumed.
Total	4				1		
C15	None				None		
C16	None				None		
C17	FF/DF	58	18	S/3	None	CH/M	
	FF/DF	515	15	B/1	None	CH/M	
	FF/DF	558	18	S/3	None	CH/M	
Total	3				0		

[a]As identified in par. 2.1.
[b]The round number is the round count within a 20-round magazine (see par. 2.1 for detailed explanation).
[c]Mode of Fire: B = Fired in short bursts; A = Fired in a continuous burst; S = Fired semiautomatically.
[d]As identified in par. 2.1.

Table 2.6-IV. Cyclic Rates of Fire During Humidity Test

Firing Day	Rifle No. A15	A16	A17	B15	B16	B17	C15	C16	C17
1	883	867	873	867	893	861	853	815	834
2	889	900	928	879	875	881	875	859	879
3	891	912	926	933	908	949	877	863	887
4	908	900	926	908	873	926	855	836	863
Average	893	895	913	897	887	904	865	843	866

Table 2.6-V. Summary of Salt-Water Immersion Test

Rifle No.	Cycle No.[a]	Malfunction Type[b]	Round Count	Rd No.[c]	Mode of Fire[d]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[e]	Remarks
C9	First	None				None		
	Second	FX	61	1	B/4	None	FXT	
		FF-1	81	1	A/5	None	BA	
		FF/BB	105	5	S/6	None	BA	
		FF-1	121	1	f /7	None	BA	
	Third							Repeated failures of the bolt carrier to fully close occurred and the test was terminated. In many instances the bolt carrier could not be closed even with extreme force applied to the bolt assist (BA) device. Severe corrosion on the cartridges (Figure 2.6-1) was primarily responsible for the difficulties encountered. Even when an occasional round was fired the cartridge follower in the magazine was too corroded to elevate the next round.
C19	First	None				None		
	Second	FX	61	1	B/4	None	FXT	
		FF-1	81	1	A/5	None	BA	
		FF-1	101	1	S/6	None	BA	
		FF/BB	105	5	S/6	None	BA	
		FF-1	121	1	f /7	None	BA	
	Third							Same as third cycle above.

See footnotes on page 101.

Table 2.6-V (Cont'd)

Rifle No.	Cycle No.[a]	Malfunction Type[b]	Round Count	Rd No.[c]	Mode of Fire[d]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[e]	Remarks
C20	First	None				None		
	Second	FF/BB	61	1	B/4	None	BA	
		FF-1	81	1	A/5	None	BA	
		FF-1	101	1	S/6	None	BA	
		FTR			S/6	None		The trigger repeatedly stuck to the rear and had to be manually repositioned.
	Third							Same as third cycle on previous rifles.
C21	First	None				None		
	Second	FF/BB	71	1	B/4	None	BA	
		FF-1	81	1	A/5	None	BA	
		FF/BB	96	16	A/5	None	BA	
		FF/BB	99	19	A/5	None	BA	
		FF/BB			S/6			Repeated failures of the carrier to close were encountered and could not be overcome with the BA device.
	Third							Same as third cycle on previous rifles.
C22	First	None				None		
	Second	FF-1	101	1	S/6	None	BA	
		FF/BB	102	2	S/6	None	BA	
		FF/BB	104	4	S/6	None	BA	
		FF/BB	106	6	S/6	None	CH/M	
		FF/BB	108	8	S/6	None	CH/M	
		FTR			S/6	None		The trigger repeatedly stuck to the rear and had to be manually repositioned.

See footnotes on page 101.

Table 2.6-V (Cont'd)

Rifle No.	Cycle No.[a]	Malfunction Type[b]	Round Count	Rd No.[c]	Mode of Fire[d]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[e]	Remarks
	Third							Same as third cycle on previous rifles.
B18	First	None				None		
	Second	FF-1	101	1	S/6	None	BA	
		FF/BB	110	10	S/6	None	BA	
		FF/BB	112	12	S/6	None	BA	
		FF/BB	116	16	S/6	None	BA	
		FF-1	121	1	f /7	None	BA	
	Third							Same as third cycle on Code C rifles.
B19	First	None				None		
	Second	FF-1	81	1	A/5	None	BA	
		FF-1	121	1	f /7	None	BA	
	Third							Same as third cycle on Code C rifles.
B20	First	None				None		
	Second	FF/BB	61	1	B/4	None	BA	
		FTR			S/6	None		Same as FTR for C-22.
	Third							Same as third cycle on Code C rifles.
B22	First	None				None		
	Second	FF/BB	118	18	S/6	None	BA	
	Third							Same as third cycle on Code C rifles.
B28	First	None				None		
	Second	FX	61	1	B/4	None	FXT	
		FTR				None		Same as FTR for C22.
	Third							Same as third cycle on Code C rifles.

See footnotes on page 101.

Table 2.6-V (Cont'd)

Rifle No.	Cycle No.[a]	Malfunction Type[b]	Round Count	Rd No.[c]	Mode of Fire[d]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[e]	Remarks
A18	First	None				None		An additional 20 rounds were fired in this cycle through error; total, 80 rounds.
	Second	FF/BB	101	1	A/5	None	BA	
		FF-1	121	1	S/6	None	BA	
		FTR	122	2	S/6	None		Manually repositioned.
		FF-1	141	1	[f] /7	None	BA	
	Third							Same as third cycle on Codes B and C rifles.
A19	First	None				None		
	Second	FF-1	81	1	A/5	None	BA	
		FTR	102	2	S/6	None		Manually repositioned.
		FTR	103	3	S/6	None		Manually repositioned.
		FF/BB	104	4	S/6	None	BA	
		FF-1	121	1	[f] /7	None	BA	
	Third							Same as third cycle on Codes B and C rifles.
A20	First	FF-1	1	1	B/1	None	BA	
	Second	FF-1	101	1	A/5	None	BA	
		FTR			S/6	None		Same as FTR for C22.
		FF-1	121	1	[f] /7	None	BA	
	Third							Same as third cycle on Codes B and C rifles.
A21	First	None				None		
	Second	FX	61	1	B/4	None	[g] -	
		FF-1	81	1	A/5	None	BA	
		FF-1	101	1	S/6	None	BA	
		FFR	106	6	S/6	None	CH	

See footnotes on page 101.

Table 2.6-V (Cont'd)

Rifle No.	Cycle No.[a]	Malfunction Type[b]	Round Count	Rd No.[c]	Mode of Fire[d]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[e]	Remarks
	Third							Same as third cycle on Codes B and C rifles.
A22	First	FTR	35	15	S/3	None		Manually repositioned.
		FTR	38	18	S/3	None		Manually repositioned.
	Second	FX	61	1	B/4	None	FXT	
		FF-1	81	1	A/5	None	BA	
		FF/BB	90	10	A/5	None	BA	
		FF-1	101	1	S/6	None	BA	
		FF/BB	105	5	S/6	None	BA	In addition to the noted malfunctions, repeated instances occurred of the bolt carrier remaining rearward after firing a round.
	Third							Same as third cycle on Codes B and C rifles.

[a]Five 60-round firing cycles were to be attempted; one each on the 1st, 3rd, 5th, 8th, and 10th days of the test.
[b]As identified in par. 2.1.
[c]The round number is the round count within a 20-round magazine (see par. 2.1 for detailed explanation).
[d]Mode of Fire: B = Fired in short bursts; A = Fired in a continuous burst; S = Fired semiautomatically.
[e]As identified in par. 2.1.
[f]Occurred on the attempt to load the rifle for storage prior to the third cycle.
[g]The tool intended to aid in FX removal was not successful in clearing and a cleaning rod was used.

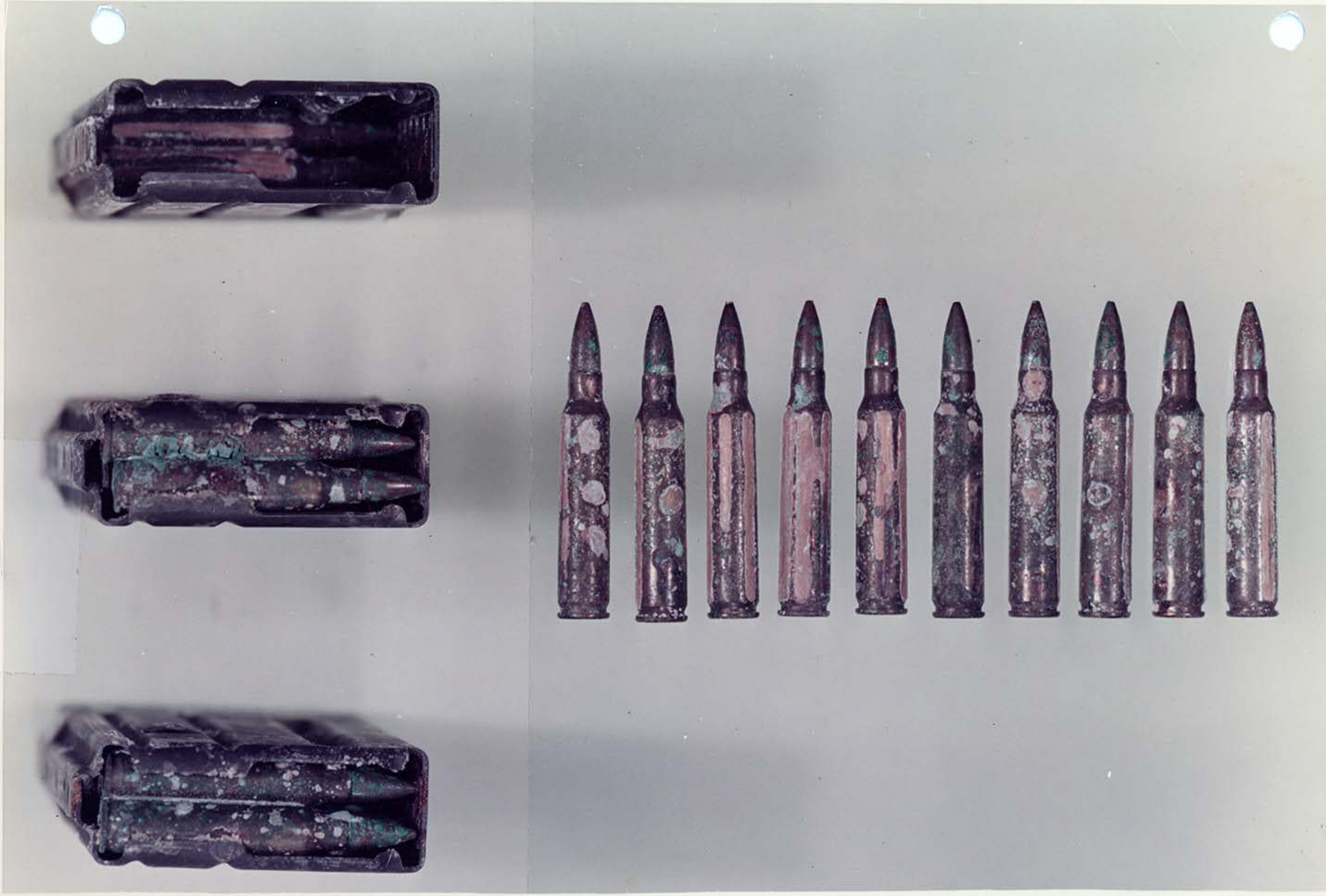


Figure 2.6-1. At Left Are Top Views of Three Loaded Magazines with Sample Cartridges at Right. The Corrosion Is the Result of Four Days of Storage Following Salt Water Immersion. Note that Cartridges Have Been Removed From the Magazine at Upper Left But the Cartridge Follower Has Remained Depressed.

Table 2.6-VI. Cyclic Rates of Fire
During Salt-Water Immersion Test

Legend: NR = Not recorded.

Firing Day	Rifle No. A18	A19	A20	A21	A22	B18	B19	B20	B22	B28	C9	C19	C20	C21	C22
1	808	822	840	844	786	808	859	863	808	863	808	791	775	811	772
2	775	775	847	851	NR	772	827	834	791	840	747	756	746	728	730

Table 2.6-VII. Summary of Dynamic Dust Test

Rifle No.	Cycle No.[a]	Malfunction Type[b]	Round Count	Round No.[c]	Mode of Fire[d]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[e]	Remarks
A1	First	FF-1	41	1	B/3	None	BA	
		FF-1	61	1	A/4	None	BA	
		FF-1	101	1	B/6	None	BA	
		FF-1	121	1	A/7	None	BA	
	Second	FF-1	161	1	S/2	None	BA	
		FF-1	181	1	B/3	None	BA	
		FF-1	201	1	A/4	None	BA	
		FF-1	221	1	S/5	None	BA	
		FF-1	241	1	B/6	None	BA	
		FF-1	261	1	A/7	None	BA	
	Third	FF-1	361	1	S/5	None	BA	
		FF-1	401	1	A/7	None	BA	
A2	First	FF-1	21	1	S/2	None	BA	
		FF-1	121	1	A/7	None	BA	
	Second	None				None		
	Third	FF-1	361	1	S/5	None	CH	On two occasions the bolt failed to move forward when the bolt release was depressed.
		FF-1	401	1	A/7	None	CH	

[a] Five 140-round firing cycles were attempted with each rifle.
[b] As identified in par. 2.1.
[c] The round number is the round count within a 20-round magazine (see par. 2.1 for detailed explanation).
[d] Mode of fire: B = Fired in short bursts; A = Fired in a continuous burst; S = Fired semiautomatically.
[e] As identified in par. 2.1.

Table 2.6-VII (Cont'd)

Rifle No.	Cycle No.[a]	Malfunction Type[b]	Round Count	Round No.[c]	Mode of Fire[d]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[e]	Remarks
A3	First	FF-1	41	1	B/3	None	BA	
		FF-1	61	1	A/4	None	BA	
		FF-1	81	1	S/5	None	BA	
		FTR		Not recorded	S/5	None	Manually reposi- tioned	
		FF-1	101	1	B/6	None	BA	
		FF-1	121	1	A/7	None	BA	
	Second	FF-1	161	1	S/2	None	BA	
		FF-1	201	1	A/4	None	BA	
		FF-1	221	1	S/5	None	BA	
		FF-1	241	1	B/6	None	BA	
		FF-1	261	1	A/7	None	BA	
	Third	FF-1	301	1	S/2	None	BA	
		FF-1	321	1	B/3	None	BA	
		FF-1	341	1	A/4	None	BA	
		FF-1	361	1	S/5	None	BA	
		FF-1	381	1	B/6	None	BA	
		FF-1	401	1	A/7	None	BA	
Total		33				None		

[a]Five 140-round firing cycles were attempted with each rifle.
[b]As identified in par. 2.1.
[c]The round number is the round count within a 20-round magazine (see par. 2.1 for detailed explanation).
[d]Mode of fire: B = Fired in short bursts; A = Fired in a continuous burst; S = Fired semiautomatically.
[e]As identified in par. 2.1.

Table 2.6-VII (Cont'd)

Rifle No.	Cycle No.[a]	Malfunction Type[b]	Round Count	Round No.[c]	Mode of Fire[d]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[e]	Remarks
B1	First	FF-1	61	1	A/4	None	BA	
		FF-1	121	1	A/7	None	BA	
	Second	FF-1	161	1	S/2	None	BA	
		FF-1	181	1	B/3	None	BA	
		FF-1	201	1	A/4	None	BA	
		FF-1	221	1	S/5	None	BA	
		FF-1	241	1	B/6	None	BA	
		FF-1	261	1	A/7	None	BA	
		FF/BB	276	16	A/7	None	Not recorded	
	Third							The third cycle was suspended when repeated failures of the bolt carrier to fully close occurred. Successful firing could not be resumed.
B2	First	FF-1	81	1	S/5	None	BA	
		FF/BB	97	17	S/5	None	CH	
		FF-1	101	1	B/6	None	BA	
	Second	FF-1	201	1	B/3	None	BA	
		FF-1	241	1	B/6	None	BA/CH	
	Third	FF-1	329	1	A/4	None	BA	
		FBR	368	20	S/5	None	CH	
		FF-1	389	1	A/7	None	BA	
		FBR	398	20	A/7	None	CH	

[a] Five 140-round firing cycles were attempted with each rifle.
[b] As identified in par. 2.1.
[c] The round number is the round count within a 20-round magazine (see par. 2.1 for detailed explanation).
[d] Mode of fire: B = Fired in short bursts; A = Fired in a continuous burst; S = Fired semiautomatically.
[e] As identified in par. 2.1.

Table 2.6-VII (Cont'd)

Rifle No.	Cycle No.[a]	Malfunction Type[b]	Round Count	Round No.[c]	Mode of Fire[d]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[e]	Remarks
B3	First	FF/DF	37	17	S/2	None	CH	
		FF/BB	38	18	S/2	None	BA	
		FF/BB	39	19	S/2	None	BA	
		FF/DF	95	16	S/5	None	CH/M	
		FF/BB	98	2	B/6	None	BA	
		FF-1	116	1	A/7	None	BA	
	Second	FF-1	137	1	A/1	None	BA	
		FF-1	157	1	S/2	None	BA	
		FF/DF	174	17	S/2	None	CH	
		FF-1	176	1	B/3	None	BA	
		FF-1	196	1	A/4	None	BA	
		FF/BB	213	17	A/4	None	CH	
		FF-1	215	1	S/5	None	BA	
		FF-1	235	1	B/6	None	BA	
		FF-1	255	1	A/7	None	BA	
	Third	FF-1	295	1	S/2	None	CH	
		FF/BB	296	2	S/2	None	CH/BA	
		FF/BB	297	3	S/2	None	CH/BA	
		FF/BB	298	4	S/2	None	CH/BA	Test was terminated after last malfunction as it was not possible to close the bolt using the bolt assist (BA) device.
Total		37				None		

[a]Five 140-round firing cycles were attempted with each rifle.
[b]As identified in par. 2.1.
[c]The round number is the round count within a 20-round magazine (see par. 2.1 for detailed explanation).
[d]Mode of fire: B = Fired in short bursts; A = Fired in a continuous burst; S = Fired semiautomatically.
[e]As identified in par. 2.1.

Table 2.6-VII (Cont'd)

Rifle No.	Cycle No.[a]	Malfunction Type[b]	Round Count	Round No.[c]	Mode of Fire[d]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[e]	Remarks
C1	First	None				None		
	Second	FF-1	201	1	A/4	None	BA	
		FF-1	221	1	S/5	None	BA	
	Third	FF-1	301	1	S/2	None	BA	
		FF-1	321	1	B/3	None	BA	
		FF-1	341	1	A/4	None	BA	
		FF-1	361	1	S/5	None	BA	
		FF-1	381	1	B/6	None	BA	
		FF-1	401	1	A/7	None	CH	
C2	First	FF-1	121	1	A/7	None	BA	
	Second	FF-1	181	1	B/3	None	BA	
		FF-1	201	1	A/4	None	BA	
		FF-1	221	1	S/5	None	BA	
		FF-1	261	1	A/7	None	BA	
	Third	FF-1	321	1	B/3	None	BA	
		FF-1	341	1	A/4	None	BA	
		FF/BB	342	2	A/4	None	CH	
		FF-1	361	1	S/5	None	BA	
		FF-1	381	1	B/6	None	BA	
		FF-1	401	1	A/7	None	CH	
		FF/BB	402	2	A/7	None	BA	
		FF/BB	403	3	A/7	None	CH	
C3	First	None				None		
	Second	FF-1	241	1	B/6	None	BA	
		FF-1	261	1	A/7	None	BA	
	Third	FF/BB	342	2	A/4	None	BA	
Total		24				None		

[a] Five 140-round firing cycles were attempted with each rifle.
[b] As identified in par. 2.1.
[c] The round number is the round count within a 20-round magazine (see par. 2.1 for detailed explanation).
[d] Mode of fire: B = Fired in short bursts; A = Fired in a continuous burst; S = Fired semiautomatically.
[e] As identified in par. 2.1.

Table 2.6-VIII. Cyclic Rates of Fire During Dynamic Dust Test

Cycle No.[a]	Rifle No. A1	A2	A3	B1	B2	B3	C1	C2	C3
First	772	804	840	791	827	842	796	778	799
	719	NR	804	NR	804	761	773	765	796
	791	825	811	NR	823	829	740	NR	825
Second	NR	772	783	723	781	762	704	726	744
	NR	794	761	755	NR	NR	762	765	724
	NR	761	791	741	809	783	784	804	773
Third	747	761	NR	NF	786	727	NR	747	724
	775	808	NR	-	778	NF	726	NR	NR
	776	NR	NR	-	820	-	752	NR	762

[a]Three cycles of 140 rounds each were attempted with each rifle and cyclic rates were measured at 1-20, 61-80 and 121-140 rounds in each cycle.

NR = Not recorded.
NF = This cycle was not completed.

Table 2.6-IX. Summary of Water-Spray Test

Rifle No.	Cycle No.[a]	Malfunction Type[b]	Round Count	Rd No.[c]	Mode of Fire[d]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[e]
A1		None				None	
A2		None				None	
A3	Third	FF-1	201	1	B/1	None	BA
Total		1				None	
B1		None				None	
B2		None				None	
B3		None				None	
Total		None				None	
C1		None				None	
C2	Third	FF-1	201	1	B/1	None	BA
	Fourth	FF-1	301	1	B/1	None	BA
C3	Third	FF-1	201	1	B/1	None	BA
	Fourth	FF-1	301	1	B/1	None	BA
Total		4				None	

[a]Six 100-round cycles are fired as specified in par. 3.3.4 of Reference 17.
[b]As identified in par. 2.1.
[c]The round number is the round count within a 20-round magazine (see par. 2.1 for detailed explanation).
[d]Mode of Fire: B = Fired in short bursts; A = Fired in a continuous burst; S = Fired semiautomatically.
[e]As identified in par. 2.1.

Table 2.6-X. Cyclic Rates of Fire During Water-Spray Test

Cycle No.[a]	Rifle No. A1	A2	A3	B1	B2	B3	C1	C2	C3
1	799	832	885	873	877	887	778	897	844
2	770	791	825	849	825	851	715	794	726
3	778	770	794	840	831	840	703	767	706
4	786	767	783	842	840	827	712	772	690
5	781	759	778	829	827	857	706	773	691
6	775	783	781	834	842	844	716	768	710

[a]Six 100-round cycles were fired with each rifle; the cyclic rate of fire was measured once in each cycle after 20 rounds had first been fired in short bursts.

Table 2.6-XI. Summary of Unlubricated Test.

Legend: NR = Not recorded.

Rifle No.	Malfunction Type[a]	Round Count	Rd No.[b]	Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	Remarks
A23	None				None		
A24	FBR	100	20	S/7	None	CH	
	FBR	120	20	B/3	None	CH	
	FF-1	601	1	B/6	None	NR	
	FF-1	701	1	B/3	None	BA	
	FF-1	861	1	B/6	None	f_	
	FF-1	881	1	S/7	None	BA	
A25	BDP	1000			Extractor Spring		The extractor spring was broken, top coil split, at test conclusion.
Total	6				1		
B9	FF/DF	216	16	B/3	None	CH/M	
	FF-1	281	1	S/7	None	NR	
	FF/DF	555	15	S/5	None	CH/M	
	FF/DF	570	15	B/6	None	CH/M	
	FF/DF	737	17	A/4	None	CH/M	
	FF-1	781	1	S/7	None	f_	
B24	FF/DF	175	15	B/6	None	CH/M	
	FBR	580	20	B/6	None	CH	
	FF-1	661	1	B/6	None	g_	
	FF/DF	777	17	B/6	None	CH/M	
	FF/DF	836	16	A/4	None	CH/M	
	FF/DF	936	16	A/4	None	CH/M	
B25	None				None		
Total	12				None		

See footnotes on next page.

Table 2.6-XI (Cont'd)

Legend: NR = Not recorded.

Rifle No.	Malfunction Type[a]	Round Count	Rd No.[b]	Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	Remarks
C24	FF-1	21	1	A/4	None	f–	
	FF/DF	58	18	S/5	None	CH/M	
	FF-1	101	1	B/3	None	f–	
	FF/DF	158	18	S/5	None	CH/M	
	FF-1	301	1	B/3	None	f–	
	FF-1	801	1	B/3	None	NR	
	FF/DF	958	18	S/5	None	CH/M	
C25	None				None		
Total	7				None		

[a]As identified in par. 2.1.
[b]The round number is the round count within a 20-round magazine (see par. 2.1 for detailed explanation).
[c]Mode of Fire: B=Fired in short bursts; A=Fired in a continuous burst; S=Fired semiautomatically.
[d]As identified in par. 2.1.
[e]Only two Code C rifles were tested; parts from C23 were employed in C34 and replacement parts for C23 were not received in time to permit testing of C23.
[f]Bolt moved forward and fed the round when rifle was accidentally bumped.
[g]Bolt moved forward successfully when magazine was touched.

Table 2.6-XII. Cyclic Rates of Fire
During Unlubricated Test

Cycle No.[a]	Rifle No. A23	A24	A25	B9	B24	B29	C24	C25
1	747	792	792	NR[b]	811	829	759	776
2	788	844	768	840	844	875	781	822
3	823	844	789	834	867	879	804	863
4	808	863	791	844	859	879	791	809
5	809	859	791	842	881	873	776	808
6	827	827	794	829	825	895	772	825
7	840	863	808	859	863	879	789	831
8	842	836	818	838	863	879	799	844
9	818	853	804	853	879	861	845	853
10	806	879	808	823	844	842	806	791

[a]Ten 100-round cycles were fired with each rifle and the cyclic rate of fire was measured once in each cycle after 20 rounds had first been fired in short bursts.
[b]NR = Not recorded.

2.6.5 Analysis

The performance results of the adverse conditions tests are summarized by test environment for each contractor in Table 2.6-XIII. The tabulation does not include broken parts, occasional failures of the trigger to return (FTR), nor 1 failure to fire (FFR). In addition, the salt-water immersion test data are summarized only to the point where grossly repetitive malfunctions occurred (through the conclusion of the second firing cycle for all rifles except A22 and C21).

Table 2.6-XIII. Summary of Adverse Conditions Tests (Not Including Low Temperature)

Rifle Code	FBR	FF/BB	FF/BOB	FF/DF	FF-1	FJ	FX	Total	No. of Rifles Tested	Rounds Fired
High Temperature (+155°F)										
A	3	3	0	0	0	0	0	6	5	5000
B	0	1	0	0	0	0	0	1	5	5000
C	0	0	0	0	0	0	0	0	5	5000
Total	3	4	0	0	0	0	0	7	15	15000
High Humidity										
A	3	6	5	0	0	1	0	15	3	3000
B	3	0	0	0	1	0	0	4	3	3000
C	0	0	0	3	0	0	0	3	3	3000
Total	6	6	5	3	1	1	0	22	9	9000
Salt Water Immersion										
A	0	4	0	0	10	0	2	16	5	600
B	0	5	0	0	4	0	1	10	5	600
C	0	11	0	0	9	0	2	22	5	600
Total	0	20	0	0	23	0	5	48	15	1800
Dynamic Dust										
A	0	0	0	0	32	0	0	32	3	1260
B	2	9	0	3	23	0	0	37	3	1260
C	0	4	0	0	20	0	0	24	3	1260
Total	2	13	0	3	75	0	0	93	9	3780
Water Spray										
A	0	0	0	0	1	0	0	1	3	1800
B	0	0	0	0	0	0	0	0	3	1800
C	0	0	0	0	4	0	0	4	3	1800
Total	0	0	0	0	5	0	0	5	9	5400

Table 2.6-XIII (Cont'd)

Rifle Code	FBR	FF/BB	FF/BOB	FF/DF	FF-1	FJ	FX	Total	No. of Rifles Tested	Rounds Fired
					Unlubricated					
A	2	0	0	0	4	0	0	6	3	3000
B	1	0	0	8	3	0	0	12	3	3000
C	0	0	0	3	4	0	0	7	2	2000
Total	3	0	0	11	11	0	0	25	8	8000
					Grand Total					
A	8	13	5	0	47	1	2	76	22	14660
B	6	15	0	11	31	0	1	64	22	14660
C	0	15	0	6	37	0	2	60	21	13660
Total	14	43	5	17	115	1	5	200	65	42980

As the various adverse conditions tests are not usually expected to detect minor or subtle differences in weapon performance; it will require considerable additional experience in these test environments to determine if a meaningful advantage or disadvantage can be ascribed to an individual producer. It is the opinion of the test agency that over-all performance was comparable among contractors in these exercises and that considering the severity of the environments, particularly salt-water immersion and dynamic dust, that the over-all malfunction rate of 5 per 1000 rounds fired (based on the data in Table 2.6-XIII) is not a significant degradation in weapon reliability.

2.7 LOW TEMPERATURE (-65°F)

2.7.1 Objective

The objective was to determine the reliability and durability of the test weapons when fired in a low temperature environment.

2.7.2 Criteria

The reliability and durability of the test weapons shall not be adversely affected to any significant degree when subjected to, and fired in, various adverse environments.

2.7.3 Method

Six rifles from each producer are fired a total of 3000 rounds in a -65°F climatic chamber observing the following procedures:

a. Rifles A4 through A7, B4 through B7, and C4 through C7 are fired with ball ammunition only; rifles A8 and A9, B8 and B9, and C12 and C35 are fired with the 4-to-1 ball and tracer mix.

b. All rifles are removed from the climatic chamber after each 1000 rounds of firing and maintained per TM9-1005-249-12.

c. A minimum conditioning period of six hours is observed prior to initiation of each 1000-round exercise and each 1000 rounds is divided into 100-round cycles with a 2-hour conditioning period between cycles.

d. During the first 1000 rounds of firing, rifles are conditioned between 100-round cycles with the bolt closed on an empty chamber; during the second 1000 rounds with the bolt closed and with a live round in the chamber; and during the third 1000 rounds with the bolt held to the rear by the bolt catch.

e. Each 100-round cycle is fired in the manner described in par. 2.4.3h.

f. Five magazines are employed throughout the test with each rifle.

2.7.4 Results

Due to the nature and the persistence of certain types of malfunctions in this test and because of the difficulty encountered in many instances in overcoming malfunctions, it is suggested that the round-by-round data contained in Appendix I be reviewed in conjunction with the summary tables presented in this paragraph.

It should also be noted that no broken or damaged parts are listed in the tables as the only reported parts failures (other than those detected by magnaglow inspection and discussed in par. 2.7.4.1) were a number of broken butt stocks which are identified in the round-by-round data. In addition, there were 92 occasions when the bolt was found to be frozen in the forward position and 41 occasions when the bolt was found to be frozen rearward (all identified in the round-by-round data) and these failures are not included in the summary tables of firing malfunctions. In the majority of instances, these problems were encountered during attempts to initiate firing following a 2-hour conditioning period, and these attempts to free the bolt resulted in the damaged and broken rifle butt stocks previously mentioned.

Low-temperature data are summarized in Tables 2.7-I through 2.7-III.

Table 2.7-I. Summary of Low Temperature (-65°F) Test Data

Round Count	FF-1[a]	FF/BB[b]	FF/BOB	FF/DF	FFR	FJ	FX	FBR	FTR	BEC	Total
Rifle A4											
1 to 1000	9	9	5	0	4	1	0	4	0	0 -16	32
1001 to 2000	2	33	0	1	9	20	0	1	0	2	68
2001 to 3000	16	4	0	0	4	0	0	2	0	0	26
Total	27	46	5	1	17	21	0	7	0	2	126
Rifle A5											
1 to 1000	11	11	3	0	1	1	0	0	0	0	27
1001 to 2000	2	44	3	1	7	5	1	0	11	0	74
2001 to 3000	13	0	0	0	4	0	0	0	2	0	19
Total	26	55	6	1	12	6	1	0	13	0	120
Rifle A6											
1 to 1000	7	4	0	0	3	0	0	1	1	0	16
1001 to 2000	0	3	0	0	6	1	0	0	0	5	15
2001 to 3000	6	3	0	0	4	0	0	0	0	5	18
Total	13	10	0	0	13	1	0	1	1	10	49
Rifle A7											
1 to 1000	12	24	6	0	3	0	0	3	1	0	49
1001 to 2000	2	35	2	1	7	4	0	1	2	0	54
2001 to 3000	12	4	0	0	0	0	1	0	0	0	17
Total	26	63	8	1	10	4	1	4	3	0	120
Rifle A8											
1 to 1000	9	4	0	0	9	0	0	1	0	0 -10	23
1001 to 2000	0	6	0	0	7	1	0	2	0	0	16
2001 to 3000	13	0	0	0	11	0	0	2	0	18	44
Total	22	10	0	0	27	1	0	5	0	18	83

[a] The FF-1 category includes all failures-to-feed which involved the first round in the magazine; the round-by-round data in Appendix I further subdivides these failures. Note in the 1001- to 2000-round intervals that the FF-1 malfunction can only occur on the final four magazines of each 100-round cycle as the rifles are conditioned between cycles with the bolt closed on the first round of the first magazine during this interval.

[b] The FF/BB category includes all failures-to-feed after firing the first round in the magazine and with the bolt behind the base of the round; the round-by-round data in Appendix I further subdivides these failures.

Table 2.7-I (Cont'd)

Round Count	FF-1[a]	FF/BB[b]	FF/BOB	FF/DF	FFR	FJ	FX	FBR	FTR	BEC	Total
Rifle A9											
1 to 1000	7	3	0	0	4	0	0	5	0	5 -13-	24
1001 to 2000	2	1	0	0	6	0	1	6	0	3	19
2001 to 3000	15	1	0	0	3	0	0	3	0	0	22
Total	24	5	0	0	13	0	1	14	0	8	65
All Code A Rifles											
1 to 1000	55	55	14	0	24	2	0	14	2	5	171
1001 to 2000	8	122	5	3	42	31	2	10	13	10	246
2001 to 3000	75	12	0	0	26	0	1	7	2	23	146
Total	c138	189	19	3	92	33	3	31	17	38	563
Rifle B4											
1 to 1000	9	21	0	0	2	0	0	0	12	0 -15-	44
1001 to 2000	2	24	1	0	3	3	0	1	30	0	64
2001 to 3000	10	6	0	3	1	0	0	0	3	0	23
Total	21	51	1	3	6	3	0	1	45	0	131
Rifle B5											
1 to 1000	6	2	0	0	1	0	0	0	1	0 -20	10
1001 to 2000	0	5	0	0	0	1	0	2	1	0	9
2001 to 3000	12	1	0	1	4	0	0	0	0	0	18
Total	18	8	0	1	5	1	0	2	2	0	37
Rifle B6											
1 to 1000	12	12	0	1	2	0	0	0	0	0 -13	27
1001 to 2000	0	12	1	1	3	2	0	0	13	0	32
2001 to 3000	14	1	0	5	3	0	0	0	1	0	24
Total	26	25	1	7	8	2	0	0	14	0	83

[a] The FF-1 category includes all failures-to-feed which involved the first round in the magazine; the round-by-round data in Appendix I further subdivides these failures. Note in the 1001- to 2000-round intervals that the FF-1 malfunction can only occur on the final four magazines of each 100-round cycle as the rifles are conditioned between cycles with the bolt closed on the first round of the first magazine during this interval.

[b] The FF/BB category includes all failures-to-feed after firing the first round in the magazine and with the bolt behind the base of the round; the round-by-round data in Appendix I further subdivides these failures.

[c] Not included are 57 instances where the bolt was either frozen in a forward position or frozen rearward and firing was initiated only with some difficulty.

Table 2.7-I (Cont'd)

(Bolt Stop Interruption)

Round Count	FF-1[a]	FF/BB[b]	FF/BOB	FF/DF	FFR	FJ	FX	FBR	FTR	BEC	Total
					Rifle C6						
1 to 1000	9	13	0	0	1	0	0	0	3	0-16	26
1001 to 2000	0	8	0	0	4	3	0	0	4	0	19
2001 to 3000	13	0	0	0	6	0	0	1	0	0	20
Total	22	21	0	0	11	3	0	1	7	0	65
					Rifle C7						
1 to 1000	9	13	2	0	0	1	0	2	5	2	34
1001 to 2000	2	28	8	0	10	9	0	3	5	0	65
2001 to 3000	11	2	0	0	0	1	0	2	31	0	47
Total	22	43	10	0	10	11	0	7	41	2	146
					Rifle C12						
1 to 1000	7	6	0	0	2	0	0	0	5	0	20
1001 to 2000	0	14	0	4	5	0	0	1	3	0	27
2001 to 3000	13	0	0	5	4	0	0	1	0	0	23
Total	20	20	0	9	11	0	0	2	8	0	70
					Rifle C35						
1 to 1000	8	0	0	0	1	1	0	2	1	0	13
1001 to 2000	1	7	0	0	4	1	0	0	2	1	16
2001 to 3000	9	3	0	0	7	0	0	0	0	0	19
Total	18	10	0	0	12	2	0	2	3	1	48
					All Code C Rifles						
1 to 1000	50	62	11	9	6	5	0	5	14	2	164
1001 to 2000	4	114	17	20	36	57	0	4	16	1	269
2001 to 3000	66	10	1	8	17	1	0	4	36	0	143
Total	[g]120	186	29	37	59	63	0	13	66	3	576

[a] The FF-1 category includes all failures-to-feed which involved the first round in the magazine; the round-by-round data in Appendix I further subdivides these failures. Note in the 1001- to 2000-round intervals that the FF-1 malfunction can only occur on the final four magazines of each 100-round cycle as the rifles are conditioned between cycles with the bolt closed on the first round of the first magazine during this interval.

[b] The FF/BB category includes all failures-to-feed after firing the first round in the magazine and with the bolt behind the base of the round; the round-by-round data in Appendix I further subdivides these failures.

[g] Not included are 46 instances where the bolt was either frozen in a forward position or frozen rearward and firing was initiated only with some difficulty.

Table 2.7-I (Cont'd)

Round Count	FF-1[a]	FF/BB[b]	FF/BOB	FF/DF	FFR	FJ	FX	FBR	FTR	BEC	Total
					Rifle B7						
1 to 1000	9	10	1	4	3	1	1	1	0	0	30
[d]1001 to 2000											
[d]2001 to 3000											
Total	9	10	1	4	3	1	1	1	0	0	30
					Rifle B8						
1 to 1000	6	1	0	0	2	0	0	0	0	0	29- 9
1001 to 2000	0	6	0	3	2	0	0	0	1	0	12
2001 to 3000	6	1	0	0	1	0	0	0	0	0	8
Total	12	8	0	3	5	0	0	0	1	0	29
					Rifle B9[e]						
					All Code B Rifles						
1 to 1000	42	46	1	5	10	1	1	1	13	0	120
1001 to 2000	2	47	2	4	8	6	0	3	45	0	117
2001 to 3000	42	9	0	9	9	0	0	0	4	0	73
Total	[f]86	102	3	18	27	7	1	4	62	0	310
					Rifle C4						
1 to 1000	9	19	6	0	0	3	0	1	0	0	38
1001 to 2000	0	21	9	3	6	9	0	0	1	0	49
2001 to 3000	11	5	1	0	0	0	0	0	4	0	21
Total	20	45	16	3	6	12	0	1	5	0	108
					Rifle C5						
1 to 1000	8	11	3	9	2	0	0	0	0	0	33
1001 to 2000	1	36	0	13	7	35	0	0	1	0	93
2001 to 3000	9	0	0	3	0	0	0	0	1	0	13
Total	18	47	3	25	9	35	0	0	2	0	139

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[a] The FF-1 category includes all failures-to-feed which involved the first round in the magazine; the round-by-round data in Appendix I further subdivides these failures. Note in the 1001- to 2000-round intervals that the FF-1 malfunction can only occur on the final four magazines of each 100-round cycle as the rifles are conditioned between cycles with the bolt closed on the first round of the first magazine during this interval.

[b] The FF/BB category includes all failures-to-feed after firing the first round in the magazine and with the bolt behind the base of the round; the round-by-round data in Appendix I further subdivides these failures.

[d] The bolt was cracked at the cam pin hole and testing was terminated as no replacement bolt was available.

[e] Rifle B9 was not tested; the bolt from this rifle replaced a defective bolt in B36 at AMSWE-QA direction and no replacement Code B bolts, were made available.

[f] Not included are 30 instances where the bolt was either frozen in a forward position or frozen rearward and firing was initiated only with some difficulty.

Table 2.7-II. Cyclic Rate of Fire Data
During the Low Temperature Test

100-Rd Cycle No.	Rifle No.[a] A4	A5	A6	A7	Avg	Rifle No.[b] A8	A9	Avg
Round Count: 1 to 1000.								
1	641	662	666	658	657	674	690	682
2	642	607	658	609	629	678	[c]687(17)	678
3	641	626	672	639	644	677	683	680
4	647	630	652	624	638	670	703	686
5	614	583	665	600	616	654	678	666
6	618	604	-	613	612	679	684	682
7	650	601	689	641	645	671	733	702
8	639	600	673	658	642	[c]649(19)	696	696
9	629	610	646	608	623	670	737	704
10	624	604	668	612	627	640	679	660
Average	634	613	665	626	634	668	698	683
Round Count: 1001 to 2000.								
1	688	694	700	674	689	752	783	768
2	670	681	682	668	675	736	767	752
3	640	646	661	648	649	699	744	722
4	643	654	667	649	653	694	729	716
5	641	661	670	620	648	686	733	710
6	622	641	675	640	644	713	726	720
7	628	703	640	658	657	700	726	713
8	620	695	652	654	655	689	718	704
9	671	643	670	651	659	695	730	712
10	630	636	664	607	634	718	711	714
Average	645	665	668	647	656	708	737	723
Round Count: 2001 to 3000.								
1	[c]742(18)	714	677	682	691	730	770	750
2	698	679	694	643	676	714	744	729
3	668	657	675	654	664	727	756	742
4	682	661	685	648	669	708	703	706
5	674	679	678	659	672	679	737	708
6	707	694	685	-	695	734	744	729
7	673	674	691	695	683	724	741	732
8	677	668	670	672	672	714	741	728
9	678	672	683	659	673	718	744	731
10	664	673	673	682	673	708	740	724
Average	680	677	681	666	676	716	742	729

[a]These rifles fired only ball ammunition.
[b]These rifles fired the 4-to-1 mix of ball and tracer.
[c]Numbers in parenthesis indicate rate was determined for a less than 20-round burst; these rates are not included in the averages.

Table 2.7-II (Cont'd)

100-Rd Cycle No.	Rifle No.[a] B4	B5	B6	B7	Avg	Rifle No.[b], B8
Round Count: 1 to 1000.						
1	670	695	672	649	671	[c]744(16)
2	603	678	672	641	648	738
3	634	688	677	[c]652(19)	666	723
4	647	680	673	658	664	702
5	654	688	684	[c]673(19)	675	689
6	684	704	672	668	682	710
7	660	685	695	693	683	727
8	693	698	693	668	688	[c]735(17)
9	654	677	690	[c]647(16)	674	696
10	677	679	694	[c]670(19)	683	767
Average	658	687	682	663	674	719
Round Count: 1001 to 2000.						
1	715	714	768	-	732	801
2	674	698	729	-	700	780
3	634	695	718	-	682	772
4	630	698	727	-	685	-
5	634	712	699	-	682	738
6	651	673	689	-	671	740
7	654	678	708	-	680	744
8	668	679	723	-	690	762
9	[c]695(17)	[c]727(16)	716	-	716	759
10	682	695	703	-	693	765
Average	660	694	718		692	762
Round Count: 2001 to 3000.						
1	672	718	715	-	702	781
2	[c]696(15)	726	723	-	724	770
3	660	707	708	-	692	780
4	[c]658(17)	[c]715(18)	[c]689(15)	-	-	767
5	672	704	696	-	691	759
6	670	707	708	-	695	759
7	[c]687(16)	720	730	-	725	775
8	689	685	707	-	694	734
9	694	719	716	-	710	780
10	691	715	716	-	707	756
Average	678	711	713		703	766

[a]These rifles fired only ball ammunition.
[b]These rifles fired the 4-to-1 mix of ball and tracer.
[c]Numbers in parenthesis indicate rate was determined for a less than 20-round burst; these rates are not included in the averages.

Table 2.7-II (Cont'd)

100-Rd Cycle No.	Rifle No.[a] C4	C5	C6	C7	Avg	Rifle No.[b] C12	C35	Avg
Round Count: 1 to 1000.								
1	688	715	666	702	693	703	719	711
2	618	675	650	674	654	716	722	719
3	675	675	668	672	672	696	707	702
4	652	678	646	668	661	706	716	711
5	636	688	668	679	668	672	693	688
6	680	718	661	699	690	683	686	684
7	678	714	698	674	691	684	690	687
8	550	688	654	657	637	685	656	670
9	641	684	641	678	661	695	683	689
10	641	674	653	633	650	678	679	678
Average	646	691	660	674	668	692	695	694
Round Count: 1001 to 2000.								
1	664	708	703	724	700	731	741	736
2	679	[c]711(18)	688	699	689	[c]703(17)	737	737
3	641	712	680	703	684	712	716	714
4	686	714	679	678	689	699	707	703
5	622	689	660	706	669	694	710	702
6	702	664	648	673	672	[c]697(16)	707	707
7	662	704	649	716	683	708	703	706
8	643	680	[c]679(18)	730	684	703	711	707
9	664	690	656	662	668	700	719	710
10	641	694	673	691	675	[c]682(15)	698	698
Average	660	695	671	698	681	707	715	712
Round Count: 2001 to 3000.								
1	716	743	719	737	729	718	737	728
2	683	720	716	[c]702(18)	706	699	712	706
3	694	734	678	-	702	711	730	720
4	674	718	703	703	700	[c]677(15)	704	704
5	665	730	682	718	699	[c]682(15)	706	706
6	711	752	704	714	720	[c]693(18)	708	708
7	678	708	703	734	706	704	[c]735(18)	704
8	704	730	668	702	701	690	703	696
9	675	714	700	695	696	684	729	706
10	698	733	684	714	707	[c]681(16)	714	714
Average	690	728	696	715	707	701	716	709

[a]These rifles fired only ball ammunition.
[b]These rifles fired the 4-to-1 mix of ball and tracer.
[c]Numbers in parenthesis indicate rate was determined for a less than 20-round burst; these rates are not included in the averages.

Table 2.7-III. Relationship of Low Temperature Test Malfunctions to Magazine Number and Round Sequence

Rifle Code[a]	Malfunction Rd No.	Magazine No. 1	2	3	4	5	Total
A	[b] 1	225	11	4	1	2	243
	2	75	0	0	2	1	78
	3	45	0	1	0	1	47
	4 to 20	110	6	25	27	27	195
Total		455	17	30	30	31	563
B	[b] 1	110	1	1	0	0	112
	2	48	0	2	0	1	51
	3	18	0	0	0	2	20
	4 to 20	50	7	39	2	29	127
Total		226	8	42	2	32	310
C	[b] 1	194	6	2	0	0	202
	2	84	0	3	0	2	89
	3	51	0	4	0	1	56
	4 to 20	122	11	51	23	22	229
Total		451	17	60	23	25	576
All rifles	[b] 1	529	18	7	1	2	557
	2	207	0	5	2	4	218
	3	114	0	5	0	4	123
	4 to 20	282	24	115	52	78	551
Total		1132	42	132	55	88	1449

[a]Appendix I contains a summary with malfunctions further subdivided in 1000-round intervals.

[b]Not included are those instances where the bolt was initially frozen forward or rearward prior to firing and firing was initiated with some difficulty (57 for Code A, 30 for Code B, and 46 for Code C). However, all other first-round failures are included here (FF-1, FJ, FX, FTR, etc.) as opposed to Table 2.7-I where only feeding failures are identified as first-round occurrences (FF-1).

Magnaglow inspection of each rifle bolt was conducted during each of the 1000-round maintenance intervals. Minor cracks were detected at the rear of both lugs on each side of the extractor slot at the conclusion of 3000 rounds of firing with the majority of bolts from all manufacturers. These failures were similar to those reported and discussed in par. 2.4 except that crack patterns developed after firing fewer rounds at -65°F than in the normal ambient endurance test firings; in many cases, cracks could be detected on both of the critical bolt lugs after 2000 rounds.

In addition to the lug cracks that were observed, the cam pin hole on the bolt of rifle B7 was cracked after 1000 rounds and this rifle was withdrawn from test because no replacement bolts were available.

2.7.5 Analysis

It is the judgment of the test agency that the reliability level of all test rifles was substantially degraded by continued exposure to the low temperature environment while attempting to fire 1000 rounds without maintenance. Malfunction rates computed from Table 2.7-I are given below:

a. Code A: 31.3/1000 rds.

b. Code B: 23.8/1000 rds.

c. Code C: 32.0/1000 rds.

The following subparagraphs contain other pertinent areas of analysis.

2.7.5.1 Cyclic Rates of Fire. The average cyclic rates of fire in Table 2.7-II, with one very significant exception, were in the range normally expected of the M16A1 rifle in an extreme low-temperature environment. The exception is the rate level for the rifles from all producers when firing the 4-to-1 mix of ball and tracer ammunition. Tracer ammunition usually provides a reduced impulse to the cyclic components of the rifle, particularly at low temperature (Reference 16), and the mix firings would normally be expected to have provided somewhat lower rates and less reliable operation than with rifles firing all ball ammunition. Exactly the opposite occurred in this test, however; rifles firing the mix were more reliable than rifles firing ball ammunition and cyclic rate levels were higher.

The reason for this occurrence is not known, but it may be conjectured that the mix-firing of cartridges loaded with two propellants, IMR8208 in tracers and WC846 in ball ammunition, tends to reduce or mitigate in some manner the total accumulation of fouling in the weapon mechanism or gas tube. It should be noted that this is strictly a subjective opinion and that no attempt was made during test to evaluate fouling accumulations.

2.7.5.2 Storage Conditions. Three different storage conditions of the rifles were observed during the test as described in par. 2.7.4d. These conditions had a significant effect on the pattern of malfunctions, although not necessarily on the total malfunction count, during each 1000-round interval. For example, note in Table 2.7-I that only 14 first-round feeding failures (FF-1) occurred with all rifles during the firing of 16,000 rounds in the second interval (1001 to 2000 rounds) as compared to more than ten times this number in either the first or third interval. However, a first-round feeding failure in this interval could only occur on the final four magazines in each 100-round cycle as the first round of the first magazine of each cycle was positioned in the chamber with the rifle bolt closed prior to attempting to fire. The net result of the storage condition was to shift the initial-round feeding problems, in the majority of instances, to the next round or to the third round and little if any real advantage was gained.

The detailed data in Appendix I indicate that other changes in the pattern of malfunctions also occurred as a function of the rifle storage condition and planning to further explore this performance characteristic is now underway at APG as recently requested by the US Army Aberdeen Research and Development Center.

2.7.5.3 Round Number and Magazine Sequence. An analysis of the data in Table 2.7-III and the round-by-round data in Appendix I, aids in identifying the performance characteristics of the M16A1 rifle which must be improved to gain acceptable reliability at low temperatures. Some of the more pertinent facts are summarized below:

a. Less than 1% of all malfunctions occurred during the 49 initial 100-round cycles at the start of each 1000-round interval.

b. During the remaining nine 100-round cycles in each 1000-round interval, 36% of all malfunctions occurred with the first rounds of the first magazine in each cycle and 59% of all malfunctions occurred within the first three rounds of the first magazine in each cycle.

c. Considering all rounds in the final four magazines in all cycles (80% of the total test) only 22% of the malfunctions occurred during these firings and the malfunction rate was approximately 8 per 1000 rounds fired.

2.7.5.4 Summary. The initial-round problems identified in this subtest, in the opinion of the test agency, are directly attributable to excessive fouling accumulation which freezes during conditioning periods and practically immobilizes cycling components until manually broken free or heated by initially fired rounds. When not fouled by previous firing, the M16A1 rifle has the capability of performing reliably at -65°F; the 49 initial 100-round cycles which were fired directly following maintenance periods, but not sooner than after six hours of temperature-conditioning, were fired at a malfunction rate of 2.4 per 1000 rounds fired (refer to round-by-round data in Appendix I).

2.8 SPECIAL FIRING TEST

2.8.1 Objective

The objective was to further explore the high incidence of double-feed malfunctions which occurred during the conduct of the initial endurance test (par. 2.4).

2.8.2 Criteria

Not applicable.

2.8.3 Method

Three rifles were fired utilizing both the government-approved test stand and the displacement-time firing mount as well as being fired from a shoulder-supported, bench-rest position and from a standing position. Firing was accomplished in the semiautomatic mode in each firing trial and the magazine was loaded with only five rounds, instead of the usual 20-round complement.

2.8.4 Results

The firing results are summarized in Table 2.8-I.

Table 2.8-I. Summary of Special Firing Test

Rifle No.	Magazine No.	Firing Support	Remarks
C33	C31-15	Shoulder	A double feed (DF) occurred after firing three rounds.
C33	A27-4	Shoulder	Satisfactory.
C33	C31-15	Shoulder	DF occurred after the first round fired.
C33	C31-15	Shoulder	DF occurred after the first round fired.
C33	C31-15	Shoulder	DF occurred after the first round fired.
C33	C31-15	Shoulder	DF occurred after the first round fired.
C33	C31-15	Shoulder	The spring and follower from magazine A27-4 were installed in magazine C31-15; DF occurred after firing three rounds.
C33	A27-4	Shoulder	The spring and follower from magazine C31-15 were installed in magazine A27-4; firing was satisfactory.
C33	A27-4	Shoulder	Same as previous except a DF occurred after two rounds.

Table 2.8-I (Cont'd)

Rifle No.	Magazine No.	Firing Support	Remarks
C33	C27-5	Shoulder	The spring and follower from magazine C31-15 were installed in magazine C27-5; firing was satisfactory.
C33	C27-5	Shoulder	Same as previous.
C33	A27-4	Shoulder	The magazine was in original assembly; firing was satisfactory.
C33	A27-4	Shoulder	Same as previous.
C33	C31-15	Shoulder	The magazine was in original assembly; DF occurred after one round.
C27	C31-15	D-T mount	The rifle was installed in the displacement-time test mount; firing was satisfactory.
C27	C31-15	D-T mount	Same as previous.
C27	C31-15	D-T mount	Same as previous.
C33	C31-15	D-T mount	Same as previous.
C33	C31-15	D-T mount	Same as previous.
C33	C31-15	D-T mount	Same as previous.
C33	C31-15	Shoulder	DF occurred after one round.
C33	C31-15	Standing	DF occurred after one round.
C33	C31-15	Shoulder	The complete upper receiver from A33 was installed on C33; firing was satisfactory.
C33	C31-15	Shoulder	Same as previous.
A33	C31-15	Shoulder	The complete upper receiver from C33 was installed on A33; DF occurred after one round.
A33	C31-15	Shoulder	Same as previous, except firing was satisfactory.
A33	C31-15	Shoulder	Same as previous, except a DF occurred after one round.
C33	C31-15	Shoulder	The upper receiver from A33 but with bolt carrier assembly from C33 installed on C33; DF occurred after one round.
A33	C31-15	Shoulder	The upper receiver from C33 with bolt carrier assembly from A33 installed on A33; firing was satisfactory.
C33	C31-15	Shoulder	The rifle was in original assembly; firing was satisfactory.
C33	C31-15	Shoulder	Same as previous, except a DF occurred after one round.
C33	C31-15	Shoulder	The bolt carrier only from A33 was installed in C33; DF occurred after three rounds.
C33	C31-15	Shoulder	The rifle was restored to original assembly except that the bolt from A33 was installed, firing was satisfactory.
C33	C31-15	Shoulder	Same as previous.
A33	C31-15	Shoulder	The bolt only from C33 was installed in A33; DF occurred after one round.

Table 2.8-I (Cont'd)

Rifle No.	Magazine No.	Firing Support	Remarks
A33	C31-15	Shoulder	Twenty attempts were made to fire A33 with C33 bolt installed; eight DF's occurred.
C33	C31-15	GA mount	Ten trials were conducted with the rifle in original assembly and mounted in the APG government-approved test stand; no failures occurred.
C33	C31-15	Shoulder	Ten trials were then conducted firing shoulder-supported from bench-rest; five DF's occurred.

2.8.5 Analysis

The limited firing-test data indicated that the bolt from a rifle which had previously experienced double-feed malfunctions (refer to rifle C33 in par. 2.4) would provide the same type of malfunction when installed in a rifle which had not experienced double feeds (none in A33 in 10,000 rounds, par. 2.4). Furthermore, the sensitivity of occurrence of the double-feed malfunction was directly related to the method of rifle support; i.e., the incidence of double feeds in either a rigid or recoiling mechanical mount was less than that experienced when the rifle was "soft" mounted as from the shoulder.

Following these firings a further study of the magazines employed in the initial endurance test was made and the results tabulated. The tables are contained in Appendix I. These data are summarized as follows:

a. All seven Code B and Code C rifles experienced at least one double-feed malfunction during the 10,000 round initial endurance test; no double feeds occurred with Code A rifles.

b. While individual magazine numbers were assigned prior to test, lot numbers were not originally noted. However, magazines from at least two lots were used in Code A rifles as well as Code B and C rifles. These lot numbers were DAAF03-69-C-0007 and DAAF03-69-C-0080.

c. Of the 280 magazines used with Code B and Code C rifles (140 per contractor), double feeds occurred with 70 of these magazines. Five magazines among these 70 magazines, tested in four rifles, accounted for one-third of all double feeds recorded.

d. Measurements of some selected magazines were made by the test agency as well as by AMSWE-QA personnel. While some irregularities existed between drawing specifications and magazine measurements, no clear relationship of dimensional irregularity to double-feed incidence was established.

In summary, the double-feed problem appeared to be related to the configuration of certain rifle bolts and, to a lesser degree, to certain magazines. As a result of this special firing test, AMSTE-BC requested that a meeting be held at APG on 19 March 1969 with representatives from AMSTE-BC, AMSWE-QA, AMCPM-RS, and from the MTD test agency attending. Subsequent to the meeting an endurance retest of M16A1 rifles was directed (Reference 12) in which particular emphasis was to be placed on the configuration of both the rifle bolt and the bolt catch. This endurance retest is reported in par. 2.9.

2.9 ENDURANCE RETEST

2.9.1 Objective

The objective was to determine the reliability and durability of the test weapons when equipped with a bolt catch of modified configuration per USAWECOM inspection sketch No. 68A20376, and with rifle bolts, which by individual inspection, have been confirmed to be within the specifications of drawing J61538.

2.9.2 Criteria

Criteria were as follows:

a. Basic performance criteria are the same as stated in par. 2.4.2a and b for the initial endurance test.

b. In addition, the modified bolt-catch configuration shall demonstrate a significant reduction in the incidence of the failure of the bolt to remain open (FBR) malfunction with Code A rifles and properly fabricated bolts shall demonstrate a significant reduction in the incidence of the double-feed (FF/DF) malfunction with Code B and Code C rifles when compared to the data in par. 2.4.4.

2.9.3 Method

The method of test is the same as outlined in par. 2.4.3 with the following exceptions.

a. All bolt catches in all rifles submitted for test are carefully measured and compared to specifications of drawing C62301 or inspection sketch No. 68A20376 (see par. 2.9.4.1 for explanation of the use of two different specification documents).

b. All rifle bolts in all rifles submitted for test are carefully measured and compared to specifications of drawing J61538 with particular emphasis given to the configuration of the leading edge of the bolt lugs.

c. Twelve rifles from each manufacturer are each fired 6000 rounds. Eight of the rifles from each manufacturer are fired with M193 ball projectile ammunition only and four rifles are fired with a 4-to-1 mix of M193 ball and M196 tracer ammunition.

d. No projectile velocity or accuracy data are obtained; cyclic rates of fire are measured on the first 20-round automatic burst after test initiation and following each 1000-round maintenance interval.

e. All firing is done from a shoulder-supported position including all cyclic rate firings.

f. Magnetic-particle inspection of rifle bolts is conducted initially and after each 3000 rounds of firing.

2.9.4 Results

The results of test are summarized in the following paragraphs and Tables 2.9-I through 2.9-V.

2.9.4.1 Bolt-Catch Inspection. Results were as follow:

a. Background. It had been determined by AMSWE-QA that the standard (original) bolt catch in current production in 1968 could be, and occasionally was, fabricated in such a manner that an interference occurred between the catch and the lower receiver. This interference prevented a full pivot action of the catch as the cartridge follower attempted to lift the catch to hold the bolt in the open position when the last round in a magazine was fired. It was further determined, due to the interrelation of certain tolerances on drawing C62301, that bolt catches could be fabricated which would meet drawing specifications but which could also cause the interference problem.

As a result of this review of drawing C62301, engineering order No. 82293, November 1968, was issued and the order changed a number of bolt catch dimensional requirements, but principally by changing the angle on the lower portion of the catch, insured that an interference would not occur with a catch made to the new specifications. The original catch is often referred to as the 10° catch and the modified catch as the 7° catch.

At the time of this endurance retest, it was presumed by the test agency that the engineering order was in effect at all contractor plants prior to production of the rifles submitted for this test. It was subsequently learned that this was not the case and that, for some interim period of time, bolt catches would be in conformance to either the original configuration of drawing C62301 or to the modified configuration of inspection sketch No. 68A20376. In general, based on rifles examined in this subtest, the practice at each contracter plant was as follows during the time period of manufacture of the test rifles:

1) Code A rifles employed bolt catches of modified configuration.

2) Code B rifles employed bolt catches of original configuration.

3) Code C rifles employed bolt catches of both configurations, proportion unknown.

b. Inspection Results. Inspection results for the bolt catches in the 42 rifles submitted for retest (12 from each contractor for test, 2 for spare parts if necessary) are contained in Table 2.9-I.

Table 2.9-I. Bolt Catch Inspection Results

	Modified Catch			Original Catch		
		Dimension			Dimension	
Rifle No.	Catch Angle	A[a], in.	Rifle No.	Catch Angle	A[a], in.	B[b], in.
Requirement:	7°30' ± 0°30'	0.151 ± 0.003	Requirement:	10°0' ± 0°30'	0.168 ± 0.003	0.110 ± 0.003
A36	7°30'	0.149	B36	10°10'	0.168	0.112
A37	7°13'	.149	B37	10°20'	.168	.110
A38	7°30'	.151	B38	10°0'	.170	.112
A39	7°30'	.149	B39	10°0'	.166	.111
A40	7°30'	.152	B40	10°0'	.168	.109
A41	7°45'	.149	B41	10°0'	.168	.111
A42	7°30'	.149	B42	10°10'	.171	.113

[a]Dimension A is the distance from the catch pivot hole to the angled catch surface and is considered critical on both modified and original catches.

[b]Dimension B is the distance from the catch pivot hole to the lower edge of the catch extension and is considered critical on original bolt catches.

Table 2.9-I (Cont'd)

	Modified Catch			Original Catch		
					Dimension	
Rifle No.	Catch Angle	Dimension A[a], in.	Rifle No.	Catch Angle	A[a], in.	B[b], in.
A43	7°30'	0.152	B43	10°15'	0.170	0.113
A44	7°15'	.153	B44	10°0'	.169	.112
A45	7°30'	.148	B45	10°0'	.168	.112
A46	7°30'	.149	B46	10°0'	.169	.112
A47	7°0'	.148	B47	10°15'	.172	.109
A48	7°0'	.148	B48	10°0'	.170	.110
A49	7°30'	.150	B49	10°30'	.170	.111
C36				10°30'	.166	.109
[c]C37	6°15'	.153				
C38	7°0'	.153				
C39	7°30'	.152				
C40	7°30'	.152				
C41	7°30'	.151				
[c]C42	6°30'	.152				
C43				10°0'	.166	.113
[c]C44	6°30'	.150				
C45	7°30'	.151				
C46	7°15'	.149				
C47	7°30'	.149				
[c]C48	6°15'	.151				
[c]C49	6°35'	.148				

[a]Dimension A is the distance from the catch pivot hole to the angled catch surface and is considered critical on both modified and original catches.

[b]Dimension B is the distance from the catch pivot hole to the lower edge of the catch extension and is considered critical on original bolt catches.

[c]Denotes bolt catches which failed to meet specifications of either IS No. 68A20376 or drawing C62301.

As shown in Table 2.9-I, all Code B catches were of the 10° configuration and as it was then learned by the test agency that the Code B contractor had been and was continuing to assemble rifles with original catches only, AMSWE-QA directed that Code B rifles be tested with the 10° catch. However, the five Code C bolt catches denoted by footnote c in Table 2.9-I were declared not acceptable for test by AMSWE-QA personnel and the Code C contractor was requested to supply replacements. In addition, the two Code C catches of 10° configuration were also excluded from test by AMSWE-QA personnel and the contractor was requested to make replacements of these catches with 7° catches also.

Subsequently, the Code C contractor submitted 18 catches to be used as replacements, but all of these catches incorporated a catch angle of approximately 6°30' and were declared unsuitable for test by AMSWE-QA personnel. A second group of 12 catches was then received from the Code C contractor and measurements indicated that seven of these were unsuitable for test, again due to less than the permitted minimum angle of 7°0'. However, the five acceptable catches were installed in the rifles designated by footnote c in Table 2.9-I and this fulfilled the minimum requirement for 12 test rifles.

2.9.4.2 Bolt Lug Inspection.

a. Background. The specification for the leading edge of all bolt lugs on drawing J61538 offers the option of either a 0.010-inch radius or a 0.010-inch by 45° chamfer. Adherence to these specifications appeared critical because the leading edge of the bolt lug is expected to provide the initial contact surface in the event that a round adjacent to the round being fed is contacted by the bolt during feeding.

   In the former instance, a very sharp leading edge, not in conformance with drawing J61538, would be likely to gouge into or drag forward an adjacent round during feeding, possibly resulting in a double-feed malfunction, while a rounded or fully-chamfered configuration would be more likely to ride over an adjacent cartridge or deflect it downward into the magazine. However, a sharp leading edge could be successfully engaged and retained by the bolt catch in a marginal situation possibly more often than would a fully chamfered or rounded configuration.

   Although the above hypothesis was conjectural, bolt lug configuration was carefully inspected on all rifles submitted for retest.

b. Inspection Results. Bolt lug inspection results are summarized as follows (the measurement techniques and the interpretation of the measurements were directed by AMSWE-QA personnel; MTD provided instrumentation and personnel to obtain the required information):

   1) Code A. As the configuration of the leading edge of Code A bolt lugs appeared to be more nearly a radius configuration than a chamfer, a single radius measurement was recorded for each lug on each bolt. In only one instance with one lug was the radius specification (0.010 ± 0.005 in.) exceeded, although all lugs were on the high side

of the permitted tolerance, varying from 0.012 to 0.014 inch on approximately 75% of the lugs.

2) Codes B and C. In comparison to Code A bolts, Code B and Code C bolts appeared to incorporate a chamfer configuration and two measurements were recorded for each bolt, one normal to the bolt face and one normal to the lug OD. Both measurements were taken at the point on the lug face and the lug OD where the first indication of a chamfer appeared. The angle of chamfer was not measured and was not requested to be measured.

The results showed that all 14 Code C bolts and 10 of the 14 Code B bolts met drawing specifications. The 4 Code B bolts which failed were below the minimum permitted depth of chamfer (0.005 in.) and the Code B contractor provided 4 acceptable bolts as replacement. It was also observed that approximately 85% of the measurements for the stripping lugs of Code B and Code C bolts were on the low side of the permitted tolerance, varying from 0.005 to 0.010 inch.

2.9.4.3 Endurance Retest Results. The results of test are summarized in Tables 2.9-II through 2.9-V.

Table 2.9-II. Summary of 6000-Round Endurance Retest of M16A1 Rifles

Rifle No.[a]	FF-1	FBR	FF/BB	FF/BOB	FF/DF	FJ	Total
A36		1					1
A37		3					3
A39	1			1			2
A40							0
A41				1			1
A42		3					3
A43	1			1			2
A44	2	6	1	3		1	13
A45T	1						1
A46T		1					1
A47T		1					1
A48T	1	6					7
Total	6	21	1	6	0	1	35

[a]The letter T following the rifle number indicates that these rifles were fired with the 4-to-1 mix of ball and tracer ammunition.

Table 2.9-II (Cont'd)

Rifle No.[a]	FF-1	FBR	FF/BB	FF/BOB	FF/DF	FJ	Total
B36	3						3
B38							0
B39	1	1					2
B40	3	1					4
B42				1			1
B43	2						2
B44							0
B45		5					5
B46T		1	3				4
B47T	4						4
B48T		1					1
B49T							0
Total	13	9	3	1	0	0	26
C37		3					3
C38							0
C39							0
C40		6					6
C41		2					2
C42	1	10					11
C44T	2						2
C45		1					1
C46	1						1
C47T	1	1					2
C48T	2		1		3		6
C49T	1	4	1		2		8
Total	8	27	2	0	5	0	42

[a]The letter T following the rifle number indicates that these rifles were fired with the 4-to-1 mix of ball and tracer ammunition.

Table 2.9-III. Parts Breakage During Endurance Retest of M16A1 Rifles

Rifle No.	Defective, Damaged, or Broken Parts[a]	Round Count
A36	Extractor spring	5000
A37	Extractor spring	6000
A39	Extractor spring	6000
A40	Extractor spring	4000
A41	Extractor spring	4000
[b]A42	Trigger assembly	200
A43	Extractor spring	5000
A44	Extractor spring (2)	3000 and 2000
A45T	Extractor spring	4000
A46T	Extractor spring	4000
A47T	None	
A48T	Extractor spring	5000
[c]B36	Extractor spring	5600
B38	Extractor spring	4000
[c]B39	Extractor spring	5969
[c]B40	Extractor spring (3)	1780, 2220, and 2000
B42	Extractor spring	5000
B43	None	
B44	None	
B45	None	
B46T	Extractor spring	6000
B47T	Extractor spring	3000
B48T	None	
B49T	None	
C37	None	
C38	None	
C39	None	
C40	None	
C41	Bolt ring	3000
C42	None	
C44T	None	
C45	Extractor spring	6000
C46	Extractor spring	6000
	Bolt ring (3)	1000, 1000, and 2000
C47T	None	
C48T	Bolt ring	3000
C49T	None	

[a]Summary does not include bolt damage.
[b]The defective trigger assembly resulted in a number of trigger return failures until the trigger and spring were replaced.
[c]The extractor springs designated by footnote c resulted in failures to extract and eject during firing and were replaced at that time; all other broken extractor springs were noted during periodic maintenance and replaced prior to malfunctions occurring.

Table 2.9-IV. Summary of Magnaglow Inspection Results of Endurance Retest M16A1 Rifle Bolts

Code A			Code B			Code C		
Rifle No.	Round Count 3000	Round Count 6000	Rifle No.	Round Count 3000	Round Count 6000	Rifle No.	Round Count 3000	Round Count 6000
A36	OK	OK	B36	R/L	R+/L	C37	OK	R
A37	OK	OK	B38	OK	R/L	C38	OK	R
A39	OK	CP	[a]B39	CP/L	-	C39	OK	R
A40	OK	OK	[a]B39A	R/L	-	C40	OK	OK
A41	OK	OK	[b]B40	R	R/L	C41	OK	R
A42	OK	CP	B42	OK	R/L	C42	OK	OK
A43	OK	OK	[c]B43	R/L	R+/L+	C44T	OK	R
A44	OK	OK	B44	L	L+/R	C45	OK	R
A45T	OK	OK	B45	OK	L/R	C46	OK	R
A46T	OK	OK	B46T	L	L+/R	C47T	OK	R
A47T	OK	R	B47T	R/L	R+/L+	C48T	OK	R/L
A48T	OK	R	B48T	R/L	R+/L	C49T	OK	R
			B49T	R/L	R+/L+			

[a]The original bolt was replaced with the bolt from B37 after 3000 rounds; the replacement bolt was numbered B39A.
[b]Both ends of the ejector retaining pin hole were cracked after 6000 rounds.
[c]All bolts were magnaglow inspected prior to test and no discontinuities were noted except for B43 bolt which appeared to contain a small crack at the rear of the left lug.

Note: Inspection abbreviations (CP, R, L, etc.) are explained in Table 2.4-IV.

Table 2.9-V. Summary of Cyclic Rate of Fire Data During Retest of M16A1 Rifles

Approx Round Count	Rifle No. A36	A37	A39	A40	A41	A42	A43	A44	A45	A46	A47	A48	Avg
Initially	827	777	791	818	827	807	851	792	721	721	777	771	790
1000	905	862	901	883	871	818	914	917	785	794	781	825	855
2000	920	861	919	884	882	884	899	903	832	825	798	823	869
3000	908	823	896	899	898	888	937	920	823	809	836	828	872
4000	903	868	922	880	919	894	932	916	803	857	901	857	888
5000	876	854	895	905	900	868	897	931	827	856	802	880	874
Average	890	841	887	878	883	860	905	896	798	810	816	831	858

Table 2.9-V (Cont'd)

Approx Round Count	Rifle No. B36	B38	B39	B40	B42	B43	B44	B45	B46	B47	B48	B49	Avg
Initially	817	811	858	775	835	781	820	799	826	848	821	860	821
1000	882	844	914	836	885	851	862	812	825	848	800	796	846
2000	908	861	910	804	848	844	825	788	862	923	824	819	851
3000	848	815	917	800	844	848	828	781	853	868	839	826	839
4000	866	813	905	798	844	793	769	788	814	846	830	839	825
5000	876	792	876	818	852	794	753	797	854	860	900	891	839
Average	866	823	897	805	851	818	810	794	839	865	836	838	837

Approx Round Count	Rifle No. C37	C38	C39	C40	C41	C42	C44	C45	C46	C47	C48	C49	Avg
Initially	836	878	855	815	886	843	810	844	843	792	796	827	835
1000	882	832	853	750	837	826	826	866	858	827	855	848	838
2000	818	846	877	786	882	793	794	856	880	779	785	814	826
3000	820	827	865	770	852	807	817	811	857	785	836	825	823
4000	807	829	841	762	877	809	793	810	825	785	833	[a]801	814
5000	809	833	856	771	882	826	846	766	835	825	852	832	828
Average	829	841	858	776	869	817	814	825	850	799	826	824	827

[a]Cyclic rate recorded for 18-round burst.

Note: Cyclic rate of fire recorded initially and after each 1000 rounds.

2.9.5 Analysis

2.9.5.1 FBR Malfunctions. The data in Table 2.9-I, when compared to the data in Table 2.4-I, show a marked reduction in the incidence of the FBR malfunctions for Code A rifles. During the first 6000 rounds in the original endurance test, 40 FBR's occurred in 42,000 rounds (7 Code A rifles), while 21 FBR's occurred during the retest in 72,000 rounds (12 Code A rifles). However, in considering Code B rifles, no FBR's were experienced with any Code B rifle in the first 6000 rounds in the original endurance test while 5 of the 12 retest rifles experienced a total of 9 FBR's. Somewhat similarly, Code C rifles experienced 11 FBR's in 42,000 rounds in the original test and 27 FBR's in 72,000 rounds in the retest.

Due to the complex and apparently sensitive interrelation between the dimensions of individual bolt lugs and bolt catches some caution must be used in reviewing these data; however, the following points are considered pertinent:

a. Bolt catches in Code A rifles were of the 10° configuration in the original test and of the 7° configuration in the retest while bolt lug radius configurations generally were comparable, i.e., tending to be on the high side of the radius specification.

b. Bolt catches in Code B rifles were of the 10° configuration in both tests. However, bolt-lug chamfer specifications were below minimum on all original test bolts and somewhat above minimum in the retest.

c. Bolt catches in Code C rifles in the original test were of the 7° or less configuration, except C33 which was a 10° catch but with incorrect hole-to-catch body dimension, and were of the 7° specification in the retest. However, as was the case with Code B bolt lugs, Code C lugs incorporated a sharp-edged, below minimum chamfer in the original test and were somewhat above minimum in the retest.

d. The points listed above suggest that bolt-lug configuration is more likely to control the incidence of the FBR malfunction than is the configuration of either the current 7° or 10° catches, and that further investigation of both components must be made if this malfunction is to be successfully controlled in future production. It should also be noted that MTD was advised by a Code A representative that the 7° catches in this retest were "hand-crafted" catches altered from 10° catches, and that every possible dimensional advantage was included on these catches to improve FBR performance. While this practice is entirely ethical in keeping with the implementation of engineering order No. 82293, it should be demonstrated that the interrelation of catch and bolt lug dimensions can be maintained on a mass production basis.

In summary, it can be expected that the occurrence of FBR's is likely to increase in any rifle independently of the current bolt catch configurations, as the chamfer or radius dimension on the bolt lugs approaches the maximum permitted, 0.015 inch, and the likelihood of bolt catch override (FBR) would probably be somewhat greater with a rounded bolt lug as compared to a chamfered bolt lug. In addition, the role of the magazine spring should also be studied closely, as previously suggested in paragraph 2.5, as the magazine spring and the cartridge follower provide a vital link in eliminating both FBR's and double-feeds.

2.9.5.2 Double-Feed Malfunctions. The data in Table 2.9-II, when compared to the data in Table 2.4-I, show an unquestionably significant reduction in the incidence of the double-feed malfunctions for Code B and Code C rifles (no double feeds occurred in either test with Code A rifles). During the first 6000 rounds in the original endurance test, a total of 118 double feeds occurred in 84,000 rounds with the Code B and Code C rifles while only 5 double feeds occurred with Code B and Code C rifles in the retest in 144,000 rounds (all five occurred with Code C rifles). The data lend strong support to the contention that a properly rounded or chamfered bolt lug aids significantly in overcoming this particular malfunction, although it is important to note that apparently the most reliable lug configuration, in reference to the double-feed malfunction, would be a near-maximum radius, but that this configuration would be expected to be the least dependable with reference to the FBR malfunction.

2.9.5.3 Reliability. The performance standards of purchase description No. SAPD-253F provide the basis for the following analysis.

a. Rifles which failed to meet the reliability criteria of SAPD-253F:

   1) Due to excessive FBR's (no more than 3 per 6000 round permitted).

      (a) Code A, Nos. 44 and 48.

      (b) Code B, No. 45.

      (c) Code C, Nos. 40, 42, and 49.

   2) Due to excessive failures of the bolt to lock (no more than 2 per 6000 rounds permitted; scored as FF-1's in Table 2.9-I): Code B, Nos. 36, 40, and 47.

b. Rifles which met all of the reliability criteria of SAPD-253F:

   1) Code A, Nos. 36, 37, 39, 40, 41, 42, 43, 45, 46, and 47.

   2) Code B, Nos. 38, 39, 42, 43, 44, 46, 48, and 49.

   3) Code C, Nos. 37, 38, 39, 41, 44, 45, 46, 47, and 48.

2.9.5.4 Durability. The following durability analysis was made considering each individual rifle against the durability standards of SAPD-253F:

a. One magazine failure occurred during firing but beyond the 250-round minimum life requirement (the failure was the same as noted in paragraph 2.4.5.2a(1)). In addition, a defective magazine spring was found in one magazine received with rifle A44 (Figure 2.9-1); the magazine could only be loaded with 19 rounds.

b. No ejector spring failures occurred.

c. Twenty-two extractor spring failures occurred in this subtest and three of these occurred at 2000 rounds or less (A44 and B40). In comparison to the original endurance test, only Code C extractor springs continued to demonstrate a superior and acceptable level of durability.

d. One "other-parts" failure occurred (limited to trigger spring, disconnect spring, hammer spring, extractor pin, and extractor) with rifle A42 when a trigger spring (and trigger) required replacement after 200 rounds.

e. Parts failures occurring beyond those permitted in the "other parts" limitation were as follows:

   1) Rifle Nos. C41, 46, and 48, broken bolt rings.

   2) Rifle Nos. A39, A42, and B39[1], bolt cracked at cam pin hole.

[1]The cracked bolt from B39 was subsequently installed in a rifle at Rock Island Arsenal and fired an additional 3000 rounds. A metallurgical study indicated that as a result of these firings the crack propagated from 0.028 inch to 0.150 inch on the cam pin hole ID, and from 0.017 inch to 0.060 inch on the OD surface. A laboratory report covering these firings is contained in Appendix I as requested by AMCPM-RS (Reference 18).

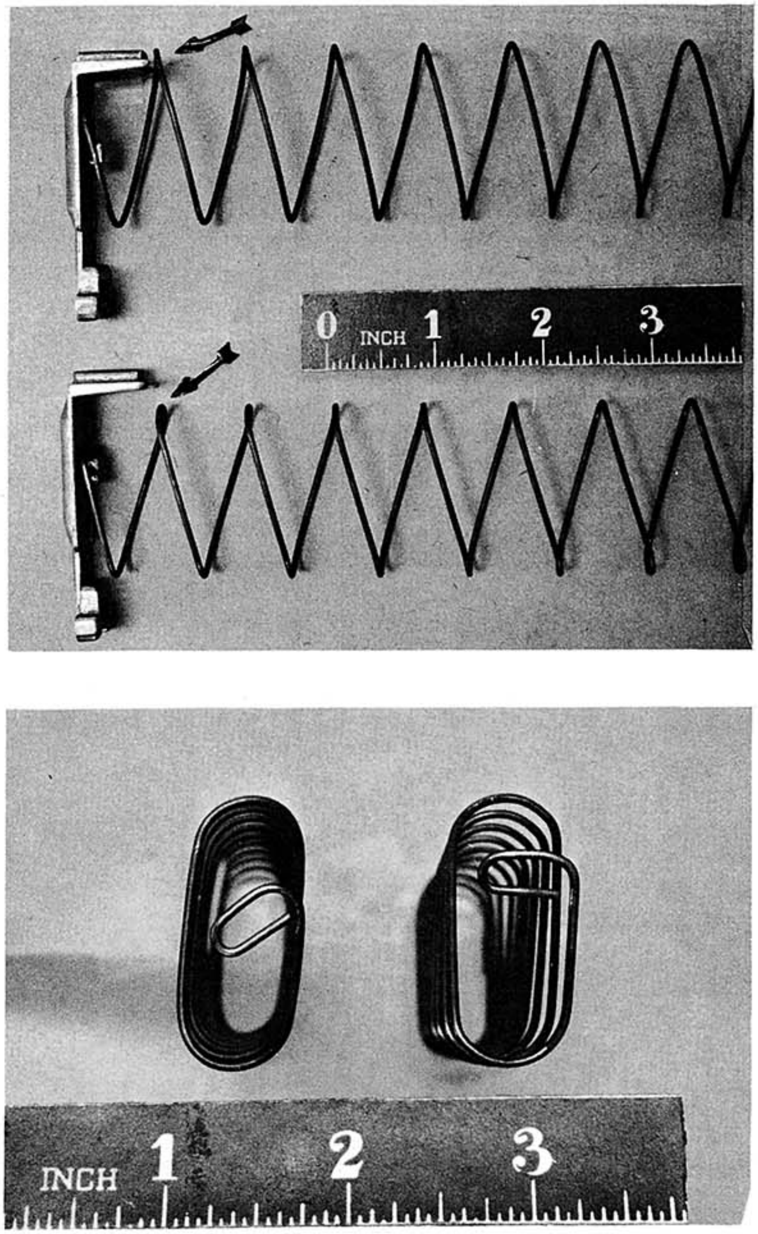

Figure 2.9-1. Top View Shows Defective Magazine Spring From A44; At Center Is Normal Spring for Comparison. Defective Spring Is Also Shown At Lower Left.

2.9.5.5 Cyclic Rate of Fire. All 36 rifles met the requirement of 700 to 940 rounds per minute for each rate obtained. Cyclic rate performance was comparable to that obtained in the original endurance test although averages were somewhat higher during the retest with Code A and Code C rifles.

2.9.5.6 Statistical Analysis. As requested by AMCPM-RS (Reference 18), the probable spread in malfunction rates for rifles from each producer in the endurance retest was computed when applying a confidence level of 95%. For comparison, data from the original endurance test was also analyzed.

The data were transformed by a variance-stabilizing transformation and the resulting data assumed to be normally distributed. The confidence limits on the mean were obtained with the transformed data and these values then converted to original data units by the inverse transformation. A confidence limit on the standard deviation of the malfunction rates was not obtainable due to the composite of distributions involved. However, estimates for the standard deviation were computed from the data.

The analysis of malfunction rates is shown in Table 2.9-VI.

Table 2.9-VI. Analysis of Malfunction Rates (Malfunctions per 1000 Rounds Fired)

Rifle Code	Mean				Standard Deviation Estimate
	Estimate	One-Sided μu	Two Sided $\mu 1$	Two Sided μu	
	Endurance Retest, 6000 Rounds				
A	0.49	0.63	0.13	0.70	0.61
B	0.36	0.46	.08	0.52	0.30
C	0.58	0.76	.14	0.84	0.58
	Original Endurance Test, 1 to 6000 Rounds				
A	1.55	2.52	.05	3.04	1.61
B	1.14	1.84	.12	2.17	1.07
C	2.26	3.45	.60	3.93	1.83
	Original Endurance TEst, 1 to 10000 Rounds				
A	3.17	4.92	.72	5.65	3.02
B	1.20	1.84	.31	2.09	1.03
C	2.59	4.06	.48	4.69	2.33

P $(\mu < \mu u) = 0.95$, one-sided.
P $(\mu 1 < \mu < \mu u) = 0.95$, two-sided.

2.9.5.7 Summary. Of the 36 rifles tested, all met the cyclic-rate-of-fire requirements, 28 met the durability requirements and 27 met the reliability requirements; 21 rifles met requirements in all three of these categories. These rifles were as follows:

a. Code A, Nos. 36, 37, 40, 41, 43, 45, 46, and 47.

b. Code B, Nos. 38, 42, 43, 44, 46, 48, and 49.

c. Code C, Nos. 37, 38, 39, 44, 45, and 47.

SECTION 3. APPENDICES

APPENDIX I - TEST DATA

SUMMARY OF ENDURANCE AND RELIABILITY DATA

Malfunction			Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	Remarks
Type[a]	Round Count	Round No.[b]				
				Rifle No. A-29		
FF-1	2481	1	S/5	0	CH	The round was stubbed in the magazine.
FF-1	2561	1	B/4	0	BA	
FF-1	2861	1	B/4	0	BA	
FF-1	3101	1	B/6	0	See remark	Accidentally cleared when the rifle was jarred.
FBR	3120	20	B/6	0	CH	The cyclic rate following the FBR was 783.
FBR	3180	20	B/9	0	CH	The cyclic rate prior to FBR was 783.
FF-1	3261	1	B/9	0	Not recorded	
BDP	3709	9	B/6	Extractor spring	ORG	The extractor spring broke and caused ejection failures. A new spring was installed.
FF-1	4780	1	S/10	0	Not recorded	The cyclic rate after the FBR was 796.
FBR	4820	20	A-33-6	0	CH	Magazine A-33-6 was inadvertently fired in this rifle.
FBR	4980	20	B/9	0	CH	The cyclic rate prior to the FBR was 773.
FBR	5140	20	A/7	0	CH	The cyclic rate at the FBR was 792.

[a]As identified in par 2.1.
[b]The round number is the round count within a 20-round magazine (see par 2.1 for detailed explanation).
[c]Mode of Fire: B = 20 rds in short bursts; A = 20 rds in a continuous burst;
S = 20 rds fired semiautomatically.
[d]As identified in par 2.1.

Malfunction Type[a]	Round Count	Round No.[b]	Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action	Remarks
FBR	5680	20	B/9	0	CH	The cyclic rate prior to the FBR was 780.
FBR	5740	20	A/7	0	CH	The cyclic rate at the FBR was 788.
FF-1	5881	1	S/10	0	M	
FF-1	5981	1	S/10	0	BA	
BDP	6000			Bolt	DSL	Magnaglow inspection revealed a definite crack at the bolt cam pin hole and a possible crack at the bolt locking lug immediately right of the extractor slot. The bolt from A-6 was installed in A-29 (40 rounds previously fired on A-6). Note: only the bolt body from A-6 installed in A-29; extractor, ejector and springs from A-29 bolt transferred to A-6 bolt.
FBR	6000+	20	S/6	0	CH	The FBR occurred during the 6000-round accuracy test.
FBR	6040	20	A/12	0	CH	Cyclic rate at FBR was 789.
FBR	6060	20	S/13	0	CH	Cyclic rate prior to FBR was 789.
FBR	6120	20	B/11	0	CH	Cyclic rate following FBR was 731.
FBR	6260	20	S/13	0	CH	Cyclic rate prior to FBR was 724.
BDP	7000			Extractor Spring	ORG	Magnaglow inspection of the bolt revealed no defects.at 7000 rounds.
FBR	7240	20	A/12	0	CH	Cyclic rate at FBR was7723.
FBR	7360	20	S/13	0	CH	Cyclic rate following FBR was 690.
FBR	7440	20	A/12	0	CH	Cyclic rate at FBR was 716.
FF-1	7581	1	S/15	0	Not recorded	
FBR	7720	20	B/11	0	CH	Cyclic rate prior to FBR was 683.
FBR	7840	20	A/12	0	CH	Cyclic rate at FBR was 695.
						Magnaglow inspection revealed no defects. High speed motion pictures were obtained during cycles between 7000 and 8000 rounds.

Malfunction			Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action	Remarks
Type[a]	Round Count	Round No.[b]				
FBR	8000+	20	S/12	0	CH	Occurred during accuracy firing.
FBR	8000+	20	S/13	0	CH	Occurred during accuracy firing.
FBR	8000+	20	S/15	0	CH	Occurred during accuracy firing.
FBR	8120	20	B/11	0	CH	Cyclic rate following FBR was 731.
FBR	8140	20	A/12	0	CH	Cyclic rate at FBR was 731.
FBR	8160	20	S/13	0	CH	Cyclic rate prior to FBR was 731.
FBR	8220	20	B/11	0	CH	Cyclic rate following FBR was 773.
FBR	8260	20	S/13	0	CH	Cyclic rate prior to FBR was 773.
FBR	8320	20	B/11	0	CH	Cyclic rate following FBR was 727.
FBR	8340	20	A/12	0	CH	Cyclic rate at FBR was 727.
FBR	8460	20	S/13	0	CH	Cyclic rate prior to FBR was 736.
FBR	8500	20	S/15	0	CH	Cyclic rate prior to FBR was 736.
FBR	8560	20	S/13	0	CH	Cyclic rate not recorded.
FBR	8580	20	B/14	0	CH	Cyclic rate not recorded.
FBR	8640	20	A/12	0	CH	Cyclic rate at FBR was 710.
FBR	8720	20	B/11	0	CH	Cyclic rate following FBR was 683.
FF-1	8821	1	A/12	0	BA	
FBR	8960	20	S/13	0	CH	Cyclic rate prior to FBR was 707.
FBR	9000	20	S/15	0	CH	Cyclic rate prior to FBR was 707.
FBR	9340	20	A/17	0	CH	Cyclic rate at FBR was 756.
FBR	9460	20	S/18	0	CH	Cyclic rate prior to FBR was 761.
FBR	9480	20	B/19	0	CH	Cyclic rate prior to FBR was 761.
FBR	9520	20	B/16	0	CH	Cyclic rate following FBR was 756.
FBR	9560	20	S/18	0	CH	Cyclic rate prior to FBR was 756.
FBR	10000+	20	S/20	0	CH	Occurred during accuracy firing. Magnaglow inspection revealed no defects.

Type[a]	Malfunction Round Count	Round No.[b]	Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	Remarks
				Rifle No. A-30		
FBR	700	20	S/5	0	CH	The cyclic rate prior to FBR was 845.
FF-1	3281	1	S/10	0	Not Recorded	
FBR	3360	20	S/8	0	CH	The cyclic rate prior to FBR was 832.
FBR	3380	20	B/9	0	CH	The cyclic rate prior to FBR was 832.
FBR	3600	20	S/10	0	CH	The cyclic rate prior to FBR was 891.
FF-1	4141	1	S/8	0	Not Recorded	The round was stubbed in the magazine.
FBR	4380	20	B/9	0	CH	The cyclic rate prior to FBR was 808.
FBR	4420	20	B/6	0	CH	The cyclic rate following FBR was 768.
FBR	4520	20	B/6	0	CH	The cyclic rate following FBR was 802.
FF-1	4561	1	B/9	0	Not Recorded	
FBR	4660	20	S/8	0	CH	The cyclic rate prior to FBR was 808.
FF-1	4681	1	S/10	0	Not Recorded	
FBR	4700	20	S/10	0	CH	The cyclic rate prior to FBR was 808.
FF-1	4761	1	B/9	0	Not Recorded	
FBR	4780	20	B/9	0	CH	The cyclic rate prior to FBR was 809.
FF-1	4861	1	B/9	0	BA	
FF-1	4881	1	S/10	0	See Remarks	Pushed up on magazine to clear.
FF-1	4981	1	S/10	0	Not Recorded	
FBR	5200	20	S/10	0	CH	Cyclic rate prior to FBR was 796.
FBR	5560	20	S/8	0	CH	Cyclic rate prior to FBR was 811.
FBR	5660	20	S/8	0	CH	Cyclic rate prior to FBR was 789.

Malfunction Type[a]	Malfunction Round Count	Round No.	Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	Remarks
FBR	5760	20	S/8	0	CH	Cyclic rate prior to FBR was 784.
FF/BB	5762	1	B/9	0	CH/BA	The bolt failed to close completely on the 2nd round. It was necessary to use the BA device to chamber the round on a second attempt. The round was not bent or damaged.
FF-1	5961	1	B/9	0	Not Recorded	
FBR	5980	20	B/9	0	CH	Cyclic rate prior to FBR was 780.
BDP	6000			Bolt		Magnaglow inspection revealed cracks at the rear of each of the lugs adjacent to each side of the extractor.
FBR	6140	20	A/12	0	CH	The cracked bolt was not replaced.
FBR	6160	20	S/13	0	CH	
FBR	6240	20	A/12	0	CH	Cyclic rate at FBR was 772.
FBR	6260	20	S/13	0	CH	Cyclic rate following FBR was 772.
FBR	6340	20	A/12	0	CH	Cyclic rate at FBR was 740.
FBR	6580	20	B/14	0	CH	Cyclic rate following FBR was 752.
FBR	6640	20	A/12	0	CH	Cyclic rate at FBR was 773.
FBR	6660	20	S/13	0	CH	Cyclic rate following FBR was 773.
FBR	6680	20	B/14	0	CH	Cyclic rate following FBR was 773.
FBR	6740	20	A/12	0	CH	Cyclic rate at FBR was 729.
FBR	6840	20	A/12	0	CH	Cyclic rate at FBR was 753. (Magnaglow inspection results at 7000 rds same as at 6000 rds.)
FBR	7060	20	S/13	0	CH	
FBR	7120	20	B/11	0	CH	
FBR	7160	20	S/13	0	CH	
FBR	7200	20	S/15	0	CH	
FF-1	7261	1	B/14	0	See Remark	The bolt closed when the rifle was bumped.

Malfunction Type[a]	Malfunction Round Count	Round No.	Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	Remarks
FBR	7340	20	A/12	0	CH	
FBR	7380	20	B/14	0	CH	
FBR	7540	20	A/12	0	CH	
FBR	7560	20	S/13	0	CH	
FBR	7620	20	B/11	0	CH	
FBR	7760	20	S/13	0	CH	
FBR	7920	20	B/11	0	CH	
						(Magnaglow inspection results at 8000 rds same as at 6000 rds.)
FBR	8000+	20	S/11	0	CH	Occurred during accuracy firing.
FBR	8000+	20	S/13	0	CH	
FBR	8000+	20	S/14	0	CH	
FBR	8000+	20	S/15	0	CH	
FBR	8060	20	S/13	0	CH	Cyclic rate prior to FBR was 780.
FBR	8080	20	B/14	0	CH	Cyclic rate prior to FBR was 780.
FBR	8160	20	S/13	0	CH	Cyclic rate prior to FBR was 726.
FBR	8180	20	B/14	0	CH	Cyclic rate prior to FBR was 726.
FBR	8200	20	S/15	0	CH	Cyclic rate prior to FBR was 726.
FBR	8360	20	S/13	0	CH	Cyclic rate prior to FBR was 726.
FBR	8380	20	B/14	0	CH	Cyclic rate prior to FBR was 726.
FBR	8440	20	A/12	0	CH	Cyclic rate at FBR was 747.
FBR	8480	20	B/14	0	CH	Cyclic rate prior to FBR was 747.
FBR	8620	20	B/11	0	CH	Cyclic rate following FBR was 719.
FBR	8640	20	A/12	0	CH	Cyclic rate at FBR was 719.
FBR	8660	20	S/13	0	CH	Cyclic rate prior to FBR was 719.
FBR	8760	20	S/13	0	CH	Cyclic rate prior to FBR was 727.
FBR	8800	20	S/15	0	CH	Cyclic rate prior to FBR was 727.
FBR	8860	20	S/13	0	CH	Cyclic rate prior to FBR was 698.
FBR	8920	20	B/11	0	CH	Cyclic rate following FBR was 702.

Malfunction Type[a]	Round Count	Round No.[b]	Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	Remarks
FBR	8980	20	B/14	0	CH	Cyclic rate prior to FBR was 702.
BDP	9000			Extractor Spring	ORG	Magnaglow inspection at 9000 rounds same as at 6000 rounds.
FBR	9080	20	B/19	0	CH	Cyclic rate prior to FBR was 747.
FBR	9140	20	A/17	0	CH	Cyclic rate at FBR was 737.
FBR	9180	20	B/19	0	CH	Cyclic rate prior to FBR was 737.
FBR	9200	20	S/20	0	CH	Cyclic rate prior to FBR was 737.
FBR	9240	20	A/17	0	CH	Cyclic rate at FBR was 743.
FBR	9260	20	S/18	0	CH	Cyclic rate prior to FBR was 743.
FBR	9300	20	S/20	0	CH	Cyclic rate prior to FBR was 743.
FBR	9320	20	B/16	0	CH	Cyclic rate following FBR was 707.
FF-1	9321	1	A/17	0	BA	
FBR	9440	20	A/17	0	CH	Cyclic rate at FBR was 746.
FBR	9460	20	S/18	0	CH	Cyclic rate prior to FBR was 746.
FBR	9480	20	B/19	0	CH	Cyclic rate prior to FBR was 746.
FF-1	9541	1	S/18	0	BA	
FBR	9640	20	A/17	0	CH	Cyclic rate at FBR was 729.
FBR	9660	20	S/18	0	CH	Cyclic rate prior to FBR was 729.
FBR	9720	20	B/16	0	CH	Cyclic rate following FBR - not recorded.
FBR	9760	20	S/18	0	CH	Cyclic rate prior to FBR - not recorded.
FBR	9780	20	B/19	0	CH	Cyclic rate prior to FBR - not recorded.
FBR	9800	20	S/20	0	CH	Cyclic rate prior to FBR - not recorded.
FF-1	9841	1	B/19	0	BA	
FBR	9900	20	S/20	0	CH	Cyclic rate prior to FBR was 712.
FBR	9920	20	B/16	0	CH	Cyclic rate following FBR was 716.
FBR	9960	20	S/18	0	CH	Cyclic rate prior to FBR was 716.
FBR	10000	20	S/20	0	CH	Cyclic rate prior to FBR was 716.
FBR	10000+	20	S/17	0	CH	Occurred during accuracy test. Magnaglow inspection at 10000 rounds same as at 6000 rounds.

Malfunction						
Type[a]	Round Count	Round No.[b]	Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	Remarks
				Rifle No. A-31		
FJ	900	20	S/5	0	See Remark	The fired case remained loose in the action on top of the empty magazine.
FF-1	3261	1	B/9	0	Not recorded	
FBR	4500	20	S/10	0	CH	Cyclic rate prior to FBR was 794.
FBR	4900	20	S/10	0	CH	Cyclic rate prior to FBR was 809.
FBR	5320	20	B/6	0	CH	Cyclic rate following FBR was 811.
FF-1	5961	1	B/9	0	Not recorded	
FBR	5980	20	B/9	0	CH	Cyclic rate prior to FBR was 778.
BDP	6000			Bolt		Magnaglow inspection revealed crack patterns at the rear of each of the lugs adjacent to each side of the extractor. The cracked bolt was not replaced.
FBR	6440	20	A/12	0	CH	Cyclic rate at FBR was 778.
FBR	6700	20	S/15	0	CH	Cyclic rate prior to FBR was 776.
FBR	6780	20	B/14	0	CH	Cyclic rate prior to FBR was 759. Magnaglow inspection failed to reveal a crack pattern at the rear of one lug that had been previously noted at 6000 rds.
FBR	7280	20	B/14	0	CH	
FFR	7882	2	S/15	0	CH)	The FFR's appeared to be due to incomplete closure of the bolt carrier.
FFR	7945	5	S/13	0	CH)	
FFR	7953	13	S/13	0	CH)	
FFR	7956	16	S/13	0	CH)	Magnaglow inspection same as at 6000 rds.

Malfunction			of Fire[c]/	Defective,		
Type[a]	Round Count	Round No.[b]	Magazine No.	Damaged or Broken Parts	Clearing Action[d]	Remarks
BDP	9000			Bolt	DSL	The bolt was cracked at the cam pin hole; the bolt was replaced.
FBR	9420	20	B/16	0	CH	Cyclic rate following FBR was 772.
FBR	9780	20	B/19	0	CH	Cyclic rate prior to FBR was 773.
FBR	9840	20	A/17	0	CH	Cyclic rate at FBR was 749.
FBR	10000+	20	S/17	0	CH	Occurred during accuracy firing. Magnaglow inspection of the bolt revealed no defects.

Malfunction Type[a]	Round Count	Round No.[b]	Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	Remarks
				Rifle No. A-32		
FJ	1653	13	S/3	0	CH	
FBR	2000+	20	S/Not recorded	0	CH	The FBR occurred during the 2000-rd accuracy firing.
FF-1	2441	1	S/3	0	BA	
FBR	3220	20	B/6	0	CH	Cyclic rate following FBR was 818.
FBR	3260	20	S/8	0	CH	Cyclic rate prior to FBR was 818.
FBR	3660	20	S/8	0	CH	Cyclic rate prior to FBR was 836.
FBR	4140	20	A/7	0	CH	While inserting a loaded magazine, the bolt closed without depressing the release; not counted as a malfunction.
FBR	4420	20	B/6	0	CH	
FBR	4440	20	A/7	0	CH	
FF/BB	4788	8	S/10	0	Not recorded	
FBR	4860	20	S/8	0	CH	
FBR	4980	20	B/9	0	CH	Cyclic rate prior to FBR was 823.
FBR	5040	20	S/7	0	CH	Cyclic rate at FBR was 883.
FBR	5160	20	B/8	0	CH	Cyclic rate prior to FBR was 838.
FBR	5440	20	S/7	0	CH	Cyclic rate at FBR was 794.
FBR	5460	20	B/8	0	CH	Cyclic rate prior to FBR was 794.
FBR	5560	20	B/8	0	CH	Cyclic rate prior to FBR was 829.
BDP	5649	9	B/8	Extractor spring	ORG	The extractor spring broke and ejection failure occurred. The spring was replaced.
BDP	6000			Bolt	DSL	Magnaglow inspection revealed a possible crack on the bolt locking lug immediately right of the extractor slot. The bolt was replaced with the bolt from A-8 (previously fired 40 rounds).

Malfunction Type[a]	Round Count	Round No.[b]	Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	Remarks
						Note: only the bolt body from A-8 installed in A-32; extractor, ejector and springs from A-32 transferred to A-8 bolt.
FBR	6000+	20	B/6	0	CH	The FBR occurred during the 6000-rd accuracy firing.
FJ	6045	5	S/13	0	CH	
FBR	6840	20	A/12	0	CH	The cyclic rate at FBR was 784. Magnaglow results indicated no defects.
FBR	7400	20	S/15	0	CH	
FBR	7440	20	A/13	0	CH	Magazine 13 fired in error; should have been No. 12.
FBR	7480	20	B/14	0	CH	
FF-1	7861	1	B/14	0	Not Recorded	The bolt closed when the rifle was bumped.
FF-1	7961	1	B/14			
						Magnaglow results at 8000 rds indicated a crack pattern at the rear of one lug.
FBR	8060	20	S/13	0	CH	Cyclic rate prior to FBR was 753.
FBR	8100	20	S/15	0	CH	Cyclic rate prior to FBR was 753.
FBR	8200	20	S/15	0	CH	Cyclic rate prior to FBR was 729.
FBR	8360	20	S/13	0	CH	Cyclic rate prior to FBR was 724.
FBR	8600	20	S/15	0	CH	Cyclic rate prior to FBR was 734.
FBR	8620	20	B/11	0	CH	Cyclic rate at FBR was 746.
FBR	8700	20	S/15	0	CH	Cyclic rate prior to FBR was 746.
FF-1	8761	1	B/14	0		
FBR	8800	20	S/15	0	CH	Cyclic rate prior to FBR was 746. Magnaglow inspection at 9000 rounds same as at 8000 rounds.

Malfunction			Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	Remarks
Type[a]	Round Count	Round No.[b]				
FBR	9080	20	B/19	0	CH	Cyclic rate prior to FBR was 726.
FBR	9120	20	B/16	0	CH	Cyclic rate following FBR was 708.
FBR	9140	20	A/17	0	CH	Cyclic rate at FBR was 708.
FBR	9320	20	B/16	0	CH	Cyclic rate following FBR was 712.
FF-1	9461	1	B/19	0	Not Recorded	
FBR	9520	20	B/16	0	CH	Cyclic rate following FBR was 700.
FBR	9540	20	A/17	0	CH	Cyclic rate at FBR was 700.
FBR	9560	20	S/18	0	CH	Cyclic rate prior to FBR was 700.
FBR	9660	20	S/18	0	CH	Cyclic rate prior to FBR was 726.
FF-1	9661	1	B/19	0	BA	
FBR	9720	20	B/16	0	CH	Cyclic rate following FBR was 723.
FF-1	9961	1	B/19	0	BA	Magnaglow inspection revealed a crack pattern at the rear of each of the bolt lugs on each side of the extractor.

Malfunction Type[a]	Round Count	Round No.[b]	Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	Remarks
				Rifle No. A-33		
FBR	900	20	S/5	0	CH	Cyclic rate prior to FBR was 883.
FF/BOB	1278	18	B/4	0	Not Recorded	
BDP	3965	5	S/5	Extractor Spring	ORG	The extractor spring broke and caused ejection failures; a new spring was installed. Two cartridges from lot TW18301 were dented and the rims were damaged. These defects occurred during ammunition production. The cartridges could not be chambered in the rifle.
						Magnaglow inspection at 6000 rds showed no defects.
BDP	7000			Bolt		Magnaglow inspection at 7000 rds. revealed a crack pattern at the rear of one bolt lug; the bolt was not replaced.
BDP	7000			Extractor Spring	ORG	
						Magnaglow inspection at 8000 rds. same a as at 7000.
FF-1	8781	1	S/15	0	BA	Magnaglow inspection at 9000 rds. same as at 7000 rds.
FF-1	9521	1	A/17	0	Not Recorded	
FF-1	9981	1	S/20	0	BA	Magnaglow inspection at 10000 rds. same as at 7000 rds.

Malfunction Type[a]	Round Count	Round No.[b]	Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	Remarks
				Rifle No. A-34		
						Five M196 rounds failed to trace in the first 1000-rd cycle; two rounds failed to trace in the second cycle and five rounds failed to trace in the third cycle.
BDP	3230	10	A/7	Extractor Spring	ORG	The extractor spring broke and caused ejection failures; a new spring was installed. Five M196 rounds failed to trace. No tracer observations were made after the fourth cycle.
BDP	6203	3	B/11	Extractor Spring	ORG	The extractor spring broke and was replaced; life of this spring was 2973 rds.
BDP	7000			Bolt		Magnaglow inspection revealed cracks at the rear of each of the lugs adjacent to each side of the extractor. The bolt was not replaced.
FF-1	7161	1	B/14	0	Not Recorded	
FF-1	7961	1	B/14	0	Not Recorded	
FF-1	7981	1	S/15	0	Not Recorded	Magnaglow results same as at 7000 rds.
FBR	8280	20	B/14	0	CH	Cyclic rate prior to FBR was 749.
BDP	8333	13	A/12	Extractor Spring	ORG	The extractor spring broke and was replaced; life of this spring was 2130 rds.
FBR	8800	20	S/15	0	CH	Cyclic rate prior to FBR was 747. Magnaglow results same as at 8000 rds.

Malfunction			Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action	Remarks
Type[a]	Round Count	Round No.[b]				
FBR	9120	20	B/16	0	CH	Cyclic rate following FBR was 815.
FBR	9420	20	B/16	0	CH	Cyclic rate following FBR was 780.
FBR	9520	20	A/17	0	CH	Cyclic rate at FBR was 778.
						A failure to fire occurred with one round of TW18301. The cartridge was disassembled and the propellant appeared contaminated with an oily-like substance.
						Magnaglow inspection after 10000 rds. revealed crack patterns at the rear of two bolt lugs.
BDP	10000+			Extractor Spring	ORG	During the final 53 rds. of accuracy firing the extractor spring broke.

Malfunction Type[a]	Round Count	Round No.[b]	Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	Remarks
				Rifle No. A-35		
						Six M196 rounds failed to trace in the first 1000-round cycle; four rounds failed to trace in the second cycle, four rounds failed to trace in the third cycle; four rounds failed to trace in the fourth cycle. No tracer observations were made after the fourth cycle.
FF-1	6841	1	S/13	0	see note	After manually assisting the loading of this round, the round would not fire. Carbon deposits on the firing pin appeared to be the likely cause.
FFR	6941	1	S/13	0	See note	The firing failure was due to carbon accumulation on the bolt and the firing pin.
BDP	7000			Bolt	DSL	First magnaglow inspection revealed cracks at the rear of each of the lugs adjacent to each side of the extractor; the bolt from A-9 was installed in A-35 but the ejector, extractor and springs from A-35 were transferred to the A-9 bolt.
FBR	7100	20	S/15	0	CH	Cyclic rate prior to FBR was 820.
FBR	7360	20	S/13	0	CH	Cyclic rate prior to FBR was 775.
FF-1	7501	1	B/11		BA	
FFR	7841	1	S/13	0	See note	Carbon accumulation in the bolt and carrier and firing pin caused the FFR.
FFR	7941	1	S/13	0	See note	Same as previous FFR.
BDP	8000			Bolt		Magnaglow inspection revealed a crack pattern at the rear of one bolt lug.
FFR	8501	1	S/11	0	See note	Same as previous FFR.
FFR	8507	7	S/11	0		Same as previous FFR.

Malfunction Type	Round Count	Round No.[b]	Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	
FFR	8775	15	B/ 14	0		Same as previous FFR.
FFR	8904	4	B/ 11	0		Same as previous FFR.
FFR	8985	5	S/ 15	0		Same as previous FFR.
						Magnaglow inspection same as at 8000 rounds.
BDP	10000+			Extractor Spring	ORG	During the final 53 rounds of accuracy firing the extractor spring broke. Final magnaglow inspection revealed crack patterns at the rear of each of the bolt lugs on each side of the extractor.

Malfunction			Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	Remarks
Type[a]	Round Count	Round No.[b]				
				Rifle No. B-29		
BDP	1420	1	A/2	Selector lever	Repositioned the selector	The selector lever was defective; ref par 2.4, continued failures occurred during subsequent firings; no replacement parts were available.
BDP	4000			Bolt		The bolt was magnaglow inspected at 3000 rds; no defects were noted. Magnaglow indicated crack patterns at the rear of each lug on each side of the extractor.
FF/DF	9775	15	B/19	0	CH/M	Magnaglow inspection at 5, 6, 7, 8, 9 and 10000 rounds same as at 4000 rounds.

Type[a]	Round Count	Round No.[b]	Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	Remarks
				Rifle No. B-30		
FF/DF	318	18	B/1	0	CH/M	
FF/DF	718	18	B/1	0	CH/M	
FF/DF	738	18	A/2	0	CH/M	
FF/DF	1838	18	A/2	0	CH/M	
BDP	3000			Bolt		Magnaglow inspection revealed crack patterns at the rear of each lug on each side of the extractor. The bolt was not replaced. Magnaglow inspection at 4000 rds same as at 3000.
FF/DF	5695	15	S/10	0	CH/M	Magnaglow inspection at 5000 and 6000 rds same as at 3000 rds.
FF/DF	6138	18	A/12	0	CH/M	
FBR	9040	20	A/17	0	CH	
FF/DF	9058	18	S/18	0	CH/M	
FF/DF	9298	18	S/20	0	CH/M	
FFR	9941	1	S/18	0	CH	The bolt carrier had failed to fully close and an FFR resulted. Magnaglow inspection at 7, 8, 9 and 10000 rounds same as at 3000 rounds.

Malfunction			Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	Remarks
Type[a]	Round Count	Round No.[b]				
				Rifle No. B-31		
FF/DF	938	18	A/2	0	CH/M	
BDP	1001	1	A/2	Selector lever	See Remark	The selector lever was manually repositioned; the selector lever was defective, ref. par 2.4.
BDP	3000			Bolt		Magnaglow inspection revealed a crack pattern at the rear of one lug.
						Magnaglow inspection at 4000 rds. revealed crack patterns at the rear of each lug on each side of the extractor groove.
						During the insertion of magazine No. 6 at 4400 rds, the bolt released from the bolt stop and closed; not scored as a malfunction.
						Magnaglow inspection at 5000 and 6000 rds same as at 4000 rds.
FF/DF	8257	17	S/13	0	CH/M	
FFR	8941	1	S/13	0	CH	The bolt carrier failed to fully close and an FFR resulted.
FF/DF	9018	18	B/16	0	CH/M	
FF/DF	9057	17	S/18	0	CH/M	
						Magnaglow inspection at 7000 rounds same as at 3000 rounds; only one lug crack pattern could be detected. Crack patterns at the rear of both lugs were again detected at 8, 9 and 10000 rounds.

Malfunction			Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	Remarks
Type[a]	Round Count	Round No.[b]				
				Rifle No. B-32		
FF/DF	58	18	S/3	0	CH/M	
FF/DF	98	18	S/5	0	CH/M	
BDP	201	1	B/1	Selector lever	Repositioned selector	The selector lever was defective; ref par 2.4
FF/DF	658	18	S/3	0	CH/M	
FF/DF	918	18	B/1	0	CH/M	
FF/DF	1177	17	B/4	0	CH/M	The defective selector continued to jam the trigger during this cycle.
FF/DF	1178	18	B/4	0	CH/M	
BDP	2100	-	S/5	Magazine	ORG	Magazine No. 5 was defective; the floorplate retainer spring failed to secure the floorplate. This failure is a Code C magazine failure and not charged to the gun.
FF/DF	2175	15	B/4	0	CH/M	The defective selector continued to jam the trigger. Magnaglow inspection of the bolt revealed no defects.
FF/DF	2997	17	S/5	0	CH/M	
FF/DF	3077	17	B/9	0	CH/M	
FF/DF	3276	16	B/9	0	CH/M	
FF/DF	3518	18	B/6	0	CH/M	
FF/DF	3877	17	B/9	0	CH/M	Magnaglow inspection revealed no defects.
FFR	4061	1	B/9	0	CH	Magnaglow inspection at 5000 rounds revealed no defects.
FF/DF	4818	18	B/6	0	CH/M	
FF-1	4961	1	B/9	0	BA	
FF-1	5261	1	B/9	0	BA	

Malfunction Type[a]	Malfunction Round Count	Malfunction Round No.[b]	Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	Remarks
BDP	6000			Bolt		Magnaglow inspection revealed a crack pattern at the rear of one bolt lug.
FF/DF	6217	17	B/11	0	CH/M	Magnaglow inspection at 7000 rounds same as at 6000.
7000+						The rear takedown pin partially backed out during firing; inspection revealed no apparent cause.
FF/DF	7217	17	B/11	0	CH/M	
FF/DF	8000+	17	S/11	0	CH/M	Occurred during accuracy firing.
BDP	8000			Extractor spring	ORG	The extractor spring was broken and the retaining ring had disassembled; a new spring and a new ring were installed.
BDP	8000			Dust cover pin retaining ring		Magnaglow inspection at 8000 rounds same as at 6000 rounds.
FF/DF	8617	17	B/11	0	CH/M	
FF/DF	9016	16	B/16	0	CH/M	
FF/DF	9017	17	B/16	0	CH/M	The cartridge case of the jammed round was punctured by the bolt lug and propellant spilled out.
FF/DF	9018	18	B/16	0	CH/M	
FF/DF	9115	15	B/16	0	CH/M	
FF/DF	9137	17	A/17	0	CH/M	
						During the 9200-round cycle, magazine B-32-16 was fired with the gun in the test stand; no DF's occurred.
FF/DF	9315	15	B/16	0	CH/M	
FF/DF	9316	16	B/16	0	CH/M	
						During the 9400-round cycle, magazine B-32-16 was again fired from the test stand; no DF's occurred.
FF/DF	9515	15	B/16	0	CH/M	
FF/DF	9618	18	B/16	0	CH/M	Fired from the test stand.

Malfunction			Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	Remarks
Type[a]	Round Count	Round No.[b]				
FF/DF	9716	16	B/16	0	CH/M	
FF/DF	9816	16	B/16	0	CH/M	Fired from test stand.
FF/DF	9916	16	B/16	0	CH/M	

Malfunction			Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	Remarks
Type[a]	Round Count	Round No.[b]				
				Rifle No. B-33		
FF/DF	78	18	B/4	0	CH/M	
FF/DF	158	18	S/3	0	CH/M	
FF/DF	278	18	B/4	0	CH/M	
FF/DF	378	18	B/4	0	CH/M	
FF/DF	678	18	B/4	0	CH/M	
FF/DF	778	18	B/4	0	CH/M	
FF/DF	878	18	B/4	0	CH/M	
FF/DF	2438	18	A/2	0	CH/M	
BDP	3000			Bolt		Magnaglow inspection revealed crack patterns at the rear of each of the bolt lugs on each side of the extractor.
FF/DF	3114	14	B/6	0	CH/M	Magnaglow inspection at 4000 rds same as at 3000 rds.
FF/DF	3315	15	B/6	0	CH/M	
FF/DF	3517	17	B/6	0	CH/M	
FF/DF	3737	17	A/7	0	CH/M	
FF/DF	4417	17	B/6	0	CH/M	Magnaglow inspection at 5000 and at 6000 rds same as at 3000 rds.
						No further malfunctions were encountered; magnaglow inspections at each 1000 rounds same as at 3000 rounds.

Malfunction			Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	Remarks
Type[a]	Round Count	Round No.[b]				
				Rifle No. B-34		
FF/DF	3018	18	B/6	0	CH/M	
FF/DF	3518	18	B/6	0	CH/M	
FF/DF	3618	18	B/6	0	CH/M	Magnaglow inspection of the bolt revealed no defects.
FF/DF	4218	18	B/6	0	CH/M	
FF/DF	4718	18	B/6	0	CH/M	
BDP	5000			Bolt		Magnaglow inspection revealed a crack pattern at the rear of one bolt lug; the bolt was not replaced.
FF/DF	5218	18	B/6	0	CH/M	
FF/DF	5318	18	B/6	0	CH/M	
FF/DF	5418	18	B/6	0	CH/M	
FF/DF	5518	18	B/6	0	CH/M	
FF/DF	5618	18	B/6	0	CH/M	
FF/DF	5718	18	B/6	0	CH/M	Magnaglow inspection of the bolt revealed a crack pattern at the rear of each lug on each side of the extractor Note: Magazine No. 6 retained in test after 6000 rds and high-speed motion pictures taken on each burst when magazine No. 6 was fired; other new magazines numbered 12 - 15.
FF-1	6141	1	S/13	0	See Remarks	The nose of the cartridge was stubbed.
FF/DF	6257	17	S/13	0	CH/M	
FF/DF	6537	17	A/12	0	CH/M	
FF-1	6621	1	A/12	0	BA	
FF-1	6721	1	A/12	0	See Remarks	Same as first FF-1

Type[a]	Round Count	Round No.[b]	Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	Remarks
BDP	7000			Extractor Spring	ORG	A broken extractor spring was replaced. Magnaglow inspection at 7000 rds revealed a crack pattern detectable at the rear of only one lug, not two as indicated at 6000 rds.
FF/DF	9158	18	S/18	0	CH/M	
FF/DF	9738	18	A/17	0	CH/M	
FF/DF	9938	18	A/17	0	CH/M	
						Magnaglow inspection at 8, 9 and 10,000 rounds revealed crack patterns at the rear of both bolt lugs.

Malfunction Type[a]	Round Count	Round No.[b]	Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	Remarks
				Rifle No:	B-35	
FF/DF	638	18	A/2	0	CH/M	No tracer observations were made with this rifle.
FF/DF	1938	18	A/2	0	CH/M	
BDP	4000			Bolt		Magnaglow inspection revealed one bolt lug cracked. The cracked bolt was replaced with a bolt from B-4 (40 rounds previously fired). The ejector, extractor, and springs from bolt B-35 were transferred to bolt B-4.
BDP	5000			Bolt		Magnaglow inspection revealed that lugs on either side of the extractor were broken. The bolt was not replaced.
BDP	5592	12	S/10	Extractor spring	ORG	The broken extractor spring resulted in a live round jammed into the base of the fired case; however, tools were not requred to clear the malfunction. The spring was replaced.
						Magnaglow inspection at 6000 rounds same as at 5000 rounds.
FF-1	7621	1	A/12	0	BA	Magnaglow inspection at 7000 rounds and at 8000 rounds same as at 5000 rounds.
FBR	8520	20	B/11	0	CH	Cyclic rate following FBR was 836.
						Magnaglow inspection at 9000 rounds same as at 5000 rounds.
FF/DF	9037	17	A/17	0	CH/M	
BDP	9992	12	S/20	Extractor spring	ORG	The extractor spring broke during firing and caused an ejection failure.
						Magnaglow inspection at 10000 rounds same as at 9000.

Malfunction			Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	Remarks
Type[a]	Round Count	Round No.[b]				
				Rifle No:	C-28	
FF/DF	118	18	B/1	0	CH/M	
FF/DF	618	18	B/1	0	CH/M	
BDP	3000			Bolt		Magnaflow inspection following 3000 rounds indicated a crack pattern at the rear of one bolt lug. The bolt was not replaced.
FF/DF	4738	18	A/7	0	CH/M	Magnaglow inspection at 4000 and 5000 rounds same as at 3000 rounds.
FBR	5160	20	S/8	0	CH	
FFR	5801	1	B/6	0	CH	The carrier did not appear to have fully closed and a FFR resulted.
FBR	6020	20	B/11	0	CH	
FBR	6080	20	B/14	0	CH	
FBR	6100	20	S/15	0	CH	
FFR	7795	2	S/15	0	CH	The malfunction is charged to the rifle although primer indent appeared normal; an inspection of the disassembled cartridge disclosed no deficiency.
						Magnaglow inspection at 7000, and 8000 rounds same as at 3000 rounds.
FBR	9620	20	B/16	0	CH	
						Magnaglow inspection at 9000 and 10000 rounds indicated a crack pattern at the rear edge of each of two bolt lugs.

Malfunction Type[a]	Round Count	Round No.[b]	Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	Remarks
				Rifle No: C-29		
FF/DF	2556	16	S/3	0	CH/M	
FF/DF	2716	16	B/1	0	CH/M	Magnaglow inspection at 3000 rounds indicated no defects.
FBR	3660	20	S/8	0	CH	Cyclic rate prior to FBR was 798.
						Magnaglow inspection at 4000 rounds same as at 3000 rounds.
						Magnaglow inspection at 5000 and 6000 rounds indicated no defects.
BDP	7000			Bolt		The front hinge pin partially backed out during firing; inspection revealed no apparent cause. The failure was not charged as a malfunction. Magnaglow inspection at 7, 8, 9 and 10000 rounds indicated a crack pattern at the rear of one bolt lug.
BDP	9000			Extractor spring	ORG	The extractor spring was found to be broken during maintenance at 9000 rounds.

Malfunction			Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	Remarks
Type[a]	Round Count	Round No.[b]				
				Rifle No: C-30		
FF/DF	158	18	S/3	0	CH/M	
FF/DF	218	18	B/1	0	CH/M	
FF/DF	558	18	S/3	0	CH/M	
FF/DF	678	18	B/4	0	CH/M	
FF/DF	746	16	S/3	0	CH/M	
FF/DF	747	17	S/3	0	CH/M	
FF/DF	838	18	A/2	0	CH/M	
FF/DF	938	18	A/2	0	CH/M	
FF/DF	958	18	S/3	0	CH/M	
FF/DF	1417	17	B/1	0	CH/M	
FF/DF	1737	17	A/2	0	CH/M	
FF/DF	2117	17	B/1	0	CH/M	
FF/DF	2556	16	S/3	0	CH/M	
FF/DF	2936	16	A/2	0	CH/M	
FF/DF	2956	16	S/3	0	CH/M	Magnaglow inspection of the bolt revealed no defects.
FF/DF	3017	17	B/6	0	CH/M	
FF/DF	3217	17	B/6	0	CH/M	
FF/DF	3237	17	A/7	0	CH/M	
FF/DF	3517	17	B/6	0	CH/M	
FF/DF	3937	17	A/7	0	CH/M	Magnaglow inspection of the bolt revealed no defects. High speed motion pictures were taken between rounds 4000-5000
						Magnaglow inspection at 5000 rounds revealed no defects.
FF/DF	5578	18	B/9	0	CH/M	Magnaglow inspection revealed no defects at 6000 rounds.

Malfunction			Mode of Fire[c]/ Magazine No.	Defective Damaged or Broken Parts	Clearing Action[d]	Remarks
Type[a]	Round Count	Round No.[b]				
FF/DF	6018	18	B/11	0	CH/M	
FF/DF	6118	18	B/11	0	CH/M	
FF/DF	6278	18	B/14	0	CH/M	
FF/DF	6318	18	B/11	0	CH/M	
FF/DF	6418	18	B/11	0	CH/M	
FF/DF	6458	18	S/13	0	CH/M	
FF/DF	6518	18	B/11	0	CH/M	
FF/DF	6556	16	S/13	0	CH/M	
FFR	6801	1	B/11	0	CH	
FFR	6841	1	S/13	0	CH	
FFR	6881	1	S/15	0	CH	
FFR	6941	1	S/13	0	CH	
FF/DF	7256	16	S/13	0	CH/M	
FF/DF	7356	16	S/13	0	CH/M	
FF/DF	7418	18	B/11	0	CH/M	
FF/DF	7556	16	S/13	0	CH/M	
FF/DF	7618	18	B/11	0	CH/M	
FFR	7747	7	S/13	0	CH	
FF/DF	7818	18	B/11	0	CH/M	
FF/DF	7858	18	S/13	0	CH/M	
FF/DF	7918	18	B/11	0	CH/M	
FF/DF	8000+	15	S/13	0	CH/M	Occurred during accuracy firing.
FF/DF	8218	18	B/11	0	CH/M	
FF/DF	8256	16	S/13	0	CH/M	
FF/DF	8318	18	B/11	0	CH/M	
FF/DF	8416	16	B/11	0	CH/M	
FF/DF	8418	18	B/11	0	CH/M	
FF/DF	8456	16	S/13	0	CH/M	
FF/DF	8618	18	B/11	0	CH/M	
FF/DF	8816	16	B/11	0	CH/M	
FF/DF	8858	18	S/13	0	CH/M	

Malfunction			Mode of Fire[c]/ Magazine No.	Defective Damaged or Broken Parts	Clearing Action[d]	Remarks
Type[a]	Round Count	Round No.[b]				
BDP	9000					Magnaglow inspection revealed no defects through 8000 rounds; at 9000 and 10000 rounds a crack pattern at the rear of one bolt lug was detected.
FBR	9400	20	S/20	0	CH	

Malfunction Type[a]	Round Count	Round No.[b]	Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	Remarks
				Rifle No:	C-31	
FF/DF	287	17	S/5	0	CH/M	
FF/DF	677	17	B/4	0	CH/M	
FF/DF	757	17	S/3	0	CH/M	
FF/DF	797	17	S/5	0	CH/M	
FF/DF	858	18	S/3	0	CH/M	
FF/DF	897	17	S/5	0	CH/M	
FF/DF	1187	17	S/5	0	CH/M	
FF/DF	1418	18	B/1	0	CH/M	
FF/DF	1436	16	A/2	0	CH/M	
FF/DF	1718	18	B/1	0	CH/M	
FF/DF	1797	17	S/5	0	CH/M	
FF/DF	2197	17	S/5	0	CH/M	Magnaglow inspection revealed no defects at 3000 rounds.
FF/DF	2218	18	B/1	0	CH/M	
FF/DF	2518	18	B/1	0	CH/M	
FF/DF	2538	18	A/2	0	CH/M	
FF/DF	3217	17	B/6	0	CH/M	
FF/DF	3277	17	B/9	0	CH/M	
FF/DF	3317	16	B/6	0	CH/M	
BDP	4000			Front sling swivel	ORG	The front sling swivel roll pin loosened and both the pin and swivel disassembled from the rifle. Magnaglow inspection revealed no defects.
FF/DF	4037	17	A/7	0	CH/M	
FF/DF	4718	18	B/6	0	CH/M	
FF/DF	4918	18	B/6	0	CH/M	Magnaglow inspection revealed no defects.
FF/DF	5018	18	B/6	0	CH/M	
FF/DF	5138	18	A/7	0	CH/M	
FF/DF	5218	18	B/6	0	CH/M	
FF/DF	5416	16	B/6	0	CH/M	

Malfunction Type[a]	Round Count	Round No.[b]	Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	Remarks
FF/3F	5616	16	B/6	0	CH/M	
FF-1	5681	1	S/10	0	BA	
FFR	5774	14	B/9	0	ch	The carrier did not appear to have fully closed on each FFR.
FFR	5849	9	S/8	0	CH	
FF-1	5881	1	S/10	0	BA	
FF-1	5941	1	S/8	0	BA	
FF-1	5981	1	S/10	0	BA	Magnaglow inspection at 6000 rounds revealed no defects
FF/DF	6098	18	S/15	0	CH/M	
FF/DF	6356	16	S/13	0	CH/M	
FF/DF	6377	17	B/14	0	CH/M	
FF/DF	6478	18	B/14	0	CH/M	
FF-1	6881	1	S/15	0	BA	
FF/BB	6882	2	S/15	0	CH	The carrier failed to fully close
FF-1	6981	1	S/15	0	BA	Magnaglow inspection revealed no defects.
FF/DF	7298	18	S/15	0	CH/M	
FF/DF	7478	18	B/14	0	CH/M	
FF/DF	7498	18	S/15	0	CH/M	
FF/DF	7596	16	S/15	0	CH/M	
FF/DF	7697	17	S/15	0	CH/M	
FF/DF	7796	16	S/15	0	CH/M	
FF/DF	7896	16	S/15	0	CH/M	
FF/DF	7898	18	S/15	0	CH/M	
FFR	7944	4	S/13	0	CH	
BDP				Bolt		Magnaglow inspection revealed a crack pattern at the rear of one bolt lug at 8000 rounds.
FF/DF	8098	18	S/15	0	CH/M	
FF/DF	8198	18	S/15	0	CH/M	
FF/DF	8397	17	S/15	0	CH/M	

Malfunction Type[a]	Round Count	Round No.[b]	Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	Remarks
FF/DF	8496	16	S/15	0	CH/M	
FF/DF	8498	18	S/15	0	CH/M	
FF/DF	8796	16	S/15	0	CH/M	
FF/DF	8798	18	S/15	0	CH/M	
FF/DF	8896	16	S/15	0	CH/M	
FF/DF	8898	18	S/15	0	CH/M	
FF/DF	8996	16	S/15	0	CH/M	
FF/DF	8997	17	S/15	0	CH/M	Magnaglow inspection at 9000 rounds same as at 8000 rounds.
FF/DF	9018	18	B/16	0	CH/M	
FF/BB	9903	3	B/16	0	BA	Additional lubricant was applied to the bolt carrier in order to complete firing in this final cycle.
						Magnaglow inspection at 10000 rounds same as at 8000 rounds.

Malfunction						
Type[a]	Round Count	Round No.[b]	Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	Remarks
Rifle No. C-32						
						Magnaglow inspection revealed no defects.
FF-1	3981	1	S/10	0	See Note	Feeding was completed by tapping the side of the magazine.
BDP	4000			Bolt		Magnaglow inspection revealed a crack pattern at the rear of one bolt lug. The bolt was not replaced.
FF/DF	4958	18	S/8	0	CH/M	
BDP	8000			Extractor Spring	ORG	The extractor spring was found to be broken during the 8000-round maintenance period.
						Magnaglow inspection of the bolt revealed no change through 9000 rounds; crack patterns at the rear of two locking lugs were detected at 10000 rounds.

Malfunction Type[a]	Round Count	Round No.[b]	Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	Remarks
				Rifle No: C-33		
FF/DF	98	18	S/5	0	CH/M	No tracer observations were made with this rifle.
FF/DF	118	18	B/1	0	CH/M	
FF/DF	598	18	S/5	0	CH/M	
FF/DF	658	18	S/3	0	CH/M	
FF/DF	678	18	B/4	0	CH/M	
FF/DF	738	18	A/2	0	CH/M	
FF/DF	898	18	S/5	0	CH/M	
FF/DF	918	18	B/1	0	CH/M	
FF/DF	1278	18	B/4	0	CH/M	
FF/DF	1418	18	B/1	0	CH/M	
FFR	1922	2	A/2	0	CH	A failure to fire occurred during the automatic burst. The rifle stopped with the hammer cocked and the firer was sure that he had not unintentionally released the trigger. The cause remained undetermined.
FF/DF	2378	18	B/4	0	CH/M	
FF/DF	2398	18	S/5	0	CH/M	
FF/DF	2998	18	S/5	0	CH/M	
BDP	4000			Bolt		Magnaglow inspection revealed a crack at the rear of one bolt lug.
FF/DF	4357	17	S/8	0	CH/M	
FF-1	4980	1	S/10	0	BA	Magnaglow inspection same as at 4000 rounds.
						Magnaglow inspection at 6000 rounds same as at 4000 rounds
FBR	6620	20	B/11	0	CH	Magnaglow inspection at 7000 rounds same as at 4000 rounds
FF-1	7241	1	S/13	0	BA	

Malfunction Type[a]	Round Count	Round No.[b]	Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	Remarks
BDP	8000+			Front sling swivel	ORG	The front sling swivel roll pin loosened and the swivel and pin disassembled from the rifle during accuracy firing. Magnaglow inspection at 8000 rounds same as at 4000 rounds.
FF/DF	8578	18	S/13	0	CH/M	
FF-1	8581	1	B/11	0	BA	Magazine No. 11 fired out of sequence through error. Magnaglow inspection at 9000 rounds same as at 4000 rounds
FBR	9380	20	B/19	0	CH	Cyclic rate prior to FBR was 780.
FF-1	9381	1	S/20	0	BA	
FBR	9460	20	S/18	0	CH	Cyclic rate prior to FBR was 806.
FF-1	9481	1	S/20	0	See Note	The round was stubbed in the magazine.
FF-1	9681	1	S/20	0	BA	
FF-1	9801	1	B/16	0	See Note	Feeding was completed when the rifle was bumped.
FF-1	9841	1	S/18	0	BA	
FF-1	9961	1	B/19	0	BA	Magnaglow inspection at 10000 rounds same as at 4000 rounds.

Malfunction Type[a]	Malfunction Round Count	Malfunction Round No.[b]	Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	Remarks
				Rifle No: C-34		
FBR	360	20	S/3	0	CH	Three M196 rounds failed to trace, cyclic rate immediately prior to FBR was 770.
FF-1	800+	1	not recorded	0	CH	
FF/DF	1418	18	B/1	0	CH/M	Tracer observations not obtained after first cycle.
FF/DF	2018	18	B/1	0	CH/M	
FBR	2060	20	S/3	0	CH	Cyclic rate immediately prior to FBR was 786.
FBR	2400	20	S/5	0	CH	Cyclic rate at time of FBR was 768.
FF/DF	2418	18	B/1	0	CH/M	
FBR	3220	20	B/6	0	CH	Cyclic rate following FBR was 773.
FF/DF	3258	18	S/8	0	CH/M	
FBR	3320	20	B/6	0	CH	Cyclic rate following FBR was 768.
FF/DF	3818	18	B/6	0	CH/M	
BDP				Bolt		Magnaglow inspection revealed that the rear of one lug was cracked. The bolt was replaced with a bolt from C-23 (40 rds fired previously). The extractor, ~~ejector~~ and springs from bolt C-34 were transferred to bolt C-23.
FBR	4020	20	B/6	0	CH	Cyclic rate following FBR was 776.
FF/DF	4338	18	A/7	0	CH/M	
FBR	4960	20	S/8	0	CH	Cyclic rate prior to FBR was 768. Magnaglow inspection revealed no defects.
FBR	5260	20	S/8	0	CH	Cyclic rate prior to FBR was 767.
FBR	5560	20	S/8	0	CH	Cyclic rate prior to FBR was 767. Magnaglow inspection revealed no defects.

Malfunction Type[a]	Round Count	Round No.[b]	Mode of Fire[c]/ Magazine No.	Defective, Damaged or Broken Parts	Clearing Action[d]	Remarks
FF-1	7861	1	B/14	0	BA	Magnaglow inspection revealed no defects at 7000 and 8000 rounds.
FBR	8000+	20	not recorded	0	CH	The first FBR occurred during the 8000-round accuracy test.
FBR	8020	20	B/11	0	CH	
FBR	8080	20	B/14	0	CH	
FBR	8140	20	A/12	0	CH	Cyclic rate at FBR was 809.
FBR	8160	20	S/13	0	CH	Cyclic rate prior to FBR was 809.
FBR	8380	20	B/14	0	CH	Cyclic rate prior to FBR was 808.
FBR	8980	20	B/14	0	CH	Cyclic rate prior to FBR was 758.
FBR	9600	20	S/20	0	CH	
FF-1	9941	1	S/18	0	BA	Magnaglow inspection revealed no defects.

ENDURANCE TEST

INDIVIDUAL CYCLIC RATE DATA- FROM 1 TO 1000 ROUNDS
(NR- NOT RECORDED)

Cycle No.	Rifle No.						
	A-29	A-30	A-31	A-32	A-33	A-34	A-35
1	849	861	822	871	871	818	801
2	838	838	789	823	834	816	811
3	832	829	765	836	834	788	818
4	836	861	811	851	838	759	811
5	842	871	831	861	829	794	809
6	849	865	818	859	838	791	832
7	834	845	834	861	849	813	811
8	836	845	857	863	857	823	815
9	834	847	851	867	883	818	838
10	849	829	838	851	867	822	831
Average	840	849	822	854	850	804	818
	B-29	B-30	B-31	B-32	B-33	B-34	B-35
1	859	851	NR	799	788	811	818
2	NR	847	786	820	NR	802	791
3	840	840	794	836	784	818	791
4	853	836	788	825	788	802	808
5	853	857	794	849	802	822	796
6	844	838	794	825	791	818	794
7	861	861	789	832	794	820	NR
8	844	NR	808	851	818	825	802
9	865	875	808	847	816	823	789
10	863	869	NR	831	811	816	798
Average	853	853	795	831	799	816	798
	C-28	C-29	C-30	C-31	C-32	C-33	C-34
1	838	863	786	816	829	869	791
2	808	832	NR	801	784	802	755
3	801	834	747	815	768	798	767
4	829	857	759	815	788	802	770
5	792	847	784	822	788	806	767
6	808	861	780	809	784	804	762
7	789	863	792	811	784	804	768
8	799	NR	796	818	804	NR	755
9	799	836	NR	815	794	820	773
10	816	836	NR	822	794	786	788
Average	808	848	778	814	792	811	770

ENDURANCE TEST

INDIVIDUAL CYCLIC RATE DATA – FROM 1001 TO 2000 ROUNDS

(NR – NOT RECORDED)

Cycle No.	Rifle No.						
	A-29	A-30	A-31	A-32	A-33	A-34	A-35
1	[a] 935	[a] 904	[a] 887	[a] 897	[a] 895	[a] 855	[a] 849
2	849	832	861	879	NR	772	816
3	827	806	825	869	849	791	809
4	811	823	831	853	851	796	808
5	827	853	834	859	845	799	804
6	831	891	845	865	859	796	813
7	816	853	836	845	869	796	809
8	844	863	849	863	867	781	806
9	857	869	857	869	832	783	806
10	865	881	859	881	863	780	802
Average	846	857	848	868	859	795	812
	B-29	B-30	B-31	B-32	B-33	B-34	B-35
1	[a] 822	[a] 853	832	[a] 844	[a] 893	[a] 883	[a] 855
2	838	881	831	857	842	801	802
3	834	863	818	869	861	798	815
4	840	889	836	853	836	802	825
5	840	877	801	875	857	808	808
6	845	NR	838	851	834	809	829
7	851	883	NR	873	865	809	794
8	831	883	811	851	815	811	811
9	844	NR	827	871	840	815	794
10	838	875	816	849	831	788	NR
Average	838	875	823	859	847	812	815
	C-28	C-29	C-30	C-31	C-32	C-33	C-34
1	[a] 844	[a] 855	[a] 784	[a] 881	[a] 842	[a] 885	[a] 815
2	794	829	778	811	796	802	784
3	813	822	804	844	816	811	762
4	789	801	792	822	792	818	786
5	802	813	796	NR	801	802	791
6	770	776	788	816	786	791	786
7	804	796	813	840	804	808	765
8	783	786	NR	809	786	809	783
9	792	796	796	849	799	802	768
10	762	792	792	816	808	NR	784
Average	795	807	794	832	803	814	782

a. Fired from test stand.

ENDURANCE TEST

INDIVIDUAL CYCLIC RATE DATA— FROM 2001 TO 3000 ROUNDS

(NR— NOT RECORDED)

Cycle No.	Rifle No.							
	A-29	A-30	A-31	A-32	A-33	A-34	A-35	
1	840	829	842	845	849	776	816	
2	847	827	840	845	861	784	811	
3	831	849	831	838	863	802	798	
4	853	823	844	853	863	796	796	
5	851	815	825	834	861	791	801	
6	829	836	809	847	853	780	809	
7	804	798	818	840	836	775	794	
8	799	832	834	834	844	784	809	
9	811	816	822	836	838	781	798	
10	799	786	820	823	849	772	802	
Average	826	821	828	839	852	784	803	
	B-29	B-30	B-31	B-32	B-33	B-34	B-35	
1	823	865	813	851	831	851	851	
2	840	883	853	831	813	834	829	
3	844	885	820	844	829	851	820	
4	853	910	825	845	834	840	815	
5	840	883	822	842	b. 818	832	813	b. 19-round burst
6	844	906	834	844	816	838	808	
7	829	887	816	834	829	840	809	
8	838	883	820	844	822	845	829	
9	836	871	804	845	827	829	816	
10	834	867	816	844	823	820	815	
Average	838	884	822	842	824	838	820	
	C-28	C-29	C-30	C-31	C-32	C-33	C-34	
1	806	816	746	840	822	859	786	
2	743	767	737	813	778	822	781	
3	778	792	773	838	799	831	781	
4	762	768	778	831	791	809	778	
5	773	775	767	831	791	806	768	
6	780	755	778	b. 801	788	820	758	
7	776	781	759	825	809	811	776	
8	772	764	756	832	798	815	768	
9	784	778	773	838	806	809	775	
10	767	775	d. 761	825	811	806	778	d. 17-round burst
Average	774	777	763	827	799	819	775	

ENDURANCE TEST

INDIVIDUAL CYCLIC RATE DATA— FROM 3001 TO 4000 ROUNDS

(NR— NOT RECORDED)

Cycle No.				Rifle No.			
	A-29	A-30	A-31	A-32	A-33	A-34	A-35
1	a. 861	a. 871	a. 865	a. 893	a. 871	a. 827	825
2	783	827	823	871	844	761	802
3	806	840	818	818	832	NR	773
4	818	832	816	847	840	776	799
5	811	820	791	857	840	762	784
6	809	818	799	829	809	768	780
7	808	891	809	836	822	755	792
8	799	840	778	816	NR	767	776
9	772	834	804	816	823	759	783
10	813	823	794	799	802	784	789
Average	808	840	810	838	831	773	790
	B-29	B-30	B-31	B-32	B-33	B-34	B-35
1	a. 865	891	a. 863	a. 879	a. 873	a. 842	a. 845
2	853	842	799	869	861	820	822
3	847	NR	NR	877	873	820	829
4	844	823	801	871	881	823	809
5	849	869	820	851	881	831	816
6	851	832	776	865	871	798	799
7	831	869	823	867	863	776	781
8	829	827	784	875	NR	796	802
9	822	871	827	873	863	798	802
10	804	844	794	879	863	801	792
Average	839	852	810	871	870	810	810
	C-28	C-29	C-30	C-31	C-32	C-33	C-34
1	a. 783	a. 859	a. 827	a. 921	a. 855	a. 853	a. 832
2	765	813	799	885	791	806	773
3	768	808	NR	869	796	789	773
4	765	822	799	869	806	804	768
5	775	825	798	855	788	802	773
6	740	818	765	853	788	762	747
7	764	798	789	842	788	762	765
8	736	822	791	840	778	770	768
9	770	779	789	847	801	780	752
10	749	792	NR	845	789	786	759
Average	761	814	795	863	798	791	771

ENDURANCE TEST

INDIVIDUAL CYCLIC RATE DATA — FROM 4001 TO 5000 ROUNDS

(NR — NOT RECORDED)

Cycle No.	Rifle No.							
	A-29	A-30	A-31	A-32	A-33	A-34	A-35	
1	842	853	815	853	822	[a] 822	[a] 832	
2	786	838	811	811	799	762	786	
3	806	768	783	818	759	784	778	
4	796	808	796	809	784	750	799	
5	767	768	794	789	764	765	786	
6	792	802	791	822	781	775	794	
7	789	808	NR	834	808	734	765	
8	770	809	799	825	801	738	775	
9	796	783	809	832	767	755	775	
10	773	781	799	823	796	755	767	
Average	792	802	800	822	788	764	786	
	B-29	B-30	B-31	B-32	B-33	B-34	B-35	
1	844	887	855	855	847	847	813	
2	831	879	827	887	853	845	827	
3	816	883	829	869	855	823	808	
4	820	887	842	863	859	851	831	
5	813	875	825	853	844	832	802	
6	815	889	804	867	834	847	822	
7	811	873	809	844	834	813	794	
8	808	869	NR	865	840	836	811	
9	808	877	813	838	825	822	791	
10	809	851	802	853	825	838	801	
Average	817	877	823	859	842	835	810	
	C-28	C-29	C-30	C-31	C-32	C-33	C-34	
1	808	827	775	[c] 886	844	799	776	c. 18-round burst
2	765	786	747	834	792	823	784	
3	719	759	744	802	781	792	744	
4	730	778	741	815	761	799	NR	
5	718	759	746	825	759	761	749	
6	720	762	772	816	775	796	756	
7	731	758	737	816	768	767	740	
8	[b] 732	770	740	808	789	799	770	
9	778	759	747	811	776	762	752	
10	715	768	755	781	772	798	768	
Average	742	773	750	819	782	790	760	

ENDURANCE TEST

INDIVIDUAL CYCLIC RATE DATA— FROM 5001 TO 6000 ROUNDS
(NR— NOT RECORDED)

Cycle No.				Rifle No.			
	A-29	A-30	A-31	A-32	A-33	A-34	A-35
1	857	844	[a]788	[a]883	[a]836	[a]825	[a]887
2	792	796	802	838	829	781	808
3	799	791	783	809	806	765	784
4	813	796	811	818	827	759	791
5	753	784	818	794	778	765	798
6	783	811	811	829	813	781	788
7	780	789	798	806	804	762	789
8	788	784	796	794	780	765	789
9	772	781	791	794	761	761	794
10	764	780	778	792	789	762	794
Average	790	796	797	816	802	773	802
	B-29	B-30	B-31	B-32	B-33	B-34	B-35
1	[a]853	[a]873	[a]829	[a]863	[a]867	[a]847	[a]863
2	813	853	816	834	816	836	NR
3	767	844	786	838	811	842	829
4	776	836	783	820	798	838	811
5	730	820	773	825	799	829	808
6	775	842	770	799	783	825	808
7	778	832	775	873	792	816	809
8	792	855	780	796	778	820	804
9	761	831	762	825	794	820	798
10	764	844	767	816	788	844	804
Average	781	843	784	829	803	837	815
	C-28	C-29	C-30	C-31	C-32	C-33	C-34
1	[a]775	[a]842	[a]806	[a]831	[a]825	[a]849	[a]895
2	749	773	781	NR	809	772	804
3	746	784	776	815	825	808	767
4	719	768	759	822	788	783	764
5	734	783	786	804	783	791	762
6	716	759	758	802	768	783	767
7	749	778	762	808	796	767	756
8	703	NR	740	NR	781	762	767
9	733	767	767	811	783	758	747
10	708	761	762	804	780	772	770
Average	733	779	770	812	794	784	780

ENDURANCE TEST

INDIVIDUAL CYCLIC RATE DATA— FROM 6001 TO 7000 ROUNDS

(NR— NOT RECORDED)

Cycle No.				Rifle No.					
	A-29	A-30	A-31	A-32	A-33	A-34	A-35		
1	789	827	780	861	840	786	823		
2	731	755	762	804	791	755	781		
3	724	772	755	804	789	749	791		
4	726	740	773	796	799	775	775		
5	737	762	778	809	804	764	788		
6	719	752	716	811	809	759	758		
7	753	773	776	822	806	744	746		
8	726	729	759	784	808	729	756		
9	734	753	765	784	784	750	756		
10	729	736	731	776	786	731	759		
Average	737	760	760	805	802	754	773		
	B-29	B-30	B-31	B-32	B-33	B-34	B-35		
1	798	844	791	836	836	849	859		
2	792	NR	789	827	822	840	829		
3	792	851	781	818	825	844	845		
4	796	863	799	823	827	859	840		
5	789	847	783	813	806	838	840		
6	796	861	776	827	808	C. 830	823		
7	801	847	759	820	802	825	816		
8	788	844	756	815	801	844	847		
9	786	838	755	815	799	844	829		
10	788	851	752	801	808	838	825		
Average	793	850	774	819	813	841	835		
	C-28	C-29	C-30	C-31	C-32	C-33	C-34		
1	722	798	761	818	827	822	799		
2	731	767	747	801	775	825	794		
3	730	758	761	820	788	813	791		
4	711	758	778	801	770	825	788		
5	737	775	753	813	770	792	767		
6	708	737	724	806	764	792	791		
7	712	750	765	806	762	756	791		
8	707	752	NR	808	759	723	791		
9	707	758	772	811	753	772	786		
10	702	747	756	796	747	767	786		
Average	717	760	757	808	771	795	788		

ENDURANCE TEST

INDIVIDUAL CYCLIC RATE DATA – FROM 7001 TO 8000 ROUNDS

(NR – NOT RECORDED)

Cycle No.	Rifle No.						
	A-29	A-30	A-31	A-32	A-33	A-34	A-35
1	759	[a]836	[a]811	[a]789	[a]811	[a]818	[a]820
2	703	773	772	743	781	770	789
3	723	761	788	733	791	767	743
4	690	727	776	726	746	756	775
5	716	734	759	749	778	750	753
6	695	720	746	711	768	750	775
7	694	729	784	724	750	804	741
8	683	719	752	720	783	758	775
9	695	726	753	731	784	731	755
10	694	731	755	711	753	767	773
Average	705	746	770	734	774	767	770
	B-29	B-30	B-31	B-32	B-33	B-34	B-35
1	[a]808	[a]883	NR	[a]838	[a]840	[a]867	[a]883
2	806	857	768	809	816	859	822
3	804	853	778	813	822	867	808
4	815	836	778	802	802	863	804
5	815	851	786	816	809	871	772
6	808	842	755	780	784	855	784
7	815	861	770	799	799	861	791
8	815	853	767	799	786	849	791
9	823	869	788	802	794	831	806
10	811	849	775	799	792	NR	808
Average	812	855	774	806	804	858	807
	C-28	C-29	C-30	C-31	C-32	C-33	C-34
1	[a]773	[a]838	[a]764	[a]857	[a]829	[a]857	[a]825
2	718	764	744	808	788	773	775
3	710	747	746	816	762	794	798
4	707	747	749	799	762	747	772
5	700	740	710	808	756	773	770
6	672	706	753	776	744	753	764
7	700	720	734	801	752	783	783
8	696	801	741	775	743	759	773
9	714	727	736	802	747	783	792
10	683	733	724	767	749	767	762
Average	707	752	740	801	763	779	781

ENDURANCE TEST

INDIVIDUAL CYCLIC RATE DATA— FROM 8001 TO 9000 ROUNDS

(NR— NOT RECORDED)

Cycle No.	Rifle No.						
	A-29	A-30	A-31	A-32	A-33	A-34	A-35
1	775	780	749	753	801	809	801
2	731	726	737	729	776	747	758
3	773	734	730	703	784	749	765
4	727	726	743	724	756	NR	762
5	736	747	741	741	761	780	759
6	NR	720	736	734	776	759	801
7	710	719	738	746	764	767	772
8	683	727	740	NR	764	747	783
9	714	698	750	737	755	761	755
10	707	702	737	703	746	753	765
Average	728	728	740	730	768	764	772
	B-29	B-30	B-31	B-32	B-33	B-34	B-35
1	808	849	783	802	776	845	853
2	788	825	761	784	796	840	867
3	809	847	765	822	806	849	867
4	791	832	755	804	811	832	867
5	808	NR	762	818	818	832	847
6	783	831	764	798	811	842	836
7	801	847	775	786	815	838	840
8	778	829	755	788	798	836	838
9	798	836	772	794	799	844	834
10	786	825	762	783	783	849	825
Average	795	836	765	798	801	841	847
	C-28	C-29	C-30	C-31	C-32	C-33	C-34
1	702	786	NR	801	792	818	799
2	702	734	723	816	778	825	809
3	720	765	727	822	780	806	813
4	694	731	699	798	784	789	808
5	700	765	691	804	794	798	809
6	683	746	720	796	758	776	784
7	693	759	702	802	791	781	776
8	684	723	750	792	756	762	772
9	698	744	679	791	767	778	778
10	703	730	700	778	764	749	758
Average	698	748	710	800	776	788	791

ENDURANCE TEST

INDIVIDUAL CYCLIC RATE DATA — FROM 9001 TO 10,000 ROUNDS

(NR — NOT RECORDED)

Cycle No.	Rifle No.						
	A-29	A-30	A-31	A-32	A-33	A-34	A-35
1	[a] 823	[a] 747	[a] 755	[a] 726	[a] 784	[a] 912	[a] 832
2	791	737	734	708	778	815	778
3	775	743	741	743	788	794	784
4	756	707	781	712	749	788	756
5	761	746	772	756	792	784	750
6	756	743	791	700	773	780	756
7	741	729	780	726	781	778	776
8	784	NR	773	723	772	786	758
9	780	712	749	714	772	759	762
10	761	716	784	723	768	755	758
Average	773	731	766	723	776	795	771
	B-29	B-30	B-31	B-32	B-33	B-34	B-35
1	834	[a] 863	[a] 792	[a] 791	[a] 801	[a] 869	[a-b] 913
2	804	849	794	NR	806	853	853
3	809	875	809	[a] 778	806	859	853
4	813	867	809	772	802	851	827
5	808	871	804	[a] 784	801	853	842
6	809	865	804	784	808	863	842
7	809	861	794	[a] 773	806	857	849
8	804	853	796	759	794	NR	820
9	801	863	801	[a] 786	801	855	844
10	801	853	NR	776	794	NR	815
Average	809	862	800	778	802	857	846
	C-28	C-29	C-30	C-31	C-32	C-33	C-34
1	[a] 727	[a] 773	[a] 762	[a] 840	[a] 808	[a] 863	[a] 883
2	707	723	731	804	759	781	794
3	715	738	688	796	761	811	794
4	680	718	710	781	734	780	798
5	702	737	699	791	741	806	792
6	682	702	729	781	724	776	776
7	699	749	707	804	756	804	799
8	677	722	708	786	718	781	773
9	695	741	690	804	747	806	801
10	619	724	712	815	714	792	776
Average	690	733	714	800	746	800	799

INITIAL INTERPLANT INTERCHANGEABILITY TEST

PERFORMED AT ROCK ISLAND ARSENAL

INTERPLANT INTERCHANGEABILITY TEST

1. PURPOSE: This document prescribes the procedure for accomplishing the Interplant Interchangeability Test for Rifle, 5.56mm, M16A1.

2. APPLICABLE PUBLICATION: SAPD-253F, Rifles, 5.56mm: M16 and M16A1, dated 22 November 1968.

3. REQUIREMENTS:

3.1 Each rifle submitted for this test shall have successfully completed all applicable requirements of SAPD-253F.

3.2 Each rifle prior to and following the interchange shall be examined by the testing agency in accordance with SAPD-253F for the following:

3.2.1 Headspace

3.2.2 Firing pin indent

3.2.3 Trigger pull

3.2.4 Functioning

3.2.5 Targeting and Accuracy

3.3 Results of all examinations taken in 3.2 shall be recorded along with the manufacturers name, weapon serial number, and weapon test number.

3.4 All test rifles shall be returned to their original configuration (i.e., rifle No. 1 with No. 1 parts, see inclosure 2) following completion of the test and tested in accordance with paragraph 3.2 above prior to return shipment to the respective manufacturer.

4. PROCEDURE: Rifles shall be tested for interplant interchangeability of parts by disassembling and reassembling the parts using the pre-arranged system (see inclosure 1). Interchange of parts shall be accomplished by dividing the parts of each rifle into 15 different groups of non-mating parts as shown in the attached parts distribution scheme inclosure 1. Groups of parts from the first rifle shall be taken in order and placed in trays 1 through 15; groups of parts from the second rifle shall be taken in order and placed in trays 2 through 15 to 1; groups of parts from the third rifle shall be taken in order and placed in trays 3 through 15 to 1 to 2; and etc until all 15 rifles are disassembled into 15 different trays. Disassembly of rifles produced by different manufacturers shall be programmed in accordance with the attached Interchange Procedure (Interplant) inclosure 2.

In the event that parts marked (*) in the parts distribution scheme are rendered unserviceable by disassembly, these parts shall be replaced without penalty to the interchangeability test. However, a record shall be kept of all parts replaced. The rifles shall be reassembled using only those parts which are in the same tray.

PARTS DISTRIBUTION SCHEME FOR
INTERPLANT INTERCHANGEABILITY TEST
M16A1 RIFLE

Group I

Takedown Pin Detent (61698)
Receiver - Upper (62278)
*Rear Sight Windage Drum Pin (95101)
Magazine Catch Spring (61759)
Trigger (61955)
*Socket Head Cap Screw (Key) (92201)

Group II

Rear Sight Detent Spring (61754)
Barrel & Sight Assy (Barrel 62181, Barrel Extension 61575, Barrel Indexing Pin 61671, Front Sight 62068, Taper Pin 62086(2), Hand Guard Cap 62087)
Extractor Pin (61563)
Butt Cap Screw (92601)
*Lockwasher (90001)

Group III

Bolt (61538) with Bolt Ring (61540,3 pcs)
Ejection Port Cover Pin (61658) and *Snap Ring (90402)
Front Sight Detent (61705)
*Trigger Guard Pivot Pin (95106)
Trigger Spring (61657)
Takedown Pin (61655)
Magazine Catch Button (62032)

Group IV

Takedown Pin Detent Spring (61692)
Bolt Carrier (62274)
Hand Guard Slip Ring (61901)
Ejector & Safety Detent Spring (61569)
Trigger and Hammer Pin (61654) (2)

Group V

Butt Stock Assembly Complete (62302)
Ejection Port Cover Spring (61518)
Hand Guard Slip Ring Spring Assy (61962)
*Ejector Pin (95102)
Disconnect (62334)
Plunger Assembly (62266)

Group VI

*Hand Guard Snap Ring (90403)
Spring, Disconnect (61925)
*Front Swivel Pin (95103)
Bolt, Cam Pin (61704)
Bolt, Catch (62301)
Pistol Grip (62194)
*Pawl Pivot Pin (95113)

Group VII

Rear Sight Spring (61708)
*Pistol Grip Screw (92701)
Gas Tube Assembly (61645)
Hammer Detail Assembly (62317)
Firing Pin Retaining Pin (62335)
Bolt Catch Plunger (62178)
Pawl (62269)

Group VIII

Firing Pin (62294)
*Gas Tube Pin (95108)
Hand Guard Assembly, L.H. (62196)
Flash Suppressor, Lock Washer (62126)
Bolt Catch Spring (62177)
Automatic Sear Pin (61615)
Pawl Detent (62270)

Group IX

*Bolt Catch Pin (95105)
Hammer, Spring (61697)
Safety (61959)
Bolt Spring (50381)
Key (61547)

Group X

Extractor (61562) W/Spring (61568)
Rear Sight Detent (61755)
Trigger Guard Assembly (61970)
Automatic Sear Assembly (61622)
Action Spring (61581)
Safety, Detent (61785)
Plunger Spring (62271)

Group XI

Lower Receiver (62222), Receiver Extension (61574) & Remaining Parts (Retainer Buffer 61582, Spring Buffer Retainer 61694)
Front Sight Post (61706

Group XII

Ejection Port Cover Assy (62112)
Barrel Nut (61902)
Front Sight Detent Spring (61709)

Group XIII

Magazine Catch (61604
Front Swivel (62280)
Buffer Assembly (62339)
Rear Sight (61700)

Group XIV

Ejector (61564)
Flash Suppressor (62348)
Rear Sight Windage Screw (61702)
Receiver Pivot Pin (62221)

Group XV

Charging Handle Assembly (62290)
Hand Guard Assembly, R. H. (62198)
Rear Sight Windage Drum (61703)

NUMBER DENOTES PARTS GROUP

13

COLOR DENOTES MANUFACTURER

DISASSEMBLE →

REASSEMBLE ↓

RIFLE NO.															
1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
2	15	1	2	3	4	5	6	7	8	9	10	11	12	13	14
3	14	15	1	2	3	4	5	6	7	8	9	10	11	12	13
4	13	14	15	1	2	3	4	5	6	7	8	9	10	11	12
5	12	13	14	15	1	2	3	4	5	6	7	8	9	10	11
6	11	12	13	14	15	1	2	3	4	5	6	7	8	9	10
7	10	11	12	13	14	15	1	2	3	4	5	6	7	8	9
8	9	10	11	12	13	14	15	1	2	3	4	5	6	7	8
9	8	9	10	11	12	13	14	15	1	2	3	4	5	6	7
10	7	8	9	10	11	12	13	14	15	1	2	3	4	5	6
11	6	7	8	9	10	11	12	13	14	15	1	2	3	4	5
12	5	6	7	8	9	10	11	12	13	14	15	1	2	3	4
13	4	5	6	7	8	9	10	11	12	13	14	15	1	2	3
14	3	4	5	6	7	8	9	10	11	12	13	14	15	1	2
15	2	3	4	5	6	7	8	9	10	11	12	13	14	15	1
TEST RIFLE →	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

US ARMY
ROCK ISLAND ARSENAL
ROCK ISLAND, ILLINOIS, 61201

INTERCHANGEABILITY PROCEDURE (INTER-PLANT)

D 19204

RESULTS OF TESTING PRIOR TO INTERCHANGE

RIFLE No.	GM	COLT	H&R	RATE	ACC.
1	3,000,038			833	3.0
2		1,289,399		802	1.8
3			2,000,085	8[illegible]3	4.4
4		1,283,769		804	2.2
5			2,000,052	842	1.6
6	3,000,082			838	3.8
7			2,000,164	856	3.3
8	3,000,061			868	3.0
9		1,286,945		801	3.3
10	3,000,027			849	2.3
11			2,000,181	812	3.7
12		1,282,292		825	1.6
13			2,000,140	857	4.0
14		1,293,993		814	3.7
15	3,000,050			855	3.6

NOTE: 1. Headspace - okay

2. Firing Pin Indent - okay

3. Trigger Pull - okay

4. Function Firing - no malfunctions

5. Targeting - okay

RESULTS OF INTERCHANGE OF PARTS

1. Rifle No 7:

a. Comment. During disassembly of Rifle Number 7, it was noted that the takedown pin (P/N 61655) was difficult to disassemble.

b. Examination. Selected dimensions of the Lower Receiver (62222), Upper Receiver (62278), Receiver Pivot Pin (62221), and Takedown Pin (61655) of Rifle 2,000,164 were measured with the following deviations noted:

Component	Characteristics	Deviating Measurements
Lower Receiver	Location Takedown Pin Hole	6.378
	Location Pivot Pin and Takedown Pin Holes	.255
Upper Receiver	Pivot Pin Lug ≑ AA.006	.012
	Takedown Pin Lug ≑ AA.006	.011
	Pivot Pin Lug Hole Location	.2547
	Pivot Pin Hole 11T .0005	.0044
	Takedown Pin Hole 11T .0005	.002
	Takedown Pin Hole width	.2522
	Perpendicularity Pivot Pin Hole to /-P-/	.040/10"
Receiver Pivot Pin		None
Takedown Pin		None

2. Test Rifle No 2:

a. Comment. During reassembly of parts (Test Rifle No 2), the Takedown Pin (P/N 61655) required heavy thumb pressure to be properly assembled.

b. Examination. Selected dimensions of the Lower Receiver (62221 of Rifle 2,000,164); Upper Receiver (62278 of Rifle 1,289,399); Receiver Pivot Pin (62221 of Rifle 1,283,769); and Takedown Pin (61655 of Rifle 3,000,050) were measured with the following deviations noted:

Component	Characteristic	Deviating Measurements
Lower Receiver	Location Takedown Pin Hole	6.378
	Location Pivot Pin and Takedown Pin Holes	.255
Upper Receiver	Pivot Pin Hole 11T .0005	.0015
	Takedown Pin Hole 11T .0005	.0007
	Lug Width (2Lugs)	.4975
Receiver Pivot Pin		None
Takedown Pin		None

3. Test Rifle No 3:

a. Comment. During reassembly of parts (Test Rifle No 3), the Takedown Pin (P/N 61655) required heavy thumb pressure to be properly assembled.

b. Examination. Selected dimensions of the Lower Receiver (62222 of Rifle 3,000,061); Upper Receiver (62278 of Rifle 2,000,085); Receiver Pivot Pin (62221 of Rifle 2,000,052); and Takedown Pin (61655 of Rifle 3,000,038) with the following deviations noted:

Component	Characteristic	Deviating Measurements
Lower Receiver	Location Pivot Pin and Takedown Pin Holes	.2455
Upper Receiver	Takedown Pin Lug Hole Location	.249
Receiver Pivot Pin		None
Takedown Pin		None

4. Test Rifle No 3:

a. Comment. During reassembly of parts (Test Rifle No 3), it was noted that the Slip Ring (P/N 61901) would not properly assemble over the Handguards (P/N RH, 62198) and LH, 62196).

b. Examination. Selected dimensions of the Handguard Slip Ring (61901 of Rifle 3,000,038); Handguard Assembly, RH (62198 of Rifle 1,283,769); and Handguard Assembly, LH (62196 of Rifle 2,000,181) with the following deviations noted:

Component	Characteristic	Deviating Measurements
Handguard Slip Ring		None
Handguard Assembly, Right Hand	Slip Ring Surface	1.766
Handguard Assembly, Left Hand	Slip Ring Surface Angle	1.781 82°

5. Test Rifle No 10:

a. Comment. After reassembly of parts, it was noted, during accuracy firing, that the Upper Receiver appeared loose in relation to the Lower Receiver.

b. Examination. Selected dimensions of the Lower Receiver (62222 of Rifle 3,000,050); Upper Receiver (62278 of Rifle 3,000,027); Receiver Pivot Pin (62221 of Rifle 1,282,292); and Takedown Pin (61655 of Rifle 3,000,061) were measured with the following deviations noted:

Component	Characteristic	Deviating Measurements
Lower Receiver	Location Pivot Pin and Takedown Pin Holes	.251
	Takedown Pin Hole $\perp$ AH	.004
	Pivot Pin Hole $\perp$ AH	.006
Upper Receiver	Pivot Pin Hole 11T .0005	.002
Receiver Pivot Pin		None
Takedown Pin		None

6. Test Rifle No 11:

a. Comment. During reassembly of parts (Test Rifle No 11), it was noted that the Slip Ring (P/N 61901) would not properly assemble over the Handguards (P/N RH, 62198 and LH, 62196).

b. Examination. Selected dimensions of the Handguard Slip Ring (61901 of Rifle 3,000,061); Handguard Assembly, RH (62198 of Rifle 1,282,292); and Handguard Assembly, LH (62196 of Rifle 1,283,769) with the following deviations noted:

Component	Characteristic	Deviating Measurements
Handguard Slip Ring		None
Handguard Assembly, Right Hand	Slip Ring Surface Angle	1.769 82° 30'
Handguard Assembly, Left Hand	Slip Ring Surface Angle	1.778 78°

NOTE: During reassembly of parts, the Hammer, Selector, Trigger, Trigger Spring, Sear Assembly, Disconnect, and Hammer Spring of Rifles 9 and 10 were found in the same container.

RESULTS OF TESTING AFTER INTERCHANGE

TEST RIFLE NO.	FIRING PIN INDENT w/TRIGGER	FIRING PIN INDENT w/o TRIGGER	RATE OF FIRE	ACCURACY
1	.022	.0045	810	2.4
2	.022	.005	778	3.5
3	.020	.005	832	3.4
4	.023	.003	790	4.8
5	.022	.005	822	3.0
6	.021	.0035	813	3.2
7	.0225	.0015	804	4.5 2.8
8	.022	.005	795	3.5
9	.023	.003	837	3.6
10	.023	.0045	800	4.5
11	.023	.004	799	1.7
12	.021	.004	748	3.7
13	.023	.004	838	4.6 3.5
14	.022	.0035	775	3.6
15	.023	.004	868	3.3

NOTE:
1. Headspace - okay
2. Trigger Pull - okay
3. Function Firing - no malfunctions
4. Targeting - okay, except test rifle No 8 shot 8 to 10 inches to the right

Individual Trigger Pull Measurements (lbs)

BEFORE FIRING

Rifle No.	Weapon Code: A, Trial No. 1	2	3	Avg	Weapon Code: B, Trial No. 1	2	3	Avg	Weapon Code: C, Trial No. 1	2	3	Avg
1	8.7	8.9	9.0	8.9	7.9	7.7	7.7	7.8	7.2	7.0	7.7	7.3
2	7.5	7.6	7.7	7.6	7.8	7.4	7.6	7.6	7.7	7.8	7.8	7.8
3	8.2	8.0	7.9	8.0	8.0	7.9	7.6	7.8	7.5	7.6	7.4	7.5
4	7.0	6.9	6.6	6.8	8.1	8.1	7.7	8.0	7.4	7.5	7.3	7.4
5	7.2	7.2	6.8	7.1	8.3	8.1	8.0	8.1	7.5	7.7	7.5	7.6
6	8.3	8.3	7.9	8.2	7.6	7.5	7.3	7.5	7.9	7.8	7.5	7.7
7	8.0	7.8	8.1	8.0	9.1	8.8	9.1	9.0	8.5	8.4	8.6	8.5
8	8.4	7.9	8.8	8.4	7.6	8.0	7.9	7.8	7.1	6.7	6.9	6.9
9	7.8	8.1	7.9	7.9	8.0	8.2	8.6	8.2	7.5	7.8	7.6	7.6
10	8.4	8.6	8.2	8.4	7.0	7.2	7.1	7.1	7.2	8.1	7.4	7.6
11	7.9	7.8	7.8	7.8	10.0	9.0	8.8	9.3	8.1	7.7	7.8	7.9
12	7.5	7.8	7.9	7.7	7.6	7.4	7.1	7.4	7.3	8.0	7.9	7.7
13	7.5	8.1	7.8	7.8	8.5	8.6	7.8	8.3	7.4	7.4	7.2	7.3
14	7.5	7.5	7.6	7.5	7.8	7.8	7.8	7.8	8.9	8.6	8.5	8.7
15	6.7	6.6	6.7	6.7	8.0	7.9	7.8	7.9	8.9	8.2	8.2	8.4
16	7.3	7.3	7.5	7.4	7.4	7.6	7.4	7.5	7.0	6.8	7.6	7.1
17	7.7	7.5	7.8	7.7	8.6	7.4	7.8	7.9	7.8	7.8	7.6	7.7
18	7.2	7.3	7.4	7.3	8.2	8.5	8.3	8.3	8.3	7.8	7.7	7.9
19	6.6	6.7	6.6	6.6	8.0	7.8	8.0	7.9	8.3	8.5	8.0	8.3
20	6.9	7.0	6.8	6.9	7.5	7.2	7.2	7.3	7.3	7.6	7.6	7.5
21	8.0	7.7	7.4	7.7	7.8	7.8	7.8	7.8	7.4	7.7	7.5	7.5
22	7.1	7.2	6.8	7.0	9.0	8.8	9.4	9.1	7.9	8.4	8.3	8.2
23	8.2	8.4	8.5	8.4	8.1	8.6	8.5	8.4	8.3	7.9	7.6	7.9
24	7.5	7.8	7.9	7.7	7.6	7.4	7.4	7.5	7.6	7.4	7.6	7.5
25	7.9	8.3	8.1	8.1	7.4	7.4	7.6	7.5	7.9	7.7	8.0	7.9
26	7.8	8.3	8.5	8.2	8.4	8.3	8.5	8.4	8.6	8.4	8.4	8.5
27	7.3	7.3	7.3	7.3	7.5	7.4	7.6	7.5	8.4	8.8	7.9	8.4
28	8.2	8.3	8.6	8.4	7.5	7.5	7.4	7.5	8.0	8.4	8.2	8.2
29	8.1	8.0	7.9	8.0	7.3	7.9	7.9	7.7	8.4	8.3	8.3	8.3
30	7.5	7.0	7.3	7.3	7.9	7.4	7.8	7.7	7.5	7.6	7.7	7.6
31	6.4	6.8	6.9	6.7	7.6	7.6	7.3	7.5	7.1	7.5	7.5	7.4
32	7.9	8.1	8.3	8.1	7.9	7.5	7.5	7.6	7.7	8.3	7.8	7.9
33	8.0	7.6	8.1	7.9	7.8	7.6	7.5	7.6	8.0	7.7	7.9	7.9
34	7.7	7.4	7.5	7.5	7.6	7.5	7.8	7.6	7.4	7.4	7.3	7.4
35	6.9	7.0	7.3	7.1	8.0	8.0	7.4	7.8	7.5	7.7	7.6	7.6
Avg				7.66				7.88				7.79

AFTER COMPLETION OF ENDURANCE TEST
(Only endurance test rifles were measured after firing).

Rifle No.	Weapon Code: A, Trial No. 1	2	3	Avg
29	6.5	6.4	6.4	6.4
30	5.4	5.6	5.5	5.5
31	5.4	5.5	5.5	5.5
32	5.7	5.4	5.4	5.5
33	5.6	5.5	5.8	5.6
34	5.5	5.6	5.7	5.6
35	5.7	5.9	5.7	5.7
Avg				5.42

Rifle No.	Weapon Code: B, Trial No. 1	2	3	Avg
29	6.5	6.5	6.4	6.5
30	7.5	7.4	6.8	7.2
31	6.0	6.3	6.3	6.3
32	6.5	6.7	6.9	6.7
33	6.7	6.2	6.3	6.4
34	6.0	7.5	7.8	7.1
35	8.7	7.1	7.6	7.8
Avg				6.81

Rifle No.	Weapon Code: C, Trial No. 1	2	3	Avg
28	7.2	7.8	7.6	7.5
29	6.7	6.2	6.0	6.3
30	8.2	8.5	8.7	8.4
31	6.0	6.0	6.2	6.0
32	6.3	6.3	6.6	6.4
33	6.1	6.4	6.6	6.4
34	6.6	6.5	6.8	6.6
Avg				6.80

DEPARTMENT OF THE ARMY

HEADQUARTERS, UNITED STATES ARMY WEAPONS COMMAND

ROCK ISLAND, ILLINOIS 61201

AMSWE-QA FEB 14 1969

SUBJECT: M16A1 Initial Production Test and Comparison Test

Commanding General
U. S. Army Test and Evaluation Command
ATTN: AMSTE-BC
Aberdeen Proving Ground, Maryland 21005

1. Reference is made to our message No. 2748 dated 31 Jan 69, subject: M16A1 Rifle Initial Production Test (Project No 8-9-0200-25) and Comparison Test (Project No 8-9-0200-27).

2. Forwarded herewith are results (Incl 1) of rifle inspection performed at Rock Island Arsenal's Metrology Laboratory on 1 Feb 69. Inclosure 2 provides measurements made on the Frankford Arsenal firing pin indent fixture, and the Aberdeen Proving Ground maximum and minimum headspace gages.

3. The rifle components and gages were returned to Aberdeen Proving Ground on 2 February 1969 by a representative of Rock Island Arsenal.

4. This Command has taken action to provide Aberdeen Proving Ground with replacement parts for those components containing the discrepancies noted in Inclosure 1.

FOR THE COMMANDER:

2 Incl
as

C. A. MacLEOD
Chairman, M16A1 Rifle Task Group
Quality Assurance Directorate

CF:
CO, Aberdeen Proving Ground
ATTN: STEAP-MT-TI w/incl
CO, Rock Island Arsenal
ATTN: SWERI-QA w/incl

Inspection Performed at RIA Metrology Lab (1 Feb 69)

1. Characteristics.

   a. Rifle headspace
   b. Conc. of Chamber diameter to bore
   c. Chamber rear body diameter
   d. Chamber body diameter
   e. Chamber neck diameter
   f. Chamber second shoulder depth
   g. Chamber bullet seat depth
   h. Chamber first shoulder depth
   i. Visual of Chamber (bore scope)

2. Results.

The rifles were inspected using certified gages for the above characteristics. Characteristics were acceptable, except as noted below:

Rifle	Comments
C1	Bad Finish in Chamber
C2	
C6	Chamber body scored Chamber first shoulder very rough
C12	Rejected by gage for characteristic 1b above
C17	The bolt face has a 1/32" step at .377 dia. (Ref .380 + .005 dia) Bolt face concave
C18	First shoulder of chamber has tool tear
C34	
C35	Rejected by gage for characteristic 1h above Bad finish in Chamber
B21	First shoulder very rough ..130R omitted at first shoulder and neck dia. Annular tool rings in chamber body
B23	Pronounced annular rings in chamber body Chamber first shoulder very rough
B28	

Incl 1

Measurements Made at RIA Metrology Lab (1 Feb 69)

Firing Pin Indent Fixture

Required	Actual
1.437 ± .001	1.442
1.4640 ± .0002	1.4655
.250 ± .001	.2485
.8489 T.P.I. (calculated)	.8500
.353 dia ref	.351
.3765 ± .0015	.3745
.4849 ± .001	.4841

Headspace Gages

Required	Actual
Min Gage 1.4646	1.4660
Max Gage 1.4706	1.4717

MULTIPLE STARGAGE MEASUREMENT & INSPECTION DATA FORM

5.56 MM Barrel

NUMBER: 1342697 C-10

MODEL:

MANUFACTURER:

CASTING NUMBER:

DATE OF GAUGING: 23 JAN 1969

FIRING STATUS (Check One): BEFORE ✓ AFTER

NUMBER OF ROUNDS: B. C. 3+ ARG

PROOF OFFICER: Wilson W.O. 324-712-90

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.	1.35	+.0004	.0000	+.0006	+.0008
19.70	2.00	3	0	7	6
18.70	3.00	5	-.0001	7	6
17.70	4.00	2	-.0002	7	6
16.70	5.00	2	3	6	5
15.70	6.00	-.0004	3	6	5
14.70	7.00	+.0003	.0000	6	5
13.70	8.00	.0000	-.0003	6	4
12.70	9.00	0	1	6	5
11.70	10.00	-.0002	3	6	6
10.70	11.00	+.0001	4	6	6
9.70	12.00	1	6	7	6
8.70	13.00	2	4	6	5
7.70	14.00	-.0002	3	6	5
6.70	15.00	+.0001	4	6	5
5.70	16.00	1	4	6	6
4.70	17.00	-.0001	5	5	6
3.70	18.00	1	4	5	5
3.35	18.35	2	5	7	5
2.85	18.85	2	5	7	5
2.60	19.10	-.0003	-.0007	+.0007	+.0005

BORESCOPE REMARKS: circumferential tool marks encircling bullet seat. Light carbon deposits in [illegible] and main bore

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

MULTIPLE STARGAGE MEASUREMENT & INSPECTION DATA FORM

MODEL	NUMBER	CASTING NUMBER	MANUFACTURER
5.56 MM Barrel	134 4157 C-13	X	

DATE OF GAUGING: 23 JAN 69'

FIRING STATUS (Check One): BEFORE ✓ AFTER

NUMBER OF ROUNDS: 8 F at ARC

PROOF OFFICER: Wilson W.O. 324-712-90

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.	1.35	+.0003	+.0003	+.0001	+.0002
19.70	2.00	1	1	1	1
18.70	3.00	1	1	3	2
17.70	4.00	1	1	2	2
16.70	5.00	-.0001	1	.0000	1
15.70	6.00	.0000	1	0	2
14.70	7.00	0	1	-.0001	1
13.70	8.00	-.0003	2	.0000	-.0001
12.70	9.00	+.0002	2	+.0001	+.0002
11.70	10.00	2	2	1	2
10.70	11.00	1	1	1	2
9.70	12.00	1	1	1	2
8.70	13.00	1	1	1	2
7.70	14.00	-.0002	1	1	2
6.70	15.00	+.0002	1	1	2
5.70	16.00	2	3	1	1
4.70	17.00	2	2	1	1
3.70	18.00	2	2	1	1
3.35	18.35	2	2	2	2
2.85	18.85	2	2	2	2
2.60	19.10	+.0002	+.0003	+.0002	+.0002

BORESCOPE REMARKS: circumferential tool marks throughout from start of chamber to muzzle end. Light carbon deposits in chamber AND MAIN BORE

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

MULTIPLE STARGAGE MEASUREMENT & INSPECTION DATA FORM

	5.56 MM Barrel
CASTING NUMBER	
MANUFACTURER	
MODEL	
NUMBER	134 4252 c14
5.56 MM Barrel	
PROOF OFFICER	Wilson W.O. 324-712-90
NUMBER OF ROUNDS	B-f 3+ APG
FIRING STATUS (Check One)	BEFORE ✓ / AFTER
DATE OF GAUGING	23 JAN. 69

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.	1.35	+.0003	+.0002	+.0003	+.0003
19.70	2.00	3	3	3	2
18.70	3.00	2	1	3	1
17.70	4.00	1	1	2	1
16.70	5.00	.0000	1	1	1
15.70	6.00	0	-.0001	.0000	1
14.70	7.00	0	1	0	1
13.70	8.00	0	1	-.0003	1
12.70	9.00	+.0002	+.0001	+.0001	1
11.70	10.00	1	.0000	.0000	1
10.70	11.00	.0000	0	0	1
9.70	12.00	0	-.0003	+.0002	1
8.70	13.00	+.0001	+.0001	1	1
7.70	14.00	2	.0000	1	1
6.70	15.00	2	+.0002	1	2
5.70	16.00	3	2	1	2
4.70	17.00	2	2	2	2
3.70	18.00	2	2	2	2
3.35	18.35	2	2	2	2
2.85	18.85	2	2	2	2
2.60	19.10	+.0002	+.0003	+.0002	+.0002

BORESCOPE REMARKS: circumferential tool marks throughout from straight of chamber to muzzle end. Light carbon deposits in chamber and main bore

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

MULTIPLE STARGAGE MEASUREMENT & INSPECTION DATA FORM

Field	Entry
CASTING NUMBER	
MANUFACTURER	
PROOF OFFICER	Wilson W.O. 324-712-70
MODEL	
NUMBER OF ROUNDS	B.S. at APG
NUMBER	1345582 C-21
FIRING STATUS (Check One)	AFTER / ✓ BEFORE
	5.56 MM Barrel
DATE OF GAUGING	23 JAN. 69'

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.	1.35	.0000	-.0001	-.0002	-.0002
19.70	2.00	+.0001	1	1	1
18.70	3.00	-.0001	.0000	1	1
17.70	4.00	1	0	1	1
16.70	5.00	2	-.0001	1	1
15.70	6.00	2	1	2	2
14.70	7.00	2	+.0001	2	1
13.70	8.00	1	1	1	1
12.70	9.00	.0000	-.0001	1	1
11.70	10.00	0	1	1	1
10.70	11.00	-.0002	1	1	1
9.70	12.00	1	3	1	1
8.70	13.00	1	3	1	1
7.70	14.00	+.0001	.0000	1	1
6.70	15.00	1	0	1	1
5.70	16.00	1	+.0001	1	1
4.70	17.00	1	1	1	1
3.70	18.00	1	1	1	1
3.35	18.35	1	1	1	.0000
2.85	18.85	1	1	.0000	0
2.60	19.10	+.0001	+.0001	.0000	.0000

BORESCOPE REMARKS: Circumferential tool marks throughout from straight of chamber to muzzle end. Light [illegible] deposits in chamber and main bore

MULTIPLE STARGAGE MEASUREMENT & INSPECTION DATA FORM

5.56 MM Barrel

DATE OF GAUGING: 26 Jun 69
NUMBER OF ROUNDS: B.F. at APG
PROOF OFFICER: Wilson W.O. 324-712-90
FIRING STATUS (Check One): BEFORE ✓ AFTER
NUMBER: 1348141 C-33
MODEL:
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.	Hor.	Grooves .2235" Vert.	Hor.
20.	1.35	+.0002	+.0002	-.0002	-.0001
19.70	2.00	3	1	+.0001	1
18.70	3.00	1	2	1	+.0001
17.70	4.00	1	2	1	1
16.70	5.00	2	2	1	1
15.70	6.00	2	1	.0000	1
14.70	7.00	1	1	-.0003	1
13.70	8.00	1	1	.0000	1
12.70	9.00	1	1	+.0001	1
11.70	10.00	2	2	1	2
10.70	11.00	2	2	1	2
9.70	12.00	2	1	1	2
8.70	13.00	2	1	2	2
7.70	14.00	3	2	2	2
6.70	15.00	3	2	2	2
5.70	16.00	3	2	2	2
4.70	17.00	4	2	2	2
3.70	18.00	3	2	2	2
3.35	18.35	3	2	2	2
2.85	18.85	2	2	2	2
2.60	19.10	+.0002	+.0002	+.0002	+.0002

BORESCOPE REMARKS: circumferential tool marks throughout from front slope of chamber to muzzle end. light carbon deposits in chamber and main bore.

MULTIPLE STARGAGE MEASUREMENT & INSPECTION DATA FORM

5.56 MM Barrel

CASTING NUMBER: X

MANUFACTURER:

PROOF OFFICER: Wilson [illegible] 712-70

MODEL:

NUMBER OF ROUNDS: [illegible] APG

NUMBER: 134/8506 2-75

FIRING STATUS (Check One): BEFORE ✓ AFTER

DATE OF GAUGING: 24 [illegible] 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.	1.35	.0000	-.0001	+.0001	+.0001
19.70	2.00	-.0001	1	2	3
18.70	3.00	.0000	.0000	4	3
17.70	4.00	0	-.0002	5	3
16.70	5.00	-.0002	5	4	3
15.70	6.00	2	5	2	3
14.70	7.00	4	5	1	2
13.70	8.00	3	3	1	1
12.70	9.00	2	4	3	2
11.70	10.00	2	4	3	2
10.70	11.00	3	6	3	2
9.70	12.00	4	5	3	3
8.70	13.00	6	8	2	1
7.70	14.00	8	7	2	1
6.70	15.00	2	6	2	2
5.70	16.00	1	3	2	2
4.70	17.00	.0000	3	3	2
3.70	18.00	0	3	2	2
3.35	18.35	0	3	2	2
2.85	18.85	0	3	2	2
2.60	19.10	.0000	+.0003	+.0002	+.0002

BORESCOPE REMARKS: Circumferential tool marks throughout from front slope of chamber to muzzle end. Light carbon deposits in chamber and main bore.

INSPECTION REPORT - 5.56mm

Date Presented 1 Mar 68
Qty. Packed 2,526,720 Rds.
(In addition, 1000 rds. shipped to LCAAP for fouling test.)
FSN: 1305-926-3930-A071
AMCMS Code: 4810.16.0217.2.CJ
Spec. No.: MIL-C-9963D Rev. A3
Dwg. No. D 10523632
Rev. D Date: 2/17/65

CTGS. 5.56MM BALL M193
Lot No. TW-18301

Accepted (1st Test) 7 Mar 68

Contr: Federal Ctg. Corp.
Contr. #DA-36-038-AMC-1099(A)
Primer No. 195
Primer Lot Nos: 367A, 368A, 369A, 370A, 371A
Propellant Type: WC846
A.L. No: 45476
Chg. (Grs) 27.6
Case: Brass
Headstamp(Yr): 1967
Bullet Jacket: Gilding Metal

FIRING TESTS

CHAMBER PRESSURE	Amb	125°	160°	-65°
Record	49500	+1400	-3900	-7100
Avg + 3 SD	53800			
PORT PRESSURE (PSI)				
Record	15120	-50	-130	-520
VELOCITY 15 FT. (FS)				
Record	3240	+44	-22	-138
Std. Dev.	18.2			

ACCURACY (inches)	Rds. Fired	Record	Limit
Mean Radii @ 200 yds.	90	.88	2.0
ACTION TIME (MS)	50	1.38	4.0

FUNCTION & CASUALTY	Rds Fired	Record
Rifle, 5.56mm, XM16E1	720	
Casualties		None

WATERPROOF TEST

No. Tested: 50
No. Failed: 0
Spec. Limit: 3

BULLET EXTRACTION TEST (Lbs)

No. Tested: 25
Spec. Min: 35
No. Failed: 0
Max: 80
Min: 56
Mean: 69

VISUAL GAGE & WEIGH INSPECTION

1st Sample: 2400 Date: 3/1/68

	Critical	Major	Minor
No. Defective		0	3
			2/19 1/9
Total		0	3

PACKING INSPECTION-CONTAINER CONTENT

Sub-Lot	Major % Defective	Minor % Defective
1st	0	0
2nd	0	0

Total Authorized Rds Expended in Tests: 1040

INSPECTION REPORT - 5.56mm

Date Presented 22 Nov 68
Qty. Packed 2,983,680 Rds.
(In addition, 1000 rds. shipped to LCAAP for fouling test.)
FSN 1305-926-3930-A071
AMCMS Code 4810.16.0229.2.07
Spec. No. MIL-C-9963-D Rev. A4
Date: 2/16/68
Dwg. No. 010523632
Rev. E Date: 8/11/66

CTGS. 5.56MM BALL M193
Lot No. TW-18399

Accepted (First Test) 25 Nov 68

Contr: Federal Ctg. Corp.
Contr. #DA36-038-AMC-1099(A)
Primer No. 195
Primer Lot Nos: 553A, 553B, 555A, 555B, 556A 558A, 559A, 559B, 560A 560B, 561A
Propellant Type: WC846
A.L. No. 45610, 45613, 45735
Chg.(Grs) 27.1, 27.2, 27.3 27.5
Case: Brass
Headstamp(Yr) 1968
Bullet Jacket: Gilding Metal

FIRING TESTS

CHAMBER PRESSURE	Amb	125°	160°	-65°
Record	46400	+1300	700	-4800
Avg + 3 SD	52200			
PORT PRESSURE (PSI)				
Record	15090	+330	+100	-330
VELOCITY 15 FT. (FS)				
Record	3236	+47	-30	-180
Std. Dev.	37.3			

ACCURACY (inches)	Rds. Fired	Record	Limit
Mean Radii @ 200 yds	90	1.2	2.0
ACTION TIME (MS)	50	1.19	4.0

FUNCTION & CASUALTY	Rds. Fired	Record
Rifle, 5.56mm, XM16E1	720	

Casualties: None

WATERPROOF TEST

No. Tested: 50
No. Failed: 0
Spec.Limit: 3

BULLET EXTRACTION TEST (Lbs)

No. Tested: 25
Spec. Min: 35
No. Failed: 0
Max: 108
Min: 58
Mean: 72

VISUAL GAGE & WEIGH INSPECTION

1st Sample: 2400 Date: 11/22/68

	Critical	Major	Minor
NO Defective		0	2
			1/19 1/42
Total		0	2

PACKING INSPECTION - CONTAINER CONTENT

Sub-Lot	Major % Defective	Minor % Defective
1st	0	0

Total Authorized Rds Expended in Tests: 1040

Inter-organization Letters Only

Date February 13, 1969

Subject I.P.T. Rifles - Contract DAAF03-68-C-0048

To Mr. B. E. Coutts
Contract Administrator

Address

Below are listed the targeting and accuracy results on the 35 rifles requested per your letter of February 10, 1969.

SERIAL NO.	TARGETING	EXTREME SPREAD, 50 YARDS
A-1	OK	1.7
A-2	OK	1.9
A-3	OK	1.0
A-4	OK	1.7
A-5	OK	1.0
A-6	OK	1.5
A-7	OK	1.7
A-8	OK	1.5
A-9	OK	2.4
A-10	OK	1.7
A-11	OK	1.5
A-12	OK	1.8
A-13	OK	1.3
A-14	OK	1.7
A-15	OK	1.1
A-16	OK	2.0
A-17	OK	1.7
A-18	OK	1.4
A-19	OK	1.4
A-20	OK	1.6
A-21	OK	.9
A-22	OK	1.2
A-23	OK	1.6
A-24	OK	1.7
A-25	OK	1.7
A-26	OK	1.5
A-27	OK	1.6
A-28	OK	1.0
A-29	OK	2.3
A-30	OK	1.4
A-31	OK	1.6
A-32	OK	1.5
A-33	OK	1.8
A-34	OK	1.5
A-35	OK	1.5

R. H. Norquist
Ass't. Superintendent
Defense- Quality Control

M16A1 RIFLES TARGETING AND ACCURACY RESULTS - CODE B

Rifle S/N	Targeting	EXTREME SPREAD, 50 YARDS
B-1	OK	2.4 inches
B-2		2.4
B-3		2.0
B-4		2.0
B-5		1.7
B-6		1.7
B-7		2.0
B-8		2.0
B-9		2.0
B-10		2.1
B-11		2.0
B-12		2.4
B-13		2.0
B-14		1.6
B-15		1.8
B-16		2.1
B-17		1.7
B-18		2.0
B-19		2.4
B-20		1.8
B-21		2.4
B-22		2.3
B-23		2.0
B-24		2.0
B-25		1.7
B-26		2.4
B-27		2.4
B-28		2.2
B-29		2.0
B-30		1.2
B-31		2.0
B-32		2.0
B-33		1.8
B-34		1.8
B-35		1.7

INDEX FOR TARGET DATA

1. The first digit of the target number identifies the manufacturer; the second and third digits represent the individual APG rifle number; and the fourth and fifth digits represent the target identification number; e.g., :

12901 = Code A manufacturer; rifle no. 29; and target no. 01.

23004 = Code B manufacturer; rifle no. 30; and target no. 04.

33411 = Code C manufacturer; rifle no. 34; and target no. 11.

2. Target identification numbers are designated as follows:

01 - 05	=	Initial benchrest
06 - 10	=	Initial benchrest with bayonet
11 - 15	=	Prone with bipod
16 - 20	=	Benchrest after 2000 rounds of firing
21 - 25	=	Benchrest after 4000 rounds of firing
26 - 30	=	Benchrest after 6000 rounds of firing
31 - 35	=	Benchrest after 8000 rounds of firing
36 - 40	=	Benchrest after 10000 rounds of firing

3. On the individual extreme spread (es) measurements identified with the letter (F), i.e., **5.0 F**, one shot was determined to be a "flier" as explained in par 2.3, Table 2.3-I. Only targets numbered 1 - 15 were examined for fliers.

4. On the individual center of impact (ci) measurements identified with the letter "X", i.e., **7.2 X-7**, one or more shots were outside the target outline as explained in par 2.3, Table 2.3-I; the number following the "X" designates the number of rounds outside the outline.

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci	
									h	v
12901.	6.0	1.2	1.7	2.3	.5	.6	6.1 F	1.4	.6	-.9
12902.	3.9	.8	1.2	3.0	.8	1.0	4.3	1.3	-.2	-1.1
12903.	3.0	.6	.8	4.1	.6	1.0	4.1	1.0	-.7	-2.3
12904.	4.0	.8	1.1	3.2	.7	.9	4.4	1.2	-.4	-2.6
12905.	1.9	.5	.7	2.1	.6	.7	2.5	.8	-.1	-1.9
mean	3.8	.8	1.1	2.9	.6	.9	4.3	1.2	-.2	-1.8

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci	
									h	v
12906.	3.1	.9	1.1	1.4	.4	.5	3.3	1.0	-1.7	-2.8
12907.	2.4	.7	.8	3.2	.8	1.0	3.8	1.1	.7	-2.1
12908.	4.4	1.4	1.6	1.7	.4	.6	4.6	1.5	-2.1	-1.9
12909.	2.8	.6	.8	2.2	.5	.6	2.9	.8	-.3	-1.5
12910.	2.4	.5	.7	1.8	.5	.6	2.4	.8	-1.2	-2.2
mean	3.0	.8	1.0	2.1	.5	.7	3.4	1.1	-.9	-2.1

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci		
									h	v	
12911.	3.4	.6	.9	3.6	.8	1.0	4.9	1.0	-.6	-9.3	X-7
12912.	4.3	1.1	1.4	1.6	.3	.5	4.3	1.2	-.4	-7.0	
12913.	2.5	.6	.8	1.8	.4	.6	2.5	.8	-.2	-7.5	
12914.	2.2	.6	.7	1.8	.4	.5	2.5	.8	-2.4	-7.8	X-1
12915.	2.0	.4	.5	2.0	.5	.6	2.4	.7	.8	-5.5	
mean	2.9	.6	.9	2.1	.5	.6	3.3	.9	-.6	-7.4	

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci	
									h	v
13001.	3.9	.8	1.1	4.3	1.0	1.3	5.0	1.4	.4	.3
13002.	4.1	1.0	1.3	2.5	.7	.9	4.6	1.3	1.0	-.6
13003.	2.4	.7	.8	1.2	.3	.4	2.4	.8	.3	-.8
13004.	2.1	.5	.7	2.9	.5	.7	2.9	.8	1.1	-.5
13005.	2.7	.7	.9	3.1	.8	1.0	3.2	1.2	1.0	-1.0
mean	3.0	.8	1.0	2.8	.7	.9	3.6	1.1	.8	-.5

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci	
									h	v
13006.	3.0	.7	.9	2.8	.6	.8	3.5	1.0	2.9	.2
13007.	2.9	.5	.8	2.1	.6	.8	3.0	.9	-.4	-1.8
13008.	2.6	.8	1.0	1.9	.5	.7	2.8	1.1	2.8	.4
13009.	4.5	1.4	1.7	1.5	.4	.5	4.5	1.5	.3	-1.7
13010.	3.3	.8	1.0	2.9	.7	.9	3.5	1.2	2.1	.2
mean	3.2	.8	1.1	2.2	.6	.7	3.5	1.1	1.6	-.5

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
13011.	1.8	.5	.6	2.9	.8	.9	2.9	1.0	.9	-4.5
13012.	2.0	.7	.7	3.4	.7	1.0	3.4	1.1	1.4	-4.9
13013.	2.6	.7	.9	3.3	.8	1.0	3.3	1.1	.9	-3.3
13014.	4.0	.8	1.1	2.4	.7	.8	4.2	1.2	1.8	-4.2
13015.	3.3	.7	1.0	1.3	.5	.5	3.4	.9	1.0	-4.0
mean	2.7	.7	.9	2.6	.7	.8	3.5	1.1	1.2	-4.2

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
13101.	3.9	.8	1.1	2.4	.4	.6	4.2	.9	2.1	7.2
13102.	2.6	.5	.7	3.3	.7	.9	3.6	.9	2.4	8.7 X-5
13103.	4.5	.9	1.2	3.8	.9	1.2	4.6	1.4	1.7	9.4 X-8
13104.	2.2	.6	.7	4.5	1.0	1.4	4.5	1.3	2.0	8.9 X-7
13105.	2.7	.5	.7	4.1	.9	1.2	4.2	1.1	3.8	10.6 X-10
mean	3.2	.6	.9	3.6	.8	1.1	4.2	1.1	2.4	8.9

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
13106.	3.8	1.1	1.3	4.3	1.0	1.3	4.4	1.7	3.3	7.0 X-1
13107.	4.0	.9	1.1	4.2	1.0	1.4	5.2✓	1.4	4.6	8.8 X-8
13108.	2.7	.9	1.0	3.1	.8	1.0	3.5	1.3	3.2	8.2 X-4
13109.	4.7	1.2	1.5	3.2	.9	1.1	5.2✓	1.6	5.4	8.5 X-8
13110.	2.8	.7	.8	1.8	.5	.6	3.0	.9	2.6	7.9 X-2
mean	3.6	.9	1.2	3.3	.8	1.1	4.3	1.4	3.8	8.1

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
13111.	2.4	.5	.7	2.4	.7	.8	2.8	.9	3.0	2.5
13112.	1.9	.5	.6	2.1	.6	.7	2.1	.8	2.8	4.4
13113.	1.2	.3	.4	4.1	1.0	1.2	4.2	1.0	5.4	6.1 X-4
13114.	2.6	.5	.7	2.4	.6	.8	2.6	1.0	3.0	3.5
13115.	2.5	.5	.7	3.4	.9	1.1	3.6	1.1	4.0	5.9 X-1
mean	2.1	.5	.6	2.9	.7	.9	3.1	1.0	3.6	4.5

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
13201.	2.4	.6	.7	2.6	.5	.7	2.7	.9	-.4	.0
13202.	2.3	.6	.8	3.0	.7	.9	3.3	1.0	-.1	-.9
13203.	3.2	.7	1.0	3.5	.9	1.1	3.5	1.3	-.5	-.8
13204.	1.9	.6	.7	3.4	.7	1.0	3.4	1.0	.5	-.8
13205.	2.9	.6	.9	1.9	.5	.6	3.1	.9	.1	-1.6
mean	2.5	.6	.8	2.9	.6	.9	3.2	1.0	-.1	-.8

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
13206.	4.1	1.0	1.3	1.6	.4	.5	4.2	1.1	1.6	.1
13207.	4.0	1.1	1.3	1.8	.5	.6	4.0	1.3	-.3	-2.6
13208.	3.2	1.0	1.2	1.7	.4	.5	3.4	1.1	2.0	-1.2
13209.	3.5	.9	1.2	1.7	.4	.5	3.6	1.1	-1.3	-2.0
13210.	2.2	.5	.7	2.6	.5	.7	2.7	.8	1.8	-.6
mean	3.4	.9	1.1	1.9	.4	.6	3.6	1.1	.8	-1.3

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
13211.	2.1	.6	.8	2.6	.5	.7	3.1	.9	-.6	-5.7
13212.	3.7	.9	1.2	1.4	.4	.5	3.8	1.0	.6	-6.6
13213.	2.7	.6	.8	1.9	.4	.6	2.7	.8	.7	-6.0
13214.	3.3	.7	1.0	1.5	.3	.5	3.3	.9	1.2	-4.7
13215.	2.9	.6	.8	1.7	.4	.5	2.9	.8	-.6	-6.3
mean	2.9	.7	.9	1.9	.4	.5	3.2	.9	.3	-5.9

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
13301.	3.0	.7	.9	1.2	.3	.4	3.0	.8	2.1	1.4
13302.	2.1	.5	.6	1.6	.3	.5	2.2	.7	2.1	1.4
13303.	2.6	.5	.7	1.6	.4	.6	2.6	.8	1.5	1.5
13304.	2.3	.6	.8	1.4	.4	.5	2.6	.8	1.7	1.7
13305.	3.3	.7	1.0	3.0	.9	1.0	3.6	1.3	2.6	1.8
mean	2.7	.6	.8	1.8	.5	.6	2.8	.9	2.0	1.6

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
13306.	5.5	1.2	1.6	3.8	.9	1.1	5.8	1.7	1.2	.9
13307.	3.2	.7	.9	1.5	.4	.5	3.2	.8	2.8	1.1
13308.	3.8	.8	1.1	2.8	.5	.7	3.8	1.1	.9	2.1
13309.	3.3	1.0	1.2	3.7	.7	1.0	3.9	1.3	3.0	2.9
13310.	3.8	1.1	1.3	1.7	.5	.6	3.8	1.2	.6	.7
mean	3.9	.9	1.2	2.7	.6	.8	4.1	1.2	1.7	1.6

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
13311.	1.3	.3	.4	1.9	.5	.6	2.2	.6	1.8	-1.1
13312.	2.8	.7	.8	2.0	.4	.6	2.9	.9	-.4	-4.3
13313.	2.5	.5	.7	1.1	.2	.3	2.5	.6	3.1	-2.3
13314.	2.1	.5	.6	1.8	.5	.6	2.2	.8	1.0	-3.1
13315.	2.6	.6	.7	2.1	.6	.7	3.0	.9	3.1	-1.1
mean	2.3	.5	.7	1.8	.5	.6	2.6	.8	1.7	-2.4

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	v
13401.	3.4	1.0	1.2	2.1	.6	.8	3.6	1.3	-.5	-.3
13402.	3.7	.9	1.1	2.2	.3	.5	3.7	1.0	.3	-.7
13403.	2.2	.5	.7	2.2	.4	.6	2.6	.7	-.2	-.3
13404.	3.2	.7	.9	2.5	.5	.7	3.2	.9	1.0	-1.0
13405.	2.7	.7	.9	2.6	.6	.7	3.5	1.0	-.1	-.9
mean	3.0	.8	1.0	2.3	.5	.7	3.3	1.0	.1	-.6

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	v
13406.	2.2	.6	.8	2.5	.6	.8	2.6	.9	1.3	.4
13407.	4.1	1.3	1.6	1.4	.4	.5	4.2	1.4	.4	-.6
13408.	5.0	1.1	1.5	2.2	.5	.7	5.0	1.4	2.5	-.2
13409.	3.2	.6	.9	1.5	.3	.5	3.3	.8	.2	1.2
13410.	2.1	.7	.8	2.0	.6	.7	2.4	1.0	2.2	.2
mean	3.3	.9	1.1	1.9	.5	.6	3.5	1.1	1.3	.2

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	v
13411.	2.4	.6	.8	1.3	.3	.4	2.4	.8	1.2	-4.3
13412.	2.8	.5	.7	1.5	.3	.4	2.8	.7	.4	-5.0
13413.	1.5	.4	.5	2.0	.4	.6	2.1	.7	.2	-4.8
13414.	2.5	.5	.7	1.5	.5	.6	2.5	.8	1.9	-3.1
13415.	1.6	.4	.5	3.6	.8	1.0	3.7	1.0	.1	-5.6
mean	2.1	.5	.6	2.0	.5	.6	2.7	.8	.8	-4.6

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	v	
13501.	2.4	.7	.8	2.6	.6	.8	2.6	1.0	4.1	-1.6	
13502.	2.5	.5	.7	3.4	.9	1.1	3.4	1.2	4.4	-2.7	X-1
13503.	2.9	.5	.8	1.3	.4	.5	3.1	.7	5.0	-3.1	
13504.	2.8	.7	.9	2.4	.8	1.0	3.7	1.2	5.6	-3.5	X-5
13505.	2.3	.6	.7	2.1	.7	.8	2.3	1.0	5.9	-3.9	X-5
mean	2.6	.6	.8	2.4	.7	.8	3.0	1.0	5.0	-3.0	

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	v	
13506.	5.3	1.2	1.6	1.8	.5	.6	5.3	1.3	4.4	-5.6	
13507.	5.5	1.5	1.8	2.0	.5	.6	5.7	1.6	6.1	-2.1	X-10
13508.	5.1	1.2	1.5	2.4	.4	.7	5.3	1.3	5.4	-3.1	X-1
13509.	6.3	1.1	1.7	3.4	.9	1.1	6.4 F	1.6	7.6	-3.4	X-10
13510.	2.9	.6	.8	2.6	.4	.7	2.9	.9	4.8	-4.6	
mean	5.0	1.1	1.5	2.4	.5	.8	5.1	1.3	5.7	-3.8	

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v	
13511.	2.0	.6	.7	2.4	.6	.8	2.7	.9	5.8	-9.1	X-10
13512.	1.8	.6	.7	2.4	.5	.7	2.4	.8	4.0	-7.7	
13513.	3.1	.8	1.0	1.9	.5	.6	3.2	1.0	6.7	-5.7	X-10
13514.	5.0	1.0	1.4	1.5	.3	.5	5.0 ✓	1.1	6.1	-7.7	X-8
13515.	3.2	.7	.9	1.9	.6	.7	3.5	1.0	4.6	-7.2	X-1
mean	3.0	.7	.9	2.0	.5	.7	3.4	1.0	5.4	-7.5	

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
22901.	2.6	.7	.8	1.3	.3	.4	2.6	.8	-1.0	2.2
22902.	2.8	.6	.8	3.2	.6	.8	3.4	.9	-1.2	3.1
22903.	4.2	.9	1.2	2.2	.5	.7	4.3	1.2	-3.4	2.9
22904.	2.3	.5	.6	2.7	.8	.9	2.9	1.0	-1.5	3.2
22905.	3.2	.6	.9	4.1	.9	1.2	5.0	1.2	-2.7	3.2
mean	3.0	.6	.9	2.7	.6	.8	3.7	1.0	-2.0	2.9

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
22906.	3.8	.7	1.1	2.3	.5	.7	4.5 F	.9	-.9	2.5
22907.	3.9	1.0	1.3	2.6	.9	1.0	4.1	1.5	-1.3	2.0
22908.	3.0	.8	1.0	1.4	.3	.4	3.0	.9	-1.1	2.2
22909.	3.3	.8	1.0	2.0	.4	.5	3.5	1.0	-1.2	.9
22910.	3.2	.9	1.1	2.0	.6	.7	3.3	1.1	-.9	1.5
mean	3.5	.9	1.1	2.1	.5	.7	3.7	1.1	-1.1	1.8

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
22911.	3.3	.7	1.0	3.3	.7	1.0	4.0	1.1	-.8	.1
22912.	4.6	1.0	1.4	2.2	.6	.8	4.6	1.3	-2.5	-1.2
22913.	4.4	1.1	1.3	2.3	.6	.8	4.4	1.4	-.9	.3
22914.	2.3	.7	.8	1.8	.4	.6	2.8	.9	-1.9	-.4
22915.	2.9	.6	.8	2.0	.5	.7	3.0	.9	-.7	1.1
mean	3.5	.9	1.1	2.3	.6	.8	3.8	1.1	-1.4	-.0

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
23001.	3.4	.7	1.0	2.1	.6	.8	3.8 F	1.1	1.3	-2.3
23002.	3.1	.8	1.0	1.7	.5	.6	3.1	1.0	.7	-2.0
23003.	2.3	.6	.7	1.2	.4	.5	2.5	.7	2.8	-1.2
23004.	1.8	.6	.7	1.1	.3	.4	1.9	.7	.0	-2.0
23005.	2.6	.7	.8	3.0	.6	.8	3.1	1.0	2.2	-.7
mean	2.6	.7	.9	1.8	.5	.6	2.9	.9	1.4	-1.6

tgt									ci	
no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	h	v
23006.	3.1	1.1	1.3	4.4	1.1	1.4	4.7	1.7	1.3	-2.4
23007.	2.2	.7	.8	1.7	.4	.6	2.2	.9	3.5	.2
23008.	4.9	1.0	1.4	2.7	.7	.9	5.3	1.3	1.9	-2.9
23009.	3.0	.7	.9	2.5	.6	.8	3.4	1.0	2.4	-1.1
23010.	2.0	.5	.7	2.4	.8	.9	2.7	1.0	1.9	-3.6
mean	3.1	.8	1.0	2.8	.7	.9	3.7	1.2	2.2	-2.0

tgt									ci	
no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	h	v
23011.	3.7	1.0	1.2	2.0	.5	.7	3.9	1.2	2.5	-6.6
23012.	3.7	.8	1.1	3.9	.7	1.1	3.9	1.4	3.5	-5.6
23013.	4.2	.7	1.2	2.4	.6	.8	4.2 F	1.0	1.9	-5.7
23014.	3.2	1.0	1.2	2.3	.6	.7	3.4	1.2	2.1	-3.7
23015.	4.6	1.1	1.4	2.8	.5	.7	4.8	1.3	1.6	-5.9
mean	3.9	.9	1.2	2.7	.6	.8	4.0	1.2	2.3	-5.5

tgt									ci	
no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	h	v
23101.	2.7	.5	.7	4.3	1.0	1.4	4.7	1.3	.5	-.5
23102.	4.1	.9	1.2	4.7	1.0	1.4	4.7	1.5	.8	-.8
23103.	2.4	.8	.9	2.2	.8	.9	3.1	1.1	-.7	-.9
23104.	2.5	.5	.7	3.1	.8	1.0	3.2	1.1	.0	.5
23105.	3.7	.9	1.2	4.2	1.2	1.5	5.1	1.6	.0	.1
mean	3.1	.7	.9	3.7	1.0	1.2	4.2	1.3	.1	-.3

tgt									ci	
no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	h	v
23106.	4.3	1.0	1.3	2.4	.7	.9	4.7	1.3	1.9	-1.3
23107.	3.0	.8	1.0	4.8	1.0	1.5	5.4	1.4	.1	-2.5
23108.	3.3	1.0	1.2	5.1	.9	1.4	5.2	1.5	.1	-1.6
23109.	3.6	.9	1.2	3.6	.8	1.1	3.8	1.3	.2	-2.9
23110.	2.4	.4	.6	3.1	.9	1.1	3.1	1.1	1.7	-1.5
mean	3.3	.8	1.1	3.8	.9	1.2	4.4	1.3	.8	-2.0

tgt									ci		
no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	h	v	
23111.	3.1	.7	.9	3.2	.8	1.0	3.3	1.2	3.1	-6.9	
23112.	4.8	1.0	1.4	4.3	1.0	1.2	5.1	1.6	2.7	-8.1	x-3
23113.	5.0	1.2	1.5	3.5	.7	1.0	5.3	1.5	1.2	-2.8	
23114.	3.2	.7	1.0	2.7	.7	.9	3.6	1.1	1.5	-4.0	
23115.	2.4	.7	.9	2.9	.7	.9	3.4	1.1	2.7	-5.3	
mean	3.7	.9	1.1	3.3	.8	1.0	4.1	1.3	2.3	-5.4	

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
23201.	1.2	.3	.4	2.3	.5	.7	2.3	.7	-1.3	-1.5
23202.	2.3	.7	.8	1.3	.3	.4	2.3	.8	-1.5	-1.2
23203.	2.9	.8	1.0	1.4	.4	.5	2.9	1.0	-.6	.3
23204.	4.1	1.0	1.3	2.7	.6	.8	4.2	1.3	-2.3	-1.6
23205.	3.4	1.0	1.2	3.0	.9	1.1	4.3	1.4	-.5	.7
mean	2.8	.8	.9	2.1	.6	.7	3.2	1.0	-1.2	-.6

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
23206.	3.3	.7	1.0	2.5	.6	.7	3.6	1.0	-1.3	-1.7
23207.	2.5	.7	.9	2.0	.6	.7	2.9	1.0	.1	-.6
23208.	1.8	.5	.6	3.6	.9	1.1	3.9	1.1	-1.2	-2.0
23209.	3.4	.8	1.0	1.4	.5	.6	3.6	1.0	.2	-1.1
23210.	3.4	.7	1.0	2.3	.8	.9	3.8	1.2	-.9	-2.4
mean	2.9	.7	.9	2.4	.7	.8	3.6	1.0	-.6	-1.5

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
23211.	4.7	.9	1.3	2.2	.4	.6	4.7	1.1	-.1	-8.7 X-4
23212.	3.3	.8	1.0	1.6	.4	.5	3.5	.9	.1	-3.2
23213.	3.4	.9	1.1	2.2	.5	.7	3.7	1.1	-1.3	-3.5
23214.	2.5	.7	.8	2.4	.6	.8	2.9	1.0	-.8	-3.2
23215.	3.2	.8	1.0	2.1	.6	.7	3.4	1.1	-1.0	-4.5
mean	3.4	.8	1.0	2.1	.5	.7	3.6	1.0	-.6	-4.6

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
23301.	3.8	.9	1.2	3.2	.7	.9	4.2	1.3	.1	-1.3
23302.	1.5	.4	.5	2.5	.7	.9	2.8	.9	.4	-1.0
23303.	2.6	.8	1.0	3.5	.7	1.0	3.5	1.2	-1.0	-1.8
23304.	2.7	.9	1.0	3.7	.7	1.0	3.7	1.2	.1	.4
23305.	2.5	.6	.8	2.7	.6	.9	3.0	1.0	-1.3	-2.5
mean	2.6	.7	.9	3.1	.7	1.0	3.5	1.1	-.3	-1.2

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
23306.	4.0	.7	1.0	2.2	.5	.7	4.1	1.0	-.2	-1.5
23307.	5.2	.9	1.4	3.8	.8	1.1	5.6	1.4	.0	-2.4
23308.	1.8	.6	.7	2.7	.8	.9	2.9	1.0	1.2	-1.7
23309.	3.3	.9	1.1	2.1	.5	.7	3.3	1.2	-.8	-3.5
23310.	4.4	.8	1.2	2.9	.7	.9	5.2	1.2	1.2	-2.3
mean	3.7	.8	1.1	2.7	.7	.9	4.2	1.2	.3	-2.3

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
23311.	2.9	.7	.9	3.5	.8	1.1	4.1	1.2	.6	-5.9
23312.	3.6	1.1	1.3	2.9	1.0	1.1	4.7	1.5	-1.2	-3.5
23313.	2.9	.9	1.0	2.1	.6	.7	3.2	1.1	-.6	-4.0
23314.	3.9	1.2	1.4	4.7	1.4	1.6	5.8	1.9	-1.1	-3.7
23315.	3.5	.7	1.0	2.5	.7	.8	3.8	1.0	-.5	-4.5
mean	3.4	.9	1.1	3.1	.9	1.1	4.3	1.4	-.5	-4.3

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v	
23401.	3.1	.9	1.1	1.2	.4	.5	3.3	1.0	-1.1	-2.2	
23402.	2.2	.5	.7	2.2	.4	.6	2.4	.8	-1.7	-1.7	
23403.	3.1	.8	1.0	2.2	.7	.8	3.4	1.1	.2	.4	
23404.	3.4	.8	1.0	2.6	.9	1.0	3.5	1.3	-1.4	-1.0	
23405.	3.7	.7	1.0	2.3	.6	.7	4.0	1.0	-.1	-.1	
mean	3.1	.8	1.0	2.1	.6	.7	3.3	1.0	-.8	-.9	

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v	
23406.	2.2	.4	.6	2.5	.6	.8	2.7	.8	-.4	-2.3	
23407.	4.7	.9	1.3	2.5	.7	.8	4.8	1.3	.1	-.6	
23408.	4.7	1.0	1.4	3.1	.6	.8	4.7	1.3	-.2	-2.5	
23409.	2.6	.7	.8	2.6	.7	.9	2.9	1.1	1.0	-1.0	
23410.	3.6	.7	1.0	2.2	.5	.7	3.6	1.0	-.2	-2.3	
mean	3.6	.7	1.0	2.6	.6	.8	3.8	1.1	.1	-1.7	

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v	
23411.	2.4	.5	.7	1.8	.6	.7	2.7	.8	-.2	-6.2	
23412.	2.9	.5	.8	2.0	.5	.6	2.9	.8	.3	-3.0	
23413.	4.6	.9	1.3	3.3	.9	1.1	5.4	1.4	-.5	-4.5	
23414.	4.6	1.1	1.3	3.1	.8	1.0	5.3	1.4	.1	-2.2	
23415.	5.4	1.1	1.5	2.4	.5	.7	5.8	1.3	.0	-5.3	
mean	4.0	.8	1.1	2.5	.6	.8	4.4	1.1	-.0	-4.3	

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v	
23501.	3.9	.8	1.1	1.3	.4	.4	3.9	1.0	3.8	-.7	
23502.	3.5	.8	1.1	1.9	.5	.6	3.8	1.0	4.4	1.0	
23503.	2.3	.7	.8	1.3	.3	.4	2.3	.8	2.1	-.7	
23504.	3.2	.6	.9	3.7	.8	1.1	4.7	1.1	5.1	.9	X-1
23505.	5.3	1.2	1.6	2.0	.5	.6	5.4	1.4	2.5	-1.2	
mean	3.6	.8	1.1	2.0	.5	.6	4.1	1.1	3.6	-.1	

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v	
23506.	2.5	.7	.8	2.8	.6	.8	2.8	1.0	5.3	.4	X-2
23507.	2.8	.7	.9	3.2	.8	1.0	3.4	1.1	4.1	-1.8	
23508.	3.8	.7	1.0	2.6	.5	.7	4.0	.9	5.0	-2.0	X-1
23509.	4.0	1.0	1.2	3.1	.6	.9	5.0	1.2	3.6	-2.5	
23510.	2.0	.5	.6	2.5	.5	.7	3.0	.8	5.0	.2	X-1
mean	3.0	.7	.9	2.8	.6	.8	3.7	1.0	4.6	-1.1	

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
23511.	4.3	1.2	1.5	2.7	.8	1.0	4.4	1.6	3.9	-3.1
23512.	3.3	1.1	1.3	3.1	.8	1.0	3.7	1.5	3.3	-3.7
23513.	4.1	.9	1.3	2.4	.6	.8	4.2	1.2	4.5	-2.4
23514.	3.3	.6	.9	1.7	.5	.6	3.7	.9	4.5	-4.5
23515.	3.1	.8	1.0	2.3	.6	.8	3.3	1.1	4.3	-2.6
mean	3.6	.9	1.2	2.4	.7	.8	3.8	1.3	4.1	-3.2

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
32801.	2.7	.9	1.0	2.0	.6	.8	3.0	1.2	.6	7.0
32802.	3.6	.7	.9	1.9	.5	.6	4.1	.9	-.2	5.8
32803.	3.2	.8	1.0	2.7	.6	.8	3.2	1.1	.5	6.1
32804.	3.1	.7	.9	3.0	.6	.8	3.2	1.1	-.0	6.0
32805.	3.1	.9	1.1	2.7	.7	.9	3.3	1.2	.6	6.6
mean	3.1	.8	1.0	2.5	.6	.8	3.3	1.1	.3	6.3

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
32806.	3.3	.8	1.0	2.3	.7	.8	3.6	1.1	.2	4.6
32807.	3.3	.9	1.1	2.1	.4	.6	3.6	1.0	.5	4.7
32808.	2.4	.6	.8	2.2	.6	.7	2.5	1.0	.6	4.9
32809.	3.4	.8	1.0	2.1	.6	.7	3.4	1.1	.6	5.1
32810.	3.5	.8	1.1	2.2	.6	.7	3.5	1.1	.0	5.3
mean	3.2	.8	1.0	2.2	.6	.7	3.3	1.1	.4	4.9

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
32811.	3.6	.8	1.1	2.0	.5	.6	3.8	1.0	1.0	4.1
32812.	3.0	.7	.9	3.6	1.1	1.3	3.9	1.4	.8	2.0
32813.	3.6	1.0	1.2	2.9	.9	1.1	3.6	1.5	.2	3.2
32814.	2.0	.5	.6	2.6	.7	.9	2.9	1.0	.0	3.3
32815.	3.3	.9	1.1	3.1	.7	.9	3.3	1.3	-.6	3.0
mean	3.1	.8	1.0	2.8	.8	1.0	3.5	1.2	.3	3.1

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v	
32901.	2.6	.7	.9	1.7	.4	.6	2.6	.9	-6.1	6.6	X-8
32902.	1.4	.4	.5	2.7	.5	.8	2.8	.7	-8.1	4.7	X-10
32903.	1.7	.4	.6	2.3	.6	.7	2.4	.7	-6.3	4.1	X-8
32904.	3.0	.8	1.0	1.8	.5	.6	3.0	1.0	-8.4	3.6	X-10
32905.	3.1	1.0	1.1	1.6	.4	.5	3.2	1.1	-5.9	5.4	X-6
mean	2.3	.7	.8	2.0	.5	.6	2.8	.9	-7.0	4.9	

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v	
32906.	4.0	1.0	1.2	2.2	.5	.7	4.1	1.2	-6.7	4.0	X-9
32907.	2.5	.7	.8	2.4	.6	.8	2.7	1.0	-7.9	4.3	X-10
32908.	3.2	.8	1.1	2.2	.6	.7	3.9	1.1	-6.7	4.1	X-9
32909.	2.3	.8	1.0	2.3	.6	.8	3.0	1.1	-6.8	5.3	X-8
32910.	4.8	1.0	1.4	1.9	.5	.6	4.8	1.2	-6.3	3.7	X-7
mean	3.4	.9	1.1	2.2	.6	.7	3.7	1.1	-6.9	4.3	

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v	
32911.	5.5	1.3	1.8	2.9	.9	1.0	5.5	1.7	-6.0	2.1	X-5
32912.	3.0	.7	.9	3.2	.6	.9	3.6	1.0	-7.1	-1.7	X-9
32913.	5.3	1.5	1.8	2.9	.8	1.0	5.7	1.8	-7.2	1.6	X-8
32914.	2.9	.7	.9	2.7	.6	.8	3.9	1.0	-8.6	.0	X-10
32915.	5.4	1.1	1.5	3.4	.6	.9	5.8	1.4	-6.2	1.4	X-7
mean	4.4	1.1	1.4	3.0	.7	.9	4.9	1.4	-7.0	.7	

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
33001.	2.9	.5	.8	2.1	.5	.6	3.1	.8	-.3	2.3
33002.	4.7	.8	1.2	2.2	.6	.7	4.7	1.2	1.5	3.5
33003.	3.7	1.3	1.5	3.3	.7	1.0	4.9	1.5	-.9	.7
33004.	3.4	.7	1.0	2.7	.6	.8	3.7	1.1	1.6	1.8
33005.	2.5	.6	.8	2.3	.7	.9	2.7	1.1	.9	2.1
mean	3.4	.8	1.1	2.5	.6	.8	3.8	1.1	.6	2.1

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
33006.	4.3	1.0	1.3	2.3	.6	.8	4.4	1.3	.0	.4
33007.	2.8	.9	1.0	2.6	.7	.9	3.1	1.3	.8	.8
33008.	3.0	.7	.9	2.4	.6	.7	3.1	1.0	.6	.6
33009.	5.2	1.3	1.6	3.3	.9	1.1	5.2	1.6	2.1	2.7
33010.	4.9	1.3	1.6	1.9	.6	.7	4.9	1.5	.3	1.6
mean	4.0	1.0	1.3	2.5	.7	.8	4.2	1.3	.8	1.2

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
33011.	4.5	1.1	1.4	2.4	.7	.9	4.9	1.4	.5	-4.3
33012.	5.8	1.6	1.9	2.1	.7	.8	5.8	1.8	1.8	-1.4
33013.	4.3	1.1	1.4	2.2	.5	.7	4.3	1.3	2.3	-5.6
33014.	5.6	1.2	1.7	3.7	.9	1.1	6.0	1.7	.9	-2.2
33015.	3.1	1.0	1.2	2.1	.4	.6	3.2	1.1	.4	-3.2
mean	4.7	1.2	1.5	2.5	.6	.8	4.8	1.5	1.2	-3.3

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
33101.	1.9	.5	.6	2.5	.8	.9	3.0	1.0	-.1	6.2
33102.	2.1	.5	.7	2.7	.8	.9	3.2	1.0	-1.9	5.6
33103.	2.0	.5	.6	3.7	.7	1.0	3.7	.9	.2	6.4
33104.	3.2	.8	1.0	2.8	1.0	1.1	3.9	1.4	-1.5	4.5
33105.	1.8	.5	.6	2.1	.6	.7	2.1	.8	-.4	6.8
mean	2.2	.6	.7	2.8	.8	.9	3.2	1.0	-.7	5.9

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
33106.	2.6	.7	.8	2.9	.6	.8	3.2	1.0	.2	4.7
33107.	3.7	1.0	1.2	2.5	.6	.9	4.1	1.3	-1.5	4.3
33108.	4.3	.8	1.2	1.5	.3	.4	4.3 F	.9	-2.8	-2.9
33109.	2.3	.6	.8	4.6	1.0	1.3	4.6	1.3	-.9	4.8
33110.	3.0	.7	.9	1.6	.5	.5	3.0	.9	-.1	7.3
mean	3.2	.8	1.0	2.6	.6	.8	3.8	1.1	-1.0	3.7

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
33111.	3.0	.8	.9	2.1	.4	.6	3.1	.9	.7	1.1
33112.	4.9	1.2	1.5	1.4	.3	.4	5.0	1.2	-1.3	2.0
33113.	3.4	.8	1.1	2.8	.7	.9	4.2	1.2	-.9	2.2
33114.	3.3	.9	1.1	1.5	.4	.5	3.6	1.1	-2.3	1.1
33115.	4.4	1.0	1.3	1.6	.4	.5	4.4	1.1	1.3	3.0
mean	3.8	.9	1.2	1.9	.4	.6	4.1	1.1	-.5	1.9

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
33201.	1.4	.3	.4	2.7	.6	.8	2.8 F	.7	-3.6	-.5
33202.	2.8	.8	1.0	1.7	.4	.5	2.9	1.0	-2.0	1.1
33203.	3.0	.9	1.1	2.2	.5	.6	3.1	1.1	-2.8	-.6
33204.	2.1	.7	.8	1.6	.5	.6	2.3	.9	-2.2	-.6
33205.	3.7	1.0	1.2	3.8	.8	1.1	4.2	1.4	-3.8	-1.4 X-1
mean	2.6	.7	.9	2.4	.5	.7	3.0	1.0	-2.9	-.4

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
33206.	4.7	1.0	1.4	2.7	.7	.9	5.0	1.3	-2.8	-1.8
33207.	2.8	.6	.9	1.8	.5	.6	2.9	.9	-2.0	-1.0
33208.	3.9	1.0	1.3	2.7	.8	.9	4.5	1.3	-.2	6.0
33209.	2.7	.6	.8	.9	.2	.3	2.7	.7	-2.1	-.3
33210.	3.7	.9	1.2	1.9	.5	.6	3.8	1.1	-2.6	-1.2
mean	3.6	.8	1.1	2.0	.5	.7	3.8	1.1	-2.0	.3

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
33211.	3.6	.7	1.1	1.6	.5	.6	3.9	1.0	-2.1	-8.5 X-3
33212.	2.9	.9	1.1	1.7	.4	.5	3.2	1.0	-1.1	-4.5
33213.	3.6	1.1	1.3	1.8	.4	.5	3.7	1.2	-3.8	-4.9
33214.	2.9	.6	.9	1.8	.5	.6	3.1	.9	-2.0	-2.4
33215.	3.6	1.0	1.2	1.5	.4	.5	3.7	1.2	-3.6	-3.9
mean	3.3	.9	1.1	1.7	.4	.6	3.5	1.0	-2.5	-4.9

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
33301.	3.4	.9	1.1	1.6	.3	.4	3.4	1.0	-1.1	2.4
33302.	2.8	.7	.9	2.5	.5	.7	3.4	1.0	-2.5	.6
33303.	4.1	.9	1.3	1.9	.4	.6	4.1	1.0	-1.1	2.0
33304.	2.8	.8	1.0	4.5	.9	1.3	4.8 F	1.4	-1.3	.9
33305.	2.6	.6	.8	2.8	.7	.9	3.2	1.0	-1.0	.8
mean	3.2	.8	1.0	2.7	.6	.8	3.8	1.1	-1.4	1.3

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
33306.	3.8	1.1	1.3	2.4	.6	.7	3.8	1.4	-.9	1.4
33307.	4.0	.8	1.1	2.5	.7	.9	4.0	1.3	-1.6	.9
33308.	2.1	.6	.8	2.7	.6	.8	2.7	1.0	-1.6	.7
33309.	3.0	.9	1.0	1.8	.5	.6	3.3	1.0	-1.2	.9
33310.	2.0	.6	.7	2.2	.6	.7	2.9	.9	-1.1	1.7
mean	3.0	.8	1.0	2.3	.6	.8	3.3	1.1	-1.3	1.1

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
33311.	2.2	.5	.7	1.4	.4	.5	2.3	.7	.3	-2.9
33312.	2.6	.7	.8	1.9	.6	.7	2.9	1.0	-1.6	-2.3
33313.	2.6	.5	.7	1.7	.6	.7	3.0	.8	-1.4	-.6
33314.	3.7	.9	1.1	2.2	.4	.6	3.8	1.1	-1.6	-2.4
33315.	4.2	1.0	1.3	2.5	.6	.8	4.5	1.3	-1.1	.1
mean	3.1	.7	.9	1.9	.5	.7	3.3	1.0	-1.1	-1.6

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
33401.	2.7	.6	.8	2.0	.6	.7	3.0	1.0	-.3	3.9
33402.	2.5	.6	.8	3.6	.7	1.0	4.1	1.0	-.8	3.7
33403.	3.8	1.0	1.2	3.0	.7	1.0	4.2	1.4	-.4	3.7
33404.	1.9	.5	.6	1.9	.4	.5	1.9	.7	-.0	3.6
33405.	2.5	.7	.8	2.4	.6	.8	2.9	1.0	.3	3.4
mean	2.7	.7	.8	2.6	.6	.8	3.2	1.0	-.2	3.7

tgt									ci	
no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	h	v
33406.	2.6	.7	.9	1.6	.4	.5	2.7	.9	-.6	2.6
33407.	3.3	.7	1.0	2.7	.6	.8	3.5	1.0	-.5	2.4
33408.	3.6	1.2	1.4	1.5	.4	.5	3.8	1.3	-.8	1.8
33409.	3.4	.7	1.0	1.2	.3	.4	3.4	.9	-.5	3.2
33410.	2.7	.5	.7	2.1	.6	.7	2.7	.9	-.6	2.9
mean	3.1	.8	1.0	1.8	.5	.6	3.2	1.0	-.6	2.6

tgt									ci	
no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	h	v
33411.	3.4	.7	1.0	2.2	.6	.7	3.8	1.0	-1.0	-.2
33412.	3.4	.7	1.0	2.6	.7	.9	3.7	1.1	-1.5	-.7
33413.	2.5	.5	.7	2.2	.6	.8	2.7	.8	-.2	-1.3
33414.	2.8	.8	.9	2.0	.6	.7	2.9	1.0	-.9	-.3
33415.	4.7	1.0	1.3	2.0	.5	.6	4.7	1.2	.3	-1.1
mean	3.4	.7	1.0	2.2	.6	.7	3.6	1.0	-.7	-.7

tgt									ci	
no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	h	v

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
12916.	5.4	1.4	1.8	4.8	.9	1.3	7.2	1.8	2.5	-.8
12917.	2.6	.5	.7	1.8	.4	.5	2.9	.7	2.4	-1.8
12918.	2.8	.8	1.0	3.9	1.0	1.2	4.8	1.3	1.2	-1.6
12919.	2.1	.6	.7	2.1	.5	.7	2.4	.8	1.1	-2.4
12920.	2.3	.6	.7	2.8	.9	1.0	2.8	1.1	.9	-2.3
mean	3.1	.8	1.0	3.1	.7	1.0	4.0	1.2	1.6	-1.8

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
13016.	3.6	1.2	1.4	2.6	.7	.9	3.8	1.5	2.0	1.9
13017.	4.3	1.2	1.5	2.1	.6	.7	4.3	1.4	2.2	1.6
13018.	3.7	.9	1.2	2.2	.6	.7	3.9	1.2	2.6	.5
13019.	3.7	1.0	1.3	3.8	.7	1.1	5.2	1.3	2.7	-.2
13020.	2.9	.7	.9	2.5	.7	.8	3.9	1.0	2.6	-.5
mean	3.6	1.0	1.2	2.6	.6	.8	4.2	1.3	2.4	.7

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
13116.	2.2	.5	.6	2.2	.5	.7	2.3	.8	5.1	3.7
13117.	2.8	.5	.8	2.5	.6	.8	3.4	.8	4.2	3.6
13118.	4.7	.8	1.3	2.4	.6	.7	4.7	1.2	4.3	4.6
13119.	2.9	.8	1.0	1.4	.4	.5	3.0	1.0	3.1	4.8
13120.	2.4	.6	.8	2.7	.6	.8	2.8	1.0	3.7	4.9
mean	3.0	.6	.9	2.2	.5	.7	3.2	.9	4.1	4.3

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
13216.	4.2	1.0	1.2	3.2	.6	.9	5.1	1.2	2.3	-2.0
13217.	4.2	.9	1.2	2.7	.7	.9	4.2	1.3	2.5	-1.8
13218.	2.8	.7	.9	2.8	.7	.9	2.9	1.0	2.4	-2.9
13219.	4.5	.9	1.3	1.9	.5	.6	4.8	1.1	1.3	-1.8
13220.	3.0	.9	1.1	2.2	.5	.6	3.1	1.1	1.3	-1.0
mean	3.7	.9	1.1	2.6	.6	.8	4.0	1.1	1.9	-1.9

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
13316.	6.0	1.6	2.0	5.2	1.3	1.7	7.6	2.1	2.2	1.5
13317.	1.9	.5	.7	2.3	.6	.8	2.3	.9	3.8	-.6
13318.	3.2	.8	1.1	2.5	.5	.7	3.4	1.0	3.0	.2
13319.	3.0	.9	1.0	1.7	.4	.6	3.0	1.0	3.1	.3
13320.	1.7	.4	.5	2.4	.6	.8	2.6	.8	3.4	.3
mean	3.2	.8	1.0	2.8	.7	.9	3.8	1.2	3.1	.3

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
13416.	3.1	.6	.8	2.1	.4	.6	3.3	.8	1.1	-1.6
13417.	3.9	.9	1.2	1.7	.4	.6	3.9	1.1	1.7	-2.4
13418.	4.1	1.0	1.2	3.9	1.0	1.2	5.2	1.5	.9	-2.0
13419.	2.1	.5	.7	2.2	.6	.8	2.7	.9	1.4	-2.2
13420.	4.0	1.2	1.4	2.6	.6	.8	4.1	1.4	1.2	-2.8
mean	3.4	.9	1.1	2.5	.6	.8	3.9	1.1	1.2	-2.2

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
13516.	3.0	.9	1.1	2.9	.8	1.0	3.5	1.3	5.2	-3.5
13517.	5.7	.9	1.4	1.7	.6	.7	5.7	1.2	5.7	-3.8
13518.	3.7	.8	1.2	2.1	.7	.8	3.9	1.2	5.9	-3.3
13519.	5.6	1.2	1.6	3.3	.7	1.0	5.8	1.5	6.2	-3.2
13520.	2.2	.5	.7	2.7	.7	.9	2.8	1.0	6.2	-3.8
mean	4.0	.9	1.2	2.6	.7	.9	4.3	1.3	5.8	-3.5

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
22916.	3.9	.7	1.1	2.6	.7	.8	4.0	1.1	-2.0	2.6
22917.	3.7	.9	1.2	1.9	.6	.7	4.1	1.2	-1.3	1.7
22918.	4.4	.9	1.2	2.7	.6	.9	4.4	1.2	-.5	.3
22919.	6.0	1.2	1.6	1.9	.6	.7	6.0	1.4	-.9	.2
22920.	3.3	1.0	1.2	2.3	.7	.8	3.6	1.3	-1.5	1.4
mean	4.3	.9	1.3	2.3	.6	.8	4.4	1.2	-1.2	1.2

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
23016.	3.5	.7	1.0	1.6	.2	.4	3.5	.9	2.2	-2.4
23017.	4.0	1.0	1.3	3.0	.6	.8	4.6	1.3	2.6	-3.0
23018.	4.2	.8	1.1	2.9	.7	.9	4.4	1.2	2.6	-2.5
23019.	4.6	1.2	1.5	2.3	.6	.7	4.7	1.5	2.4	-3.4
23020.	2.6	.7	.9	2.2	.5	.7	2.7	1.0	2.3	-3.4
mean	3.8	.9	1.2	2.4	.5	.7	4.0	1.2	2.4	-2.9

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
23116.	3.9	1.1	1.4	3.0	.8	.9	4.3	1.5	-.7	-3.5
23117.	3.9	.9	1.2	3.4	.6	.9	4.9	1.2	-.6	-3.2
23118.	4.1	1.0	1.3	2.4	.5	.7	4.2	1.3	-1.0	-1.8
23119.	4.3	1.3	1.5	2.8	.6	.8	4.3	1.6	-.8	-2.4
23120.	3.0	.8	1.0	3.5	.6	1.0	4.3	1.2	-.9	-3.5
mean	3.8	1.0	1.3	3.0	.6	.9	4.4	1.3	-.8	-2.9

tgt									ci	
no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	h	v
23216.	4.0	1.0	1.3	2.2	.4	.6	4.1	1.2	-.4	-.5
23217.	4.1	.8	1.1	2.7	.6	.8	4.9	1.1	-.2	-.7
23218.	3.8	.9	1.2	2.2	.5	.6	3.9	1.1	-.4	-.7
23219.	6.5	1.4	1.9	4.4	.8	1.1	7.8	1.6	-.7	-1.8
23220.	5.8	1.4	1.8	2.3	.5	.7	5.8	1.6	-.5	.5
mean	4.8	1.1	1.5	2.7	.6	.8	5.3	1.3	-.4	-.6

tgt									ci	
no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	h	v
23316.	3.8	1.0	1.3	3.6	.9	1.1	4.4	1.5	.3	-1.0
23317.	3.9	.9	1.2	2.1	.4	.6	4.0	1.1	-.2	-.6
23318.	3.5	.7	1.0	1.7	.4	.5	3.5	.9	-.1	-1.6
23319.	3.6	.9	1.1	3.5	.8	1.1	4.4	1.3	.0	-1.5
23320.	3.1	.8	1.0	3.6	.9	1.1	4.3	1.2	1.0	-1.5
mean	3.5	.9	1.1	2.9	.7	.9	4.1	1.2	.2	-1.2

tgt									ci	
no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	h	v
23416.	3.2	.7	.9	2.1	.5	.7	3.3	1.0	-3.5	-3.0
23417.	2.9	.8	1.0	1.8	.4	.5	3.0	.9	-3.3	-2.7
23418.	2.9	1.0	1.1	2.9	.6	.9	4.1	1.2	-3.2	-2.2
23419.	3.5	.8	1.1	3.5	.8	1.0	3.9	1.2	-3.0	-1.5
23420.	3.9	1.2	1.4	2.6	.7	.9	4.2	1.5	-2.7	-1.6
mean	3.3	.9	1.1	2.6	.6	.8	3.7	1.2	-3.2	-2.2

tgt									ci	
no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	h	v
23516.	1.9	.6	.7	2.6	.7	.9	2.7	1.1	2.0	-1.4
23517.	4.4	1.0	1.3	4.5	.9	1.3	5.6	1.5	1.6	-2.9
23518.	3.7	.8	1.1	2.9	.6	.8	3.7	1.1	2.1	-1.6
23519.	2.6	.9	1.0	2.5	.6	.8	2.8	1.2	1.3	-1.2
23520.	1.9	.6	.7	3.1	.6	.9	3.7	.9	2.0	-.9
mean	2.9	.8	1.0	3.1	.7	1.0	3.7	1.2	1.8	-1.6

tgt									ci	
no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	h	v
32816.	3.2	.8	1.1	3.5	.7	1.0	3.5	1.3	1.8	6.1
32817.	2.2	.6	.8	2.3	.7	.9	2.8	1.0	1.5	6.7
32818.	2.9	.8	1.1	1.8	.3	.5	2.9	1.0	1.2	5.7
32819.	3.9	.8	1.1	2.3	.6	.7	3.9	1.1	.5	5.6
32820.	5.7	1.4	19	2.3	.6	.7	5.8	1.6	.6	4.5
mean	3.6	.9	1.2	2.4	.6	.8	3.8	1.2	1.1	5.7

tgt									ci	
no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	h	v
32916.	3.4	.8	1.0	3.6	.7	1.0	3.6	1.2	-3.9	6.2
32917.	4.3	1.0	1.3	2.4	.7	.8	4.4	1.3	-4.0	4.4
32918.	3.5	1.0	1.3	2.8	.6	.8	3.5	1.3	-3.9	5.3
32919.	3.8	.9	1.2	2.6	.7	.9	3.8	1.3	-4.3	5.0
32920.	3.8	.9	1.2	1.5	.4	.5	3.8	1.1	-4.5	4.7
mean	3.7	.9	1.2	2.6	.6	.8	3.8	1.2	-4.1	5.1

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	v
33016.	1.7	.5	.6	4.2	1.0	1.3	4.2	1.2	1.8	2.8
33017.	3.8	1.3	1.5	1.9	.5	.6	4.1	1.4	2.7	3.2
33018.	2.9	.6	.8	3.2	.8	.9	3.3	1.1	2.8	-.3
33019.	5.7	1.2	1.6	2.6	.6	.8	5.8	1.5	2.4	1.7
33020.	4.3	.9	1.2	4.3	.8	1.2	5.1	1.3	2.2	2.6
mean	3.7	.9	1.1	3.3	.7	1.0	4.5	1.3	2.4	2.0

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	v
33116.	2.0	.6	.7	2.5	.6	.8	2.6	1.0	-.4	6.6
33117.	2.2	.6	.8	1.9	.6	.7	2.5	.9	-.1	6.1
33118.	2.9	.8	1.0	2.5	.6	.8	3.2	1.1	-.3	5.3
33119.	2.8	.5	.8	1.6	.4	.5	2.8	.8	.1	5.0
33120.	4.7	1.2	1.5	2.6	.6	.8	4.9	1.5	-.6	5.4
mean	2.9	.7	1.0	2.2	.6	.7	3.2	1.0	-.3	5.7

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	v
33216.	3.1	.8	.9	1.7	.5	.6	3.4	.9	-3.1	2.5
33217.	3.2	.8	1.1	2.3	.4	.6	3.5	1.0	-3.0	1.2
33218.	2.7	.6	.8	3.0	.7	.9	4.0	1.0	-3.4	1.2
33219.	4.6	1.3	1.5	2.3	.5	.7	4.6	1.5	-3.3	1.1
33220.	4.4	1.3	1.5	2.5	.6	.8	4.4	1.5	-3.3	1.9
mean	3.6	.9	1.2	2.4	.5	.7	4.0	1.2	-3.2	1.6

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	v
33316.	4.6	1.1	1.4	1.7	.4	.5	4.6	1.3	-2.0	3.0
33317.	2.4	.6	.8	2.0	.6	.7	2.5	.9	-2.6	3.4
33318.	1.6	.4	.5	1.7	.6	.7	2.2	.8	-1.1	3.7
33319.	2.9	.8	1.0	1.8	.5	.6	2.9	1.0	-1.0	3.5
33320.	3.7	.8	1.1	1.8	.5	.6	3.9	1.0	-1.8	3.7
mean	3.0	.7	1.0	1.8	.5	.6	3.2	1.0	-1.7	3.5

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	v
33416.	1.9	.4	.5	1.2	.3	.4	2.1	.6	-2.1	5.1
33417.	2.7	.5	.8	2.5	.5	.7	2.9	.8	-1.1	5.4
33418.	3.5	.7	1.0	2.6	.7	.8	3.8	1.1	-1.2	5.4
33419.	2.1	.6	.7	1.5	.4	.5	2.1	.8	-.4	6.3
33420.	2.4	.5	.7	1.6	.4	.5	2.4	.7	-.8	5.8
mean	2.5	.5	.7	1.9	.5	.6	2.6	.8	-1.1	5.6

tgt									ci	
no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	h	v
12921.	4.9	1.4	1.7	2.3	.5	.7	4.9	1.6	-.1	-1.9
12922.	2.9	.9	1.0	2.0	.5	.7	3.2	1.1	1.1	-.8
12923.	4.1	.8	1.1	2.8	.6	.8	4.4	1.1	1.8	-2.5
12924.	4.7	1.1	1.4	1.6	.4	.5	4.7	1.2	2.1	-2.7
12925.	5.8	1.9	2.3	1.5	.3	.4	5.9	2.0	2.0	-3.3
mean	4.5	1.2	1.5	2.1	.5	.6	4.6	1.4	1.4	-2.2

tgt									ci	
no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	h	v
13021.	5.6	1.2	1.6	3.1	.8	1.0	5.8	1.6	1.2	1.0
13022.	2.0	.5	.7	2.5	.6	.8	3.1	.9	2.2	1.0
13023.	4.0	.8	1.1	3.6	.9	1.2	4.3	1.4	1.6	.3
13024.	3.2	.7	1.0	2.3	.4	.6	3.2	1.0	3.2	-1.0
13025.	3.5	.8	1.1	3.4	1.0	1.2	4.1	1.4	2.4	-2.3
mean	3.6	.8	1.1	3.0	.7	1.0	4.1	1.2	2.1	-.2

tgt									ci	
no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	h	v
13121.	2.8	.6	.8	2.2	.6	.7	2.8	.9	6.0	5.0
13122.	3.5	.8	1.0	3.5	.9	1.2	3.5	1.4	4.7	3.6
13123.	4.0	1.1	1.4	2.5	.7	.8	4.3	1.4	5.0	2.9
13124.	2.4	.6	.8	3.0	.8	1.0	3.0	1.1	3.4	3.1
13125.	3.8	.7	1.0	2.1	.7	.8	3.8	1.1	4.1	3.3
mean	3.3	.8	1.0	2.7	.7	.9	3.5	1.2	4.6	3.6

tgt									ci	
no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	h	v
13221.	5.5	1.1	1.5	2.1	.4	.6	5.8	1.3	2.6	-2.1
13222.	3.3	.7	.9	2.1	.5	.6	3.3	.9	2.3	-2.1
13223.	3.5	.8	1.1	2.8	.5	.8	4.2	1.1	1.8	-1.9
13224.	2.9	.6	.9	1.9	.5	.7	3.2	.9	2.1	-2.2
13225.	3.2	.9	1.1	4.1	.7	1.1	4.1	1.3	.8	-3.5
mean	3.7	.8	1.1	2.6	.5	.8	4.1	1.1	1.9	-2.3

tgt									ci	
no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	h	v
13321.	2.2	.5	.7	2.6	.7	.8	3.0	.9	3.8	-.2
13322.	3.5	.8	1.0	2.5	.7	.9	4.3	1.1	3.1	-.8
13323.	3.2	.6	.9	1.6	.5	.5	3.4	.8	3.9	.7
13324.	2.8	.8	.9	2.4	.4	.6	3.1	.9	2.7	.4
13325.	2.5	.6	.8	1.7	.3	.5	2.5	.7	3.4	1.8
mean	2.8	.6	.8	2.1	.5	.7	3.3	.9	3.4	.4

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
13421.	2.6	.6	.8	3.0	.7	.9	3.2	1.1	1.0	-1.1
13422.	3.4	.9	1.1	2.2	.5	.6	3.4	1.1	1.8	-1.6
13423.	2.8	.8	1.0	1.6	.4	.5	3.0	1.0	1.0	-1.6
13424.	4.7	1.1	1.4	2.7	.7	.8	5.4	1.3	2.0	-.7
13425.	5.7	1.2	1.6	2.3	.6	.7	5.7	1.5	.8	-.6
mean	3.8	.9	1.2	2.3	.6	.7	4.1	1.2	1.3	-1.1

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
13521.	2.6	.8	.9	2.0	.6	.7	2.8	1.0	6.8	-2.5
13522.	2.7	.6	.8	1.5	.5	.6	2.8	.8	6.8	-3.0
13523.	3.5	.7	1.0	1.6	.4	.5	3.5	.9	7.7	-1.5
13524.	3.3	.9	1.0	2.4	.5	.7	3.6	1.1	7.3	-2.6
13525.	2.8	.8	1.0	2.1	.6	.7	2.8	1.1	6.3	-3.5
mean	3.0	.7	.9	1.9	.5	.6	3.1	1.0	7.0	-2.6

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
22921.	4.0	1.1	1.4	2.0	.5	.6	4.1	1.2	-1.6	1.5
22922.	3.7	.9	1.2	2.3	.6	.7	3.7	1.2	-1.2	.5
22923.	5.8	1.2	1.7	3.1	.6	.8	6.0	1.4	-.7	-1.8
22924.	2.8	.6	.9	1.8	.6	.7	3.0	1.0	-.7	-1.0
22925.	4.1	1.3	1.5	2.4	.6	.8	4.1	1.5	-1.5	-.4
mean	4.1	1.0	1.3	2.3	.6	.7	4.2	1.3	-1.1	-.2

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
23021.	2.8	.6	.8	3.5	.7	1.0	3.6	1.1	2.7	-2.4
23022.	5.1	1.4	1.7	2.9	.5	.8	5.5	1.6	3.1	-1.5
23023.	4.4	1.4	1.6	2.5	.5	.7	4.5	1.6	3.6	-1.7
23024.	4.6	1.0	1.4	.8	.3	.3	4.6	1.1	3.2	-1.2
23025.	3.3	.8	1.0	2.6	.7	.8	4.1	1.1	3.3	-2.3
mean	4.1	1.0	1.3	2.5	.5	.7	4.5	1.3	3.2	-1.8

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
23121.	6.0	1.5	1.8	3.3	.7	1.0	6.6	1.7	.2	-3.2
23122.	3.0	.8	1.0	3.2	1.0	1.1	4.3	1.3	.7	-3.2
23123.	3.4	.5	.9	2.3	.7	.8	3.5	.9	.3	-.6
23124.	3.3	1.0	1.2	3.4	.6	1.0	4.1	1.2	.1	-1.4
23125.	2.8	.8	.9	4.0	1.0	1.3	4.1	1.3	.1	-.3
mean	3.7	.9	1.2	3.2	.8	1.0	4.5	1.3	.3	-1.7

tgt									ci	
no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	h	v
23221.	6.4	1.6	2.1	2.2	.7	.8	6.4	1.9	.2	2.1
23222.	3.9	.8	1.1	1.9	.5	.6	3.9	1.1	-.3	3.4
23223.	5.0	1.2	1.5	2.0	.6	.7	5.1	1.4	.4	3.6
23224.	3.4	.8	1.0	2.8	.6	.8	3.5	1.1	.4	1.9
23225.	2.8	.5	.8	2.6	.5	.7	2.8	.8	.2	1.5
mean	4.3	1.0	1.3	2.3	.6	.7	4.4	1.3	.2	2.5

tgt									ci	
no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	h	v
23321.	3.7	1.0	1.2	2.6	.6	.8	3.8	1.3	-.2	4.8
23322.	4.5	1.3	1.5	2.9	1.0	1.1	4.8	1.7	-.5	4.4
23323.	3.3	.7	1.0	1.7	.4	.5	3.3	.9	-.4	5.5
23324.	4.3	.9	1.2	2.7	.5	.8	4.4	1.2	-.2	4.7
23325.	2.7	.9	1.0	1.9	.4	.6	2.7	1.0	-.9	5.1
mean	3.7	.9	1.2	2.4	.6	.8	3.8	1.2	-.5	4.9

tgt									ci	
no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	h	v
23421.	3.3	.8	1.1	1.9	.4	.6	3.4	1.0	-3.1	-3.1
23422.	2.5	.8	.9	2.4	.7	.8	3.2	1.1	-3.2	-2.1
23423.	2.0	.5	.6	4.2	1.1	1.3	4.2	1.2	-3.2	-2.1
23424.	2.7	.8	.9	1.5	.3	.4	3.0	.9	-3.2	-1.6
23425.	1.5	.4	.5	2.0	.4	.5	2.1	.6	-2.6	-1.1
mean	2.4	.6	.8	2.4	.6	.7	3.2	1.0	-3.1	-2.0

tgt									ci	
no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	h	v
23521.	3.3	.6	.9	3.1	.9	1.0	3.6	1.2	1.2	-1.6
23522.	3.4	.9	1.1	2.6	.6	.8	3.5	1.2	1.6	-1.4
23523.	2.5	.7	.8	2.1	.5	.7	2.6	1.0	.7	-1.1
23524.	2.5	.6	.8	2.0	.5	.6	3.0	.8	1.5	-1.1
23525.	4.0	.8	1.2	2.2	.7	.8	4.2	1.2	1.7	-1.2
mean	3.2	.7	1.0	2.4	.6	.8	3.4	1.1	1.3	-1.3

tgt									ci	
no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	h	v
32821.	5.5	1.5	1.9	2.1	.5	.6	5.9	1.6	.8	6.9
32822.	2.9	.7	.9	1.3	.3	.4	3.0	.8	1.1	8.0
32823.	1.1	.4	.4	1.9	.5	.6	2.0	.7	1.2	5.9
32824.	1.9	.5	.6	2.1	.4	.6	2.1	.7	1.3	6.1
32825.	3.9	1.1	1.4	2.0	.5	.7	4.2	1.3	1.2	5.3
mean	3.1	.8	1.0	1.9	.5	.6	3.4	1.0	1.1	6.4

tgt									ci	
no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	h	v
32921.	2.1	.5	.6	2.3	.6	.8	2.6	.9	-3.7	7.6
32922.	3.0	.8	1.0	1.6	.4	.5	3.1	.9	-2.8	6.6
32923.	1.3	.3	.4	1.5	.4	.5	1.6	.6	-3.7	6.6
32924.	4.5	1.1	1.4	2.9	.5	.8	4.5	1.3	-3.5	6.0
32925.	3.3	.8	1.0	2.3	.6	.8	3.4	1.1	-3.2	6.7
mean	2.8	.7	.9	2.1	.5	.7	3.0	1.0	-3.4	6.7

tgt									ci	
no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	h	v
33021.	4.2	1.0	1.3	3.2	.8	1.0	4.6	1.3	2.4	3.8
33022.	2.2	.5	.7	3.7	.7	1.0	4.2	.9	2.9	2.3
33023.	3.6	.7	1.0	3.1	.8	.9	4.4	1.1	3.8	1.7
33024.	3.1	1.0	1.2	2.6	.5	.7	3.4	1.2	2.2	3.7
33025.	3.5	.8	1.0	3.5	.6	.9	3.6	1.2	3.2	3.6
mean	3.3	.8	1.0	3.2	.7	.9	4.0	1.1	2.9	3.0

tgt									ci	
no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	h	v
33121.	3.8	1.0	1.2	2.2	.6	.7	4.2	1.2	-.8	7.7
33122.	2.6	.7	.9	1.8	.3	.5	2.7	.9	-.3	6.0
33123.	4.9	1.0	1.4	4.2	1.1	1.3	5.7	1.6	-.7	6.7
33124.	4.8	.9	1.3	1.5	.4	.5	4.8	1.1	-.3	5.8
33125.	4.1	1.4	1.6	1.9	.5	.6	4.3	1.5	-.5	5.3
mean	4.0	1.0	1.3	2.3	.6	.7	4.3	1.3	-.5	6.3

tgt									ci	
no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	h	v
33221.	2.1	.6	.7	3.1	.5	.8	3.2	.9	-2.4	1.8
33222.	4.3	.9	1.2	2.9	.6	.8	4.8	1.1	-2.9	2.9
33223.	6.1	1.3	1.7	2.6	.6	.8	6.1	1.6	-3.2	2.0
33224.	3.5	1.1	1.3	3.0	.8	1.0	3.8	1.4	-3.2	2.6
33225.	2.8	.8	1.0	2.4	.6	.8	2.8	1.2	-2.8	1.8
mean	3.8	.9	1.2	2.8	.6	.8	4.2	1.2	-2.9	2.2

tgt									ci	
no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	h	v
33321.	2.6	.6	.8	1.5	.4	.5	2.7	.8	-1.0	4.7
33322.	3.6	1.0	1.2	2.5	.6	.8	3.6	1.2	-.8	4.4
33323.	2.8	.7	.9	1.9	.5	.6	2.9	.9	-.3	4.3
33324.	3.3	.9	1.1	2.3	.5	.7	3.4	1.1	.2	4.2
33325.	2.8	.6	.8	1.9	.3	.5	2.9	.8	.0	5.7
mean	3.0	.8	1.0	2.0	.5	.6	3.1	1.0	-.4	4.7

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	v
33421.	2.9	.7	.9	1.8	.5	.6	3.0	.9	-.7	6.6
33422.	2.4	.6	.8	1.8	.3	.5	2.5	.7	-.1	6.1
33423.	3.6	.8	1.1	1.4	.4	.5	3.6	1.0	-.4	7.0
33424.	2.5	.6	.7	1.3	.4	.4	2.6	.7	-.2	6.7
33425.	1.9	.4	.6	2.0	.4	.5	2.3	.6	.1	6.2
mean	2.7	.6	.8	1.7	.4	.5	2.8	.8	-.3	6.5

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	v

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
12926.	4.2	1.0	1.3	1.6	.4	.5	4.2	1.2	.9	1.3
12927.	3.0	1.0	1.2	.9	.3	.4	3.0	1.1	.8	-1.8
12928.	1.8	.5	.6	1.8	.4	.6	2.1	.7	.6	-2.4
12929.	4.1	.7	1.1	1.6	.5	.6	4.1	.9	.2	-2.0
12930.	3.6	.8	1.1	1.6	.5	.5	3.6	1.0	-.3	-1.9
mean	3.3	.8	1.1	1.5	.4	.5	3.4	1.0	.5	-1.4

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
13026.	1.8	.5	.6	3.8	1.0	1.2	3.9	1.2	1.3	.9
13027.	4.2	1.3	1.5	1.4	.4	.5	4.2	1.4	1.5	.7
13028.	4.5	1.0	1.3	3.5	1.0	1.2	5.5	1.5	1.8	.4
13029.	3.9	.9	1.2	3.1	.6	.8	4.9	1.1	2.4	-.8
13030.	4.1	.6	1.1	2.8	.6	.8	4.4	1.0	3.4	-2.0
mean	3.7	.8	1.1	2.9	.7	.9	4.6	1.2	2.1	-.1

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
13126.	2.8	.8	1.0	2.9	.7	.8	3.6	1.1	5.3	5.3
13127.	6.0	1.3	1.8	3.1	.9	1.0	6.3	1.7	3.9	6.5
13128.	3.7	1.0	1.3	2.7	.7	.9	4.4	1.4	2.9	6.3
13129.	3.3	.7	.9	4.5	.8	1.2	5.0	1.2	3.3	6.0
13130.	1.9	.4	.5	2.4	.5	.7	2.5	.6	3.6	6.6
mean	3.5	.8	1.1	3.1	.7	.9	4.4	1.2	3.8	6.1

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
13226.	2.5	.6	.8	1.8	.4	.5	2.5	.9	1.7	-.4
13227.	2.7	.5	.7	2.8	.7	.9	3.2	1.0	1.5	-.7
13228.	3.9	.8	1.1	2.3	.7	.8	4.0	1.2	.8	-1.1
13229.	3.5	.8	1.1	1.6	.3	.5	3.5	1.0	.3	-1.1
13230.	1.3	.3	.4	1.7	.4	.5	1.8	.6	.6	-.8
mean	2.8	.6	.8	2.0	.5	.7	3.0	.9	1.0	-.8

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
13326.	5.1	1.3	1.8	6.3	1.4	2.0	8.1	2.0	1.7	2.2
13327.	1.8	.6	.7	1.4	.4	.5	2.1	.8	3.6	1.0
13328.	2.6	.6	.7	1.7	.4	.5	2.7	.8	3.3	1.5
13329.	3.6	.7	1.0	1.8	.7	.8	4.0	1.1	2.7	1.5
13330.	4.1	.8	1.1	2.6	.5	.8	4.8	1.0	2.7	1.9
mean	3.4	.8	1.1	2.8	.7	.9	4.3	1.1	2.8	1.6

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
13426.	2.8	.6	.8	2.5	.7	.9	3.1	1.1	.4	-1.1
13427.	1.5	.5	.6	2.0	.5	.7	2.2	.8	-.0	-2.1
13428.	2.9	.7	.9	2.1	.5	.7	3.3	.9	-.1	-1.8
13429.	1.7	.3	.5	1.6	.5	.6	1.9	.7	.3	-1.5
13430.	1.5	.5	.5	2.9	.6	.8	3.1	.8	.4	1.8
mean	2.1	.5	.7	2.2	.6	.7	2.7	.8	.2	-1.0

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
13526.	3.6	.7	1.1	2.0	.5	.6	3.6	1.0	5.5	-1.9
13527.	2.6	.7	.8	3.3	.6	.9	3.5	1.0	6.3	-3.2
13528.	2.8	.6	.9	1.3	.3	.4	2.9	.7	-6.4	-3.6
13529.	2.1	.5	.7	2.5	.7	.9	2.7	1.0	6.6	-3.2
13530.	4.7	.9	1.3	2.2	.5	.7	4.9	1.1	6.1	-2.3
mean	3.1	.7	.9	2.3	.5	.7	3.5	1.0	3.6	-2.8

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
22926.	4.7	1.1	1.5	3.2	.8	1.0	4.7	1.6	-.8	5.0
22927.	2.4	.7	.9	2.4	.7	.9	2.7	1.1	-.3	3.6
22928.	7.3	1.4	2.0	1.4	.3	.4	7.3	1.5	-.8	3.4
22929.	4.3	1.1	1.4	2.7	.7	.9	4.6	1.4	-.8	3.2
22930.	4.6	1.1	1.4	1.9	.5	.6	4.6	1.3	-.8	4.1
mean	4.7	1.1	1.4	2.3	.6	.8	4.8	1.4	-.7	3.9

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
23026.	2.3	.7	.8	2.3	.5	.7	3.1	.9	1.0	-1.9
23027.	4.3	1.5	1.7	2.5	.7	.9	4.4	1.8	1.7	-.4
23028.	1.9	.7	.8	2.6	.6	.8	3.1	1.0	2.6	.6
23029.	3.1	.6	.8	2.9	.7	.9	3.5	1.0	1.8	-.7
23030.	3.3	1.0	1.2	3.4	.9	1.1	4.6	1.4	2.6	2.6
mean	3.0	.9	1.1	2.7	.7	.9	3.7	1.2	1.9	.1

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
23126.	3.4	.8	1.0	3.0	.6	.9	3.6	1.1	-.8	-1.7
23127.	2.7	.6	.7	3.7	1.1	1.3	3.7	1.3	-.5	.0
23128.	3.4	.7	1.0	2.0	.6	.7	3.9	1.0	-.9	-1.8
23129.	3.1	1.0	1.1	3.7	1.0	1.2	3.8	1.5	-1.0	-.4
23130.	3.7	1.1	1.2	2.3	.5	.7	3.7	1.2	-1.1	-.9
mean	3.3	.8	1.0	2.9	.7	.9	3.8	1.2	-.8	-1.0

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
23226.	2.2	.7	.8	3.9	.9	1.1	4.0	1.2	-1.4	3.2
23227.	2.7	.8	.9	2.4	.6	.8	3.0	1.1	-1.0	.2
23228.	3.5	.8	1.1	1.7	.5	.6	3.7	1.1	-.0	1.2
23229.	3.9	.9	1.2	2.8	.5	.8	3.9	1.2	-.9	2.2
23230.	4.9	1.0	1.4	2.0	.5	.7	4.9	1.2	.0	3.6
mean	3.4	.9	1.1	2.5	.6	.8	3.9	1.2	-.6	2.1

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
23326.	3.7	.9	1.2	2.5	.6	.8	3.9	1.3	-1.8	.8
23327.	3.8	.8	1.1	1.5	.3	.4	3.9	.9	-1.1	1.7
23328.	4.3	1.0	1.4	3.0	.7	.9	4.4	1.4	-1.9	.6
23329.	3.4	1.1	1.3	3.0	.9	1.1	4.3	1.5	-1.2	1.8
23330.	3.1	.8	1.0	3.1	.6	.8	3.4	1.1	-1.6	.4
mean	3.7	.9	1.2	2.6	.6	.8	4.0	1.2	-1.5	1.1

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
23426.	4.6	.9	1.3	3.0	.9	1.1	4.7	1.4	-5.0	.6
23427.	3.9	.9	1.1	2.8	.8	1.0	4.4	1.3	-3.9	.4
23428.	3.5	.8	1.1	1.1	.3	.4	3.5	.9	-4.0	1.3
23429.	2.6	.6	.8	2.4	.5	.7	2.9	.9	-4.0	1.0
23430.	2.2	.5	.7	3.4	.8	1.0	3.5	1.1	-3.7	.4
mean	3.4	.8	1.0	2.5	.7	.9	3.8	1.1	-4.1	.7

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
23526.	3.2	.8	1.1	3.8	.8	1.1	4.6	1.3	.5	1.3
23527.	3.4	1.0	1.2	2.5	.5	.8	3.7	1.2	.6	2.0
23528.	3.2	.8	1.0	3.5	1.1	1.3	4.0	1.5	.4	-1.6
23529.	3.0	.6	.9	2.3	.7	.9	3.8	1.0	.8	-1.9
23530.	2.6	.7	.9	3.3	.7	.9	3.5	1.1	1.4	-1.6
mean	3.1	.8	1.0	3.1	.8	1.0	3.9	1.2	.7	-.4

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
32826.	1.6	.5	.5	2.2	.6	.8	2.7	.8	1.4	6.9
32827.	2.8	.7	.9	2.3	.6	.8	3.0	1.0	-.2	6.7
32828.	2.8	.8	.9	2.5	.7	.8	3.2	1.1	.8	7.1
32829.	4.4	1.0	1.3	1.2	.4	.4	4.4	1.1	.2	7.1
32830.	2.4	.6	.8	2.2	.7	.8	2.5	1.1	.3	5.9
mean	2.8	.7	.9	2.1	.6	.7	3.2	1.0	.5	6.7

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
32926.	2.9	.9	1.0	2.9	.6	.8	3.0	1.2	-3.8	8.0
32927.	5.7	1.1	1.6	3.0	.7	1.0	5.8	1.5	-2.6	6.3
32928.	3.1	.8	1.0	2.3	.6	.7	3.2	1.0	-4.3	6.1
32929.	3.9	1.0	1.2	2.0	.5	.7	4.0	1.2	-2.9	4.8
32930.	3.4	1.0	1.2	3.4	.7	1.0	3.8	1.3	-3.9	4.7
mean	3.8	.9	1.2	2.7	.6	.8	4.0	1.3	-3.5	6.0

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
33026.	1.5	.5	.6	3.3	.6	.9	3.5	.9	2.0	3.2
33027.	3.3	.7	.9	3.7	.7	1.0	3.7	1.2	2.5	3.6
33028.	3.5	1.0	1.2	1.5	.4	.5	3.7	1.1	1.2	2.7
33029.	2.4	.6	.8	2.5	.6	.8	3.2	1.0	2.0	2.2
33030.	2.4	.7	.9	1.4	.4	.5	2.5	.9	1.9	1.3
mean	2.6	.7	.9	2.5	.6	.7	3.3	1.0	1.9	2.6

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
33126.	4.7	.9	1.2	3.1	.8	1.0	4.7	1.3	-.2	7.0
33127.	3.2	.9	1.1	1.4	.4	.5	3.3	1.1	-.8	5.6
33128.	3.2	.8	1.0	1.5	.4	.5	3.2	1.0	-.9	6.5
33129.	4.5	.9	1.2	2.6	.6	.8	4.6	1.2	-1.7	5.9
33130.	5.2	1.4	1.8	3.1	1.0	1.2	5.3	1.8	-.4	6.9
mean	4.2	1.0	1.3	2.3	.6	.8	4.2	1.3	-.8	6.4

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
33226.	1.2	.4	.4	2.4	.5	.7	2.6	.7	-3.6	1.7
33227.	2.6	.7	.9	2.9	.6	.8	3.3	1.0	-3.4	.6
33228.	3.0	1.1	1.3	2.5	.5	.7	3.6	1.3	-3.9	1.7
33229.	1.6	.4	.5	1.8	.4	.5	2.3	.6	-3.1	1.6
33230.	2.6	.9	1.0	2.4	.6	.8	2.9	1.1	-3.2	1.1
mean	2.2	.7	.8	2.4	.5	.7	2.9	1.0	-3.4	1.4

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
33326.	2.1	.4	.6	2.7	.6	.8	2.9	.8	-1.0	2.0
33327.	3.0	.9	1.1	1.5	.4	.5	3.1	1.0	-1.0	1.5
33328.	2.4	.7	.9	2.2	.5	.6	3.0	.8	-1.5	1.0
33329.	1.8	.7	.7	2.1	.5	.6	2.4	.8	-1.4	1.8
33330.	2.2	.5	.7	2.4	.5	.7	3.1	.8	-2.2	1.6
mean	2.3	.6	.8	2.2	.5	.6	2.9	.9	-1.4	1.6

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
33426.	1.7	.4	.5	2.3	.5	.6	2.4	.6	-.4	3.9
33427.	1.8	.5	.6	1.6	.4	.5	1.9	.7	-.7	2.6
33428.	3.2	.8	1.0	2.4	.6	.8	3.5	1.1	-.1	4.3
33429.	3.4	.9	1.2	3.3	.7	1.0	3.7	1.3	-.5	2.6
33430.	3.0	.8	1.0	2.3	.5	.7	3.0	1.0	-.8	3.9
mean	2.6	.7	.9	2.4	.6	.7	2.9	1.0	-.5	3.4

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
12931.	3.0	.6	.9	2.0	.5	.6	3.0	.9	1.0	-.6
12932.	2.6	.9	1.0	1.8	.4	.6	2.8	1.0	1.8	-1.0
12933.	3.1	.7	.9	1.4	.4	.5	3.1	.8	.9	-3.3
12934.	3.5	.9	1.2	2.7	.5	.7	3.9	1.1	.7	-3.2
12935.	3.6	.8	1.0	1.7	.5	.6	3.6	1.0	.6	-3.7
mean	3.1	.8	1.0	1.9	.5	.6	3.3	1.0	1.0	-2.4

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
13031.	6.4	1.4	1.9	3.7	.9	1.1	7.4	1.7	3.6	2.2
13032.	5.2	1.6	1.9	1.5	.4	.5	5.2	1.7	-1.5	1.8
13033.	7.3	1.6	2.1	2.4	.7	.8	7.4	1.9	2.4	-.3
13034.	3.1	.8	1.0	3.0	.7	.9	3.8	1.1	2.6	-1.8
13035.	2.4	.6	.7	2.0	.4	.6	2.4	.8	2.9	-.2
mean	4.9	1.2	1.5	2.5	.6	.8	5.2	1.4	2.0	.3

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
13131.	3.4	.7	1.0	3.3	.8	1.1	4.5	1.2	4.1	5.7
13132.	3.5	.8	1.1	1.6	.5	.6	3.7	1.0	3.5	8.3
13133.	1.5	.6	.7	2.5	.6	.8	2.6	.9	4.0	7.1
13134.	4.0	1.0	1.2	2.6	.7	.9	4.1	1.4	4.3	8.1
13135.	4.9	1.0	1.4	1.4	.4	.5	5.0	1.2	4.3	3.2
mean	3.5	.8	1.1	2.3	.6	.7	4.0	1.1	4.0	6.5

tt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
13231.	1.6	.3	.5	1.3	.3	.4	1.8	.5	1.6	.7
13232.	2.0	.5	.6	1.4	.3	.4	2.0	.7	1.4	.9
13233.	.9	.3	.3	1.6	.3	.5	1.7	.5	.5	.5
13234.	3.6	.7	1.0	1.9	.5	.6	3.6	.9	.7	-.9
13235.	3.0	1.0	1.1	1.1	.3	.4	3.0	1.1	.6	.7
mean	2.2	.6	.7	1.5	.4	.5	2.4	.7	1.0	.4

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
13331.	5.3	1.7	1.9	5.2	1.9	2.1	7.4	2.6	.8	4.0
13332.	3.3	1.0	1.2	3.7	.6	1.0	4.2	1.3	2.6	2.5
13333.	1.6	.4	.6	2.4	.4	.7	2.6	.7	3.6	1.2
13334.	3.3	.6	1.0	1.7	.4	.5	3.3	.9	3.5	2.7
13335.	2.2	.6	.7	1.5	.5	.6	2.7	.8	2.9	.8
mean	3.1	.9	1.1	2.9	.8	1.0	4.1	1.2	2.7	2.3

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
13431.	1.7	.4	.5	2.3	.6	.7	2.6	.7	-.0	1.0
13432.	3.0	.7	.9	1.9	.5	.6	3.3	.9	-.7	-.2
13433.	1.9	.4	.6	2.0	.5	.6	2.1	.7	-1.3	-.2
13434.	3.3	.7	.9	3.0	.9	1.1	3.4	1.2	-.8	-.6
13435.	3.6	1.0	1.2	2.3	.7	.8	4.1	1.3	-1.0	-.2
mean	2.7	.6	.8	2.3	.6	.8	3.1	1.0	-.7	-.0

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
13531.	3.4	.7	1.0	2.1	.6	.7	3.5	1.1	4.6	.9
13532.	1.9	.5	.6	2.7	.6	.8	2.8	.9	4.7	.1
13533.	2.0	.6	.7	3.9	.7	1.1	3.9	1.0	3.8	-.5
13534.	4.1	.7	1.1	2.3	.7	.8	4.1	1.1	4.5	-.8
13535.	3.0	.8	1.0	2.6	.8	.9	3.2	1.2	4.8	-.4
mean	2.9	.7	.9	2.7	.7	.9	3.5	1.1	4.5	-.1

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
22931.	2.4	.6	.8	6.0	1.2	1.7	6.3	1.5	-.2	1.6
22932.	3.0	.8	1.0	3.2	.9	1.1	4.0	1.3	-1.8	.2
22933.	2.9	.7	.9	1.4	.3	.4	2.9	.8	-.8	-1.0
22934.	3.2	1.0	1.2	3.0	.6	.9	3.3	1.3	-1.8	-.9
22935.	3.5	.8	1.0	2.3	.5	.7	3.5	1.1	-1.2	-.2
mean	3.0	.8	1.0	3.2	.7	1.0	4.0	1.2	-1.2	-.1

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
23031.	3.7	.9	1.1	1.9	.5	.6	4.0	1.1	2.3	-1.3
23032.	3.8	.8	1.1	3.0	.8	1.0	4.6	1.2	2.2	-.4
23033.	5.2	1.3	1.7	2.2	.5	.6	5.3	1.5	2.3	-2.0
23034.	3.5	.9	1.1	2.4	.7	.8	3.5	1.3	2.5	-1.9
23035.	3.8	.9	1.2	3.0	.7	.9	4.1	1.2	2.7	-2.6
mean	4.0	1.0	1.2	2.5	.6	.8	4.3	1.3	2.4	-1.6

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
23131.	2.9	.8	1.0	2.3	.6	.7	3.0	1.1	.2	-.1
23132.	3.3	.7	1.1	1.6	.5	.6	3.7	.9	-.8	.3
23133.	4.8	.8	1.2	3.7	.8	1.1	4.9	1.3	-.2	1.2
23134.	3.4	.8	1.1	4.7	1.0	1.4	4.7	1.5	-.5	-.3
23135.	3.3	1.0	1.1	2.4	.8	.9	3.7	1.3	-.5	1.0
mean	3.6	.8	1.1	3.0	.7	.9	4.0	1.2	-.3	.4

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
23231.	5.6	1.4	1.8	2.0	.6	.7	5.6	1.6	-.2	2.6
23232.	4.5	.8	1.3	2.3	.4	.6	4.5	1.1	.0	1.2
23233.	3.7	.7	1.0	2.5	.8	.9	3.7	1.2	-.4	.0
23234.	2.5	.8	.9	2.2	.7	.8	2.8	1.1	.7	1.9
23235.	1.1	.3	.4	2.6	.5	.7	2.6	.7	-.4	.8
mean	3.5	.8	1.1	2.3	.6	.8	3.9	1.1	-.1	1.3

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
23331.	2.4	.7	.9	2.8	.7	.9	3.6	1.1	.2	-1.0
23332.	5.1	1.1	1.6	2.4	.7	.9	5.4	1.5	-1.5	-2.8
23333.	3.1	.8	1.0	1.7	.5	.6	3.2	1.0	-.6	-1.5
23334.	3.0	.6	.8	2.9	.7	.9	3.0	1.1	-2.0	-2.0
23335.	3.2	.8	1.1	2.6	.9	1.0	4.0	1.3	-.8	-2.5
mean	3.4	.8	1.1	2.5	.7	.8	3.8	1.2	-1.0	-1.9

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
23431.	1.8	.4	.5	2.0	.5	.6	2.0	.7	-3.0	-1.6
23432.	2.5	.5	.7	1.8	.6	.7	3.0	.8	-3.1	-1.3
23433.	2.1	.5	.6	2.9	.8	1.0	2.9	1.1	-3.2	-.9
23434.	3.4	.9	1.1	1.1	.3	.4	3.4	1.0	-2.5	-1.5
23435.	2.5	.6	.8	3.1	.7	1.0	3.4	1.1	-2.7	-1.0
mean	2.4	.6	.7	2.2	.6	.7	3.0	.9	-2.9	-1.3

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
23531.	2.8	.8	.9	3.3	.8	1.0	4.0	1.2	.5	-.3
23532.	3.7	.9	1.2	3.0	.9	1.0	4.0	1.4	2.4	-.7
23533.	2.7	.6	.8	1.8	.6	.7	2.9	.9	1.7	-.2
23534.	2.6	.7	.9	1.5	.4	.5	3.0	.9	1.1	-.3
23535.	2.2	.7	.8	4.0	.8	1.1	4.0	1.2	2.1	.0
mean	2.8	.8	.9	2.7	.7	.9	3.6	1.1	1.6	-.3

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
32831.	3.2	.8	1.0	3.3	.8	1.0	4.1	1.2	1.9	4.9
32832.	3.7	.8	1.1	2.5	.5	.7	3.7	1.1	.6	6.1
32833.	2.1	.5	.7	2.2	.7	.8	2.5	1.0	.2	5.0
32834.	3.2	1.0	1.2	3.0	.8	1.0	3.5	1.4	.3	4.7
32835.	3.7	.8	1.2	1.9	.6	.7	3.7	1.1	.0	5.2
mean	3.2	.8	1.0	2.6	.7	.9	3.5	1.2	.6	5.2

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
32931.	4.1	1.0	1.3	2.4	.7	.8	4.4	1.3	-2.7	6.6
32932.	2.4	.6	.8	3.6	.6	1.0	3.9	1.0	-3.6	4.6
32933.	2.3	.8	.9	1.4	.4	.4	2.4	.9	-3.7	5.3
32934.	3.0	.7	.9	2.8	.6	.8	3.2	1.0	-3.6	4.2
32935.	3.1	.9	1.1	2.2	.5	.7	3.4	1.2	-3.6	4.6
mean	3.0	.8	1.0	2.5	.6	.7	3.5	1.1	-3.4	5.1

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
33031.	1.8	.5	.6	3.1	.6	.9	3.1	.8	.9	2.4
33032.	3.0	.8	1.0	2.2	.6	.8	3.1	1.1	1.4	1.4
33033.	3.4	.9	1.1	3.4	.7	1.0	3.4	1.4	1.6	2.5
33034.	3.8	.9	1.1	1.8	.5	.6	3.8	1.1	1.5	1.4
33035.	3.2	.8	1.1	2.2	.5	.7	3.2	1.1	1.7	.9
mean	3.0	.8	1.0	2.5	.6	.8	3.3	1.1	1.4	1.7

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
33131.	3.8	.8	1.1	2.1	.5	.7	4.3	1.0	-1.4	6.2
33132.	4.1	.9	1.3	2.6	.8	.9	4.6	1.4	-.4	7.0
33133.	3.6	1.1	1.3	2.0	.5	.7	3.6	1.3	-.1	5.8
33134.	5.2	1.2	1.6	2.4	.5	.7	5.7	1.4	-.4	6.0
33135.	4.0	1.0	1.2	1.4	.4	.5	4.0	1.2	-.3	5.7
mean	4.1	1.0	1.3	2.1	.5	.7	4.4	1.3	-.5	6.1

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
33231.	4.9	1.0	1.3	3.2	.8	1.1	5.0	1.4	-2.6	-.5
33232.	2.4	.6	.8	3.7	.7	1.1	3.8	1.1	-2.9	.5
33233.	3.3	.9	1.1	3.7	.7	1.1	3.8	1.4	-3.3	.6
33234.	4.2	1.2	1.5	3.3	.6	.9	4.3	1.5	-3.6	.3
33235.	2.7	.7	.9	1.5	.5	.6	2.8	.9	-3.5	.4
mean	3.5	.9	1.1	3.1	.7	.9	3.9	1.3	-3.2	.3

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
33331.	1.8	.4	.5	1.8	.5	.6	2.2	.7	-1.5	2.7
33332.	2.5	.7	.9	2.1	.6	.7	2.8	1.0	-.8	2.0
33333.	2.5	.8	.9	2.6	.5	.8	3.6	1.0	-.5	1.3
33334.	2.1	.4	.6	2.1	.6	.7	2.2	.8	-1.1	1.6
33335.	2.3	.4	.6	3.2	.7	.9	3.3	.9	-.9	1.6
mean	2.2	.5	.7	2.4	.6	.7	2.8	.9	-1.0	1.9

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
33431.	4.1	.9	1.2	2.0	.5	.7	4.1	1.1	-.7	4.9
33432.	3.0	.7	.9	2.4	.6	.8	3.3	.9	-1.5	3.2
33433.	3.1	.8	1.0	2.2	.6	.8	3.2	1.0	-.6	3.6
33434.	1.4	.4	.5	1.5	.5	.6	1.6	.7	-.9	4.2
33435.	2.8	.7	.9	2.9	.7	.8	3.7	1.0	-.7	4.0
mean	2.9	.7	.9	2.2	.6	.7	3.2	1.0	-.9	4.0

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
12936.	4.9	1.5	1.7	2.1	.6	.8	5.3	1.7	-.2	1.5
12937.	2.9	.6	.8	3.0	.5	.8	3.3	.9	.9	3.0
12938.	3.8	.9	1.1	2.2	.5	.7	4.0	1.1	.9	1.8
12939.	4.1	1.0	1.3	1.3	.3	.4	4.2	1.1	1.1	3.3
12940.	3.5	1.0	1.3	1.2	.4	.5	3.6	1.1	1.8	.8
mean	3.9	1.0	1.2	2.0	.5	.6	4.1	1.2	.9	2.1

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
13036.	7.7	2.2	2.7	4.3	.9	1.2	7.9	2.5	1.8	1.0
13037.	3.0	.8	1.0	2.0	.6	.7	3.6	1.1	1.3	2.3
13038.	4.1	1.0	1.3	4.1	1.1	1.4	5.7	1.6	1.8	.6
13039.	1.6	.4	.5	1.2	.3	.3	1.6	.5	3.3	-.8
13040.	2.1	.5	.6	2.5	.7	.8	2.7	.9	3.1	-1.2
mean	3.7	1.0	1.2	2.8	.7	.9	4.3	1.3	2.3	.4

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
13136.	3.3	.8	1.0	4.6	1.0	1.4	5.0	1.4	3.4	6.0
13137.	3.2	.6	.9	1.1	.3	.4	3.4	.7	3.4	6.9
13138.	4.3	1.0	1.2	4.4	.8	1.2	4.7	1.4	2.3	7.8
13139.	2.5	.6	.7	2.2	.4	.6	2.7	.8	3.2	6.9
13140.	2.9	.7	.9	2.3	.6	.8	3.0	1.1	3.8	5.9
mean	3.2	.7	1.0	2.9	.6	.9	3.7	1.1	3.2	6.7

tgt									ci	
no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	h	v
13236.	4.6	1.3	1.5	1.7	.4	.5	4.6	1.4	1.7	-1.3
13237.	3.6	.5	.9	2.5	.6	.8	3.9	.9	.3	-.0
13238.	1.9	.5	.6	3.0	.7	.9	3.3	.9	.5	-.8
13239.	2.8	.7	.9	3.0	.8	1.0	3.0	1.2	-.4	-1.2
13240.	1.6	.4	.5	2.9	.6	.8	3.1	.7	.2	-1.4
mean	2.9	.7	.9	2.6	.6	.8	3.6	1.0	.5	-.9

tgt									ci	
no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	h	v
13336.	6.4	1.2	1.7	7.0	1.2	1.9	8.6	1.8	-1.2	4.3
13337.	2.2	.4	.6	1.9	.5	.6	2.5	.8	.8	2.8
13338.	2.1	.6	.7	3.1	.6	.9	3.5	.9	1.8	2.3
13339.	2.9	.8	1.0	2.5	.4	.7	3.2	1.0	2.5	1.7
13340.	4.3	.8	1.1	1.0	.4	.4	4.3	.9	2.4	1.8
mean	3.6	.8	1.0	3.1	.6	.9	4.4	1.1	1.3	2.6

tgt									ci	
no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	h	v
13436.	2.7	.7	.9	1.8	.5	.6	2.9	.9	-.5	-.5
13437.	1.9	.5	.6	2.1	.5	.6	2.3	.8	1.0	.0
13438.	1.1	.2	.3	1.7	.4	.5	1.7	.5	-.0	-.4
13439.	2.8	.6	.8	3.0	.9	1.1	3.9	1.2	-.3	.2
13440.	2.3	.5	.7	2.6	.7	.9	2.7	1.0	-.0	-.1
mean	2.2	.5	.7	2.2	.6	.7	2.7	.9	.0	-.2

tgt									ci	
no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	h	v
13536.	2.4	.8	.9	1.6	.5	.6	2.4	.9	4.6	-1.1
13537.	3.1	.7	.9	3.0	.7	.9	3.1	1.1	5.4	-.1
13538.	5.0	1.1	1.4	3.3	.7	1.0	5.1	1.5	4.7	-1.1
13539.	1.6	.3	.4	2.3	.6	.7	2.6	.7	5.4	-1.0
13540.	4.3	.9	1.2	2.2	.5	.7	4.3	1.1	5.6	-1.6
mean	3.3	.7	1.0	2.5	.6	.8	3.5	1.1	5.1	-1.0

tgt									ci	
no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	h	v
22936.	6.6	1.2	1.8	10.8	2.2	3.0	11.7	2.7	.9	4.4
22937.	5.1	1.3	1.6	1.6	.5	.6	5.1	1.4	-.0	3.7
22938.	4.2	1.2	1.4	2.4	.6	.8	4.3	1.4	-.2	2.1
22939.	3.1	.9	1.1	4.6	.9	1.2	4.9	1.4	.7	3.5
22940.	3.2	.8	1.0	2.3	.7	.8	3.2	1.2	-.0	3.2
mean	4.4	1.1	1.4	4.3	1.0	1.3	5.9	1.6	.3	3.4

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
23036.	2.2	.5	.6	2.6	.7	.9	2.6	1.0	3.4	1.0
23037.	2.9	1.0	1.1	3.9	1.0	1.2	4.2	1.4	3.0	1.0
23038.	3.3	1.1	1.3	4.2	.7	1.1	5.3	1.4	2.6	1.8
23039.	2.9	.8	1.0	2.2	.5	.7	3.7	.9	2.6	1.2
23040.	3.5	1.1	1.3	3.5	.7	1.0	4.3	1.3	3.0	1.1
mean	3.0	.9	1.1	3.3	.7	1.0	4.0	1.2	2.9	1.2

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
23136.	6.5	1.3	1.9	2.2	.6	.8	6.7	1.6	1.2	-3.1
23137.	3.8	1.0	1.3	2.5	.6	.9	3.8	1.4	.4	-2.0
23138.	2.0	.5	.6	2.1	.5	.7	2.6	.7	.4	-1.5
23139.	4.5	1.0	1.3	2.0	.5	.6	4.6	1.2	.7	-1.4
23140.	4.2	1.0	1.3	1.7	.5	.6	4.2	1.2	-.3	-.9
mean	4.2	1.0	1.3	2.1	.5	.7	4.4	1.2	.5	-1.8

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
23236.	4.5	1.1	1.4	2.2	.6	.7	4.5	1.3	-.6	5.0
23237.	2.6	.7	.8	2.1	.5	.7	2.7	1.0	-1.1	3.7
23238.	2.7	.5	.7	1.3	.3	.4	2.7	.6	-2.0	3.5
23239.	2.9	.6	.8	2.4	.7	.8	3.1	1.0	-.7	4.2
23240.	2.0	.6	.7	1.5	.3	.4	2.0	.8	-1.3	3.6
mean	2.9	.7	.9	1.9	.5	.6	3.0	.9	-1.1	4.0

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
23336.	2.6	.5	.8	2.1	.5	.7	3.0	.8	-.5	1.1
23337.	5.0	1.3	1.7	3.2	.8	1.1	5.4	1.6	-.9	1.4
23338.	4.5	1.0	1.3	2.7	.8	.9	4.5	1.4	-.8	-.0
23339.	4.1	1.0	1.3	2.1	.7	.8	4.1	1.3	-.8	.4
23340.	3.4	1.0	1.2	2.9	.9	1.1	4.0	1.4	-1.5	-.6
mean	3.9	1.0	1.3	2.6	.7	.9	4.2	1.3	-.9	.5

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
23436.	1.5	.3	.5	1.8	.3	.5	2.1	.5	-4.6	-2.2
23437.	2.5	.6	.8	2.8	.7	.9	3.2	1.0	-4.8	-2.7
23438.	2.5	.6	.8	2.0	.5	.7	2.6	.9	-3.8	-2.5
23439.	2.7	.7	.9	2.0	.6	.7	2.7	1.0	-3.3	-1.9
23440.	2.2	.4	.6	2.3	.5	.7	2.3	.8	-3.8	-2.4
mean	2.3	.5	.7	2.2	.5	.7	2.6	.8	-4.1	-2.3

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
23536.	2.7	.8	1.0	1.3	.4	.5	2.8	.9	2.4	.4
23537.	2.8	.7	.9	2.8	.7	.9	3.7	1.0	2.2	1.4
23538.	2.1	.4	.6	2.8	.6	.9	2.9	.8	.9	.3
23539.	2.7	.9	1.0	2.6	.8	.9	3.5	1.2	2.7	1.1
23540.	2.6	.8	.9	1.6	.4	.5	2.8	.9	1.7	.4
mean	2.6	.7	.9	2.2	.6	.7	3.1	1.0	2.0	.7

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
32836.	3.2	.6	1.0	2.5	.8	.9	3.8	1.1	2.4	6.5
32837.	3.2	1.0	1.2	4.7	.9	1.3	4.9	1.5	1.7	6.3
32838.	4.9	1.0	1.3	2.7	.6	.8	5.1	1.2	1.1	6.0
32839.	2.5	.7	.8	1.7	.4	.6	2.9	.8	.2	5.0
32840.	2.2	.5	.6	1.6	.5	.6	2.4	.7	.4	5.4
mean	3.2	.8	1.0	2.6	.6	.8	3.8	1.1	1.2	5.8

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
32936.	2.6	.9	1.1	1.8	.6	.7	3.0	1.1	-3.1	6.3
32937.	4.1	.9	1.3	2.1	.6	.7	4.1	1.2	-3.5	4.9
32938.	2.3	.7	.8	1.5	.4	.5	2.7	.8	-3.0	5.9
32939.	2.1	.6	.7	1.1	.3	.4	2.4	.7	-3.5	4.6
32940.	2.7	.5	.7	1.3	.2	.3	2.8	.6	-3.3	4.2
mean	2.8	.7	.9	1.6	.4	.5	3.0	.9	-3.3	5.2

tgt no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	ci h	ci v
33036.	2.1	.5	.7	2.2	.5	.6	2.5	.7	2.1	5.1
33037.	2.0	.5	.6	2.7	.7	.8	3.0	.9	2.1	3.8
33038.	2.3	.6	.8	2.0	.4	.6	2.3	.9	2.0	3.3
33039.	1.0	.3	.3	2.3	.6	.7	2.5	.7	2.0	3.7
33040.	2.4	.5	.7	2.5	.6	.8	2.8	.8	1.8	3.7
mean	2.0	.5	.6	2.4	.5	.7	2.6	.8	2.0	3.9

tgt									ci	
no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	h	v
33136.	5.3	1.1	1.5	2.8	.6	.8	5.3	1.4	.0	6.7
33137.	3.1	.9	1.1	2.8	.7	.9	4.1	1.3	.2	6.4
33138.	4.4	.9	1.2	1.9	.5	.6	4.5	1.1	-.6	4.6
33139.	3.2	.9	1.1	2.0	.5	.6	3.2	1.1	-.8	5.1
33140.	2.7	.7	.9	1.9	.5	.6	2.7	.9	-.6	4.7
mean	3.8	.9	1.2	2.3	.5	.7	4.0	1.2	-.4	5.5

tgt									ci	
no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	h	v
33236.	2.0	.4	.6	1.6	.5	.6	2.3	.7	-2.1	.7
33237.	5.0	.9	1.4	2.6	.6	.8	5.0	1.2	-1.9	.6
33238.	4.1	.9	1.2	3.0	.7	.8	4.2	1.2	-2.3	-.3
33239.	2.1	.4	.6	.7	.2	.3	2.1	.5	-2.3	.1
33240.	4.8	.9	1.3	1.4	.3	.5	4.8	1.0	-2.4	1.3
mean	3.6	.7	1.0	1.9	.5	.6	3.7	.9	-2.2	.5

tgt									ci	
no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	h	v
33336.	1.9	.5	.6	2.1	.4	.6	2.1	.8	-.5	3.3
33337.	2.7	.8	1.0	2.6	.5	.7	3.3	1.0	-1.7	1.6
33338.	2.9	.6	.8	2.4	.6	.7	3.7	.9	-1.6	1.8
33339.	3.6	.8	1.0	2.7	.7	.9	4.1	1.2	-1.7	2.6
33340.	2.8	.8	.9	.7	.2	.2	2.8	.8	-1.2	1.5
mean	2.8	.7	.9	2.1	.5	.6	3.2	.9	-1.4	2.2

tgt									ci	
no.	ev	mvd	vsd	eh	mhd	hsd	es	mr	h	v
33436.	3.0	.6	.9	1.6	.4	.5	3.0	.8	-.0	4.3
33437.	3.5	.6	1.0	1.5	.5	.6	3.8	.9	-.5	4.5
33438.	2.1	.7	.8	.9	.2	.3	2.1	.8	-.4	5.0
33439.	2.0	.5	.6	2.4	.5	.7	2.4	.8	-.3	4.7
33440.	2.7	.5	.7	1.7	.4	.6	2.7	.8	-.8	3.7
mean	2.7	.6	.8	1.6	.4	.5	2.8	.8	-.4	4.4

Malfunctions and Unserviceable Parts Permitted in 6,000 Round Endurance Test

Malfunctions[1]	Single Rifle	Four Rifles
Failure of bolt to lock[2]	2	4
Failure to fire	2	4
Failure to feed (from magazine)	4	9
Failure to eject	2	4
Failure to chamber	3	7
Failure to extract	1	2
Bolt fails/hold rear	3	8
All other malfunctions[4]	0	0
Total - above malfunctions combined	9	22

Unserviceable Parts[1]	Minimum Life[5] Rounds	Four Rifles[6] Combined
Magazine Assembly	250	2
Ejector Spring	3,000	2
Extractor Spring	2,000	4
Other parts	3,000	1 (See Note 3)
Total unserviceable parts - above unserviceable parts combined		4

[1]When malfunctions are traceable to particular parts, it is permissible to replace such parts and record them as unserviceable, subject to the limitations of Table I. When verified by the government representative that previously recorded malfunctions are attributable to an unserviceable part, such malfunctions shall not be counted against the rifle being tested, provided that they occurred not more than 200 rounds prior to replacement of the unserviceable part. These 200 rounds shall have been fired with the unserviceable part. However, such malfunctions shall remain recorded and properly identified. Malfunction attributable solely to ammunition defects, as verified by the government representative, shall not be counted against the rifle; however, such malfunctions shall be recorded.

[2]In the event of any failure of bolt to lock malfunction, the forward assist assembly shall be operated. Failure of the forward assist assembly to remain engaged with the bolt carrier assembly during manual attempt to lock bolt shall be considered an additional malfunction in the category of "other malfunctions".

[3]Other parts shall be limited to trigger spring, disconnect spring, hammer spring, extractor pin, and extractor.

[4]Other malfunctions include, but are not limited to: occurrence of doubling (two shots fired with a single trigger pull) during semi-automatic firing; failure to immediately stop firing when the trigger is released (uncontrolled fire) during burst firing; and failure of forward bolt assist assembly to remain engaged with bolt carrier assembly during manual attempt to lock the bolt, etc.

[5]Minimum life rounds is the minimum allowable life of an individual part, whether it is the original part or a replacement part, expressed in the number of weapon rounds fired prior to failure. For example, an extractor spring failing prior to firing 2000 rounds on a new rifle, has not met the minimum life rounds. The failure shall be recorded and shall be cause for test failure.

[6]The allowable number of unserviceable parts shown for 4 rifles combined applies only to parts failing after the minimum life rounds have been fired on the weapon. For example, ejector springs failing at 3500 rounds on one rifle and at 4100 rounds on a second weapon fall within the allowable limits of 2 on 4 rifles combined; however, failure of an ejector spring on a third rifle after firing 3000 rounds, exceeds the allowance and shall be cause for test failure.

MAGNAGLOW INSPECTION OF RIFLE BOLTS FROM ENDURANCE TEST RIFLES

PROCEDURE:

The bolts were circularly magnetized with contact plates energized with 500 amperes DC, and longitudinally magnetized with a 5 turn coil energized with 300 amperes DC. While being magnetized they were washed with the fluorescent magnetic particle bath. They were then inspected under black light for patterns indicative of cracks or other flaws. The bolts were also demagnetized after each inspection.

INSTRUMENTATION:

Magnaflux unit; wet continuous method, coil and contact plates energized with low voltage to a maximum of 500 amperes DC, No. 14A fluorescent magnetic particle concentrate suspended in a petroleum base distillate bath, black light.

RESULTS:

Note: The width of each of the 7 lugs is approximately 3/32-inch. The left rear corner of each lug was chamfered 1/32-inch. The cracks at the base of the lugs appeared to have started in the fillet, then advanced across the chamfered corner and outward at an angle matching the chamfer. The longitudinally milled extractor slot will represent the dividing line between the right and left sides of the bolts. Looking at the slot, the lug designated "left" is at the viewer's left, "right" is at the viewer's right.

Date of Inspection 1969	APG Designated Bolt Nos.	Bolts from Rifle Nos.	Round Status	Inspection Results
13 Feb	A29	3000282	6000	Left and right lugs cracked the full width. The crack in the left lug continued outward 1/64-inch. The wall of the cam pin hole was cracked 1/8-inch. The crack extended over the edge 1/16-inch (see the photographs in figure 1 of the Appendix). The bolt was replaced.
17 Feb	Replacement w/same No. A29	Same	93	No discontinuities noted.
18 Feb	Replacement No. A29	Same	1000	No discontinuities noted.
25 Feb	Replacement No. A29	Same	2000	No discontinuities noted.
6 Mar	Replacement No. A29	Same	3000	No discontinuities noted.
11 Mar	Replacement No. A29	Same	4000	No discontinuities noted.
13 Feb	A30	3000286	6000	No discontinuities noted.
17 Feb	A30	Same	6053	Rear fillet of the right lug cracked full width. 1/32-inch pattern at the bore of the left lug.
19 Feb	A30	Same	7000	Crack pattern at the base of the right lug now extends around the right edge 1/64-inch. The left lug remained the same.

Date of Inspection 1969	APG Designated Bolt Nos.	Bolts from Rifle Nos.	Round Status	Inspection Results
24 Feb	A30	Same	8000	No change noted.
26 Feb	A30	Same	9000	No change noted.
27 Feb	A30	Same	10,000	No change noted in the crack at the base of the right lug. The base of the left lug was now cracked 3/64-inch.
13 Feb	A31	3000287	6000	No discontinuities noted.
17 Feb	A31	Same	6053	The rear fillets of the right and left lugs contained 1/16-inch crack patterns.
19 Feb	A31	Same	7000	No change noted.
24 Feb	A31	Same	8000	The crack pattern at the base of the right lug now extends around the right edge 1/64-inch. The crack pattern at the base of the left lug now extends around the left edge 1/32-inch.
26 Feb	A31	Same	9000	The cracks at the base of each of the lugs remained the same. The left bottom edge of the cam pin hole was now cracked. The crack was 1/32-inch in the wall of the hole and extended around the edge 1/64-inch.
6 Mar	Replacement w/Same No. A31	Same	40	No discontinuities noted.
12 Mar	Replacement No. A31	Same	1000	No discontinuities noted.

Date of Inspection 1969	APG Designated Bolt Nos.	Bolts from Rifle Nos.	Round Status	Inspection Results
13 Feb	A32	3000289	6000	The rear fillets at the base of the right and left lugs contained crack patterns. The patterns were the full width of the lugs and are shown in figure 3 of the Appendix. The bolt was replaced.
17 Feb	Replacement w/Same No. A32	Same	40	No discontinuities noted.
18 Feb	Replacement A32	Same	1000	No discontinuities noted.
24 Feb	Replacement A-32	Same	2000	A 1/64-inch indication was noted at the base of the left lug.
26 Feb	Replacement A32	Same	3000	No change noted.
27 Feb	Replacement A32	Same	4000	The pattern at the base of the left lug remained the same. The fillet at the base of the right lug contained a 3/64-inch crack pattern. The pattern continued around the right edge for 1/64-inch.
13 Feb	A33	3000290	6000	No discontinuities noted.
17 Feb	A33	Same	6053	No discontinuities noted.
18 Feb	A33	Same	7000	Contained an indication at the base of the right lug. The pattern began at the right rear corner.

Date of Inspection 1969	APG Designated Bolt Nos.	Bolts from Rifle Nos.	Round Status	Inspection Results
24 Feb	A33	Same	8000	No change noted.
26 Feb	A33	Same	9000	The pattern at the right rear corner of the right lug was now cracked 3/64-inch.
27 Feb	A33	Same	10,000	The pattern at the base of the right lug now extended around the right corner 1/64-inch.
14 Feb	A34	3000295	7000	The left lug contained a 1/32-inch crack pattern at the base of the left rear corner. The right lug was cracked its full width and the pattern extended 1/64-inch around the right edge.
19 Feb	A34	Same	8000	The pattern at the base of the left lug increased to 5/64-inch. The pattern at the base of the right lug remained the same.
20 Feb	A34	Same	9000	No change noted.
25 Feb	A34	Same	10,000	No change noted.
14 Feb	A35	3000297	7000	The rear fillets at the base of the right and left lugs contained crack patterns. The patterns were the full width of the lugs. The bolt was replaced.
17 Feb	Replacement w/Same No. A35	Same	40	No discontinuities noted.
19 Feb	Replacement A35	Same	1000	Contained a very small 1/64-inch indication in the fillet at the base of the left rear corner of the left lug.

Date of Inspection 1969	APG Designated Bolt Nos.	Bolts from Rifle Nos.	Round Status	Inspection Results
20 Feb	Replacement A35	Same	2000	No change noted.
25 Feb	Replacement A35	Same	3000	No change noted.
17 Feb	B29	2000909	3000	No discontinuities noted.
18 Feb	B29	Same	4000	The rear fillets at the base of the right and left lugs contained crack patterns. The patterns were the full width of the lugs.
22 Feb	B29	Same	5000	No change noted.
24 Feb	B29	Same	6000	The crack pattern at the base of the right lug had now extended around the right edge 1/64-inch and the crack at the base of the left lug had now extended around the left edge 1/32-inch.
26 Feb	B29	Same	7000	No change noted.
1 Mar	B29	Same	8000	The 1/64-inch crack around the right edge of the right lug was now 1/32-inch. No change in the pattern in the left lug.
6 Mar	B29	Same	9000	No change noted.
8 Mar	B29	Same	10,000	No change noted.
17 Feb	B30	2000929	3000	The rear fillets at the base of the right and left lugs contained crack patterns. The patterns were the full width of the lugs.

Date of Inspection 1969	APG Designated Bolt Nos.	Bolts from Rifle Nos.	Round Status	Inspection Results
19 Feb	B30	Same	4000	No change noted.
22 Feb	B30	Same	5000	The pattern at the base of the left lug had now extended around the left edge 1/64-inch. The pattern at the base of the right lug did not change.
24 Feb	B30	Same	6000	The pattern at the base of the right lug progressed around the right edge 1/64-inch. The pattern at the base of the left lug did not change.
26 Feb	B30	Same	7000	The patterns at the base of both lugs had now extended around the edges 1/32-inch.
27 Feb	B30	Same	8000	No change noted.
8 Mar	B30	Same	9000	The pattern at the base of the right lug did not change. The crack pattern at the base of the left lug now extended around and outward 1/16-inch.
17 Feb	B31	2000948	3000	The fillet at the base of the left lug contained a 1/32-inch crack pattern.
19 Feb	B31	Same	4000	The pattern at the base of the left lug was now 3/64-inch. A 1/32-inch crack pattern was now noted at the base of the right lug.
22 Feb	B31	Same	5000	The crack pattern at the base of the left lug was now the full width and extended around the left edge 1/32-inch. The pattern at the base of the right lugdid not change.
24 Feb	B31	Same	6000	No change noted.

Date of Inspection 1969	APG Designated Bolt Nos.	Bolt from Rifle Nos.	Round Status	Inspection Results
26 Feb	B31	Same	7000	No change noted.
1 Mar	B31	Same	8000	No change noted.
6 Mar	B31	Same	9000	No change noted.
8 Mar	B31	Same	10,000	The crack pattern in the base of the right lug was now the full width of the lug, 1/16-inch. No change was noted in the pattern at the base of the left lug.
18 Feb	B32	2000959	3000	No discontinuities noted.
20 Feb	B32	Same	4000	No discontinuities noted.
22 Feb	B32	Same	5000	The fillet at the base of the right lug contained a very fine 1/64-inch pattern.
25 Feb	B32	Same	6000	The pattern in the right lug increased to 1/32-inch.
26 Feb	B32	Same	7000	No change noted.
3 Mar	B32	Same	8000	No change noted.
6 Mar	B32	Same	9000	No change noted.
8 Mar	B32	Same	10,000	A 1/32-inch crack pattern was now noted in the fillet at the base of the left lug. The pattern at the base of the right lug remained the same.

Date of Inspection 1969	APG Designated Bolt Nos.	Bolt from Rifle Nos.	Round Status	Inspection Results
18 Feb	B33	2000961	3000	The rear fillets at the base of the right and left lugs contained crack patterns. The patterns were the full width of the lugs.
20 Feb	B33	Same	4000	No change noted.
22 Feb	B33	Same	5000	The crack pattern at the base of the right lug had now extended around the right edge 1/64-inch and the crack at the base of the left lug had now extended around the left edge 1/64-inch.
25 Feb	B33	Same	6000	No change noted.
26 Feb	B33	Same	7000	No change noted.
3 Mar	B33	Same	8000	No change noted.
6 Mar	B33	Same	9000	No change noted.
8 Mar	B33	Same	10,000	The crack pattern at the base of the right lug had now extended around the right edge 3/64-inch and the crack at the base of the left lug did not change.
14 Feb	B34	2000972	4000	No discontinuities noted.
19 Feb	B34	Same	5000	The left corner fillet at the base of the left lug contained a 1/32-inch crack pattern.
20 Feb	B34	Same	6000	The fillet at the base of the right lug was now cracked 1/64-inch. No change noted in the pattern at the base of the left lug.
25 Feb	B34	Same	7000	No change noted.

Date of Inspection 1969	APG Designated Bolt Nos.	Bolt from Rifle Nos.	Round Status	Inspected Results
5 Mar	B34	Same	8000	The patterns in both lugs now extended around the corners slightly.
7 Mar	B34	Same	9000	The pattern in the left lug now extended around the left corner 1/32-inch. The pattern in the right lug did not change.
8 Mar	B34	Same	10,000	The left lug was now cracked its full width. No change noted in the pattern in the right lug.
14 Feb	B35	2000992	4000	The fillet at the base of the right lug was cracked its full width and the same pattern continued around and outward from the right corner 1/64-inch.
17 Feb	Replacement w/Same No. B35	Same	40	No discontinuities noted.
19 Feb	Replacement B35	Same	1000	The fillet at the base of the right and left lugs each contained 1/32-inch crack patterns.
20 Feb	Replacement B35	Same	2000	No change noted.
22 Feb	Replacement B35	Same	3000	The pattern at the base of the right lug now extended around the right corner 1/32-inch.
24 Feb	Replacement B35	Same	4000	The pattern at the base of the right lug was now the full width of the lug (1/16-inch). The pattern at the base of the left lug was 3/32-inches in length.
25 Feb	Replacement B35	Same	5000	No change noted.

Date of Inspection 1969	APG Designated Bolt Nos.	Bolt from Rifle Nos.	Round Status	Inspection Results
26 Feb	Replacement B35	Same	6000	The pattern at the base of the left lug was now the full width of the lug. The pattern extended across the chamfered edge and slightly beyond. Total length of the pattern was now 1/8-inch. The pattern at the base of the right lug did not change.
18 Feb	C28	1346860	3000	The fillet at the base of the right locking lug contained a 3/64-inch pattern.
20 Feb	C28	Same	4000	The pattern at the base of the right lug was now 1/16-inch and extended around the right edge 1/64-inch.
26 Feb	C28	Same	5000	No change noted.
27 Feb	C28	Same	6000	No change noted.
1 Mar	C28	Same	7000	No change noted.
3 Mar	C28	Same	8000	No change noted.
5 Mar	C28	Same	9000	No change noted in the pattern at the base of the right lug. The fillet at the base of the left lug now contained a 3/64-inch crack pattern.
7 Mar	C28	Same	10,000	No change noted in the pattern at the base of the right lug. The crack pattern at the base of the left lug was now its full width and around the edge 1/64-inch.

Date of Inspection 1969	APG Designated Bolt Nos.	Bolt from Rifle Nos.	Round Status	Inspection Results
18 Feb	C29	1347416	3000	No discontinuities noted.
20 Feb	C29	Same	4000	No discontinuities noted.
26 Feb	C29	Same	5000	The left rear corner of the left lug contained a very small pattern.
27 Feb	C29	Same	6000	No change noted.
1 Mar	C29	Same	7000	The fillet at the base of the right lug was cracked half the width of the lug. The pattern extended slightly around the right edge.
3 Mar	C29	Same	8000	The right lug was now cracked its full width.
5 Mar	C29	Same	9000	No change noted.
7 Mar	C29	Same	10,000	No change noted.
18 Feb	C30	1347476	3000	No discontinuities noted.
20 Feb	C30	Same	4000	No discontinuities noted.
25 Feb	C30	Same	5000	No discontinuities noted.
5 Mar	C30	Same	6000	No discontinuities noted.
7 Mar	C30	Same	7000	No discontinuities noted.
8 Mar	C30	Same	8000	No discontinuities noted.

Date of Inspection 1969	APG Designated Bolt Nos.	Bolt from Rifle Nos.	Round Status	Inspection Results
11 Mar	C30	Same	9000	The fillet at the base of the right lug contained a 1/32-inch pattern.
12 Mar	C30	Same	10,000	The crack pattern at the base of the right lug was now 3/64-inch in length.
18 Feb	C31	1347528	3000	No discontinuities noted.
20 Feb	C31	Same	4000	No discontinuities noted.
26 Feb	C31	Same	5000	No discontinuities noted.
27 Feb	C31	Same	6000	No discontinuities noted.
1 Mar	C31	Same	7000	No discontinuities noted.
3 Mar	C31	Same	8000	The fillet at the base of the right rear corner of the right lug contained a 1/32-inch crack pattern.
5 Mar	C31	Same	9000	No change noted.
7 Mar	C31	Same	10,000	No change noted.
18 Feb	C32	1347994	3000	No discontinuities noted.
20 Feb	C32	Same	4000	The fillet at the base of the right lug contained a 1/32-inch crack pattern.
26 Feb	C32	Same	5000	No change noted.
27 Feb	C32	Same	6000	The pattern now extended to 3/64-inch.

Date of Inspection 1969	APG Designated Bolt Nos.	Bolt from Rifle Nos.	Round Status	Inspection Results
1 Mar	C32	Same	7000	The crack pattern at the base of the right lug was now the full width of the lug and had started around the right corner.
3 Mar	C32	Same	8000	No change noted.
5 Mar	C32	Same	9000	No change noted.
7 Mar	C32	Same	10,000	No change noted in the pattern at the base of the right lug. The left lug now contained a slight pattern in the left rear corner.
14 Feb	C33	1348141	4000	The fillet at the base of the rear side of the right lug contained at 1/32-inch pattern.
19 Feb	C33	Same	5000	The crack pattern was now 3/64-inch long .
20 Feb	C33	Same	6000	The crack pattern was now the full width of the right lug and extended around the right corner 1/64-inch.
22 Feb	C33	Same	7000	No change noted.
24 Feb	C33	Same	8000	No change noted.
25 Feb	C33	Same	9000	No change noted.
26 Feb	C33	Same	10,000	No change noted in the crack pattern at the base of the right lug. The left lug was crack free.
14 Feb	C34	1348380	4000	The fillet at the base of the right lug contained a crack the full width of the lug and the pattern extended around the right corner 1/32-inch. The bolt was replaced.

Date of Inspection 1969	APG Designated Bolt Nos.	Bolt from Rifle Nos.	Round Status	Inspection Results
17 Feb	Replacement w/Same No. 34	Same	40	No discontinuities noted.
19 Feb	Replacement C34	Same	1000	No discontinuities noted.
20 Feb	Replacement C34	Same	2000	No discontinuities noted.
22 Feb	Replacement C34	Same	3000	No discontinuities noted.
24 Feb	Replacement C34	Same	4000	No discontinuities noted.
25 Feb	Replacement C34	Same	5000	No discontinuities noted.
26 Feb	Replacement C34	Same	6000	No discontinuities noted.

Table . Displacement-Time Data

Date: Feb 1969

Record No.: A26-7-301

Weapon
Model: M16A1
Caliber: 5.56-mm
Serial No.: A26
~~Bolt Carrier Group:~~
Test Condition: D-T mount

Ammunition
Projectile Type: M193
Propellant Type: WC846
Lot No.: TW18301

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	27	42	10	79	759
2	28	42	10	79	759
3	30	46	10	86	698
4	30	45	10	85	706
5	28	46	10	84	714
6	27	49	10	77	779
7	28	53	10	80	750
8	27	49	10	75	800
9	25	48	10	72	833
10	24	48	10	72	833
11	24	37	10	71	845
12	24	36	10	70	857
13	24	39	10	73	822
14	24	37	10	71	845
15	24	37	10	70	857
16	24	37	10	71	845
17	25	36	10	71	845
18	24	37	10	70	857
19	23	35	10	69	870
20	23				

Total Cycle Time, msec: 1425 Average Cyclic Rate of Fire, rds/min : 800

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires; only selected rounds in a burst are measured.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date: Feb 1969

Record No.: A 26-8-301

Weapon
Model: M16A1
Caliber: 5.56-~~mm~~
Serial No.: A 26
~~Bolt Carrier Group:~~
Test Condition: D-T mount

Ammunition
Projectile Type: M193
Propellant Type: WC 846
Lot No.: TW 18301

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	27	43	10	81	741
2	30	43	10	86	698
3	28	42	10	80	750
4	27	40	10	78	769
5	25	39	10	74	811
6	26	40	10	77	779
7	26	40	10	75	800
8	24	38	10	71	845
9	25	38	10	74	811
10	23	38	10	71	845
11	26	38	10	74	811
12	25	38	10	73	822
13	27	38	10	75	800
14	24	38	10	71	845
15	25	38	10	73	822
16	23	36	10	69	870
17	24	37	10	71	845
18	23	36	10	69	870
19	23	36	10	69	870
20	23				

Total Cycle Time, msec: 1411 Average Cyclic Rate of Fire, rds/min : 808

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires; only selected rounds in a burst are measured.
c. Individual total cycle time converted to a rate of fire in rds/min.
d. Minus values if [illegible]

Table . Displacement-Time Data

Date: Feb 1969 Record No.: A26-9-301

Weapon
Model: M16A1
Caliber: 5.56 ~~mm~~
Serial No.: A26
~~Bolt Carrier Group:~~
Test Condition: D-T mount

Ammunition
Projectile Type: M193
Propellant Type: WC846
Lot No.: TW18301

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	28	42	10	80	750
2	26	42	10	79	759
3	29	43	10	83	723
4	30	44	10	84	714
5	27	41	10	78	769
6	24	39	10	74	811
7	23	40	10	73	822
8	25	37	10	73	822
9	24	38	10	72	833
10	24	38	10	72	822
11	25	40	10	76	789
12	25	39	10	74	811
13	25	39	10	74	811
14	24	37	10	71	845
15	25	39	10	75	800
16	25	38	10	74	811
17	26	38	10	75	800
18	25	38	10	74	811
19	25	38	10	74	811
20	25				

Total Cycle Time, msec: 1435 Average Cyclic Rate of Fire, rds/min : 794

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires: only selected rounds in a burst are measured.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date: Feb 1969

Record No.: A26-10-077

Weapon
  Model: M16A1
  Caliber: 5.56 ~~mm~~
  Serial No.: A26
  ~~Bolt Carrier Group:~~

Ammunition
  Projectile Type: M196
  Propellant Type: IMR8208
  Lot No.: TW[illegible]

Test Condition: D-T MOUNT

Cycle No.[a]	Time, msec: Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	31	44	10	85	706
2	37	50	10	97	618
3	37	51	10	97	618
4	37	50	10	97	618
5	40	54	10	104	577
6	41	55	10	106	566
7	36	50	10	95	632
8	36	50	10	96	625
9	34	49	10	92	652
10	32	49	10	91	659
11	35	51	10	95	632
12	34	50	10	95	632
13	40	55	10	105	571
14	39	55	10	104	577
15	35	49	10	94	638
16	38	52	10	100	600
17	40	55	10	105	571
18	40	56	10	105	571
19	39	52	10	101	594
20	40				

Total Cycle Time, msec: 1864 Average Cyclic Rate of Fire, rds/min: 612

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires; only selected rounds in a burst are measured.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date: Feb 1969

Record No.: A26-11-077

Weapon
Model: M16A1
Caliber: 5.56~~-mm~~
Serial No.: A26
~~Bolt Carrier Group:~~
Test Condition: D-T mount

Ammunition
Projectile Type: M196
Propellant Type: IMR 8208
Lot No.: TW18077

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	41	55	10	105	571
2	41	55	10	105	571
3	41	55	10	105	571
4	41	55	10	105	571
5	40	54	10	104	577
6	40	55	10	105	571
7	40	55	10	105	571
8	38	56	10	103	582
9	40	55	10	105	571
10	39	55	10	104	577
11	40	55	10	105	571
12	40	56	10	106	566
13	40	56	10	106	566
14	40	56	10	105	571
15	40	56	10	105	571
16	40	55	10	105	571
17	40	55	10	105	571
18	40	54	10	104	577
19	40	55	10	105	571
20	40				

Total Cycle Time, msec: 1992 Average Cyclic Rate of Fire, rds/min : 572

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires; only selected rounds in a burst are measured.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date: Feb 1969

Record No.: A26-12-077

Weapon
Model: M16A1
Caliber: 5.56-~~mm~~
Serial No.: A26
~~Bolt Carrier Group:~~
Test Condition: D-T mount

Ammunition
Projectile Type: M196
Propellant Type: [illegible]
Lot No.: TW18077

Cycle No.[a]	Time, msec: Recoil	Time, msec: Counter Recoil	Time, msec: Dwell[b]	Time, msec: Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	41	59	10	109	550
2	40	56	10	105	571
3	40	56	10	106	566
4	41	55	10	106	566
5	41	56	10	106	566
6	40	55	10	105	571
7	42	56	10	107	561
8	41	55	10	105	571
9	41	55	10	107	561
10	41	56	10	107	561
11	36	50	10	95	632
12	37	53	10	99	606
13	36	50	10	95	632
14	32	49	10	90	667
15	32	49	10	91	659
16	40	59	10	109	550
17	38	52	10	100	600
18	41	56	10	106	566
19	33	49	10	92	652
20	36				

Total Cycle Time, msec: 1940 Average Cyclic Rate of Fire, rds/min : 588

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires; only selected rounds in a burst are measured.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date: Feb 1969

Record No.: A26-13-4 and 1

Weapon
Model: M16A1
Caliber: 5.56-mm
Serial No.: A26
~~Bolt Carrier Group:~~
Test Condition: D-T MOUNT

Ammunition
Projectile Type: 4-1, M193/M196
Propellant Type: WC 846/IMR8208
Lot No.: TW18301/TW18077

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	27	41	10	78	769
2	29	41	10	79	759
3	30	41	10	81	741
4	29	39	10	78	769
5	41	56	10	108	556
6	26	39	10	75	800
7	26	39	10	75	800
8	26	39	10	75	800
9	26	39	10	74	811
10	32	47	10	89	674
11	25	38	10	72	833
12	24	37	10	70	857
13	23	35	10	69	870
14	23	35	10	69	870
15	30	40	10	80	750
16	24	37	10	72	833
17	24	36	10	71	845
18	23	37	10	70	857
19	23	37	10	70	857
20	30				

Total Cycle Time, msec: 1455 Average Cyclic Rate of Fire, rds/min : 784

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires; only selected rounds in a burst are measured.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date: Feb 1969

Record No.: A26-14-4 and 1

Weapon
Model: M16A1
Caliber: 5.56 mm
Serial No.: A26
~~Bolt Carrier Group:~~
Test Condition: D-T mount

Ammunition
Projectile Type: ~~M~~4-1, M193/M196
Propellant Type: WC 846/IMR 8208
Lot No.: TW 18301/TW 18077

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	28	41	10	78	769
2	27	41	10	78	769
3	27	40	10	78	769
4	25	38	10	73	822
5	30	46	10	86	698
6	26	38	10	75	800
7	25	39	10	74	811
8	24	36	10	70	857
9	25	38	10	73	822
10	30	42	10	81	741
11	25	38	10	72	833
12	25	40	10	76	789
13	26	38	10	75	800
14	25	38	10	72	833
15	31	47	10	89	674
16	26	39	10	75	800
17	25	37	10	71	845
18	24	37	10	71	845
19	24	36	10	71	845
20	30				

Total Cycle Time, msec: 1438 Average Cyclic Rate of Fire, rds/min : 793

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires; only selected rounds in a burst are measured.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date: Feb 1969

Record No.: A26-15-4 and 1

Weapon
Model: M16A1
Caliber: 5.56-mm
Serial No.: A26
~~Bolt Carrier Group:~~

Test Condition: D-T mount

Ammunition
Projectile Type: 4-1, M193/M196
Propellant Type: WC 846/IMR 8208
Lot No.: TW18301/TW18077

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	25	39	10	74	811
2	27	40	10	77	779
3	28	40	10	77	779
4	26	39	10	75	800
5	31	48	10	89	674
6	26	39	10	75	800
7	25	38	10	73	822
8	24	36	10	71	845
9	23	36	10	70	857
10	31	46	10	87	690
11	26	37	10	73	822
12	24	37	10	71	845
13	25	38	10	73	822
14	24	37	10	71	845
15	29	43	10	71	845
16	25	39	10	74	811
17	23	37	10	70	857
18	23	38	10	71	845
19	23	37	10	70	857
20	29				

Total Cycle Time, msec: 1412 Average Cyclic Rate of Fire, rds/min : 807

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.

b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires; only selected rounds in a burst are measured.

c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date: Feb 1969

Record No.: A27-7-301

Weapon
Model: M16A1
Caliber: 5.56 mm
Serial No.: A27
~~Bolt Carrier Group:~~
Test Condition: D-T mount

Ammunition
Projectile Type: M193
Propellant Type: WC846
Lot No.: TW18301

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	29	45	10	84	714
2	36	52	10	99	606
3	27	42	10	79	759
4	30	48	10	88	682
5	30	43	10	82	732
6	28	41	10	80	750
7	29	41	10	80	750
8	27	41	10	79	759
9	27	40	10	78	769
10	25	40	10	75	800
11	26	40	10	75	800
12	24	38	10	72	833
13	24	37	10	71	845
14	24	37	10	71	845
15	23	37	10	70	857
16	22	38	10	70	857
17	23	38	10	71	845
18	23	38	10	71	845
19	23	36	10	69	870
20	22				

Total Cycle Time, msec: 1464 Average Cyclic Rate of Fire, rds/min : 779

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires: only selected rounds in a burst are measured.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date:

Record No.: A 27-8-301

Weapon
Model: M16A1
Caliber: 5.56-mm
Serial No.: A27
~~Bolt Carrier Group:~~
Test Condition: D-T mount

Ammunition
Projectile Type: M193
Propellant Type: WC846
Lot No.: TW18301

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	29	46	10	86	698
2	31	47	10	89	674
3	31	46	10	87	690
4	28	43	10	81	741
5	30	46	10	86	698
6	27	41	10	78	769
7	27	42	10	78	769
8	28	41	10	79	759
9	26	41	10	77	779
10	26	41	10	77	779
11	25	41	10	77	779
12	25	40	10	76	789
13	28	40	10	78	769
14	27	40	10	78	769
15	26	40	10	77	779
16	26	40	10	76	789
17	26	40	10	77	779
18	25	40	10	75	800
19	25	39	10	74	811
20	25				

Total Cycle Time, msec: 1506 Average Cyclic Rate of Fire, rds/min : 757

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fire only selected rounds in a burst are measured.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date:

Record No.: A-27-9-301

Weapon
Model: M16A1
Caliber: 5.56-mm
Serial No.: A27
~~Bolt Carrier Group:~~
Test Condition: D-T mount

Ammunition
Projectile Type: M193
Propellant Type: WC846
Lot No.: TW18301

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	29	42	10	80	750
2	28	42	10	80	750
3	29	42	10	80	750
4	28	42	10	80	750
5	28	40	10	78	769
6	30	46	10	85	706
7	25	39	10	74	811
8	31	48	10	89	674
9	29	43	10	82	732
10	27	40	10	76	789
11	24	40	10	75	800
12	28	40	10	78	769
13	26	40	10	75	800
14	26	40	10	75	800
15	26	40	10	76	789
16	26	39	10	74	811
17	25	38	10	72	833
18	24	38	10	72	833
19	24	36	10	70	857
20	25				

Total Cycle Time, msec: 1471 Average Cyclic Rate of Fire, rds/min : 775

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires; only selected rounds in a burst are measured.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date: Feb 1969

Record No.: A 27-10-077

Weapon
Model: M16A1
Caliber: 5.56 mm
Serial No.: A 27
~~Buffer:~~
Test Condition: D-T Mount

Ammunition
Projectile Type: M196
Propellant Type: IMR 8208
Lot No.: TW 18077

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	40	56	10	107	561
2	39	57	10	105	571
3	40	57	10	107	561
4	41	56	10	107	561
5	38	51	10	99	606
6	39	59	10	107	561
7	41	55	10	106	566
8	40	58	10	108	556
9	40	57	10	106	566
10	39	58	10	106	566
11	39	58	10	106	566
12	40	57	10	106	566
13	39	57	10	105	571
14	40	56	10	106	566
15	38	56	10	103	582
16	41	55	10	106	566
17	40	56	10	105	571
18	40	55	10	104	577
19	40	54	10	103	582
20	39	51			
	FBR				

Total Cycle Time, msec: 2002 Average Cyclic Rate of Fire, rds/min : 569

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

9AR

Table . Displacement-Time Data

Date: Feb 1969

Record No.: A27-11-077

Weapon
Model: M16A1
Caliber: 5.56-~~mm~~
Serial No.: A 27
~~Bolt Carrier Group:~~

Ammunition
Projectile Type: M196
Propellant Type: IMR 8208
Lot No.: TW18077

Test Condition: D-T mount

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	40	56	10	106	566
2	41	57	10	108	556
3	41	57	10	108	556
4	40	59	10	109	550
5	40	55	10	105	571
6	41	57	10	107	561
7	40	54	10	104	577
8	39	57	10	106	566
9	40	57	10	106	566
10	40	58	10	107	561
11	40	56	10	105	571
12	40	56	10	105	571
13	40	56	10	105	571
14	40	59	10	108	556
15	38	57	10	105	571
16	40	54	10	103	582
17	40	54	10	104	577
18	39	58	10	108	556
19	38	56	10	103	582
20	39	50			
	FBR				

Total Cycle Time, msec: 2012 Average Cyclic Rate of ____, rds/min : 567

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires; only selected rounds in a burst are measured.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date: Feb 1969

Record No.: A27-12-077

Weapon
Model: M16A1
Caliber: 5.56 ~~mm~~
Serial No.: A27
~~Bolt Carrier Group:~~
Test Condition: D-T mount

Ammunition
Projectile Type: M196
Propellant Type: IMR 8208
Lot No.: TW18077

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	41	54	10	106	566
2	41	54	10	105	571
3	40	55	10	105	571
4	38	60	10	108	556
5	40	55	10	105	571
6	41	57	10	108	556
7	40	55	10	104	577
8	40	55	10	105	571
9	40	56	10	106	566
10	39	58	10	106	566
11	39	58	10	106	566
12	41	55	10	106	566
13	40	57	10	106	566
14	39	54	10	102	588
15	39	56	10	104	577
16	41	54	10	104	577
17	40	53	10	103	582
18	37	54	10	102	588
19	39	52	10	101	594
20	39	49			
	FBR				

Total Cycle Time, msec: 1992 Average Cyclic Rate of Fire, rds/min : 572

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires; only selected rounds in a burst are measured.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date: Feb 1969

Record No.: A27-13-077

Weapon
Model: M16A1
Caliber: 5.56mm
Serial No.: A27
~~Buffer:~~
Test Condition: D-T MOUNT

Ammunition 4-1,
Projectile Type: M193/M196
Propellant Type: WC846/IMR8208
Lot No.: TW18301/TW18077

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	27	40	10	76	789
2	29	42	10	82	732
3	29	41	10	80	750
4	29	41	10	80	750
5	40	55	10	105	571
6	29	43	10	81	741
7	26	38	10	75	800
8	27	40	10	77	779
9	26	38	10	75	800
10	40	52	10	102	588
11	26	39	10	76	789
12	26	39	10	75	800
13	26	40	10	76	789
14	25	36	10	71	845
15	31	45	10	87	690
16	24	34	10	69	870
17	25	38	10	72	833
18	25	38	10	73	822
19	26	38	10	74	811
20	31				

Total Cycle Time, msec: 1506 Average Cyclic Rate of Fire, rds/min : 757

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date: Feb 1969

Record No.: A27-14-077

Weapon
Model: M16A1
Caliber: 5.56mm
Serial No.: A27
~~Buffer:~~
Test Condition: D-T mount

Ammunition
Projectile Type: 4-1, M193/M196
Propellant Type: WC846/IMR8208
Lot No.: TW18301/TW18077

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	29	43	10	81	741
2	32	47	10	88	682
3	30	41	10	81	741
4	28	43	10	81	741
5	41	54	10	105	571
6	27	42	10	79	759
7	28	42	10	80	750
8	28	41	10	79	759
9	29	39	10	78	769
10	33	49	10	92	652
11	27	39	10	75	800
12	27	40	10	78	769
13	27	40	10	78	769
14	26	38	10	73	822
15	31	47	10	88	682
16	25	39	10	73	822
17	25	39	10	75	800
18	25	40	10	75	800
19	26	38	10	73	822
20	32				

Total Cycle Time, msec: 1532 Average Cyclic Rate of Fire, rds/min : 744

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date Feb 1969

Record No.: A27-15-077

Weapon
Model: M16A1
Caliber: 5.56 mm
Serial No.: A27
~~Buffer:~~
Test Condition: D-T mount

Ammunition
Projectile Type: 4:1, M193/M196
Propellant Type: WC846/IMR8208M
Lot No.: TW18301/TW18077

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	30	41	10	81	741
2	29	42	10	81	741
3	27	41	10	78	769
4	28	40	10	78	769
5	35	48	10	92	652
6	29	42	10	81	741
7	28	41	10	79	759
8	29	42	10	81	741
9	28	39	10	78	769
10	34	49	10	93	645
11	24	39	10	73	822
12	27	40	10	78	769
13	27	39	10	75	800
14	25	39	10	74	811
15	33	50	10	93	645
16	27	41	10	78	769
17	27	39	10	75	800
18	25	39	10	75	800
19	24	38	10	71	845
20	32				

Total Cycle Time, msec: 1514 Average Cyclic Rate of Fire, rds/min : 753

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date Feb 1969

Record No.: B26-7-301

Weapon
Model: M16A1
Caliber: 5.56mm
Serial No.: B26
~~Buffer:~~
Test Condition: D-T mount

Ammunition
Projectile Type: M193
Propellant Type: WC846
Lot No.: TW18301

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	32	47	10	90	667
2	39	57	10	106	566
3	41	57	10	108	556
4	38	53	10	100	600
5	38	51	10	99	606
6	30	46	10	86	698
7	30	46	10	86	698
8	32	49	10	81	741
9	27	40	10	78	769
10	29	42	10	81	741
11	28	40	10	78	769
12	30	42	10	83	723
13	28	39	10	78	769
14	26	38	10	74	811
15	26	39	10	76	789
16	26	39	10	75	800
17	26	37	10	73	822
18	27	39	10	75	800
19	27	38	10	74	811
20	27				

Total Cycle Time, msec: 1601 Average Cyclic Rate of Fire, rds/min : 712

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date Feb 1969 | Record No.: B26-8-301

Weapon
Model: M16A1
Caliber: 5.56mm
Serial No.: B26
~~Buffer:~~
Test Condition: D-T mount

Ammunition
Projectile Type: M193
Propellant Type: WC 846
Lot No.: TW18301

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	31	46	10	87	690
2	37	51	10	98	612
3	34	48	10	92	652
4	32	46	10	89	674
5	36	51	10	97	618
6	30	43	10	83	723
7	30	44	10	84	714
8	28	41	10	89	732
9	33	49	10	83	723
10	30	42	10	82	732
11	30	43	10	83	723
12	29	40	10	79	789
13	28	38	10	76	789
14	27	38	10	75	800
15	27	38	10	75	800
16	28	39	10	77	779
17	28	39	10	77	779
18	28	39	10	77	779
19	26	39	10	74	811
20	25				

Total Cycle Time, msec: 1585 Average Cyclic Rate of Fire, rds/min : 719

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date Feb 1969

Record No.: B26-9-[illegible]

Weapon
Model: M16A1
Caliber: 5.56 mm
Serial No.: B26
~~Buffer:~~

Ammunition
Projectile Type: M193
Propellant Type: WC846
Lot No.: TW18301

Test Condition: D-T mount

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	33	50	10	92	652
2	35	48	10	93	645
3	36	51	10	98	612
4	38	51	10	100	600
5	36	50	10	96	625
6	30	46	10	96	625
7	42	54	10	106	566
8	31	45	10	87	690
9	30	44	10	55	706
10	29	42	10	81	741
11	28	41	10	80	750
12	30	41	10	81	741
13	28	41	10	80	750
14	28	37	10	74	811
15	30	43	10	83	723
16	29	39	10	78	769
17	28	39	10	76	789
18	28	39	10	77	779
19	27	39	10	75	800
20	27				

Total Cycle Time, msec: 1638 Average Cyclic Rate of Fire, rds/min : 646

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date Feb 1969

Record No.: B26-10-077

Weapon
Model: M16A1
Caliber: 5.56 mm
Serial No.: B26
~~Buffer:~~
Test Condition: D-T mount

Ammunition
Projectile Type: M196
Propellant Type: IMR 8208
Lot No.: TW 18077

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	44	56	8	108	556
2	44	53	8	105	571
3	41	57	9	107	561
4	41	55	9	105	571
5	41	57	8	106	566
6	43	55	8	106	566
7	38	57	8	103	582
8	42	56	8	106	566
9	40	56	8	104	577
10	41	56	8	105	571
11	40	56	8	104	577
12	42	55	8	105	571
13	41	56	8	105	571
14	36	48	8	92	652
15	37	50	8	95	632
16	43	53	8	104	577
17	39	56	8	103	582
18	42	53	8	103	582
19	42	53	8	103	582
20	42	49	FBR	—	

Total Cycle Time, msec: 1969 Average Cyclic Rate of Fire, rds/min : 579

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date Feb 1969

Record No.: B26-11-077

Weapon M16A1
Model:
Caliber: 5.56 mm
Serial No.: B26
~~Buffer:~~
Test Condition: D-T mount

Ammunition
Projectile Type: M196
Propellant Type: IMR 8208
Lot No.: TW 18077

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	39	61	8	109	550
2	36	56	COEC		
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

Total Cycle Time, msec: Average Cyclic Rate of Fire, rds/min :

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date Feb 1969

Record No.: B26-11A-077

Weapon
Model: M16A1
Caliber: 5.56 mm
Serial No.: B26
~~Buffer:~~
Test Condition: D-T mount

Ammunition
Projectile Type: M196
Propellant Type: IMR 8208
Lot No.: TW18077

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	38	65	COEC		
2	37	BOB			
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

Total Cycle Time, msec: Average Cyclic Rate of Fire, rds/min :

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date Feb 1969

Record No.: B26-12-4#1

Weapon
Model: M16A1
Caliber: 5.56 mm
Serial No.: B26
~~Buffer~~:
Test Condition: D-T mount

Ammunition
Projectile Type: 4-1, M193/M196
Propellant Type: WC846/IMR 8208
Lot No.: TW18301/TW18077

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	31	46	10	87	690
2	43	60	10	113	531
3	42	55	10	107	561
4	33	46	8	87	690
5	40	56	8	104	577
6	30	45	8	83	723
7	28	43	9	80	750
8	27	38	10	75	800
9	27	38	10	75	800
10	33	48	8	89	674
11	25	40	10	75	800
12	27	38	10	75	800
13	27	38	10	75	800
14	26	37	10	73	822
15	30	45	10	85	706
16	24	37	10	71	845
17	25	37	10	72	833
18	25	37	10	72	833
19	25	37	10	72	833
20	30				

Total Cycle Time, msec: 1570 Average Cyclic Rate of Fire, rds/min : 726

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date Feb 1969 Record No.: B26-13-441

Weapon
Model: M16A1
Caliber: 5.56mm
Serial No.: B26
~~Buffer:~~
Test Condition: D-T mount

Ammunition
Projectile Type: 4-1, M193/M196
Propellant Type: WC846/IMR8208
Lot No.: TW18301/TW18077

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	30	44	10	84	714
2	31	45	10	86	698
3	31	44	10	85	706
4	33	47	10	90	667
5	41	54	10	105	571
6	27	41	10	78	769
7	27	41	10	78	769
8	26	40	10	76	789
9	26	40	10	76	789
10	33	47	10	90	667
11	25	37	10	72	833
12	25	37	10	72	833
13	25	37	10	72	833
14	26	36	10	72	833
15	33	45	10	88	682
16	24	35	10	69	870
17	26	37	10	73	822
18	27	38	10	75	800
19	27	38	10	75	800
20	33	—			

Total Cycle Time, msec: 1516 Average Cyclic Rate of Fire, rds/min : 752

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date Feb 1969 Record No.: 826-14-4+1

Weapon
Model: M16A1
Caliber: 5.56 mm
Serial No.: B26
~~Buffer:~~
Test Condition: D-T mount

Ammunition
Projectile Type: 4-1, M193/M196
Propellant Type: WC846/IMR8208
Lot No.: TW18301/TW18077

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	31	45	10	86	698
2	32	46	10	88	682
3	30	45	10	85	706
4	28	43	10	81	741
5	40	56	10	106	566
6	30	45	10	85	706
7	29	43	10	82	732
8	30	45	10	85	706
9	27	38	10	75	800
10	34	51	10	96	625
11	27	42	10	79	759
12	27	37	10	74	811
13	27	39	10	76	789
14	26	37	10	73	822
15	41	55	10	106	566
16	25	38	10	73	822
17	25	38	10	73	822
18	25	37	10	72	833
19	26	37	10	73	822
20	34	—			

Total Cycle Time, msec: 1568 Average Cyclic Rate of Fire, rds/min : 727

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date Feb 1969

Record No.: B27-7-301

Weapon
Model: M16A1
Caliber: 5.56mm
Serial No.: B27
~~Buffer:~~
Test Condition: D-T mount

Ammunition
Projectile Type: M193
Propellant Type: WC 846
Lot No.: [redacted] TW18301

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	30	42	10	82	732
2	32	45	10	87	690
3	33	46	10	89	674
4	28	40	10	78	769
5	28	42	10	80	750
6	27	38	10	75	800
7	27	42	10	79	759
8	27	40	10	77	779
9	27	38	10	75	800
10	26	37	10	73	822
11	28	41	10	79	759
12	27	37	10	74	811
13	27	37	10	74	811
14	27	37	10	74	811
15	26	36	10	72	833
16	27	37	10	74	811
17	25	37	10	72	833
18	25	37	10	72	833
19	25	37	10	72	833
20	24	—			

Total Cycle Time, msec: 1458 Average Cyclic Rate of Fire, rds/min : 782

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date Feb 1969 Record No.: B27-8-301

Weapon
Model: M16A1
Caliber: 5.56mm
Serial No.: B27
~~Buffer:~~
Test Condition: D-T mount

Ammunition
Projectile Type: M193
Propellant Type: WC846
Lot No.: TW18301

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	30	43	10	83	723
2	32	46	10	88	682
3	30	42	10	82	732
4	30	43	10	83	723
5	30	43	10	83	723
6	28	38	10	76	789
7	31	46	10	87	690
8	26	37	10	73	822
9	28	37	10	75	800
10	28	38	10	76	789
11	28	41	10	79	760
12	30	42	10	82	732
13	27	37	10	74	811
14	27	37	10	74	811
15	26	37	10	73	822
16	26	37	10	73	822
17	27	37	10	74	811
18	24	37	10	71	845
19	25	37	10	72	833
20	25	—			

Total Cycle Time, msec: 1478 Average Cyclic Rate of Fire, rds/min : 771

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date Feb 1969

Record No.: B-27-9-301

Weapon
Model: M16A1
Caliber: 5.56 mm
Serial No.: B27
~~Buffer:~~
Test Condition: D-T mount

Ammunition
Projectile Type: M193
Propellant Type: WC846
Lot No.: TW18301

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	31	43	10	84	714
2	32	46	10	88	682
3	30	45	10	85	706
4	28	43	10	81	741
5	28	43	10	81	741
6	27	39	10	76	789
7	29	44	10	83	723
8	27	43	10	80	750
9	27	38	10	75	800
10	26	37	10	73	823
11	26	38	10	74	811
12	27	38	10	75	800
13	26	37	10	73	823
14	26	37	10	73	823
15	27	37	10	74	811
16	26	37	10	73	823
17	27	37	10	74	811
18	26	37	10	74	811
19	27	37	10	74	811
20	26	—			

Total Cycle Time, msec: 1470 Average Cyclic Rate of Fire, rds/min : 776

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date Feb 1969

Record No.: B27-10-077

Weapon
Model: M16A1
Caliber: 5.56 mm
Serial No.: B27
~~Buffer:~~
Test Condition: D-T mount

Ammunition
Projectile Type: M196
Propellant Type: IMR 8208
Lot No.: TW 18077

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	35	46	10	91	659
2	38	53	10	101	594
3	43	55	10	108	556
4	41	54	10	105	571
5	37	51	10	99	606
6	33	46	10	89	674
7	35	48	10	93	645
8	32	46	10	88	682
9	32	46	10	88	682
10	32	45	10	87	690
11	32	46	10	88	682
12	32	46	10	88	682
13	32	49	8	91	659
14	34	47	10	91	659
15	32	45	10	87	690
16	32	46	10	88	682
17	33	47	10	90	667
18	33	48	10	91	659
19	33	46	10	89	674
20	33	-			

Total Cycle Time, msec: 1752 Average Cyclic Rate of Fire, rds/min : 651

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date Feb 1969

Record No.: 827-11-077

Weapon
Model: M16A1
Caliber: 5.56 mm
Serial No.: B27
~~Buffer:~~

Ammunition
Projectile Type: M196
Propellant Type: IMR 8208
Lot No.: TW18077

Test Condition: D-T mount

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	46	62	10	118	508
2	46	62	10	118	508
3	47	60	10	117	513
4	46	58	10	114	526
5	45	61	10	116	517
6	45	60	10	115	522
7	40	53	10	103	582
8	43	54	10	107	561
9	36	51	10	97	618
10	36	51	10	97	618
11	41	56	10	107	561
12	36	48	10	94	638
13	40	53	10	103	582
14	40	53	10	103	582
15	40	53	10	103	582
16	36	46	10	92	652
17	35	45	10	90	667
18	32	44	10	86	698
19	32	44	10	86	698
20	35	-			

Total Cycle Time, msec: 1966 Average Cyclic Rate of Fire, rds/min : 580

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date Feb 1969

Record No.: B27-12-077

Weapon
Model: M16A1
Caliber: 5.56 mm
Serial No.: B27
~~Buffer:~~

Ammunition
Projectile Type: M196
Propellant Type: IMR 8208
Lot No.: TW18077

Test Condition: D-T mount

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	44	56	10	110	545
2	43	56	10	109	550
3	44	57	10	111	540
4	43	56	10	109	550
5	43	55	10	108	556
6	43	54	10	107	561
7	43	55	10	108	556
8	44	53	10	107	561
9	42	54	10	106	566
10	37	52	10	99	606
11	36	51	10	97	618
12	37	53	10	100	600
13	41	56	10	107	561
14	40	52	10	102	582
15	36	50	10	96	625
16	37	51	10	98	612
17	35	48	10	93	645
18	35	48	10	93	645
19	34	46	10	90	667
20	34	—			

Total Cycle Time, msec: 1950 Average Cyclic Rate of Fire, rds/min : 585

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date Feb 1969

Record No.: B27-13- 4+1

Weapon
Model: M16A1
Caliber: 5.56 mm
Serial No.: B27
~~Buffer:~~

Ammunition
Projectile Type: 4-1, M193/M196
Propellant Type: WC846/IMR8208
Lot No.: TW18301/TW18077

Test Condition: D-T mount

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	28	40	10	78	769
2	31	43	10	84	714
3	28	42	10	80	750
4	32	45	10	87	690
5	43	54	10	107	561
6	27	37	10	74	811
7	26	38	10	74	811
8	27	37	10	74	811
9	27	40	10	77	779
10	34	47	10	91	659
11	26	38	10	74	811
12	26	37	10	73	821
13	27	38	10	75	800
14	27	37	10	74	811
15	31	46	10	87	690
16	26	37	10	73	821
17	25	37	10	72	833
18	25	37	10	72	833
19	26	37	10	73	821
20	28	-			

Total Cycle Time, msec: 1499 Average Cyclic Rate of Fire, rds/min : 760

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date Feb 1969

Record No.: B27-14-441

Weapon
Model: M16A1
Caliber: 5.56 mm
Serial No.: B27
~~Buffer:~~
Test Condition: D-T mount

Ammunition
Projectile Type: 4-1, M193/M196
Propellant Type: WC846/IMR8208
Lot No.: TW18301/TW18077

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	27	40	10	77	779
2	30	42	10	82	732
3	30	42	10	82	732
4	30	43	10	83	723
5	36	49	10	95	632
6	27	40	10	77	779
7	26	38	10	74	811
8	27	38	10	75	800
9	30	45	10	85	706
10	30	46	10	86	698
11	25	37	10	72	833
12	26	38	10	74	811
13	26	37	10	73	822
14	27	37	10	74	811
15	33	48	10	91	695
16	25	36	10	71	845
17	25	37	10	72	833
18	27	37	10	74	811
19	25	37	10	72	833
20	30	—			
	—				

Total Cycle Time, msec: 1489 Average Cyclic Rate of Fire, rds/min : 766

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date Feb 1969 Record No.: B27-15-4+1

Weapon
Model: M16A1
Caliber: 5.56mm
Serial No.: B27
~~Buffer:~~
Test Condition: D-T mount

Ammunition
Projectile Type: 4-1, M193/M196
Propellant Type: WC846/IMR8208
Lot No.: TW18301/TW18077

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	28	38	10	76	789
2	30	43	10	83	723
3	29	42	10	81	741
4	27	41	10	78	769
5	35	51	10	96	625
6	26	42	10	78	769
7	27	40	10	77	779
8	27	38	10	75	800
9	27	38	10	75	800
10	34	48	10	92	652
11	27	41	10	78	769
12	25	38	10	73	823
13	25	37	10	72	833
14	26	37	10	73	823
15	33	47	10	90	667
16	25	37	10	72	833
17	26	37	10	73	823
18	25	37	10	72	833
19	25	36	10	71	845
20	30	–			

Total Cycle Time, msec: 1485 Average Cyclic Rate of Fire, rds/min : 768

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date Feb 1969 Record No.: C26-7-301

Weapon
Model: M16A1
Caliber: 5.56 mm
Serial No.: C26
~~Buffer:~~
Test Condition: D-T mount

Ammunition
Projectile Type: M193
Propellant Type: WC 846
Lot No.: TW18301

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	38	53	10	101	594
2	33	47	10	90	667
3	32	48	10	90	667
4	33	50	10	93	645
5	30	46	10	86	698
6	31	46	10	87	690
7	30	45	10	85	706
8	30	44	10	84	714
9	30	45	10	85	706
10	28	42	10	80	750
11	30	45	10	85	706
12	27	40	10	77	779
13	35	48	10	93	645
14	27	41	10	78	769
15	26	40	10	76	789
16	26	38	10	74	811
17	26	38	10	74	811
18	27	40	10	77	779
19	25	38	10	73	822
20	25	—			

Total Cycle Time, msec: 1588 Average Cyclic Rate of Fire, rds/min : 718

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date Feb 1969 Record No.: C26-8-301

Weapon
Model: M16A1
Caliber: 5.56mm
Serial No.: C26
~~Buffer:~~

Ammunition
Projectile Type: M193
Propellant Type: WC846
Lot No.: TW18301

Test Condition: D-T mount

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	34	50	10	94	638
2	37	52	10	99	606
3	30	47	10	87	690
4	37	55	10	102	588
5	30	46	10	86	698
6	30	45	10	85	706
7	30	46	10	86	698
8	30	43	10	83	723
9	34	47	10	91	659
10	28	42	10	80	750
11	37	51	10	96	625
12	27	40	10	87	690
13	30	45	10	85	706
14	27	40	10	77	779
15	26	42	10	78	769
16	27	42	10	79	759
17	32	45	10	87	690
18	28	42	10	80	750
19	27	38	10	75	800
20	27	—			

Total Cycle Time, msec: 1637 Average Cyclic Rate of Fire, rds/min : 696

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date Feb 1969

Record No.: C26-9-301

Weapon
Model: M16A1
Caliber: 5.56 mm
Serial No.: C26
~~Buffer:~~
Test Condition: D-T mount

Ammunition
Projectile Type: M193
Propellant Type: WC846
Lot No.: TW18301

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	30	47	10	87	690
2	36	55	10	101	594
3	33	52	10	95	632
4	34	50	10	94	638
5	32	48	10	90	667
6	29	44	10	83	723
7	31	46	10	87	690
8	30	43	10	83	723
9	30	45	10	85	706
10	28	43	10	81	741
11	32	47	10	89	674
12	27	43	10	80	750
13	27	42	10	79	759
14	27	41	10	78	769
15	30	44	10	84	714
16	27	40	10	87	690
17	27	43	10	80	750
18	30	43	10	83	723
19	27	37	10	74	811
20	24	–			

Total Cycle Time, msec: 1620   Average Cyclic Rate of Fire, rds/min : 704

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date Feb 1969

Record No.: C26-10-077

Weapon
Model: M16A1
Caliber: 5.56 mm
Serial No.: C26
~~Buffer:~~

Test Condition: D-T mount

Ammunition
Projectile Type: M196
Propellant Type: IMR 8208
Lot No.: TW 18077

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	40	55	9	104	5[illegible]
2	37	BOB			
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

Total Cycle Time, msec: Average Cyclic Rate of Fire, rds/min :

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date Feb 1969

Record No.: C26-11-077

Weapon
Model: M16A1
Caliber: 5.56 mm
Serial No.: C26
~~Buffer:~~
Test Condition: D-T mount

Ammunition
Projectile Type: M196
Propellant Type: IMR 8208
Lot No.: TW 18077

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	37	52	COEL		
2	37	52	COEL		
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

Total Cycle Time, msec: Average Cyclic Rate of Fire, rds/min :

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date Feb 1969

Record No.: C26-12-077

Weapon
Model: M16A1
Caliber: 5.56mm
Serial No.: C26
~~Buffer:~~
Test Condition: D.T mount

Ammunition
Projectile Type: M196
Propellant Type: IMR 8208
Lot No.: TW18077

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	37	56	COEC		
2	37	53	COEC		
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

Total Cycle Time, msec: Average Cyclic Rate of Fire, rds/min :

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date Feb 1969

Record No.: C26-13-471

Weapon
Model: M16A1
Caliber: 5.56 mm
Serial No.: C26
~~Buffer:~~
Test Condition: D-T mount

Ammunition
Projectile Type: 4-1, M193/M196
Propellant Type: WC 846/IMR8208
Lot No.: TW18301/TW18077

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	35	48	10	93	645
2	33	48	10	91	659
3	31	46	10	87	690
4	32	47	10	89	674
5	37	58	10	105	571
6	32	44	10	86	698
7	29	45	10	84	714
8	31	44	10	85	706
9	30	44	10	84	714
10	37	56	10	103	582
11	27	43	10	80	750
12	27	40	10	77	779
13	40	54	10	104	577
14	26	41	10	77	779
15	40	55	10	105	571
16	28	43	10	81	741
17	26	41	10	77	779
18	28	42	10	80	750
19	27	37	10	74	811
20	34	—			

Total Cycle Time, msec: 1662 Average Cyclic Rate of Fire, rds/min : 686

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date Feb 1969

Record No.: C26-14-441

Weapon
Model: M16A1
Caliber: 5.56mm
Serial No.: C26
~~Buffer:~~

Ammunition
Projectile Type: 4-1, M193/M196
Propellant Type: WC846/IMR8208
Lot No.: TW18301/TW18077

Test Condition: D-T mount

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	31	44	10	85	706
2	30	44	10	84	714
3	34	51	10	95	632
4	30	43	10	83	723
5	40	55	8	103	582
6	27	43	9	79	759
7	28	45	9	82	732
8	28	42	9	79	759
9	29	43	9	81	741
10	41	55	9	105	571
11	26	41	9	76	789
12	27	41	10	78	769
13	26	40	9	75	800
14	25	38	9	72	833
15	34	48	9	91	659
16	25	38	9	72	833
17	27	42	9	78	769
18	25	37	9	71	845
19	24	37	9	70	857
20	30	—			

Total Cycle Time, msec: 1559 Average Cyclic Rate of Fire, rds/min : 731

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date Feb 1969

Record No.: C26-15-441

Weapon
Model: M16A1
Caliber: 5.56mm
Serial No.: C26
~~Buffer:~~

Test Condition: D-T mount

Ammunition
Projectile Type: 4-1, M193/M196
Propellant Type: WC846/IMR8208
Lot No.: TW18301/TW18077

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	30	43	10	83	723
2	30	45	10	85	706
3	28	40	10	78	769
4	30	43	10	83	723
5	38	51	10	99	606
6	27	43	10	80	750
7	27	42	10	79	759
8	28	41	10	79	759
9	26	42	10	78	769
10	42	53	10	105	571
11	27	42	10	79	759
12	26	39	10	75	800
13	27	41	10	78	769
14	27	40	10	77	779
15	40	54	10	104	577
16	32	47	10	89	675
17	25	37	10	72	833
18	26	40	10	76	789
19	27	40	10	77	779
20	30	-			

Total Cycle Time, msec: 1576 Average Cyclic Rate of Fire, rds/min : 723

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date Feb 1969

Record No.: C27-7-301

Weapon
Model: M16A1
Caliber: 5.56 mm
Serial No.: C27
~~Buffer:~~
Test Condition: D-T mount

Ammunition
Projectile Type: M193
Propellant Type: WC846
Lot No.: TW18301

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	36	51	10	97	618
2	30	44	10	84	714
3	30	44	10	84	714
4	30	43	10	83	723
5	32	45	10	87	690
6	28	43	10	81	741
7	30	44	10	84	714
8	28	42	10	80	750
9	26	39	10	75	800
10	26	41	10	77	779
11	27	40	10	77	779
12	25	37	10	72	833
13	25	38	10	73	822
14	27	42	10	79	759
15	26	38	10	74	811
16	26	37	10	73	822
17	26	38	10	74	811
18	26	39	10	75	800
19	26	37	10	73	822
20	25	–			

Total Cycle Time, msec: 1502 Average Cyclic Rate of Fire, rds/min : 759

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date Feb 1969

Record No.: C27-8-301

Weapon
Model: M16A1
Caliber: 5.56mm
Serial No.: C27
~~Buffer:~~
Test Condition: D-T mount

Ammunition
Projectile Type: M193
Propellant Type: WC846
Lot No.: TW18301

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	36	53	10	99	606
2	33	47	10	90	667
3	31	44	10	85	706
4	34	48	10	92	652
5	28	42	10	80	750
6	30	44	10	84	714
7	32	47	10	89	674
8	33	50	10	93	645
9	27	42	10	79	759
10	32	45	10	87	690
11	28	42	10	80	750
12	27	41	10	78	769
13	27	41	10	78	769
14	26	40	10	76	789
15	26	39	10	75	800
16	26	38	10	74	811
17	26	38	10	74	811
18	26	38	10	74	811
19	25	37	10	72	833
20	25	—			

Total Cycle Time, msec: 1559 Average Cyclic Rate of Fire, rds/min : 731

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date Feb 1969 Record No.: 627-9-301

Weapon
Model: M16A1
Caliber: 5.56 mm
Serial No.: C27
~~Buffer~~:
Test Condition: D-T mount

Ammunition
Projectile Type: M193
Propellant Type: WC846
Lot No.: TW18301

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	33	46	10	89	674
2	40	54	10	104	577
3	30	47	10	87	690
4	27	43	10	80	750
5	28	43	10	81	741
6	27	42	10	79	759
7	27	42	10	79	759
8	27	42	10	79	759
9	30	43	10	83	723
10	26	40	10	76	789
11	28	42	10	80	750
12	25	37	10	72	833
13	26	40	10	76	789
14	26	40	10	76	789
15	26	40	10	76	789
16	26	41	10	77	779
17	26	40	10	76	789
18	27	42	10	79	759
19	28	41	10	79	759
20	26	—			

Total Cycle Time, msec: 1528 Average Cyclic Rate of Fire, rds/min : 746

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date Feb 1969 Record No.: C27-10-077

Weapon
Model: M16A1
Caliber: 5.56mm
Serial No.: C27
~~Buffer:~~
Test Condition: D-T mount

Ammunition
Projectile Type: M196
Propellant Type: IMR 8208
Lot No.: TW18077

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	41	56	9	106	566
2	41	55	9	105	571
3	42	55	9	106	566
4	40	56	8	104	577
5	41	56	8	105	571
6	38	58	8	104	577
7	41	56	8	105	571
8	41	56	8	105	571
9	38	60	8	106	566
10	41	56	8	105	571
11	39	57	8	104	577
12	38	61	8	107	561
13	38	58	8	104	577
14	38	59	8	105	571
15	40	57	8	105	571
16	38	56	8	102	588
17	38	56	8	102	588
18	41	55	8	104	577
19	41	50	8	99	606
20	37	47	FBR		

Total Cycle Time, msec: 1983 Average Cyclic Rate of Fire, rds/min : 575

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date Feb 1969

Record No.: C27-11-077 and 12

Weapon
Model: M16A1
Caliber: 5.56mm
Serial No.: C27
~~Buffer~~:
Test Condition: D-T mount

Ammunition
Projectile Type: M196
Propellant Type: IMR 8208
Lot No.: TW18077

Cycle No.[a]	Time, msec: Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	37	70	COEC		
2	36	55	COEC		
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

Total Cycle Time, msec: Average Cyclic Rate of Fire, rds/min :

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date Feb 1969 Record No.: C27-13-441

Weapon
Model: M16A1
Caliber: 5.56mm
Serial No.: C27
~~Buffer:~~
Test Condition: D-T mount

Ammunition
Projectile Type: 4-1, M193/M196
Propellant Type: WC846/IMR8208
Lot No.: TW19301/TW18077

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	35	49	9	93	645
2	27	44	9	80	750
3	29	45	9	83	723
4	27	42	9	78	769
5	41	56	9	106	566
6	28	45	9	82	732
7	27	44	9	80	750
8	27	43	9	79	759
9	25	42	9	76	789
10	37	55	9	101	594
11	28	44	9	81	741
12	27	44	9	80	750
13	30	44	9	83	723
14	26	41	9	76	789
15	36	50	9	95	632
16	25	41	9	75	800
17	25	38	9	72	833
18	25	40	9	74	811
19	26	40	9	75	800
20	33	—			

Total Cycle Time, msec: 1569 Average Cyclic Rate of Fire, rds/min : 726

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date Feb 1969

Record No.: C27-14-441

Weapon
Model: M16A1
Caliber: 5.56mm
Serial No.: C27
~~Buffer:~~
Test Condition: D-T MOUNT

Ammunition
Projectile Type: 4-1, M193/M196
Propellant Type: WC846/IMR8208
Lot No.: TW18301/TW18077

Cycle No.[a]	Time, msec Recoil	Counter Recoil	Dwell[b]	Total Cycle	Cyclic Rate of Fire, rds/min[c]
1	35	52	10	97	618
2	31	47	10	88	682
3	30	45	10	85	706
4	30	43	10	83	723
5	41	55	10	106	566
6	27	44	10	81	741
7	28	44	10	82	732
8	27	42	10	79	759
9	26	40	10	76	789
10	40	57	10	107	561
11	30	44	10	84	714
12	26	42	10	78	769
13	30	43	10	83	723
14	26	38	10	74	811
15	36	50	10	96	625
16	26	41	10	77	779
17	27	40	10	77	779
18	26	40	10	76	789
19	26	38	10	74	811
20	35	—			

Total Cycle Time, msec: 1603 Average Cyclic Rate of Fire, rds/min : 711

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table . Displacement-Time Data

Date Feb 1969

Record No.: C27-18-441

Weapon
Model: M16A1
Caliber: 5,56mm
Serial No.: C27
~~Buffer:~~
Test Condition: D-T mount

Ammunition
Projectile Type: 4-1 M193/M196
Propellant Type: WC846/IMR8208
Lot No.: TW18301/TW18077

Cycle No.[a]	Recoil (Time, msec)	Counter Recoil (Time, msec)	Dwell[b] (Time, msec)	Total Cycle (Time, msec)	Cyclic Rate of Fire, rds/min[c]
1	30	43	10	83	723
2	28	43	10	81	741
3	28	42	10	80	750
4	26	43	8	77	779
5	41	55	8	104	577
6	27	46	8	81	741
7	30	46	8	84	714
8	28	45	8	81	741
9	30	44	9	83	723
10	40	56	9	105	571
11	26	44	9	79	759
12	26	43	9	78	769
13	25	40	9	74	811
14	25	43	9	77	779
15	40	55	9	104	577
16	25	42	10	77	779
17	27	40	10	77	779
18	26	42	10	78	769
19	25	38	10	73	822
20	33	–			

Total Cycle Time, msec: 1576 Average Cyclic Rate of Fire, rds/min : 723

a. Each cycle begins at the point of initial rearward movement of the bolt carrier and ends at the final moment of bolt carrier dwell.
b. Measured from point of initial bolt carrier contact with the barrel extension, at conclusion of counter recoil, to initial rearward movement of the carrier as next round fires.
c. Individual total cycle time converted to a rate of fire in rds/min.

Table I. Summary of Double-Feed Malfunctions in Initial Endurance Test of M16A1 Rifles

Magazine No.[a]	Mode of Fire	Rifle No. B-29	B-30	B-31	B-32	B-33	B-34[c]	B-35[c]	C-28	C-29	C-30	C-31	C-32	C-33[c]	C-34[c]
1	B	0	2	0	1	0	0	0	2	1	3	4	0	3	3
2	A	0	2	1	0	1	0	2	0	0	4	2	0	1	0
3	S	0	0	0	2	1	0	0	0	1	7	2	0	1	0
4	B	0	0	0	3	6	0	0	0	0	1	1	0	3	0
5	S	0	0	0	2	0	0	0	0	0	0	6	0	5	0
6	B	0	0	0	2	4	11	0	0	0	3	8	0	0	1
7	A	0	0	0	0	1	0	0	1	0	2	2	0	0	1
8	S	0	0	0	0	0	0	0	0	0	0	0	1	1	1
9	B	0	0	0	3	0	0	0	0	0	1	1	0	0	0
10	S	0	1	0	0	0	0	0	0	0	0	0	0	0	0
11	B	0	0	0	4	0	0	0	0	0	15	0	0	0	0
12	A	0	1	0	0	0	1	0	0	0	0	0	0	0	0
13	S	0	0	1	0	0	1	0	0	0	10	1	0	1	0
14	B	0	0	0	0	0	0	0	0	0	1	3	0	0	0
15	S	0	0	0	0	0	0	0	0	0	0	19	0	0	0
16	B	0	0	1	11	0	0	0	0	0	0	1	0	0	0
17	A	0	0	0	1	0	2	1	0	0	0	0	0	0	0
18	S	0	1	1	0	0	1	0	0	0	0	0	0	0	0
19	B	1	0	0	0	0	0	0	0	0	0	0	0	0	0
20	S	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Total		1	8	4	29	13	16	3	3	2	47	50	1	15	6
					74[d]						124[d]				

[a]Rifles were fired to a total of 10000 rounds with new magazines introduced each 3000 rounds. Sets of 5 magazines were fired with each rifle and rotated during firing so that 600 rounds were fired with every magazine.

[b]Magazines No. 1, 4, 6, 9, 11, 14, 16, 19 were fired in short burst (4-5 rds) = B; magazines No. 2, 7, 12, 17 were fired in the fully automatic mode (continuous 20-rd burst) = A, and all other magazines were fired in the semiautomatic mode = S.

[c]These rifles were fired with a 4-to-1 mix of ball and tracer cartridges with magazines loaded so that the first four rounds fired were ball rounds, the fifth a tracer, etc.

[d]The seven rifles from each manufacturer were fired a total of 70000 rounds per manufacturer; no double-feeds occurred while firing 70000 rounds with the rifles manufactured by the Code A contractor.

Table II. Summary of Double-Feed Malfunctions Versus Mode of Fire in Initial Endurance Test of M16A1 Rifles

Rifle No.	Mode of Fire[a] B1	A	S1	B2	S2
B-29	0	0	0	1	0
B-30	2	3	1	0	2
B-31	1	1	2	0	0
B-32	18	1	2	6	2
B-33	4	2	1	6	0
B-34	11	3	2	0	0
B-35	0	3	0	0	0
Total	36	13	8	13	4
C-28	2	1	0	0	0
C-29	1	0	1	0	0
C-30	21	6	17	3	0
C-31	13	4	3	5	25
C-32	0	0	1	0	0
C-33	3	1	3	3	5
C-34	4	1	1	0	0
Total	44	13	26	11	30
Total	80	26	34	24	34

Total Number of Double-Feeds per Mode of Fire		Total Number of 20-rd Trials Attempted per Mode of Fire	Frequency of Double-Feeds per Mode of Fire
B (B1 & B2)	104	2800	.037
A	26	1400	.018
S (S1 & S2)	68	2800	.024

[a] All rifles were fired in 100-rd cycles with complete cooling between cycles; each cycle was composed of 20 rounds in short bursts (B1), 20 rounds in a continuous burst (A), 20 rounds in semiautomatic (S1), 20 rounds in short bursts (B2), and 20 rounds in semiautomatic (S2).

[b] As almost all double-feeds occurred only once in any single 20-round trial, the frequency is expressed as the number of double-feeds per 20-round trial per mode of fire; the frequency cited is not the frequency per round fired.

Table III. Summary of Double-Feed Malfunctions Versus Rifle Round Count in Initial Endurance Test of M16A1 Rifles

Rifle No.	Rifle Round Count[a] 1-1000	1001-2000	2001-3000	3001-4000	4001-5000	5001-6000	6001-7000	7001-8000	8001-9000	9001-10000
B-29	0	0	0	0	0	0	0	0	0	1
B-30	3	1	0	0	0	1	1	0	0	2
B-31	1	0	0	0	0	0	0	0	1	2
B-32	4	2	2	4	1	0	1	1	2	12
B-33	7	0	1	4	1	0	0	0	0	0
B-34	0	0	0	3	2	6	2	0	0	3
B-35	1	1	0	0	0	0	0	0	0	1
Total	16	4	3	11	4	7	4	1	3	21
C-28	2	0	0	0	1	0	0	0	0	0
C-29	0	0	2	0	0	0	0	0	0	0
C-30	9	2	4	5	0	1	8	8	10	0
C-31	6	5	4	3	3	5	4	8	11	1
C-32	0	0	0	0	1	0	0	0	0	0
C-33	8	2	3	0	1	0	0	0	1	0
C-34	0	1	2	2	1	0	0	0	0	0
Total	25	10	15	10	7	6	12	16	22	1
Total	41	14	18	21	11	13	16	17	25	22

a. Rifle round count pertains to the "age" in rounds fired of the rifle only and not necessarily to the magazine as new magazines were introduced after each 3000 rounds of rifle firing.

Table IV. Summary of Double-Feed Malfunctions Versus Magazine Round Count in Initial Endurance Test of M16A1 Rifles

Rifle No.	Magazine Round Count[a] 14	15	16	17	18
B-29	0	1	0	0	0
B-30	0	1	0	0	7
B-31	0	0	0	2	2
B-32	0	4	6	10	9
B-33	1	1	0	3	8
B-34	0	0	0	2	14
B-35	0	0	0	1	2
Total	1	7	6	18	42
C-28	0	0	0	0	3
C-29	0	0	2	0	0
C-30	1	0	12	10	24
C-31	0	0	13	14	23
C-32	0	0	0	0	1
C-33	0	0	0	1	14
C-34	0	0	0	0	6
Total	1	0	27	25	71
Total	2	7	33	43	113

a. The magazine round count is defined as the particular cycle, among twenty cycles in each magazine, during which the double-feed occurred; e.g. a double-feed occurring on magazine round count No. 16 is a double feed which immediately followed the firing of the 16th round in the magazine and the 17th and 18th rounds became "jammed".

SCIENCE AND TECHNOLOGY LABORATORY REPORT
OF

DATE:	LAB. NO:	M16A1 RIFLE BOLT FROM INITIAL PRODUCTION TEST	ION NO:
MANUFACTURER: 69-1342		MANUFACTURER'S DESIGNATION:	

CONCLUSIONS

1. Magnetic particle inspection of the bolt submitted for examination (identified B-39) confirmed a crack at the cam pin hole location after the reported 3000 rd. firing at TECOM. A very "light" indication was revealed extending from approximately .028" within the ID surface to .017" on the OD surface.

2. Magnetic particle inspection of this bolt after an additional 3000 rd. firing at RIA revealed that the crack had progressed to a total length of .150" on the ID surface and .060" on the OD surface.

3. Metallurgical evaluations indicate that the bolt met drawing requirements and that heat treat processing had been consistent with bolts of acceptable quality.

INTRODUCTION

This investigation was requested by AMSWE-QA in a DF dated 23 April. One bolt identified B-39 was supplied by AMSWE-QAT for the investigation. Reportedly this bolt was "cracked" at the cam pin hole after 3000 rd. firing at TECOM. This investigative effort was funded on X.O. 443907-5013-Eng. Spt. to M16A1 Rifle.

PROCEDURE AND RESULTS

Magnetic particle inspections were made on the bolt as received from TECOM after 3000 rd. firing and after an additional 3000 rd. firing at RIA. Location and extent of cracking is shown in Figs. 1 and 2.

Surface hardness of the bolt was Rockwell 15N-90 which is within the 89-90.5 specified on the drawing.

Metallographic examination revealed the bolt had a carburized case depth of .012" which also is within the range specified on the drawing. Microstructure of the case and core were satisfactory without evidence of excess retained austenite or intergranular oxide conditions.

Longitudinal sections normal to the crack were prepared for microscopic examination. Photomicrographs of these sections are shown inFigs. 3, 4, and 5.

Incl 1

DISCUSSION

Metallurgically, the subject bolt appears comparable to previously examined bolts which have successfully completed 10,000 rds. without initiation of a crack at the critical cam pin hole location. No evidence was uncovered to clearly indicate the reason for premature crack initiation. Other manufacture or process variables may have caused or contributed to the problem. Configuration variation at the critical cam pin hole lip location, lack of optimum compressive stress pattern from shot peening operations, or minor surface finish deviation could increase susceptibility to cracking at this known fatigue sensitive area.

Phillip E. Goettsch

DR. ALEXANDER HAMMER
Director of Research

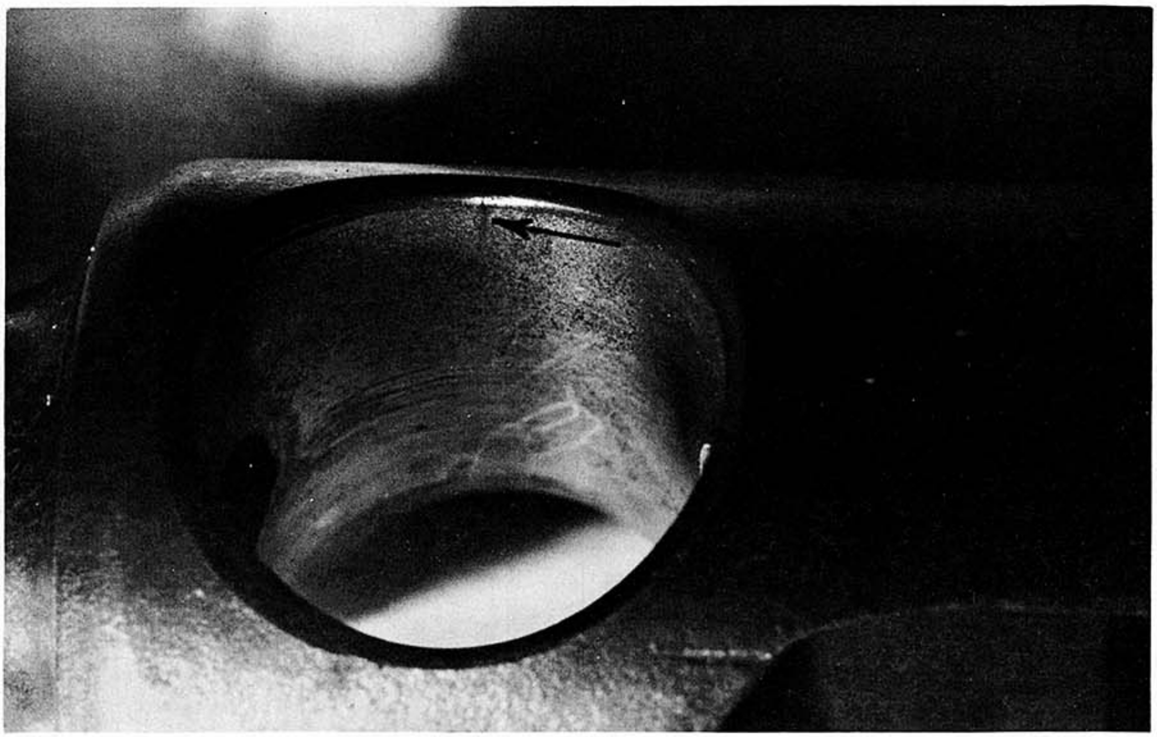

FIG 1

M16A1 RIFLE BOLT. MAGNETIC PARTICLE CRACK INDICATION AT CAM PIN HOLE AFTER 3000 ROUNDS. 9X

NEG. NO. 7909

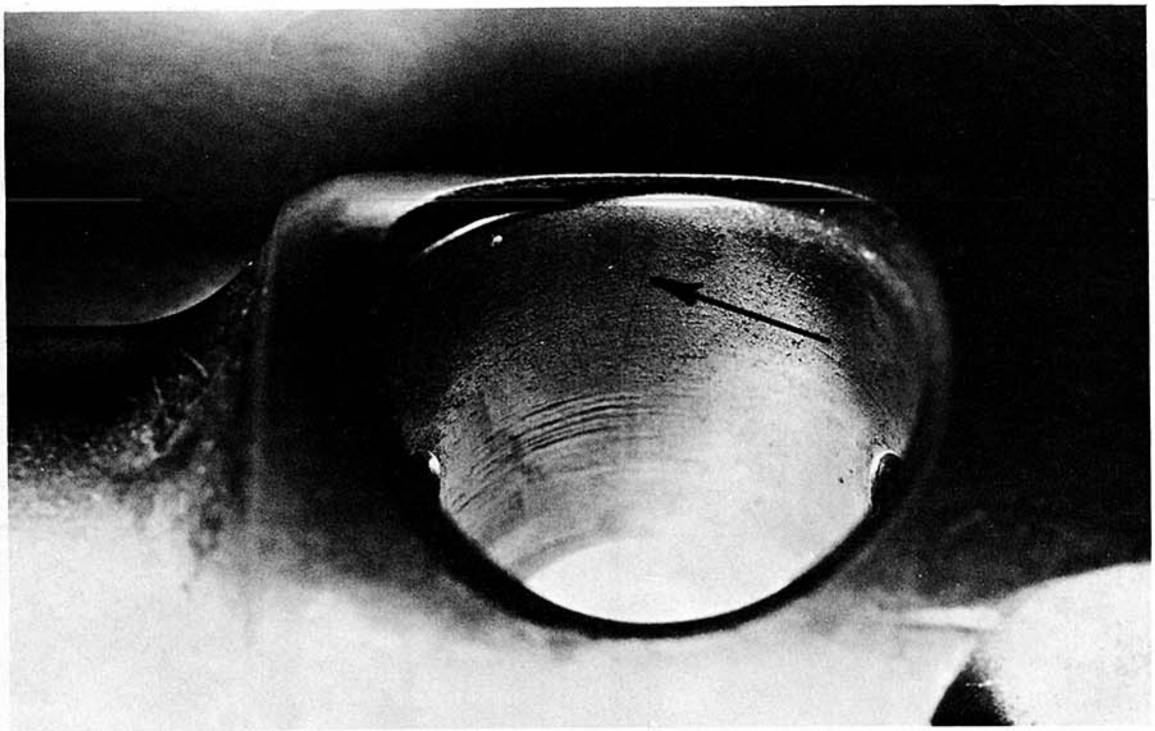

FIG 2

M16A1 RIFLE BOLT. MAGNETIC PARTICLE CRACK INDICATION AT CAM PIN HOLE AFTER 6000 ROUNDS. 9X

NEG. NO. 7910

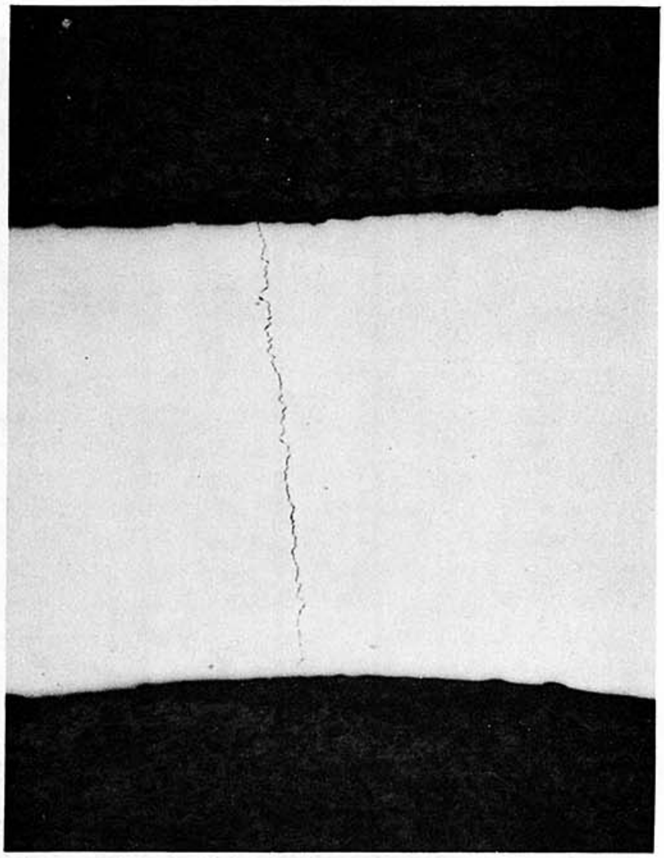

FIGURE 3

X-100 AS POLISHED
LONGITUDINAL SECTION THROUGH CRACK IN M16A1 RIFLE BOLT.
SECTIONED APPROX. .025" BELOW LIP OF CAM PIN HOLE.
SPECIMEN No. 1-95.

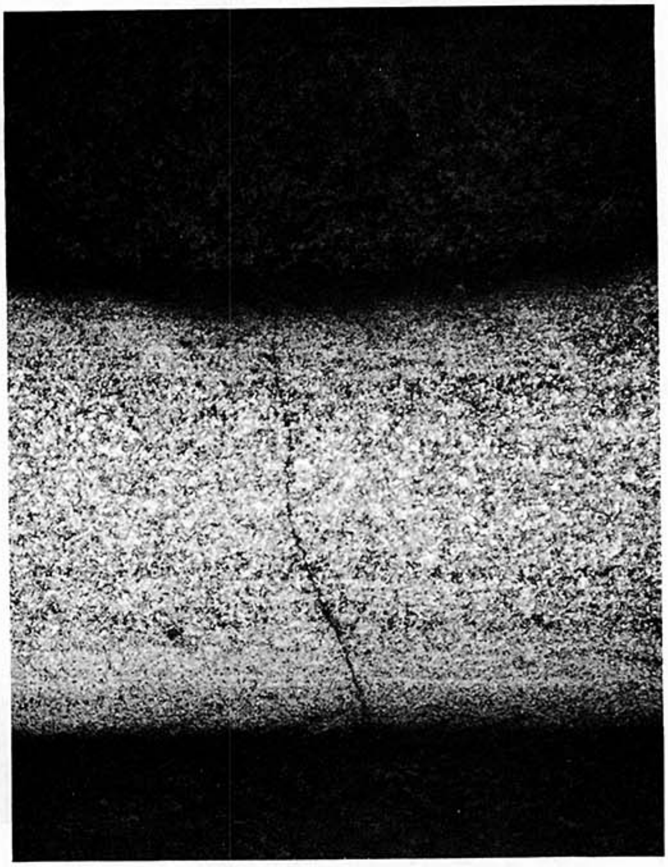

FIGURE 4

X-100 NITAL ETCH

LONGITUDINAL SECTION THROUGH CRACK IN M16A1 RIFLE BOLT. SECTIONED APPROX. .025" BELOW LIP OF CAM PIN HOLE.

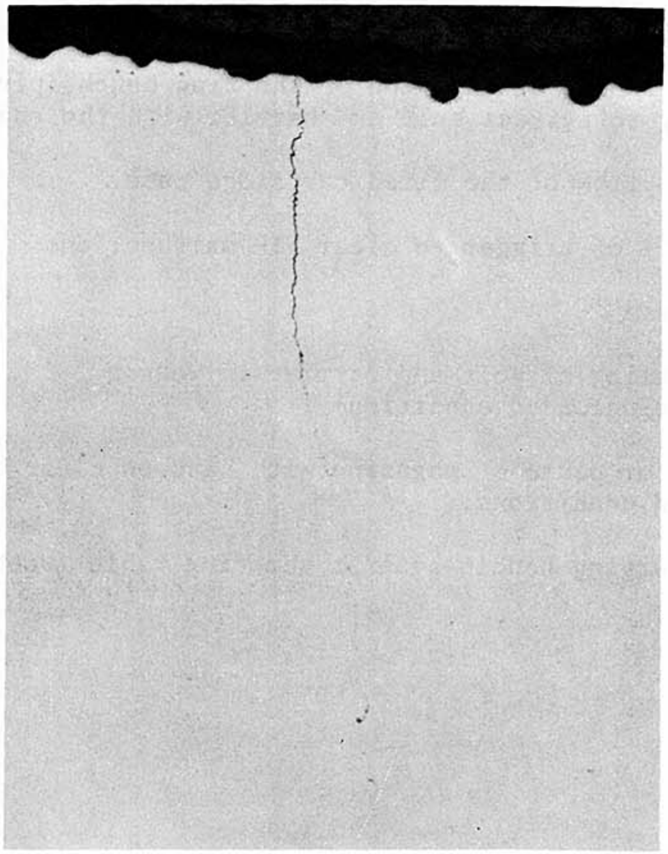

FIGURE 5

X-100 AS POLISHED
LONGITUDINAL SECTION THROUGH
CRACK IN M16A1 RIFLE BOLT.
SECTIONED APPROX. .055" BELOW
LIP OF CAM PIN HOLE.

BA - Bolt assist

CH - Charging handle

R - Manual recocking of hammer by pivoting lower receiver and cocking hammer with the shooters thumb.

M - Magazine withdrawn from weapon

BS - Buttstock impact against top of shooting bench (plywood) while attempting to retract bolt and carrier with the charging handle.

ME - Manual ejection of the fired cartridge case

DP - Double pull of trigger to clear FTR malfunctions

BR - Bolt release

HS - Manual cycling of bolt and carrier in weapon (weapon in unloaded condition)

SM - Strike floor plate of magazine with hand to clear stub round conditions.

CHI - Impact charging handle against shooting table (wood) to unlock bolt.

ROUND-BY-ROUND DATA FOR LOW TEMPERATURE TEST

Malfunction Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks
			Weapon No. A-4		
FS-1	101	1	B/3	BA	
FL	102	2	B/3	BA	
BOB	103	3	B/3	CH	Caused by short recoil of previous round.
BOB	104	4	B/3	CH	
FS	105	5	B/3	BA	
FS	106	6	B/3	BA	
FS-1	201	1	B/3	BA	
FFR	201	1	B/3	CH	Light indent on primer.
FL	202	2	B/3	BA	
FS-1	301	1	B/3	BA	
FFR	301	1	B/3	R	
FF	302	2	B/3	CH	Caused by short recoil of previous round(COEC)
FBR	360	20	S/5	CH	Cyclic rate prior to FBR was 647 rds/min.
FBR	400	20	S/7	CH	Cyclic rate prior to FBR was 647 rds/min.
FS-1	401	1	B/3	BA	
FFR	401	1	B/3	R	
BOB	402	2	B/3	CH/BA	
FJ	402	2	B/3	CH/M	Ejector frozen to rear.
FFR	403	3	B/3	R	
FL	404	4	B/3	BA	
BOB	408	8	B/3	CH/BA	
BFF(FU)	500	-	-	CH/BS	
FS-1	501	1	B/3	BA	
BOB	502	2	B/3	CH/BA	
FF	504	4	B/3	BA	
FBR	560	20	S/5	CH	Cyclic rate prior to FBR was 618 rds/min.
BFF(FU)	600	-	-	CH/BS	Hand-cycled bolt 5 times prior to loading.
FL	604	4	B/3	BA	
FL	655	15	S/5	BA	
FBR	680	20	B/6	CH	Cyclic rate prior to FBR was 650 rds/min.
BFF(FU)	700	-	-	CH/BS	Hand-cycled bolt 12 times prior to loading.
BFF(FU)	800	-	-	CH/5BS	Hand-cycled bolt 14 times prior to loading.
FS-1	801	1	B/3		
FC-1	821	1	A/4		
BFF(FU)	900	0	0	CH/9BS	Hand-cycled bolt 15 times prior to loading.
FS-1	901	1	B/3	BA	
FC-1	921	1	A/4	BA	
					Butt plate of stock cracked.
FL	1102	2	B/3	BA	
FL	1103	3	B/3	BA	
FL	1104	4	B/3	BA	
FFR	1201	1	B/3	CH	Very light firing pin indent.
FC	1202	2	B/3	BA	

Malfunction Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks
					Weapon No. A-4
FFR	1202	2	B/3	CH	Light firing pin indent.
FC	1203	3	B/3	BA	
FFR	1203	3	B/3	CH	Light firing pin indent.
FC	1281	1	S/7	BA	
DF	1299/ 1300	19/ 20	S7	CH/M	
FFR	1301	1	B/3	CH	Light firing pin indent.
FC	1302	2	B/3	BA	
FL	1303	3	B/3	BA	
FL	1304	4	B/3	BA	
FL	1305	5	B/3	BA	
FFR	1401	1	B/3	CH	Light firing pin indent.
FJ	1401	1	B/3	ME	
FL	1402	2	B/3	BA	
FL	1403	3	B/3	BA	
FFR	1501	1	B/3	R	Firing pin sticking.
FFR	1501	1	B/3	R	Firing pin sticking.
FJ	1501	1	B/3	ME	
FL	1502	2	B/3	BA	
FJ	1502	2	B/3	ME	
FL	1503	3	B/3	BA	
FL	1510	10	B/3	BA	
FFR	1601	1	B/3	R	
FJ	1601	1	B/3	ME	
FL	1602	2	B/3	BA	
FJ	1602	2	B/3	ME	
FL	1603	3	B/3	BA	
FJ	1603	3	B/3	ME	
FL	1604	4	B/3	BA	
FJ	1604	4	B/3	ME	
FL	1605	5	B/3	BA	
FJ	1605	5	B/3	ME	
FL	1606	6	B/3	BA	
FC	1621	1	A/4	BA	
FFR	1701	1	B/3	CH	
FJ	1701	1	B/3	ME	
FL	1702	2	B/3	BA	
FJ	1702	2	B/3	ME	
FL	1703	3	B/3	BA	
FL	1704	4	B/3	BA	
FJ	1704	4	B/3	ME	
FL	1705	5	B/3	BA	
FBR	1800	20	S/7	CH	Cyclic rate prior to FBR was 620 rds/min.
FJ	1801	1	B/3	ME	
FL	1802	2	B/3	BA	
FJ	1802	2	B/3	ME	

Malfunction Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks
			Weapon No. A-4		
FL	1803	3	B/3	BA	
FJ	1803	3	B/3	ME	
FL	1804	4	B/3	BA	
FJ	1804	4	B/3	ME	
FL	1805	5	B/3	BA	
FL	1806	6	B/3	BA	
FJ	1901	1	B/3	ME	
FL	1902	2	B/3	BA	
FJ	1902	2	B/3	ME	
FL	1903	3	B/3	BA	
FJ	1903	3	B/3	ME	
FL	1904	4	B/3	BA	
FJ	1904	4	B/3	ME	
FL	1905	5	B/3	BA	
FJ	1905	5	B/3	ME	
FL	1906	6	B/3	BA	
BSI	1919	19	B/3	BR	
BSI	1999	19	S/7	BR	
					Cyclic rate prior to BSI was 630 rds/min.
FS-1	2101	1	B/3	BA	
FBR	2180	20	B/6	CH	Cyclic rate prior to FBR was 698 rds/min.
FBR	2280	20	B/6	CH	Cyclic rate prior to FBR was 668 rds/min.
FS-1	2301	1	B/3	BA	
FS-1	2401	1	B/3	BA	
FS-1	2501	1	B/3	BA	
FL-1	2501	1	B/3	M/CH	Ejector sticks in bolt. BA device would not lock bolt.
FFR-1	2501	1	B/3	CH	Firing pin sticks. Round fired on 2nd trial.
BFR	2600	-	-	CH	Bolt frozen to rear. BA device non-functional
FS1	2601	1	B/3	BA	
FL	2601	1	B/3	-	BA device would not lock bolt. Ejector sticks.
FL	2601	1	B/3	CH	Ejector sticks.
FFR	2601	1	B/3	CH	Firing pin sticks. Round fired on 2nd trial.
BFR	2700	-	-	CH	Bolt frozen to rear. BA device non-functional.
FS1	2701	1	B/3	BA	
FL	2701	1	B/3	-	BA device would not lock bolt. Ejector sticks
FL	2701	1	B/3	CH	Ejector sticks
FFR	2701	1	B/3	CH	Firing pin sticks. Round fired on 2nd trial.
BFR	2800	-	-	CH	Bolt frozen to rear. BA device non-functional.

Malfunction Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks
FS1	2801	1	B/3	BA	
FL	2801	1	B/3	-	BA device would not lock bolt. Ejector sticks.
FL	2801	1	B/3	CH	Ejector sticks.
FFR	2801	1	B/3	CH	Firing pin sticks. Round fired on 2nd trial.
FF	2860	20	S/5	CH	Round 20 prematurely released from magazine feed-lips and was caught between bolt and face of barrel extension.
FS-1	2901	1	B/3	CH/5BS	Inadvertent storage with bolt closed on on empty chamber.
FL	2901	1	B/3	BA	
FS	2902	2	B/3	BA	
FS	2903	3	B/3	BA	
FF	2920	20	B/3	BC	Round 20 prematurely released from magazine feed-lips. Round on top of feed lips, bolt to rear.

Malfunction Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks
Weapon No. A-5					
FS-1	101	1	B/3	BA	
FS	102	2	B/3	BA	
FL	103	3	B/3	BA	
FL	104	4	B/3	BA	
FL	107	7	B/3	BA	
FL	108	8	B/3	BA	
FS-1	201	1	B/3	BA	
FFR	201	1	B/3	R	Round fired on 2nd trial.
FJ	201	1	B/3	-	
FL	203	3	B/3	BA	
FL	204	4	B/3	BA	
FS-1	301	1	B/3	BA	
BOB	302	2	B/3	CH	
FS-1	401	1	B/3	BA	
BOB	402	2	B/3	CH	
BFF(FU)	500	-	-	CH/20BS	Buttstock broke on 18th impact.
FS-1	501	1	B/3	BA	
BOB	502	2	1	CH	
FL	504	4	B/3	BA	
-	600	-	-	-	Installed new buttstock prior to firing.
BFF(FU)	600	-	-	CH/8BS	Hand-cycled bolt 10 times prior to loading. BA device used 6 times to free bolt forward
FS1	601	1	B/3	BA	
FL	606	6	B/3	BA	
BFF(FU)	700	-	-	CH/4BS	Hand-cycled bolt 9 times prior to loading.
FS1	701	1	B/3	BA	
FL	702	2	B/3	BA	
FL	705	5	B/3	BA	
BFF(FU)	800	-	-	CH/12BS	Hand-cycled bolt 15 times prior to loading.
FS-1	801	1	B/3	BA	
FC	821	1	A/4	-	
BFF(FU)	901	0	-	CH/7BS	Hand-cycled bolt 14 times prior to loading.
FS1	901	1	B/3	BA	
FL	921	1	A/4	BA	
FL	1102	2	B/3	BA	
FL	1103	3	B/3	BA	
FL	1104	4	B/3	BA	
FL	1109	9	B/3	BA	
FFR	1201	1	B/3	CH	Light indent on primer. Round fired on second trial.
FC	1202	2	B/3	BA	
FL	1203	3	B/3	BA	
FFR	1301	1	B/3	CH	Light indent on primer. Round fired on second trial.

Malfunction Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks
				Weapon No. A-5	
FC	1302	2	B/3	BA	
BOB	1303	3	B/3	CH	
FC	1321	1	A/4	BA	
FFR	1401	1	B/3	CH	Light indent on primer. Rd fired on 2nd trial
FC	1402	2	B/3	BA	
FL	1403	3	B/3	BA	
FL	1404	4	B/3	BA	
FL	1405	5	B/3	BA	
FTR	1446	6	S/5	DP	
FX	1501	1	B/3	CH/BS	Dust cover did not open when round fired. This indicates a short recoil or failure to unlock condition.
FL	1502	2	B/3		
FL	1503	3	B/3		
FL	1504	4	B/3		
FL	1505	5	B/3		
FL	1506	6	B/3		
FL	1507	7	B/3		
FL	1508	8	B/3		
FL	1509	9	B/3		
FL	1510	10	B/3		
FC	1521	1	A/4	BA	
FJ	1601	1	B/3	ME	
FL	1602	2	B/3	BA	
BOB	1603	3	B/3	CH	
FL	1603	3	B/3	BA	
FL	1605	5	B/3	BA	
FL	1606	6	B/3	BA	
FTR	1683	3	S/7	DP	
FTR	1687	7	S/7	DP	
FFR	1701	1	B/3	R	
FJ	1701	1	B/3	ME	
FL	1702	2	B/3	BA	
FJ	1702	2	B/3	ME	
FL	1703	3	B/3	BA	
FL	1704	4	B/3	BA	
DF	1759/ 1760	19/ 20	B/6	CH/M	
FFR	1801	1	B/3	R	
FJ	1801	1	B/3	ME	
FL	1802	2	B/3	BA	
FL	1803	3	B/3	BA	
FL	1804	4	B/3	BA	
FL	1805	5	B/3	BA	
FL	1806	6	B/3	BA	
FL	1807	7	B/3	BA	
FL	1808	8	B/3	BA	
FL	1809	9	B/3	BA	
FL	1810	10	B/3	BA	

Malfunction Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks
				Weapon No. A-5	
FFR	1810	10	B/3	R	
FL	1811	11	B/3	BA	
FL	1858	18	S/5	BA	
FFR	1901	1	B/3	R	
FJ	1901	1	B/3	ME	
FL	1902	2	B/3	BA	
BOB	1903	3	B/3	CH	
FL	1903	3	B/3	BA	
FL	1904	4	B/3	BA	
FL	1905	5	B/3	BA	
FL	1906	6	B/3	BA	
FL	1909	9	B/3	BA	
FTR	1982	2	S/7	DP	
FTR	1987	7	S/7	DP	
FTR	1988	8	S/7	DP	
FTR	1989	9	S/7	DP	
FTR	1990	10	S/7	DP	
FTR	1912	12	S/7	DP	
FTR	1913	13	S/7	DP	
FTR	1915	15	S/7	DP	
FS-1	2101	1	B/3	BA	Charging handle frozen in forward position and was difficult to manually retract.
FS-1	2201	1	B/3	BA	
FS-1	2301	1	B/3	BA	
FS-1	2401	1	B/3	BA	
BFR	2500	-	-	CH	BA device is non-functional.
FS-1	2501	1	B/3	BA	
FL	2501	1	B/3	CH	Ammunition cleared from weapon and bolt hand-cycled 5 times prior to re-loading
BFR	2600	-	-	CH	BA device is non-functional.
FS-1	2601	1	B/3	BA	
FL	2601	1	B/3	-	First two trials to chamber by charging handle and BA device failed to loosen frozen ejector and bolt
FL	2601	1	B/3	-	
FL	2601	1	B/3	CH/BA	
FFR	2601	1	B/3	CH	
FFR	2601	1	B/3	CH	
FFR	2601	1	B/3	CH	Firing pin sticks. Round fired on 4th trial.
BFR	2700	-	-	CH	
FS1	2701	1	B/3	BA	
BFR	2800	-	-	CH	
FS1	2801	1	B/3	BA	
FFR	2801	1	B/3	R	Firing pin sticks. Round fired on 2nd trial.
BFR	2900	-	-	CH	
FS1	2901	1	B/3	BA	
FTR	2944	4	S/5	DP	
FTR	2957	17	S/5	DP	

Malfunction Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks
				Weapon No. A-6	
-	0	-	-	-	Installed new bolt
FL	101	1	B/3	BA	
FL	102	2	B/3	BA	
FL	401	1	B/3	BA	
FF	420	20	B/3	BR	Round 20 loose on top of magazine. Boltstop engaged.
BFF(FU)	500	-	-	CH/10BS	
FC-1	501	1	B/3	BA	
FFR-1	501	1	B/3	CH	Firing pin sticks. Round fired on 2nd trial.
FF	520	20	B/3	BR	Round 20 loose on top of magazine. Boltstop engaged.
BFF(FU)	600	-	-	CH/1BS	
FC	601	1	B/3	BA	
BFF/FU)	700	-	-	CH/1BS	
FC	701	1	B/3	BA	
FFR	701	1	B/3	CH	Firing pin sticks. Round fired on 2nd trial.
FF	720	20	B/3	BR	Round 20 loose on top of magazine. Boltstop engaged.
FTR	788	8	S/7	DP	
BFF(FU)	800	-	-	CH/2-BS	
FC	801	1	B/3	BA	
FFR	801	1	B/3	CH	Firing pin sticks. Round fired on 2nd trial.
FBR	860	20	S/5	CH	
BFF(FU)	900	-	-	CH/1BS	After bolt retraction bolt stuck to rear. Weapon muzzle impacted against bench to release bolt.
FC	901	1	B/3	BA	
BSI	1020	20	B/3	BR	
BSI	1120	20	B/3	BR	
FFR	1201	1	B/3	R	Firing pin sticks. Round fired on 2nd trial.
FFR	1301	1	B/3	R	Firing pin sticks. Round fired on 2nd trial.
BSI	1420	20	S/7	BR	
FFR	1501	1	B/3	R	Firing pin sticks. Round fired on 2nd trial.
BSI	1520	20	B/3	BR	
FFR	1601	1	B/3	R	
FF	1702	2	B/3	CH	Caused by short recoil of round 1
FFR	1801	1	B/3	R	
FF	1802	2	B/3	CH	Caused by short recoil of round 1.
BSI	1820	20	B/3	BR	
FFR	1901	1	B/3	R	Firing pin sticks. Round fired on 2nd trial.
FJ	1901	1	B/3	CH	Round 1 returned to chamber due to short recoil.
FF	1902	2	B/3	CH/ME	Ejector sticks, requiring manual ejection of round. Fouling deposits cover bolt face.
BSI	2100	20	S/7	BR	
FL	2201	1	B/3	BA	
FS	2301	1	B/3	BA	Cover not opened with initial release of bolt.

Malfunction			Mode of Fire/ Magazine No.	Clearing Action	Remarks
Type	Round Count	Round No.			
				Weapon No. A-6	
FS	2401	1	B/3	BA	Cover not opened with initial release of bolt.
BFR	2500	-	-	CH	
FL	2501	1	B/3	HS1	
FFR	2501	1	B/3	CH	Firing pin sticks. Round fired on 2nd trial.
BFR	2600	-	-	CH	
FL	2601	1	B/3	HS1	
BSI	2620	20	B/3	BR	
FC	2701	1	B/3	BA	
FFR	2701	1	B/3	CH	Firing pin sticks. Round fired on 2nd trial.
BSI	2720	20	B/3	BR	
FF	2800	20	S/7	BR	Round No. 20 loose on top of magazine. Boltstop engaged.
FL	2801	1	B/3	HS3	
FFR	2801	1	B/3	CH	Firing pin sticks. Round fired on 2nd trial.
BSI	2820	20	B/3	BR	
BFR	2900	-	-	CH	
FL	2901	1	B/3	HS2	
FFR	2901	1	B/3	CH	Firing pin sticks. Round fired on 2nd trial.
BSI	2920	20	B/3	BR	

Malfunction			Mode of Fire/ Magazine No.	Clearing Action	Remarks
Type	Round Count	Round No.			
				Weapon No. A-7	
-	0	-	-	-	Installed new bolt
FS1	101	1	B/3	BA	
BOB	102	2	B/3	CH	
FS	103	3	B/3	BA	
FL	104	4	B/3	BA	
FL	105	5	B/3	BA	
FL	106	6	B/3	BA	
FL	107	7	B/3	BA	
BOB	108	8	B/3	CH	
FS	109	9	B/3	BA	
FL	110	10	B/3	BA	
FS1	201	1	B/3	BA	
FFR	201	1	B/3	R	Round fired in 2nd trial.
BOB	203	3	B/3	CH	
FL	203	3	B/3	BA	
BOB	204	4	B/3	CH	
FL	204	4	B/3	BA	
BOB	205	5	B/3	CH	
FL	205	5	B/3	BA	
FS	301	1	B/3	BA	
FFR	301	1	B/3	R	Round fired on 2nd trial.
FF	302	2	B/3	CH	Caused by short recoil of round 1 (COEC)
FL	307	7	B/3	BA	
FS1	401	1	B/3	BA	
BOB	402	2	B/3	CH	
FL	403	3	B/3	BA	
FL	406	6	B/3	BA	
FS	421	1	A/4	BA	
BFF(FU)	500	-	-	CH/3BS	
FS1	501	1	B/3	BA	
FFR	501	1	B/3	R	Round fired on 2nd trial.
FL	502	2	B/3	BA	
FS1	521	1	A/4	BA	
FBR	560	20	S/5	CH	
BFF(FU)	600	-	-	CH/5BS	Manually cycled bolt 11 times prior to loading.
FS1	601	1	B/3	BA	
FBR	660	20	S/5	CH	
BFF(FU)	700	-	-	CH/5BS	Manually cycled bolt 12 times prior to loading.
FS1	701	1	B/3	BA	
FL	702	2	B/3	BA	
FBR	760	20	S/5	CH	
BFF(FU)	800	-	-	CH/5BS	Manually cycled bolt 12 times prior to loading.
FS1	801	1	B/3	BA	
FL	802	2	B/3	BA	
FL	803	3	B/3	BA	
FS1	821	1	A/4	BA	

Malfunction Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks
			Weapon No. A-7		
BFF(FU)	900	-	-	CH/7BA	Manually cycled bolt 14 times prior to loading
FS1	901	1	B/3	BA	
FL	902	2	B/3	BA	
FL	903	3	B/3	BA	
FL	904	4	B/3	BA	
FL	908	8	B/3	BA	
FS1	921	1	A/4	BA	
FS1	941	1	S/5	BA	
FTR	987	7	S/7	DP	
FL	1102	2	B/3	BA	
FL	1103	3	B/3	BA	
FL	1104	4	B/3	BA	
FL	1105	5	B/3	BA	
FL	1106	6	B/3	BA	
FFR	1201	1	B/3	CH	
FS	1202	2	B/3	BA	
FFR	1202	2	B/3	CH	
FS	1203	3	B/3	BA	
FL	1204	4	B/3	BA	
FL	1205	5	B/3	BA	
FL	1206	6	B/3	BA	
FL	1209	9	B/3	BA	
BOB	1302	2	B/3	CH	
FL	1303	3	B/3	BA	
BOB	1402	2	B/3	CH	
FL	1403	3	B/3	BA	
FL	1404	4	B/3	BA	
FL	1405	5	B/3	BA	
FFR	1501	1	B/3	R	
BFF(FU)	1501	1	B/3	CH	Dust cover did not open when round 1 fired. Weapon manually reloaded.
FS	1502	2	B/3	BA	
FL	1503	3	B/3	BA	
FL	1504	4	B/3	BA	
FL	1505	5	B/3	BA	
FL	1506	6	B/3	BA	
FS1	1521	1	A/4	BA	
FBR	1600	20	S/7	CH	
FFR	1601	1	B/3	R	
FJ	1601	1	B/3	ME	
FL	1602	2	B/3	BA	
FL	1603	3	B/3	BA	
FL	1604	4	B/3	BA	
FL	1687	7	S/7	BA	

Malfunction Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks
				Weapon No. A-7	
FFR	1701	1	B/3	R	
FFR	1701	1	B/3	R	
FJ	1701	1	B/3	ME	
FL	1702	2	B/3	BA	
FL	1703	3	B/3	BA	
FL	1704	4	B/3	BA	
FJ	1801	1	B/3	ME	
FL	1802	2	B/3	BA	
FL	1803	3	B/3	BA	
FFR	1901	1	B/3	R	
FJ	1901	1	B/3	ME	
FL	1902	2	B/3	BA	
FL	1903	3	B/3	BA	
FL	1904	4	B/3	BA	
FL	1905	5	B/3	BA	
FL	1906	6	B/3	BA	
FTR	1943	3	S/5	DP	
FTR	1947	7	S/5	DP	
STUB	1961	1	B/6	SM	
STUB	1962	2	B/6	SM	
DF	1979/80	19/20	B/6	CH/M	
FS	2062	2	B/4	BA	Magazine No. 1 thru 5 used.
FS1	2101	1	B/1	BA	Dust cover did not open with release of bolt.
FL	2102	2	B/1	BA	
FL	2104	4	B/1	BA	
FS1	2201	1	B/1	BA	Dust cover did not open with release of bolt.
FS1	2301	1	B/1	BA	Dust cover did not open with release of bolt.
BFR	2400	-	-	CH	
FS1	2401	1	B/1	BA	
BFR	2500	-	-	CH	
FS1	2501	1	B/1	BA	
FL	2501	1	B/1	CH/2HS	
BFR	2600	-	-	CH	
FS1	2601	1	B/1	BA	
BFR	2700	-	-	CH	
FS1	2701	1	B/1	BA	
BFR	2800	-	-	CH	
FC	2801	1	B/1	BA	
FL	2802	2	B/1	BA	
STUB	2821	1	A/2	SM	
STUB	2841	1	S/3	SM	
FFR	2860	20	S/3	CH	No indent on primer. Round fired on 2nd trial.
BFR	2900	-	-	CH	
FS1	2901	1	B/1	BA	Prior to firing. The automatic sear pin was found to be protruding from left side of reciever (1/16-inch). Pin was seated flush with receiver.

Malfunction Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks
					Weapon No. A-8
	0	-	-	-	Installed new bolt
FL	101	1	B/3	BA	
FL	201	1	B/3	BA	
FL	202	2	B/3	BA	
FL	301	1	B/3	BA	
FL	302	2	B/3	BA	
FS1	401	1	B/3	BA	
FFR	401	1	B/3	CH	
FBR	480	20	B/6	CH	
BFF(FU)	500	-	-	CH/2BS	
FL	501	1	B/3	BA	
FFR	501	1	B/3	CH/BA	
BFF(FU)	600	-	-	CH/2BS	
FS1	601	1	B/3	BA	
FFR-1	601	1	B/3	CH/BA	
FL	602	2	B/3	CH	
BFF(FU)	700	-	-	CH/4BS	
FS1	701	1	B/3	BA	
FFR	701	1	B/3	CH/BA	
FF	740	20	A/4	-	Base of round caught between top of bolt and inside of charging handle. Magazine removed, bolt held back with pencil, charging handle pushed forward while weapon was vigorously shaken.
BFF(FU)	800	-	-	1CHI	
FL	801	1	B/3	BA	
FFR	801	1	B/3	CH	Firing pin sticks.
FFR	801	1	B/3	CH	Firing pin sticks.
FFR	801	1	B/3	CH	Firing pin sticks. Round fired on 4th trial.
BFF(FU)	900	-	-	1CHI	
FC	901	1	B/3	BA	
FFR	901	1	B/3	CH	Firing pin sticks.
FFR	901	1	B/3	CH	Firing pin sticks. Round fired on 3rd trial.
FBR	1200	20	S/7	CH	Cyclic rate prior to FBR was 736 rds/min.
FL	1202	2	B/3	BA	
FL	1203	3	B/3	BA	
FBR	1280	20	B/6	CH	Cyclic rate prior to FBR was 699 rds/min.
FFR	1501	1	B/3	R	Firing pin sticks. Round fired on 2nd trial.
BFF(FU)	1501	1	B/3	CH/4HS	No apparent rearward movement of bolt. Bolt was difficult to manually unlock.
FF	1602	2	B/3	CH	Caused by short recoil of round 1.
FFR	1701	1	B/3	R	Firing pin sticks. Round fired on 2nd trial.
FF	1702	2	B/3	CH	Caused by short recoil of round 1.
FFR	1702	2	B/3	CH/BA	Firing pin sticks. Round fired on 2nd trial.
FFR	1801	1	B/3	R	Firing pin sticks. Round fired on 2nd trial.
FJ	1801	1	B/3	CH	Caused by short recoil of round 1 and stuck ejector

Malfunction Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks

Weapon No. A-8

Malfunction Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks
FS	1802	2	B/3	BA	
FFR	1802	2	B/3	CH/BA	
FFR	1805	5	B/3	CH	Charged to ammunition. Round disassembled and found to contain an oily substance covering inside bottom of case.
FFR	1901	1	B/3	R	Firing pin sticks. Round fired on 2nd trial.
FF	1902	2	B/3	CH/BA	Caused by short recoil of round 1.
FS1	2201	1	B/3	BA	Cover not opened by initial bolt release.
FBR	2300	20	S/7	CH	Cyclic rate prior to FBR was 727 rds/min.
FS1	2301	1	B/3	BA	Cover not opened by initial bolt release.
FS1	2381	1	B/7	BA	
FS1	2401	1	B/3	BA	Cover not opened by initial bolt release.
BFR	2500	-	-	CH	
FS1	2501	1	B/3	BA	Cover not opened by initial bolt release.
FL	2501	1	B/3	CH/5HS	
BFR	2600	-	-	CH	
FS1	2601	1	B/3	BA	
FL	2601	1	B/3	CH/5HS	
FFR	2601	1	B/3	CH	Firing pin sticks
FFR	2601	1	B/3	CH	Firing pin sticks. Round fired on 3rd trial.
BSI	2653	13	S/5	BR]	During this cycle, the bolt stop engaged approximately 1/2 the height of the locking lugs. Possible cause is weapon fouling.
BSI	2657	17	S/5	BR]	
BSI	2659	19	S/5	BR]	
5-BSI	-	-	B/6	BR]	
BSI	2686	6	S/7	BR]	
BSI	2690	10	S/7	BR]	
BSI	2694	14	S/7	BR]	
FS1	2701	1	B/3	BA	
FL	2701	1	B/3	CH/5HS	
FFR	2701	1	B/3	CH	Firing pin sticks. Round fired on 2nd trial.
BSI	2757	17	S/5	BR	
6BSI	-	-	B/6	BR	Continued interruption of burst fire.
BFR	2800	-	-	CH	
FS1	2801	1	B/3	BA	
7FFR	2801	1	B/3	CH	Firing pin would not indent primer sufficiently to cause functioning.
BFR	2900	-	-	CH	
FS1	2901	1	B/3	BA	
FL	2901	1	B/3	CH/HS	
FFR	2901	1	B/3	CH	Firing pin sticks. Round fired on 2nd trial.
FBR	2940	20	B/4	CH	Cyclic rate prior to FBR was 708 rds/min.

Malfunction			Mode of Fire/	Clearing	
Type	Round Count	Round No.	Magazine No.	Action	Remarks
				Weapon A-9	
-	-	0	-	-	Installed new bolt.
BSI	98	18	S/7	BR	Bolt stop at maximum engagement with bolt.
FS1	101	1	B/3	BA	
FL	102	2	B/3	BA	
FBR	180	20	B/6	CH	Cyclic rate prior to FBR was 686 rds/min.
FBR	240	20	A/4	CH	Cyclic rate prior to FBR was 683 rds/min.
BSI	257	17	S/5	BR	Bolt stop engagement was 1/2 bolt lug height.
FBR	260	20	S/5	CH	Cyclic rate prior to FBR was 683 rds/min.
BSI	285	5	S/7	BR	Bolt stop engagement was 1/2 bolt lug height.
FL	301	1	B/3	BA	Bolt stop engagement was 1/2 bolt lug height.
FFR	401	1	B/3	CH/BA	
FBR	440	20	A/4	CH	Cyclic rate prior to FBR was 678 rds/min.
FBR	480	20	B/6	CH	Cyclic rate prior to FBR was 678 rds/min.
BFF(FU)	500	-	-	CH/5BS	Buttplate cracked during impact on shooting bench.
FL	501	1	B/3	CH/5HS	
FFR	501	1	B/3	CH/BA	Firing pin sticks. Round fired on 2nd trial.
BSI	557	17	S/5	BR	Bolt stop engagement was 1/2 bolt lug height.
BSI	575	15	B/6	BR	Bolt stop engagement was 1/2 bolt lug height.
BFF(FU)	600	-	-	2CHI	
FS1	601	1	B/3	BA	
FL	602	2	B/3	BA	
BFF(FU)	700	-	-	4CHI	
FC	701	1	B/3	BA	
FFR	701	1	B/3	CH/BA	Firing pin sticks. Round fired on 2nd trial.
FF	780	20	B/6	CH/BR	Cartridge caught between face of barrel extension and bolt face. Retracted charging handle to drop round on top of magazine then released bolt with bolt release and round chambered.
BFF(FU)	800	-	-	1CHI	
FL	801	1	B/3	BA	
FFR	801	1	B/3	CH/BA	Firing pin sticks. Round fired on 2nd trial.
BFF(FU)	900	-	-	1CHI	
FS1	901	1	B/3	BA	
FBR	1020	20	B/3	CH	Cyclic rate prior to BBR was 783 rds/min.
STUB	1141	1	S/5	SM	
FBR	1160	20	S/5	CH	Cyclic rate prior to FBR was 767 rds/min.
FBR	1460	20	S/5	CH	Cyclic rate prior to FBR was 733 rds/min
BSI	1473	13	B/6	BR	
FBR	1500	20	S/7	CH	Cyclic rate prior to FBR was 733 rds/min
FFR	1501	1	B/3	R	Firing pin sticks. Round fired on 2nd trial.
BFF(FU)	1501	1	B/3	CH/5HS	
FL	1502	1	B/3	BA	
FL	1602	2	B/3	BA	
FBR	1660	20	S/5	CH	Cyclic rate prior to FBR was 726 rds/min.
BSI	1680	20	B/6	BR	Bolt stop engagement was 1/2 bolt lug height.

Malfunction Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks
				Weapon A-9	
FFR	1701	1	B/3	R	Firing pin strike. Round fired on second trial.
BSI	1780	20	B/6	BR	Boltstop engagement was 1/2 bolt lug height.
FFR	1801	1	B/3	R	Firing pin sticks.
FFR	1801	1	B/3	R	Firing pin sticks. Round fired on 3rd trial.
FFR	1901	1	B/3	R	Firing pin sticks. Round fired on 2nd trial.
FFR	1902	2	1	CH	FFR caused by FL of round 2.
FX	1902	2	B/3	CH	Extractor was not fully engaged with case rim which caused partial rim shear and the FX when round was fired.
FBR	1940	20	A/4	CH	Cyclic rate prior to FBR was 711 rds/min.
FS1	2101	1	B/3	BA	Cover did not open upon initial bolt release.
STUB	2141	1	S/5	SM	
FS1	2201	1	B/3	BA	Cover did not open upon initial bolt release.
FBR	2280	20	B/6	CH	Cyclic rate prior to FBR was 756 rds/min.
FS1	2301	1	B/3	BA	Cover did not open upon initial bolt release.
FS1	2401	1	B/3	BA	Bolt very hard to lock with/BA device.
BFR	2500	-	-	CH	
FS1	2501	1	B/3	BA	
FL	2501	1	B/3	CH/5HS	
FFR	2501	1	B/3	CH	Firing pin sticks. Round fired on 2nd trial.
FBR	2540	20	A/4	CH	Cyclic rate prior to FBR was 744 rds/min.
FS1	2601	1	B/3	BA	
FL	2601	1	B/3	CH/2HS	
FFR	2601	1	B/3	CH	Firing pin sticks. Round fired on 2nd trial.
FS1	2701	1	B/3	BA	
FL	2701	1	B/3	CH/4HS	
FFR	2701	1	B/3	CH	Firing pin sticks. Round fired on 2nd trial.
BFR	2800	-	-	CH	
FS1	2801	1	B/3	BA	
FL	2801	1	B/3	CH/5HS	
FBR	2860	20	S/5	CH	
BFR	2900	-	-	CH	
FS1	2901	1	B/3	BA	
FL	2901	1	B/3	CH/3HS	
FF	2980	20	B/6	CH/BR	Round caught between face of barrel extension and face of bolt.

Malfunction Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks
					Weapon No. B-4
--	0	--	--	--	Bolt from Weapon No. B-21 installed.
FC	101	1	B/3	BA	
FC	102	2	B/3	BA	
FC	103	3	B/3	BA	
FF	104	4	B/3	CH	Caused by short recoil of Round #3
FC	105	5	B/3	BA	
FC	106	6	B/3	BA	
FL	109	9	B/3	BA	
FL	111	11	B/3	BA	
FL	113	13	B/3	BA	
FL	115	15	B/3	BA	
--	200	--	--	--	Bolt difficult to manually retract.
FC	201	1	B/3	BA	
FF	202	2	B/3	CH/BA	Caused by short recoil of Round #1.
FF	203	3	B/3	CH/BA	
FF	204	4	B/3	CH/BA	
FL	204	4	B/3	BA	
FL	205	5	B/3	BA	
FL	206	6	B/3	BA	
--	300	--	--	--	Bolt difficult to manually retract.
FSI	301	1	B/3	BA	
FL	302	2	B/3	BA	
FL	307	7	B/3	BA	
BFF(FU)	400	--	--	CH/1-BS	
FSI	401	1	B/3	BA	
BFF(FU)	500	--	--	CH/BS 6-HS	Buttstock broken due to impact of buttstock on shooting table.
FL	501	1	B/3	BA	
BFF(FU)	600	--	--	4-CHI 12-HS	
FL	601	1	B/3	3-CH	Ejector sticks.
FFR	601	1	B/3	R	Firing pin sticks.
FFR	601	1	B/3	R	Firing pin sticks. Round fired on 3rd trial.
FTR	642	2	S/5	DP	
FTR	644	4	S/5	DP	
FTR	646	6	S/5	DP	
FTR	648	8	S/5	DP	
FTR	650	10	S/5	DP	
FTR	652	12	S/5	DP	
FTR	654	14	S/5	DP	
FTR	656	16	S/5	DP	
FTR	658	18	S/5	DP	
FTR	660	20	S/5	DP	
FTR	682	2	S/7	DP	
FTR	699	19	S/7	DP	
	700	--	--	--	Replace damaged buttstock.
BFF(FU)	700	--	--	CH/BS	
FL	701	1	B/3	2-HS	Ejector sticks.

Malfunction Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks
				Weapon No. B-4	
BFF(FU)	800	--	--	CH/6-BS	
FSI	801	1	B/3	BA	Weapon was very hard to lock w/BA device.
FS	802	2	B/3	BA	
FL	803	3	B/3	BA	
BFF(FU)	900	--	--	CH/10-BS 4-CHI	Shattered buttplate
FSI	901	1	B/3	BA	
FC	902	2	B/3	BA	
FF	903	3	B/3	CH	Caused by short recoil of Round # 2.
FL	1102	2	B/3	BA	
FL	1103	3	B/3	BA	
FL	1104	4	B/3	BA	
FL	1105	5	B/3	BA	
FL	1106	6	B/3	BA	
BOB	1109	9	B/3	CH	
FL	1115	15	B/3	BA	
FL	1201	1	B/3	BA	
FL	1202	2	B/3	BA	
FL	1203	3	B/3	BA	
FL	1204	4	B/3	BA	
FL	1205	5	B/3	BA	
FL	1206	6	B/3	BA	
FL	1207	7	B/3	BA	
FL	1210	10	B/3	BA	
FL	1216	16	B/3	BA	
FF	1302	2	B/3	CH/BA	Caused by short recoil of Round #1.
FC	1303	3	B/3	BA	
FL	1304	4	B/3	BA	
FF	1305	5	B/3	CH/BA	Caused by short recoil of Round #4.
FF	1308	8	B/3	CH/BA	Caused by short recoil of Round #7.
FL	1321	1	A/4	BA	
FF	1402	2	B/3	CH/BA	Caused by short recoil of Round #1.
BFF(FU)	1501	1	B/3	CH	Manual extraction of fired case ok.
FS	1502	2	B/3	BA	
FL	1502	2	B/3	CH/M 5-HS	
FBR	1560	20	S/5	CH	Cyclic rate prior to FBR was 651 rds/min.
18- FTR	1583-1600	3 thru 20	S/7	DP	
FJ	1601	1	B/3	CH	Caused by short recoil of Round #1.
FTR	1646	6	S/5	DP	
FTR	1652	12	S/5	DP	
FTR	1656	16	S/5	DP	
FFR	1701	1	B/3	R	
FF	1702	2	B/3	CH	Caused by short recoil of Round #1.
FTR	1742	2	S/5	DP	
FTR	1744	4	S/5	DP	

Malfunction Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks
				Weapon No. B-4	
FTR	1783	3	S/7		
FTR	1785	5	S/7		
FTR	1792	12	S/7		
FTR	1796	16	S/7		
FTR	1797	17	S/7		
FFR	1801	1	B/3	R	Firing pin sticks.
FF	1802	2	B/3	CH	Caused by short recoil of Round #1 which was rechambered after firing.
FTR	1891	11	S/7	DP	
FFR	1901	1	B/3	R	
FJ	1901	1	B/3	CH	Caused by short recoil of Round #1. Ejector sticks.
FJ	1902	2	B/3	CH	Caused by short recoil of Round #1. Ejector sticks.
FTR	1990	10	S/7	DP	
--	2000	--	--	--	Buttstock replaced.
FL	2101	1	B/3	BA	
FL	2102	2	B/3	BA	
DF	2116/2117	16/17	A/4	CH/M	
FS-1	2201	1	B/3	BA	
FL	2202	2	B/3	BA	
FL	2203	3	B/3	BA	
FL	2204	4	B/3	BA	
FL	2205	5	B/3	BA	
FL	2208	8	B/3	BA	
FC	2301	1	B/3	BA	
DF	2338/2339	18/19	A/4	CH/M	
FC	2401	1	B/3	BA	
BFR	2500	--	--	CH	
FSI	2501	1	B/3	BA	
FL	2501	1	B/3	CH/11-HS	
BFR	2600	--	--	CH	
FL	2601	1	B/3	CH/5-HS	
DF	2617/2618	17/18	B/3	CH/M	
FL	2701	1	B/3	CH/10-HS	
FTR	2758	18	S/5	DP	
FL	2801	1	B/3	CH/7-HS	
FL	2901	1	B/3	CH/9-HS	
FFR	2901	1	B/3	CH	Firing pin sticks. Round fired on 2nd trial.
FTR	2952	12	S/5	DP	
FTR	2957	17	S/5	DP	

Malfunction Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks
			Weapon No. B-5		
--	300	--	--	--	Manual retraction of bolt beginning to become sluggish.
--	400	--	--	--	Manual retraction of bolt is difficult.
FSI	401	1	B/3	BA	
FF	402	2	B/3	CH/BA	
BFF(FU)	500	--	--	CH/5-BS	
FL	501	1	B/3	BA	
FFR	501	1	B/3	CH	Firing pin sticks. Rd fired on 2nd trial.
BFF(FU)	600	--	--	CH/BS	
FL	601	1	B/3	BA	
BFF(FU)	700	--	--	CH/BS	
FL	701	1	B/3	BA	
FTR	756	16	S/5	DP	
BFF(FU)	800	--	--	CH/4-BS	
FSI	801	1	B/3	BA	
BFF(FU)	900	--	--	CH/5-BS 4-CHI	
FSI	901	1	B/3	BA	
FF	902	2	B/3	CH	Caused by short recoil of Round #1.
FF	1202	2	B/3	CH	Caused by short recoil of Round #1.
FBR	1300	20	S/7	CH	Cyclic rate prior to FBR was 695 rds/min.
FF	1302	2	B/3	CH/BA	Caused by short recoil of Round #1.
FF	1402	2	B/3	CH/BA	Caused by short recoil of Round #1.
FF	1502	2	B/3	CH	Caused by short recoil of Round #1 which returned round to chamber. Fired case manually cleared from weapon.
FF	1702	2	B/3	CH	Caused by short recoil of Round #1.
FBR	1760	20	S/5	CH	
FTR	1796	16	S/7	DP	
FJ	1901	1	B/3	CH/ME	Ejector sticks.
FC	2201	1	B/3	BA	
FSI	2301	1	B/3	BA	
DF	2339/2340	19/20	A/4	CH/M	
FL	2401	1	B/3	BA	
FS-1	2501	1	B/3	BA	
FL	2501	1	B/3	CH/HS	
FC	2601	1	B/3	BA	
FL	2601	1	B/3	CH/5-HS	
FC	2701	1	B/3	BA	
FFR	2701	1	B/3	CH	Firing pin sticks. Rd fired on 2nd trial.
FC	2801	1	B/3	BA	
FL	2801	1	B/3	CH/3-HS	
FFR	2801	1	B/3	CH	
FFR	2801	1	B/3	CH	Firing pin sticks. Rd fired on 3rd trial.
FSI	2901	1	B/3	BA	
FL	2901	1	B/3	CH/2-HS	
FFR	2901	1	B/3	CH	Firing pin stocks. Rd fired on 2nd trial.
FF	2960	20	S/5	CH/BR	Round prematurely released from magazine and caught between face of bolt and barrel extension.

Malfunction Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks
FL	101	1	B/3	BA	Weapon No. B-6
FL	102	2	B/3	BA	
FL	103	3	B/3	BA	
FL	106	6	B/3	BA	
--	200	--	--	--	Manual retraction of bolt is difficult.
FSI	201	1	B/3	BA	
FS	202	2	B/3	BA	
FS	207	7	B/3	BA	
--	300	--	--	--	Manual retraction of bolt is very difficult.
FL	301	1	B/3	BA	
FFR	303	3	B/3	CH	Firing pin sticks. Fouling on bolt face.
FFR	303	3	B/3	CH	Rd fired on 3rd trial.
--	400	--	--	--	Manual retraction of bolt is extremely difficult.
FSI	401	1	B/3	BA	
FF	402	2	B/3	CH	Caused by short recoil of Round #1.
FL	402	2	B/3	BA	
BFF(FU)	500	--	--	CH/10-BS 4-CHI	Cracked rubber buttplate.
FL	501	1	B/3	BA	
FL	502	2	B/3	BA	
FL	505	5	B/3	BA	
FL	541	1	S/5	BA	
BFF(FU)	600	--	--	6-CHI	
FSI	601	1	B/3	BA	
DF	616/617	16/17	B/3	CH/M	
Stub	641	1	S/5	SM	Strike base of magazine w/hand to clear.
BFF(FU)	700	--	--	CHI	
FSI	701	1	B/3	BA	
FL	701	1	B/3	CH/HS	
BFF(FU)	800	--	--	CHI	
FL	801	1	B/3	CH/HS	
FF	802	2	B/3	CH	Caused by short recoil of Round #1.
BFF(FU)	900	--	--	CHI	
FC	901	1	B/3	BA	
FF	902	2	B/3	CH	Caused by short recoil of Round #1.
FL	904	4	B/3	BA	
FF	1202	2	B/3	CH	Caused by short recoil of Round #1.
FF	1302	2	B/3	CH	Caused by short recoil of Round #1.
FL	1306	6	B/3	BA	
FF	1402	2	B/3	CH	Caused by short recoil of Round #1.
FFR	1403	3	B/3	CH	Possible cause is failure to lock bolt.
FF	1501	2	B/3	CH	Very short recoil returned fired case to chamber. Weapon manually cleared ok.
FTR	1555	15	S/5	DP	
BOB	1602	2	B/3	CH	
FTR	1648	8	S/5	DP	
FTR	1649	9	S/5	DP	
FTR	1654	14	S/5	DP	
FF	1702	2	B/3	CH	Caused by short recoil of Round #1.
FL	1703	3	B/3	BA	

Malfunction Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks
			Weapon No. B-6		
FL	1704	4	B/3	DP	
FTR	1745	5	S/5	DP	
FTR	1746	6	S/5	DP	
FTR	1791	11	S/7	DP	
FTR	1793	13	S/7	DP	
FFR	1801	1	B/3	R	Firing pin sticks. Round fired on 2nd trial.
FJ	1802	2	B/3	CH/ME	Ejector sticks.
FC	1803	3	B/3	BA	
FL	1804	4	B/3	BA	
FL	1805	5	B/3	BA	
FTR	1855	15	S/5	DP	
FFR	1901	1	B/3	R	Firing pin sticks. Round fired on 2nd trial.
FJ	1901	1	B/3	CH/HE	Ejector sticks. Short recoil may contribute to this condition.
FL	1902	2	B/3	BA	
DF	1915/1916	15/16	B/3	CH/M	
FTR	1945	5	S/5	DP	
FTR	1946	6	S/5	DP	
FTR	1947	7	S/5	DP	
FTR	1956	16	S/5	DP	
--	2000	--	--	--	Replace broken buttstock.
DF	2016/2017	16/17	CH/M		
FSI	2101	1	B/3	BA	Cover did not open on initial bolt release.
FC	2201	1	B/3	BA	
DF	2216/2217	16/17	B/3	CH/M	
FSI	2301	1	B/3	BA	Cover did not open on initial bolt release.
DF	2316/2317	16/17	A/4	CH/M	
FSI	2401	1	B/3	BA	Cover did not open on initial bolt release.
DF	2416/2417	16/17	B/3	CH/M	
FSI	2501	1	B/3	BA	
FL	2501	1	B/3	CH/7-HS	
FC	2601	1	B/3	BA	
FL	2601	1	B/3	CH/HS	
FTR	2642	2	S/5	DP	
DF	2678/2679	18/19	B/6	CH/M	
FSI	2701	1	B/3	BA	
FL	2701	1	B/3	CH/4-HS	
FFR	2701	1	B/3	CH	Firing pin sticks. Rd fired on 2nd trial.
FSI	2801	1	B/3	BA	
FL	2801	1	B/3	CH/7-HS	
FFR	2801	1	B/3	CH	
FFR	2801	1	B/3	CH	Firing pin sticks. Rd fired on 3rd trial.
FL	2803	3	B/3	BA	
FC	2901	1	B/3	BA	
FL	2901	1	B/3	CH/3-HS	

Malfunction Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks
			Weapon No. B-7		
FL	101	1	B/3	BA	
FF	102	2	B/3	CH	Caused by short recoil of Round #1.
FF	103	3	B/3	CH	Caused by short recoil of Round #2.
FFR	106	6	B/3	CH	Probable cause of these FFR's is failure to lock bolt.
FFR	108	8	B/3	CH	
FC	--	--	B/3	BA	
FFR	--	--	B/3	BA	Probable cause of this FFR is a failure to lock bolt.
--	200	--	--	--	Manual retraction of bolt is difficult.
FC	201	1	B/3	BA	
FL	202	2	B/3	BA	
BOB	203	3	B/3	CH	
FF	280	20	B/6	CH/BR	Round prematurely released from magazine and caught between face of bolt and barrel extension.
--	300	--	--	--	Manual retraction of bolt is very difficult.
FL	301	1	B/3	BA	
BFF(FU)	400	--	--	CH/6-BS	
FC	401	1	B/3	BA	
FL	**402**	**2**	**B/3**	**BA**	
FF	440	20	A/4	CH/BR	Round prematurely released from magazine and caught between face of bolt and barrel extension.
BFF(FU)	500	--	--	CH/10-BS 2-CHI	
FL	501	1	B/3	CH	
FX	501	1	B/3	CH/M	Partial rim shear. Extractor did not fully engage rim of case. Caused FF of Rd #2.
DF	556/557	16/17	S/5	CH/M	
FBR	520	20	S/5	CH	Cyclic rate prior to FBR was 668 rds/min.
DF	596/597	16/17	S/7	CH/M	
BFF(FU)	600	--	--	CH/BS	
FL	601	1	B/3	CH/M HS	Chambered ctg. not engaged by extractor during hand cycling of bolt.
DF	659/660	19/20	S/5	CH/M	
BFF(FU)	700	--	--	CH/BS	
FL	701	1	B/3	CH/M HS	Chambered ctg. not engaged by extractor during hand cycling of bolt.
FL	702	2	B/3	CH	
BFF(FU)	800	--	--	CH/3-BS	
FC	801	1	B/3	BA	
FL	802	2	B/3	BA	
DF	837/838	17/18	A/4	CH/M	
BFF(FU)	900	--	--	CH/BS	
FSI	901	1	B/3	BA	
FJ	901	1		CH/ME	Ejector sticks.
FF	940	20	A/4	CH/BR	Ctg. prematurely released from magazine and caught between face of bolt and barrel extension.
--	1000	--	--	--	Crack in bolt cam pin hole. Testing of this weapon terminated.

Malfunction Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks
				Weapon No. B-8	
FL	301	1	B/3	BA	
FFR	301	1	B/3	CH	Firing pin sticks. Rd. fired on 2nd trial.
FSI	401	1	B/3	BA	
BFF(FU)	500	--	--	CH/BS	
FL	501	1	B/3	BA	
BFF(FU)	600	--	--	CH/2-BS	
FL	601	1	B/3	BA	
FL	602	2	B/3	BA	
FFR	605	5	B/3	CH	Possible cause is FL. Rd fired on 2nd trial.
FSI	701	1	B/3	BA	
BFF(FU)	800	--	--	CH/2-BS	
BFF(FU)	900	--	--	CH/2-BS	
FC	901	1	B/3	BA	
DF	1057/1058	17/18	S/5	CH/M	
DF	1259/1260	19/20	S/5	CH/M	
FF	1502	2	B/3	CH	Caused by short recoil of Round #1.
FFR	1601	1	B/3	R	
DF	1619/1620	19/20	B/3	CH/M	
FF	1702	2	B/3	CH/BA	Caused by short recoil of Round #1.
FS	1802	2	B/3	BA	
FFR	1901	1	B/3	R	Firing pin sticks. Rd fired on 2nd trial.
FL	1902	2	B/3	BA	
FL	1903	3	B/3	BA	
FL	1904	4	B/3	BA	
FTR	1946	6	S/5	DP	
FSI	2201	1	B/3	BA	Dust cover did not open on initial bolt release.
--	2301	1	B/3	--	Slight hesitation during first-rd. stripping.
BFR	2500	--	--	CH	
FSI	2501	1	B/3	BA	
FSI	2601	1	B/3	BA	
FFR	2601	1	B/3	CA	Firing pin sticks. Rd fired on 2nd trial.
FSI	2701	1	B/3	BA	
FSI	2801	1	B/3	BA	
FL	2801	1	B/3	CH/HS	
FSI	2901	1	B/3	BA	

Malfunction Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks
				Weapon No. C-4	
FS1	101	1	B/3	BA	
FJ	101	1	B/3	-	
BOB	103	3	B/3	CH/BA	
BOB	104	4	B/3	CH/BA	
FL	105	5	B/3	BA	
FL	106	6	B/3	BA	
FL	107	7	B/3	BA	
BOB	108	8	B/3	CH/BA	
BOB	109	9	B/3	CH/BA	
FS1	201	1	B/3	BA	
FF	202	2	B/3	CH	Caused by short recoil of round 1.
FF	203	3	B/3	CH	Caused by short recoil of round 2.
FF	204	4	B/3	CH	Caused by short recoil of round 3.
FS1	301	1	B/3	BA	
BOB	302	2	B/3	CH	
BFF/ (FU)	400	-	-	CH/BS	
FS1	401	1	B/3	BA	
FJ	401	1	B/3	-	
FL	402	2	B/3	BA	
FJ	402	2	B/3	-	
FL	403	3	B/3	BA	
FL	404	4	B/3	BA	
FL	405	5	B/3	BA	
FBR	500	20	S/7	CH	
BFF(FU)	500	-	-	CH/18BS 12HS	Buttstock broken.
FS1	501	1	B/3	BA	
FL	504	4	B/3	BA	
-	600	-	-		Installed new buttstock.
BFF(FU)	600	-	-	CH/7BS 10HS	
FS1	601	1	B/3	BA	
BFF(FU)	700	-	-	CH/4BS 10HS	
FS1	701	1	B/3	BA	
FL	702	2	B/3	BA	
BFF(FU)	800	-	-	CH/4BS 20HS	Had to impact muzzle of weapon on bench each time to return bolt to a position which would allow the BA device to engage the carrier.
FS1	801	1	B/3	BA	
BOB	802	2	B/3	CH	
FL	803	3	B/3	BA	
FL	804	4	B/3	BA	
FL	805	5	B/3	BA	
FL	806	6	B/3	BA	
FL	807	7	B/3	BA	
FL	810	10	B/3	BA	

Malfunction Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks
				Weapon No. C-4	
BFF(FU)	900	-	-	CH/3BS 10HS	
FS1	901	1	B/3	BA	
FL	902	2	B/3	BA	
BOB	1102	2	B/3	CH	
FL	1103	3	B/3	BA	
FL	1104	4	B/3	BA	
BOB	1105	5	B/3	CH	
FJ	1201	1	B/3	-	
BOB	1203	3	B/3	CH	
BOB	1204	4	B/3	CH	
DF	1215/ 1216	15/ 16	B/3	CH/M	
FJ	1301	1	B/3	-	
FL	1303	3	B/3	BA	
FL	1304	4	B/3	BA	
FL	1305	5	B/3	BA	
FL	1306	6	B/3	BA	
FL	1307	7	B/3	BA	
FJ	1401	1	B/3	-	
BOB	1402	2	B/3	CH	
FL	1403	3	B/3	BA	
FL	1404	4	B/3	BA	
DF	1414/ 1415	14/ 15	B/3	CH/M	
DF	1419/ 1420	19/ 20	B/3	CH/M	
BOB	1480	20	B/6	CH	
FFR	1501	1	B/3	R	Firing pin sticks. Round fired on 2nd trial.
FJ	1501	1	B/3	-	
FL	1502	2	B/3	BA	
FFR	1502	2	B/3	R	
FJ	1502	2	B/3	-	
FL	1503	3	B/3	BA	
BOB	1504	4	B/3	CH	
FJ	1601	1	B/3	-	
FL	1602	2	B/3	BA	
FFR	1701	1	B/3	R	Firing pin sticks. Round fired on 2nd trial.
FJ	1701	1	B/3	CH/ME	
FL	1702	2	B/3	BA	
FL	1703	3	B/3	BA	
FL	1704	4	B/3	BA	
FFR	1704	4	B/3	R	Round fired on 2nd trial.
FFR	1801	1	B/3	R	
FJ	1801	1	B/3	CH/ME	
FL	1802	2	B/3	BA	
FL	1803	3	B/3	BA	
FFR	1901	1	B/3	R	Firing pin sticks. Round fired on 2nd trial.
FJ	1901	1	B/3	CH/ME	

Malfunction Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks
				Weapon No. C-4	
FL	1902	2	B/3	CH	
BOB	1903	3	B/3	CH	
FL	1903	3	B/3	BA	
FL	1904	4	B/3	BA	
BOB	1905	5	B/3	CH	
FL	1905	5	B/3	BA	
FTR	1944	4	S/5	DP	
FS1	2101	1	B/3	BA	
FL	2103	3	B/3	BA	
FS1	2201	1	B/3	BA	
BOB	2202	2	B/3	CH/BA	
FC	2203	3	B/3	BA	
FL	2206	6	B/3	BA	Dust cover did not open on initial bolt release.
FS1	2301	1	B/3	BA	Dust cover did not open on initial bolt release.
FS1	2401	1	B/3	BA	Dust cover did not open on initial bolt release.
FF	2402	2	B/3	CH	Caused by short recoil of round 1.
FL	2403	3	B/3	BA	
BFR	2500	-	-	CH	
FS1	2501	1	B/3	BA	
FL	2501	1	B/3	CH/HS	
BFR	2600	-	-	CH	
FS1	2601	B/3	BA		
FL	2601	1	B/3	CH	
FS1	2701	1	B/3	BA	Cover did not open on initial bolt release.
FTR	2749	9	S/5	DP	
BFR	2800	-	-	CH	
FS1	2801	1	B/3	BA	
FTR	2842	2	S/5	DP	
BFR	2900	-	-	CH	
FS1	2901	1	B/3	BA	
FTR	2944	4	S/5	DP	
FTR	2985	5	S/7	DP	

Malfunction Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks

Weapon No. C-5

Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks
DF	59/60	19/20	S/5	CH/M	
FS1	101	1	B/3	BA	
FF	104	4	B/3	CH	Caused by short recoil of round 3.
FF	105	S	B/3	CH	Caused by short recoil of round 4.
FF	106	6	B/3	CH	Caused by short recoil of round 5.
FL	198	18	S/7	BA	
FS1	201	1	B/3	BA	
FL	202	2	B/3	BA	
FL	203	3	B/3	BA	
BOB	204	4	B/3	CH/BA	
BOB	205	5	B/3	CH/BA	
FL	206	6	B/3	BA	
FL	210	10	B/3	BA	
FS1	301	1	B/3	BA	
FFR	301	1	B/3	R	Firing pin sticks. Round fired on 2nd trial.
FS	303	3	B/3	BA	
DF	379/ 380	19/ 20	B/6	CH/M	
BFF(FU)	400	-	-	CH/BS	
FS1	401	1	B/3	BA	
FFR	401	1	B/3	R	
BOB	402	2	B/3	CH	
DF	459/ 460	19/ 20	S/5	CH/M	
BFF(FU)	500	-	-	CH/7BS	
FS1	501	1	B/3	BA	
FL	501	1	B/3	8HS	
DF	556/ 557	16/ 17	S/5	CH/M	
DF	569/ 570	9/ 10	B/6	CH/M	
BFF(FU)	600	-	-	CH/6BS 15HS	
FS1	601	1	B/3	BA	
FL	602	2	B/3	BA	
FL	645	5	S/5	BA	
BFF(FU)	700	-	-	CH/6BS 12HS	
FL	707	1	B/3	BA	
DF	779/ 780	19/ 20	B/6	CH/M	
BFF(FU)	800	-	-	CH/6BS 13HS	
DF	859/ 860	19/ 20	S/5	CH/M	
DF	879/ 880	19/ 20	B/6	CH/M	

Malfunction Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks
				Weapon No. C-5	
BFF(FU)	900	-	-	CH/7BS 12HS	
DF	959/ 960	19/ 20	S/5	CH/M	
-	1000	-	-	-	Mag No. 5 and 6 replaced by Magazine 1 & 2.
DF	1079/ 1080	19/ 20	B/2	CH/M	
FFR	1101	1	B/3	CH	Firing pin sticks. Round fired on 2nd trial.
FFR	1102	2	B/3	CH	Firing pin sticks. Round fired on 2nd trial.
DF	1139/ 1140	19/ 20	A/4	CH/M	
DF	1179/ 1180	19/ 20	B/2	CH/M	
DF	1193/ 1194	13/ 14	S/7	CH/M	
FFR	1201	1	B/3	CH	
FL	1202	2	B/3	BA	
DF	1279/ 1280	19/ 20	B/2	CH/M	
FJ	1301	1	B/3	-	
DF	1399/ 1400	19/ 20	S/7	CH/M	
FL	1402	2	B/3	BA	
DF	1479/ 1480	19/ 20	B/2	CH/M	
FJ	1501	1	B/3	CH/ME	Ejector sticks in bolt.
FL	1502	2	B/3	BA	
FJ	1502	2	B/3	CH/ME	
FL	1503	3	B/3	BA	
FJ	1503	3	B/3	CH/ME	
FL	1504	4	B/3	BA	
FJ	1504	4	B/3	CH/ME	
FL	1506	6	B/3	BA	
FJ	1506	6	B/3	CH/ME	
FL	1509	9	B/3	BA	
FJ	1509	9	B/3	CH/ME	
FS1	1521	1	A/4	BA	
DF	1574/ 1575	14/ 15	B/2	CH/M	
DF	1579/ 1580	19/ 20	B/2	CH/M	
FFR	1601	1	B/3	R	
FJ	1601	1	B/3	CH/ME	Ejector sticks.
FL	1602	2	B/3	BA	
FJ	1602	2	B/3	CH/ME	Ejector sticks.
FL	1603	3	B/3	BA	
FJ	1603	3	B/3	CH/ME	Ejector sticks.
FL	1604	4	B/3	BA	
FJ	1604	4	B/3	CH/ME	Ejector sticks

Malfunction Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks
				Weapon No. C-5	
DF	1659/ 1660	19/ 20	S/1	CH/M	
DF	1674/1675	14/15	B/2	CH/M	
FJ	1701	1	B/3	CH/ME	Ejector sticks.
FL	1702	2	B/3	BA	
FJ	1702	2	B/3	CH/ME	Ejector sticks.
FL	1703	3	B/3	BA	
FJ	1703	3	B/3	CH/ME	Ejector sticks.
FL	1704	4	B/3	BA	
FJ	1704	4	B/3	CH/ME	Ejector sticks.
FL	1705	5	B/3	BA	
FJ	1705	5	B/3	CH/ME	Ejector sticks.
FL	1706	6	B/3	BA	
FJ	1706	6	B/3	CH/ME	Ejector sticks.
FL	1707	7	B/3	BA	
FL	1708	8	B/3	BA	
FL	1709	9	B/3	BA	
FL	1713	13	B/3	BA	
DF	1773/ 1774	13/ 14	B/2 B/2	CH/M	
DF	1779/ 1780	19/ 20	B/2	CH/M	Magazine 2 replaced by 3.
FFR	1801	1	B/3	R	Firing pin sticks. Round fired on 2nd trial.
FJ	1801	1	B/3	CH/M	Ejector sticks.
FL	1802	2	B/3	BA	
FJ	1802	2	B/3	CH/ME	Ejector sticks.
FL	1803	3	B/3	BA	
FJ	1803	3	B/3	CH/ME	Ejector sticks.
FL	1804	4	B/3	BA	
FJ	1804	4	B/3	CH/ME	Ejector sticks.
FL	1805	5	B/3	BA	
FJ	1805	5	B/3	CH/ME	Ejector sticks.
FL	1806	6	B/3	BA	
FJ	1806	6	B/3	CH/ME	Ejector sticks.
FL	1807	7	B/3	BA	
FJ	1807	7	B/3	CH/ME	Ejector sticks.
FL	1808	8	B/3	BA	
FFR	1808	8	B/3	R	Round fired on 2nd trial.
FTR	1855	15	S/1	DP	
FFR	1901	1	B/3	R	Firing pin sticks. Round fired on 2nd trial.
FJ	1901	1	B/3	CH/ME	Ejector sticks.
FL	1902	2	B/3	BA	
FJ	1902	2	B/3	CH/ME	Ejector sticks.
FL	1903	3	B/3	BA	
FJ	1903	3	B/3	CH/ME	Ejector sticks.
FL	1904	4	B/3	BA	
FJ	1904	4	B/3	CH/ME	Ejector sticks.
FL	1905	5	B/3	BA	
FJ	1905	5	B/3	CH/ME	Ejector sticks.

Malfunction Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks
				Weapon No. C-5	
FL	1906	6	B/3	BA	
FJ	1906	6	B/3	CH/ME	Ejector sticks
FL	1907	7	B/3	BA	
FJ	1907	7	B/3	CH/ME	Ejector sticks
FL	1908	8	B/3	BA	
FJ	1908	8	B/3	CH/ME	Ejector sticks
FL	1909	9	B/3	BA	
FJ	1909	9	B/3	CH/ME	Ejector sticks.
FL	1910	10	B/3	BA	
FJ	1912	12	B/3	CH/ME	Ejector sticks.
FL	1913	13	B/3	BA	
FJ	1921	1	A/4	CH/ME	Ejector sticks.
-	2000	-	-	-	Magazine 3 through 7 used.
FS1	2101	1	B/3	BA	
FS1	2201	1	B/3	BA	Cover not opened on initial release of bolt.
FS1	2301	1	B/3	BA	Cover not opened on initial release of bolt.
FS1	2401	1	B/3	BA	Cover not opened on initial release of bolt.
DF	2479/ 2480	19/ 20	B/6	CH/M	
FS1	2501	1	B/3	BA	Cover not opened on initial release of bolt.
DF	2579/ 2580	19/ 20	B/6	CH/M	
BFR	2600	-	-	CH/2BS	
FS1	2601	1	B/3	BA	
FS1	2701	1	B/3	BA	Bolt difficult to lock w/BA device.
DF	2715/ 2716	15/ 16	B/3	CH/M	
BFR	2800	-	-	CH	
FS1	2801	1	B/3	BA	Bolt difficult to lock w/BA device.
BFR	2900	-	-	CH	
FS1	2901	1	B/3	BA	
FTR	2943	3	S/5	DP	

Malfunction Type	Malfunction Round Count	Malfunction Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks
				Weapon No. C-6	
-	0	-	-	-	New barrel installed.
FF	5	5	B/3	CH	Caused by short recoil of round 4.
FC	101	1	B/3	BA	
FF	102	2	B/3	CH	Caused by short recoil of round 1.
FS	103	3	B/3	BA	
FS	106	6	B/3	BA	
-	200	-	-	-	Manual bolt retraction starting to get difficult.
FS1	201	1	B/3	BA	
FFR	201	1	B/3	CH	Firing pin sticks. Round fired on 2nd trial.
FL	202	2	B/3	BA	
FL	203	3	B/3	BA	
-	300	-	-	-	Manual bolt retraction is difficult.
FC	301	1	B/3	BA	
FF	302	2	B/3	CH	Caused by short recoil of round 1.
FL	302	2	B/3	BA	
-	400	-	-	-	Manual bolt retraction is difficult.
FS1	401	1	B/3	BA	
FL	402	2	B/3	BA	
FL	403	3	B/3	BA	
BFF	500	-	-	CH/3BS	
FL	501	1	B/3	CH/3HS	
BFF	600	-	-	CH/BS	
FL	601	1	B/3	BA	
FTR	693	13	S/7	-	Trigger pushed forward to clear.
BFF	700	-	-	CH/BS	
FL	701	1	B/3	BA	
FF	702	2	B/3	CH	Caused by short recoil of round 1.
BFF	800	-	-	CH/BS	Chipped butt plate during impact.
FL	801	1	B/3	BA	
FL	802	2	B/3	BA	
FS	804	4	B/3	BA	
FTR	899	19	S/7	DP	
BFF	900	-	-	CH/BS	
FL	901	1	B/3	BA	
FTR	959	19	S/5	DP	
FS	1102	2	B/3	BA	
FL	1202	2	B/3	BA	
FF	1402	2	B/3	CH	Caused by short recoil of round 1.
FFR	1501	1	B/3	R	Firing pin sticks. Round fired on 2nd trial.
FF	1502	2	B/3	CH	Caused by short recoil of round 1.
FF	1602	2	B/3	CH	Caused by short recoil of round 1.
FTR	1643	3	S/5	DP	
FTR	1652	12	S/5	DP	
FFR	1701	1	B/3	R	
FJ	1701	1	B/3	CH/ME	
FS	1702	2	B/3	-	Bolt sticks to rear. Impacted muzzle against bench to allow BA device to engage carrier.

Malfunction Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks
				Weapon No. C-6	
FL	1703	3	B/3	BA	
FL	1705	5	B/3	BA	
FTR	1784	4	S/7	DP	
FTR	1797	17	S/7	DP	
FFR	1801	1	B/3	R	Firing pin sticks. Round fired on 2nd trial.
FJ	1801	1	B/3	CH/ME	Ejector sticks.
FFR	1901	1	B/3	R	Firing pin sticks. Round fired on 2nd trial
FJ	1901	1	B/3	CH/ME	
FL	2101	1	B/3	BA	
FC	2201	1	B/3	BA	
FS1	2301	1	B/3	BA	Cover not opened on initial release of bolt.
FS1	2401	1	B/3	BA	Cover not opened on initial release of bolt.
BFR	2500	-	-	CH	
FL	2501	1	B/3	CH/HS	
FC	2601	1	B/3	BA	
FL	2601	1	B/3	CH/HS	
FC	2701	1	B/3	BA	
FL	2701	1	B/3	CH/2HS	
FFR	2701	1	B/3	CH	Firing pin sticks. Round fired on 2nd trial.
FS1	2801	1	B/3	BA	
FL	2801	1	B/3	CH/3HS	
3FFR	2801	1	B/3	CH	Firing pin sticks. Round fired on 4th trial.
FC	2901	1	B/3	BA	
FL	2901	1	B/3	CH/HS	
2-FFR	2901	1	B/3	CH	Firing pin sticks. Round fired on 3rd trial.
FBR	2980	20	B/6	CH	Cyclic rate prior to FBR was 684 rds/min.

Malfunction Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks

Weapon No. C-7

Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks
FS1	101	1	B/3	BA	
FF	102	2	B/3	CH	Caused by short recoil of round 1
FL	106	6	B/3	BA	
FS1	201	1	B/3	BA	
FF	202	2	B/3	CH	Caused by short recoil of round 1
FL	203	3	B/3	BA	
FL	207	7	B/3	BA	
FS1	301	1	B/3	BA	
BOB	302	2	B/3	CH/BA	
BOB	303	3	B/3	CH/BA	
BFF(FU)	400	-	-	CH/BS	
FS1	401	1	B/3	BA	
FL	404	4	B/3	BA	
FBR	480	20	B/6	CH	Cyclic rate prior to FBR was 679
BFF(FU)	500	-	-	CH/7-BS 10HS	Impacted muzzle of weapon against table to release bolt from rear position for first manual cycle of bolt.
FBR	580	20	B/6	CH	Cyclic rate prior to FBR was 699 rds/min.
BFF(FU)	600	-	-	CH/3-BS 14-HS	
FS1	601	1	B/3	BA	
FL	602	2	B/3	BA	
BFF(FU)	700	-	-	CH/3-BS 14-HS	
FS1	701	1	B/3	BA	
FL	704	4	B/3	BA	
BFF(FU)	800	-	-	CH/4-BS 14-HS	
FS1	801	1	B/3	BA	
2-FTR	-	-	S/7	DP	
BFF(FU)	900	-	-	CH/5-BS 15-HS	
FS1	901	1	B/3	BA	
FJ	901	1	B/3	-	
FL	902	2	B/3	BA	
FL	903	3	B/3	BA	
FL	904	4	B/3	BA	
FL	907	7	B/3	BA	
FL	908	8	B/3	BA	
FL	921	1	A/4	BA	
3-FTR	-	-	S/5	DP	
2-FTR	-	-	S/7	DP	
FBR	1060	20	S/5	CH	Cyclic rate prior to FBR was 724 rds/min.

Malfunction Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks
					Weapon No. C-7
BOB	1102	2	B/3	CH	
FJ	1201	1	B/3	-	
BOB	1203	3	B/3	CH	
FL	1204	4	B/3	BA	
BOB	1205	5	B/3	CH	
FBR	1260	20	S/5	CH	Cyclic rate prior to FBR was 703 rds/min.
BOB	1302	2	B/3	CH	
FL	1303	3	B/3	BA	
FBR	1340	20	A/4	CH	Cyclic rate prior to FBR was 678 rds/min.
FJ	1401	1	B/3	CH	
FL	1402	2	B/3	BA	
FL	1403	3	B/3	BA	
FL	1404	4	B/3	BA	
2-FFR	1501	1	B/3	R	Firing pin sticks. Round fired on 3rd trial.
FJ	1501	1	B/3	CH/ME	
FL	1502	2	B/3	BA	
FL	1503	3	B/3	BA	
BOB	1504	4	B/3	CH	
FL	1521	1	A/4	BA	
FFR	1601	1	B/3	CH	Firing pin sticks. Round fired on 2nd trial.
FJ	1601	1	B/3	CH/ME	
FL	1602	2	B/3	BA	
FL	1603	3	B/3	BA	
FL	1604	4	B/3	BA	
FL	1605	5	B/3	BA	
FL	1606	6	B/3	BA	
FTR	1641	1	S/5	DP	
FTR	1642	2	S/5	DP	
FFR	1701	1	B/3	R	
FJ	1701	1	B/3	CH/ME	
FL	1702	2	B/3	BA	
FFR	1702	2	B/3	R	
FL	1703	3	B/3	BA	
FFR	1703	3	B/3	R	
BOB	1704	4	B/3	CH/BA	
FFR	1704	4	B/3	R	
BOB	1705	5	B/3	CH/BA	
FL	1706	6	B/3	BA	
FL	1707	7	B/3	BA	
FL	1708	8	B/3	BA	
FFR	1709	9	B/3	R	
FL	1710	10	B/3	BA	
FL	1721	1	A/4	BA	
FFR	1801	1	B/3	R	
FJ	1801	1	B/3	CH/ME	

Malfunction Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks

Weapon No. C-7

Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks
FL	1802	2	B/3	BA	
FL	1803	3	B/3	BA	
FL	1804	4	B/3	BA	
BOB	1805	5	B/3	CH	
FTR	1843	3	S/5	DP	
FTR	1850	10	S/5	DP	
FTR	1854	14	S/5	DP	
FFR	1901	1	B/3	R	
FJ	1901	1	B/3	CH/ME	
FL	1902	2	B/3	BA	
FJ	1902	2	B/3	CH/ME	
FL	1903	3	B/3	BA	
FJ	1903	3	B/3	CH/ME	
FL	1904	4	B/3	BA	
FL	1905	5	B/3	BA	
FL	1906	6	B/3	BA	
FL	1907	7	B/3	BA	
FL	1908	8	B/3	BA	
FS1	2101	1	B/3	BA	Dust cover did not open on initial release of bolt.
FBR	2180	20	B/6	CH	Cyclic rate prior to FBR was 702 rds/min.
FS1	2201	1	B/3	BA	Dust cover did not open on initial release of bolt.
FJ	2221	1	A/4	CH/ME	Ctg. case head caught between face of bolt and barrel extension.
FS1	2301	1	B/3	BA	Dust cover did not open on initial release of bolt.
BFR	2400	-	-	CH	
FS1	2401	1	B/3	BA	
BFR	2500	-	-	CH	
FS1	2501	1	B/3	BA	
FL	2501	1	B/3	CH/2-HS	
BFR	2600	-	-	CH	
FS1	2601	1	B/3	BA	
FBR	2640	20	A/4	CH	Cyclic rate prior to FBR was 734 rds/min.
BFR	2700	-	-	CH	
FS1	2701	1	B/3	BA	Very difficult to lock w/BA device.
BFR	2800	-	-	CH	
FC	2801	1	B/3	BA	
FL	2801	1	B/3	CH	
FF	2820	20	B/3	BR	
4-FTR	2842/ 2845	2- 5	S/5	DP	
5-FTR	2847/ 2851	7-11	S/5	DP	

Malfunction Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks
					Weapon No. C-7
8-FTR	2853/ 2860	13-20	S/5	DP	
FTR	2882	2	S/7	-	Pushed forward on trigger to clear
FTR	2883	3	S/7	-	Pushed forward on trigger to clear
FTR	2884	4	S/7	-	Pushed forward on trigger to clear
FTR	2886	6	S/7	-	Pushed forward on trigger to clear
FTR	2887	7	S/7	-	Pushed forward on trigger to clear
FTR	2898	18	S/7	-	Pushed forward on trigger to clear
FTR	2900	20	S/7	-	Pushed forward on trigger to clear
BFR	2900	-	-	CH	
FL	2901	1	B/3	CH	
FF	2920	20	B/3	BR	
FTR	2944	4	S/5	DP	
FTR	2946	6	S/5	DP	
FTR	2950	10	S/5	DP	
FTR	2951	11	S/5	DP	
FTR	2953	13	S/5	DP	
FTR	2954	14	S/5	DP	
FTR	2960	20	S/5	DP	

Malfunction Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks
				Weapon No. C-12	
--	0	--	--	--	Installed new barrel. Magazine No. 1 - 5 used.
--	200	--	--	--	Manual retraction of bolt is difficult.
FL	201	1	B/1	BA	
FL	202	2	B/1	BA	
FL	301	1	B/1	BA	
FL	302	2	B/1	BA	
FL	401	1	B/1	BA	
FL	402	2	B/1	BA	
BFF(FU)	500	--	--	CH/BS	
FL	501	1	B/1	BA	
BFF(FU)	600	--	--	CH/4-BS	
FSI	601	1	B/1	BA	
FL	602	2	B/1	BA	
FL	605	5	B/1	BA	
BFF(FU)	700	--	--	CH/3-BS 3-HS	
FFR	702	2	B/1	CH/BA	Rd fired on 2nd trial.
BFF(FU)	800	--	--	CH/4-BS	
FSI	801	1	B/1	BA	
FFR	801	1	B/1	CH	Firing pin sticks. Rd fired on 2nd trial.
FTR	850	10	S/3	DP	
FTR	859	19	S/3	DP	
FTR	882	2	S/5	DP	
FTR	884	4	S/5	DP	
BFF(FU)	900	--	--	CH/3-BS	
FC	901	1	B/1	BA	
FL	902	2	B/1	BA	
FTR	998	18	S/5	DP	
DF	1138/1139	18/19	A/2	CH/M	
FBR	1180	20	B/4	CH	Cyclic rate prior to FBR was 703 rds/min.
FL	1202	2	B/1	BA	
FFR	1203	3	B/1	CH	Rd fired on 2nd trial.
FFR	1302	2	B/1	CH	Rd fired on 2nd trial.
FL	1402	2	B/1	BA	
FFR	1501	1	B/1	R	Firing pin sticks. Rd fired on 2nd trial.
FF	1502	2	B/1	CH/BA	Caused by short recoil of Round #1.
DF	1537/1538	17/18	A/2	CH/M	
FFR	1601	1	B/1	R	Firing pin sticks. Rd fired on 2nd trial.
FF	1602	2	B/1	CH/BA	Caused by short recoil of Round #1.
FF	1603	3	B/1	CH/BA	Caused by short recoil of Round #2.
FFR	1701	1	B/1	R	Firing pin sticks. Rd fired on 2nd trial.
FS	1702	2	B/1	BA	
FS	1703	3	B/1	BA	
FF	1802	2	B/1	CH	Rd #1 did not eject due to extremely short recoil of bolt and carrier.
FS	1802	2	B/1	BA	
FL	1803	3	B/1	BA	
FS	1901	1	B/1	BA	

Malfunction Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks
				Weapon No. C-12	
FS	1902	2	B/1	BA	
FS	1903	3	B/1	BA	
FL	1904	4	B/1	BA	
DF	1936/1937	16/17	A/2	CH/M	
DF	1939/1940	19/20	A/2	CH/M	
FTR	1946	6	S/3	DP	
FTR	1948	8	S/3	DP	
FTR	1993	13	S/5	DP	
FSI	2201	1	B/1	BA	Cover did not open on initial release of bolt.
FBR	2260	20	S/3	CH	Cyclic rate prior to FBR was 711 rds/min.
FC	2301	1	B/1	BA	
DF	2336/2337	16/17	A/2	CH/M	
FSI	2361	1	B/4	BA	
FSI	2401	1	B/1	BA	
FFR	2401	1	B/1	CH	Firing pin sticks. Rd fired on 2nd trial.
DF	2436/2437	16/17	A/2	CH/M	
FSI	2501	1	B/1	BA	
FL	2501	1	B/1	CH/2-HS	
FFR	2501	1	B/1	CH	Firing pin sticks. Rd fired on 2nd trial.
DF	2539/2540	19/20	A/2	CH/M	
FSI	2601	1	B/1	BA	
FL	2601	1	B/1	CH/HS	
FFR	2601	1	B/1	CH	Firing pin sticks. Rd fired on 2nd trial.
FSI	2701	1	B/1	BA	
FL	2701	1	B/1	CH/2-HS	
FSI	2801	1	B/1	BA	
FL	2801	1	B/1	CH/3-HS	
DF	2899/2900	19/20	S/5	CH/M	
FSI	2901	1	B/1	BA	
FFR	2902	2	B/1	CH	Apparent cause was a failure to lock.
DF	2937/2938	17/18	A/2	CH/M	

Malfunction Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks
					Weapon No. C-35
--	0	--	--	--	Install new barrel. Magazine No. 1 - 5 used.
FBR	80	20	B/4	CH	Cyclic rate prior to FBR was 719 rds/min.
FSI	201	1	B/1	BA	
FL	301	1	B/1	BA	
FL	401	1	B/1	BA	
FBR	460	20	S/3	CH	Cyclic rate prior to FBR was 693 rds/min.
BFF(FU)	500	--	--	CH/2-BS	
FSI	501	1	B/1	BA	
BFF(FU)	600	--	--	CH/4-BS	
FL	601	1	B/1	BA	
BFF(FU)	700	--	--	CH/2-BS 1-HS	
FL	701	1	B/1	BA	
BFF(FU)	800	--	--	CH/4-BS	
FC	801	1	B/1	BA	
FC	901	1	B/1	BA	
FFR	901	1	B/1	CH	Firing pin sticks. Rd fired on 2nd trial.
FJ	901	1	B/1	CH/HE	Ctg. case head caught between face of bolt and barrel extension.
FTR	995	15	S/5	DP	
FL	1202	2	B/1	BA	
FL	1203	3	B/1	BA	
FSI	1321	1	B/1	BA	
FFR	1401	1	B/1	R	Firing pin sticks. Rd fired on 2nd trial.
FFR	1501	1	B/1	R	Firing pin sticks. Rd fired on 2nd trial.
FF	1502	2	B/1	CH/BA	Caused by short recoil of Round #1.
FFR	1601	1	B/1	R	Firing pin sticks. Rd fired on 2nd trial.
FF	1602	2	B/1	CH/BA	Caused by short recoil of Round #1.
FFR	1701	1	B/1	R	Firing pin sticks. Rd fired on 2nd trial.
FF	1702	2	B/1	CH/BA	Caused by short recoil of Round #1.
FJ	1801	1	B/1	CH/ME	
FS	1802	2	B/1	BA	
FTR	1845	5	S/3	DP	
FTR	1852	12	S/3	DP	
BSI	1860	20	S/3	BR	
FF	1902	2	B/1	CH/BA	Caused by short recoil of Round #1.
FF	2360	20	S/3	CH/BR	Rd #20 prematurely released from magazine feed lips and caught between face of bolt and barrel extension.
FC	2401	1	B/1	BA	
FFR	2401	1	B/1	CH	Firing pin sticks. Rd fired on 2nd trial.
FF	2460	20	S/3	CH/BR	
FSI	2501	1	B/1	BA	
FL	2501	1	B/1	CH/3-HS	
FFR	2501	1	B/1	CH	Firing pin sticks. Rd fired on 2nd trial.
FSI	2601	1	B/1	BA	
FL	2601	1	B/1	CH/1-HS	
FFR	2601	1	B/1	CH	Firing pin sticks. Rd fired on 2nd trial.

Malfunction Type	Round Count	Round No.	Mode of Fire/ Magazine No.	Clearing Action	Remarks
			Weapon No. C-35		
FL	2602	2	B/1	BA	
FC	2701	1	B/1	BA	
2-FFR	2701	1	B/1	CH	Firing pin sticks. Rd fired on 3rd trial.
FSI	2801	1	B/1	BA	
FL	2801	1	B/1	CH/2-HS	
FFR	2801	1	B/1	CH	Firing pin sticks. Rd fired on 2nd trial.
FSI	2901	1	B/1	BA	
FFR	2901	1	B/1	CH	Firing pin sticks. Rd fired on 2nd trial.

LOW TEMPERATURE TEST MALFUNCTIONS AS RELATED TO MAGAZINE NUMBER AND ROUND SEQUENCE AND TABULATED BY 1000-ROUND INTERVALS

Cumulative Malfunction Data
1 to 1000

Wpn No.	Magazine Rd. No	First	Second	third	Fourth	Fifth	total
		Mag sequence in 100-rd cycle					
A-4	1	15	2	0	0	0	17
	2	6	0	0	0	0	6
	3	2	0	0	0	0	2
	4-20	7	0	3	1	1	12
	Total	30	2	3	1	1	37
A-5	1	18	0	0	0	0	18
	2	5	0	0	0	0	5
	3	2	0	0	0	0	2
	4-20	7	0	0	0	0	7
	total	32	0	0	0	0	32
A-6	1	15	0	0	0	0	15
	2	1	0	0	0	0	1
	3	0	0	0	0	0	0
	4-20	3	0	1	0	1	5
	total	19	0	1	0	1	21
A-7	1	17	4	1	0	0	22
	2	7	0	0	0	0	7
	3	6	0	0	0	0	6
	4-20	15	0	3	0	1	19
	Total	45	4	4	0	1	54
A-8	1	23	0	0	0	0	23
	2	3	0	0	0	0	3
	3	0	0	0	0	0	0
	4-20	0	1	0	1	0	2
	Total	26	1	0	1	0	28
A-9	1	16	0	0	0	0	16
	2	2	0	0	0	0	2
	3	0	0	0	0	0	0
	4-20	0	2	3	4	2	11
	total	18	2	3	4	2	29
A4 thro A-9							
	1	104	6	1	0	0	111
	2	24	0	0	0	0	24
	3	10	0	0	0	0	10
	4-20	32	3	10	6	5	56
	Total	170	9	11	6	5	201

Rds 1001-2000

Wpn. No.	Magazine Rd. No.	First	Second	third	Fourth	Fifth	total
A-4	1	13	1	0	0	1	15
	2	15	0	0	0	0	15
	3	13	0	0	0	0	13
	4-20	22	0	0	0	3	25
	Total	63	1	0	0	4	68
A-5	1	11	2	0	0	0	13
	2	10	0	0	0	1	11
	3	11	0	0	0	1	12
	4-20	27	0	2	1	8	38
	Total	59	2	2	1	10	74
A-6	1	7	0	0	0	0	7
	2	3	0	0	0	0	3
	3	0	0	0	0	0	0
	4-20	4	0	0	0	1	5
	total	14	0	0	0	1	15
A-7	1	11	1	0	1	0	13
	2	10	0	0	1	0	11
	3	9	0	1	0	0	10
	4-20	17	0	1	1	2	21
	Total	47	1	2	3	2	55
A-8	1	6	0	0	0	0	6
	2	7	0	0	0	0	7
	3	1	0	0	0	0	1
	4-20	1	0	0	1	1	3
	Total	15	0	0	1	1	17
A-9	1	7	0	1	0	0	8
	2	3	0	0	0	0	3
	3	0	0	0	0	0	0
	4-20	1	1	3	3	1	9
	total	11	1	4	3	1	20
A-4 thro A-9							
	1	55	4	1	1	1	62
	2	48	0	0	1	1	50
	3	34	0	1	0	1	36
	4-20	72	1	6	6	16	101
	total	209	5	8	8	19	249

Rds 2001-3000

Wpn No.	Magazine Rd. No.	First	Second	Third	Fourth	Fifth	Total
A-4	1	23	0	0	0	0	23
	2	1	0	0	0	0	1
	3	1	0	0	0	0	1
	4-20	1	0	1	2	0	4
	Total	26	0	1	2	0	29
A-5	1	22	0	0	0	0	22
	2	0	0	0	0	0	0
	3	0	0	0	0	0	0
	4-20	0	0	2	0	0	2
	Total	22	0	2	0	0	24
A-6	1	15	0	0	0	0	15
	2	0	0	0	0	0	0
	3	0	0	0	0	0	0
	4-20	4	0	0	0	2	6
	Total	19	0	0	0	2	21
A-7	1	16	1	1	0	0	18
	2	2	0	0	1	0	3
	3	0	0	0	0	0	0
	4-20	1	0	1	0	0	2
	Total	19	1	2	1	0	23
A-8	1	27	0	0	0	1	28
	2	0	0	0	0	0	0
	3	0	0	0	0	0	0
	4-20	0	1	4	11	4	20
	Total	27	1	4	11	5	48
A-9	1	20	0	1	0	0	21
	2	0	0	0	0	0	0
	3	0	0	0	0	0	0
	4-20	0	1	1	2	0	4
	Total	20	1	2	2	0	25
A4 thru A-9							
	1	123	1	2	0	1	127
	2	3	0	0	1	0	4
	3	1	0	0	0	0	1
	4-20	6	2	9	15	6	38
	Total	133	3	11	16	7	170

Rd. 1-1000

Magazine

Wpn. No.	Rd. No.	First	Second	third	Fourth	Fifth	Total
B-4	1	17	0	0	0	0	17
	2	5	0	1	0	1	7
	3	4	0	0	0	0	4
	4-20	12	0	9	0	1	22
	total	38	0	10	0	2	50
B-5	1	12	0	0	0	0	12
	2	2	0	0	0	0	2
	3	0	0	0	0	0	0
	4-20	0	0	1	0	0	1
	Total	14	0	1	0	0	15
B-6	1	15	0	0	0	0	15
	2	7	0	0	0	0	7
	3	3	0	0	0	0	3
	4-20	5	0	2	0	0	7
	Total	30	0	2	0	0	32
B-7	1	17	0	0	0	0	17
	2	5	0	0	0	0	5
	3	2	0	0	0	0	2
	4-20	4	3	3	1	1	12
	Total	28	3	3	1	1	36
B-8	1	11	0	0	0	0	11
	2	1	0	0	0	0	1
	3	0	0	0	0	0	0
	4-20	1	0	0	0	0	1
	Total	13	0	0	0	0	13
B-9		Weapons withdrawn from test					
B4 thru B8							
	1	72	0	0	0	0	72
	2	20	0	1	0	1	22
	3	9	0	0	0	0	9
	4-20	22	3	15	1	2	43
	Total	123	3	16	1	3	146

Rd. 2001 - 3000

Magazine

Wpn. No.	Rd. No.	First	Second	Third	Fourth	Fifth	Total
B-4	1	13	0	0	0	0	13
	2	2	0	0	0	0	2
	3	1	0	0	0	0	1
	4-20	4	2	3	0	0	9
	Total	20	2	3	0	0	25
B-5	1	16	0	0	0	0	16
	2	0	0	0	0	0	0
	3	0	0	0	0	0	0
	4-20	0	1	1	0	0	2
	Total	16	1	1	0	0	18
B-6	1	17	0	0	0	0	17
	2	0	0	1	0	0	1
	3	1	0	0	0	0	1
	4-20	3	1	0	1	0	5
	total	21	1	1	1	0	24
B-7	1	Test terminated on this weapon					
	2						
	3						
	4-20						
	Total						
B-8	1	9	0	0	0	0	9
	2	0	0	0	0	0	0
	3	0	0	0	0	0	0
	4-20	0	0	0	0	0	0
	Total	9	0	0	0	0	9
B-9		Weapon withdrawn from test					
B4 thru B8							
	1	55	0	0	0	0	55
	2	2	0	1	0	0	3
	3	2	0	0	0	0	2
	4-20	7	4	4	1	0	16
	Total	66	4	5	1	0	76

Rd. 1001-2000

Magazine

Wpn. No.	Rd. No.	First	Second	third	Fourth	Fifth	Total
B-4	1	7	1	1	0	0	0
	2	9	0	0	0	0	0
	3	3	0	0	0	2	0
	4-20	14	0	5	0	23	0
	Total	33	1	6	0	25	65
B-5	1	1	0	0	0	0	1
	2	5	0	0	0	0	5
	3	0	0	0	0	0	0
	4-20	0	0	1	0	2	3
	Total	6	0	1	0	2	9
B-6	1	3	0	0	0	0	3
	2	8	0	0	0	0	8
	3	3	0	0	0	0	3
	4-20	5	0	11	0	2	18
	Total	19	0	11	0	2	32
B-7	1	Test terminated on this weapon					
	2						
	3						
	4-20						
	Total						
B-8	1	2	0	0	0	0	2
	2	4	0	0	0	0	4
	3	1	0	0	0	0	1
	4-20	2	0	3	0	0	5
	Total	9	0	3	0	0	12
B-9		Weapon withdrawn from test					
B4 thru B8							
	1	13	1	1	0	0	15
	2	26	0	0	0	0	26
	3	7	0	0	0	2	9
	4-20	21	0	20	0	27	68
	Total	67	1	21	0	29	118

Rd No. 1-1000

Wpn. No.	Magazine Rd. No.	First	Second	Third	Fourth	Fifth	Total
C-4	1	17	0	0	0	0	17
	2	7	0	0	0	0	7
	3	4	0	0	0	0	4
	4-20	15	0	0	0	1	16
	Total	43	0	0	0	1	44
C-5	1	16	0	0	0	0	16
	2	3	0	0	0	0	3
	3	2	0	0	0	0	2
	4-20	7	0	6	4	1	18
	Total	28	0	6	4	1	49
C-6	1	15	0	0	0	0	15
	2	7	0	0	0	0	7
	3	3	0	0	0	0	3
	4-20	3	0	1	0	2	6
	Total	28	0	1	0	2	31
C-7	1	15	1	0	0	0	16
	2	5	0	0	0	0	5
	3	3	0	0	0	0	3
	4-20	7	0	3	2	4	16
	Total	30	1	3	2	4	40
C-12	1	14	0	0	0	0	14
	2	6	0	0	0	1	7
	3	0	0	0	0	0	0
	4-20	2	0	1	0	1	4
	Total	22	0	1	0	2	25
C-35	1	14	0	0	0	0	14
	2	0	0	0	0	0	0
	3	0	0	0	0	0	0
	4-20	0	0	1	1	1	3
	Total	14	0	1	1	1	17
C4 thru C35							
	1	91	1	0	0	0	92
	2	28	0	0	0	1	29
	3	12	0	0	0	0	12
	4-20	34	0	12	7	10	63
	Total	165	1	12	7	11	196

Rd No. 2001-3000

Magazine

Wpn No.	Rd. No.	First	Second	Third	Fourth	Fifth	Total
C-4	1	15	0	0	0	0	15
	2	2	0	1	0	0	3
	3	3	0	0	0	0	3
	4-20	1	0	2	0	1	4
	total	21	0	3	0	1	25
C-5	1	12	0	0	0	0	12
	2	0	0	0	0	0	0
	3	0	0	1	0	0	1
	4-20	1	0	0	2	0	3
	total	13	0	1	2	0	16
C-6	1	20	0	0	0	0	20
	2	0	0	0	0	0	0
	3	0	0	0	0	0	0
	4-20	0	0	0	1	0	1
	Total	20	0	0	1	0	21
C-7	1	17	1	0	0	0	18
	2	0	0	1	0	1	2
	3	0	0	1	0	1	2
	4-20	2	1	22	1	5	31
	Total	19	2	24	1	7	53
C-12	1	15	0	0	0	0	15
	2	1	0	0	0	0	1
	3	0	0	0	0	0	0
	4-20	0	4	1	1	1	7
	Total	16	4	1	1	1	23
C-35	1	16	0	0	0	0	16
	2	1	0	0	0	0	1
	3	0	0	0	0	0	0
	4-20	0	0	2	0	0	2
	Total	17	0	2	0	0	19
C4 thro C-35							
	1	95	1	0	0	0	96
	2	4	0	2	0	1	7
	3	3	0	2	0	1	6
	4-20	4	5	27	5	7	48
	Total	106	6	31	5	9	157

Rd. No. 1001-2000

Wpn. No.	Magazine Rd. No.	First	Second	Third	Fourth	Fifth	Total
C-4	1	12	0	0	0	0	12
	2	9	0	0	0	0	9
	3	9	0	0	0	0	9
	4-20	17	0	1	1	0	19
	Total	47	0	1	1	0	49
C-5	1	11	2	1	0	0	14
	2	13	0	0	0	0	13
	3	10	0	0	0	0	10
	4-20	43	1	1	9	2	56
	Total	77	3	2	9	2	93
C-6	1	7	0	0	0	0	7
	2	6	0	0	0	0	6
	3	1	0	1	0	0	2
	4-20	1	0	1	0	2	4
	Total	15	0	2	0	2	19
C-7	1	14	2	1	0	0	17
	2	9	0	1	0	0	10
	3	10	0	1	0	0	11
	4-20	22	1	4	0	0	27
	Total	55	3	7	0	0	65
C-12	1	4	0	0	0	0	4
	2	9	0	0	0	0	9
	3	5	0	0	0	0	5
	4-20	1	4	2	1	1	9
	Total	19	4	2	1	1	27
C-35	1	6	0	0	0	0	6
	2	6	0	0	0	0	6
	3	1	0	0	0	0	1
	4-20	0	0	3	0	0	3
	Total	13	0	3	0	0	16
C4 thro C35							
	1	54	4	2	0	0	60
	2	52	0	1	0	0	53
	3	36	0	2	0	0	38
	4-20	84	6	12	11	5	118
	Total	226	10	17	11	5	269

DEPARTMENT OF THE ARMY
HEADQUARTERS, UNITED STATES ARMY WEAPONS COMMAND
ROCK ISLAND ARSENAL
ROCK ISLAND, ILLINOIS 61201

AMSWE-QA

17 December 1968

SUBJECT: Quality Assurance Initial Production and Comparison Tests of the M16A1 Rifle

Commanding General
U. S. Army Test and Evaluation Command
ATTN: AMSTE-BC, Mr. Crider
Aberdeen Proving Ground, Maryland 21005

1. Reference AMCPM-RS DF dated 2 December 1968, subject: Initial Production Test Plan Rifle, 5.56mm, M16A1, dated 18 September 1968, (copy inclosed).

2. Request Accuracy, Velocity, and Yaw Requirements of Reference 1 be included in the two Initial Production Tests and the Comparison Test of the M16A1 Rifle.

3. Additional funding for the above will be provided by Project Manager, Rifles, in accordance with your estimate of $1,500 per individual test.

FOR THE COMMANDER:

C J McCutcheon

f/ C. A. MacLEOD
Chairman, M16A1 Rifle Task Group
Quality Assurance Directorate

DISPOSITION FORM

(AR 340-15)

REFERENCE OR OFFICE SYMBOL	SUBJECT
	Initial Production Test Plan Rifle, 5.56MM, M16A1 dated 18 September 1968

TO AMSWE-QAV
ATTN: C. A. MacLeod

FROM AMCPM-RS

DATE 2 DEC 1968
Mr. Ackley/rmk/6884

CMT 1

1. Request the following be added to the Endurance Section (para. 12.1.2, Part II) of subject test plan.

a. Each rifle be subjected to a dispersion test of five 10-round groups obtained at 100 meters. Intervals of fire are specified in the firing schedule below.

b. Each rifle be subjected to a velocity test of 20 rounds. Intervals of fire are specified in the firing schedule.

c. Each dispersion target be checked for yaw. Any round showing a yaw of 15 degrees or more is to be recorded.

2. Firing schedule:

	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	8,600
Accuracy:	X		X		X		X		X	X
Velocity:	X		X		X		X		X	X
Yaw:	X		X		X		X		X	X

3. Accuracy and velocity firings are to be conducted in a manner in agreement with accepted standard test procedures.

FOR THE PROJECT MANAGER:

Wm C Davis Jr

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

CONCURRENCE:

AMCPM-RS [illegible signature] 2 Dec
Quality Assurance Division Date

DA FORM 1 FEB 62 2496 REPLACES DD FORM 96, EXISTING SUPPLIES OF WHICH WILL BE ISSUED AND USED UNTIL 1 FEB 63 UNLESS SOONER EXHAUSTED. * U.S. GOVERNMENT PRINTING OFFICE : 1963 O—707-811

(COPY)

MrAWilson/ps/234-3350/4821

STEAP-MT-TI

SUBJECT: Memorandum for Record Concerning Test Objectives, Reporting Technique and Classification for IP and IC Tests of M16A1 Rifles to be Conducted by APG

TO: Commanding General, US Army Test and Evaluation Command
ATTN: AMSTE-BC
Commanding General, US Army Weapons Command, ATTN: AMCPM-RS, AMSWE-QAT, Rock Island, Illinois 61201
Commanding Officer, Rock Island Arsenal, ATTN: SWERI-QAT, Rock Island, Illinois 61202

Subject memorandum is forwarded for information and retention.

FOR THE COMMANDER:

1 Incl
as

JAMES C. WHITE
Acting Chief, Infantry and Aircraft Weapons Division
Materiel Test Directorate

MEMORANDUM FOR RECORD 10 January 1969

SUBJECT: Test Objectives, Reporting Technique and Classification for IP and IC Tests of M16A1 Rifles to be Conducted by APG

1. This memo will confirm an agreement concerning test objectives for the combined IPT and ICT of M16A1 rifles (USATECOM Projects Nos. 8-9-0200-25 and 8-9-0200-27) which was established at a conference on 9 January 1969.

2. Representatives from AMSTE-BC (Mr. Crider), SWERI-QAT (Mr. Spears), AMCPM-RS (Mr. Pelcharsky) and AMSWE-QAT (Mr. Walker) advised that the formal objectives as stated in the IPT and ICT plans of test are to be considered as objectives to be evaluated by the customer agencies following submission of the final test report by MTD.

3. The MTD test objectives were agreed to be as follows:

To conduct, analyze and report the data necessary to permit evaluation by USAWECOM and USAMC of materiel requirements as stated in the objective paragraphs of the respective test plans, and to permit USATECOM to determine the degree of suitability of the test items for issue to the user per AMCR 700-34.

4. The reporting of initial production test results for two new rifle producers and the test results for current Colt production weapons (ICT) will be reported in a single report covering all test results in a manner to facilitate comparison of results between producers.

5. Unless advised otherwise by AMCPM-RS, the test report will be unclassified but will contain a removable code sheet identifying a coded designation for each producer.

SIGNED Allan Wilson
ALLAN J. WILSON
Small Arms & Aircraft Weapons Branch
Materiel Test Directorate

CF:
AMSTE-BC
SWERI-QAT
AMCPM-RS
AMSWE-QAT

DEPARTMENT OF THE ARMY
HEADQUARTERS, UNITED STATES ARMY WEAPONS COMMAND
ROCK ISLAND ARSENAL
ROCK ISLAND, ILLINOIS 61201

IN REPLY REFER TO
AMSWE-QA

14 January 1969

SUBJECT: M16A1 Rifle Initial Production Test Plan

Commanding General
U. S. Army Test & Evaluation Command
ATTN: AMSTE-BC, Mr. Crider
Aberdeen Proving Ground, Maryland 21005

1. Reference meeting at U. S. Army Test and Evaluation Command on 9 Jan 69, subject: M16A1 Rifle and 30-Round Magazine Initial Production Test.

2. Subject test plan is to be updated in accordance with agreements reached at subject meeting between Project Managers, U. S. Army Test & Evaluation Command, Aberdeen Proving Ground, Rock Island Arsenal, and U. S. Army Weapons Command representatives.

3. The following changes are applicable to subject plan as of 13 Jan 69:

a. Para 6.6: Change August to November.

b. Para 7.2: Delete Table II and add Appendix J, para 5.0.

c. Para 8.3: Change to read, "The seven Endurance rifles shall be subjected to the following accuracy test."

d. Para 10.1.1: Change to read, "Low Temperature Test. Subject six new rifles to the low temperature test in accordance with the following procedure: Condition to weapons, 3000 rounds of ammunition and five magazines per weapon at -65°F temperature for 6 hours before firing. Test fire each weapon (three firing M193 ball ammunition and three firing a mix of 4 M193 ball to one M196 tracer cartridges). Test fire in accordance with the firing schedule in ref. 1e. Allow 2 hours between cycles. Perform maintenance at 1000-round intervals. For the first ten cycles (1000 rounds) condition the weapon with the bolt closed on an empty chamber; for cycles 11 thru 20, with the bolt closed on a loaded round; and for the last ten cycles, condition with bolt open and empty chamber. During each two hour conditioning period the dust cover is closed and selector is positioned to SAFE."

e. Para 10.1.5: Change to read, "Subject three new rifles to a dynamic dust test. ---."

AMSWE-QA 14 January 1969
SUBJECT: M16A1 Rifle Initial Production Test Plan

f. Delete para 12.1.1 and 12.1.2.

g. Change para 12.1 to read, "Use the seven rifles previously fired for accuracy, perform maintenance and inspection prior to initiation of this test. Five weapons will fire M193 ball cartridges; the remainder will fire M193 ball and M196 tracer cartridges in a ratio of 4 ball to 1 tracer. Perform maintenance and inspection at 1000-round intervals. After maintenance periods 2, 4, 6, 8 and 10, fire five 10-round targets per weapon using the accuracy test lot of ammunition. In recording cyclic rates of fire during each 100-round cycle, after maintenance periods 1, 3, 5, 7, and 9, record the first cyclic rate of each weapon from a Government-approved test stand. Conduct the remainder of testing in accordance with the firing sequence cited in Appendix G of SAPD-253F.

h. Change Appendix D per Inclosure 1.

4. In addition, Barrel Bore Gages cited in Appendix B of subject plan will not be provided due to their unavailability.

CAMacLeod

1 Incl
as

C. A. MacLEOD
Chairman, M16A1 Rifle Task Group
Quality Assurance Directorate

CF:
CO, Aberdeen Proving Ground
ATTN: STEAP-MT-TI, Michelson w/incl
CO, Rock Island Arsenal
ATTN: SWERI-QA, Ahlberg w/incl

DEPARTMENT OF THE ARMY
HEADQUARTERS, UNITED STATES ARMY WEAPONS COMMAND
ROCK ISLAND ARSENAL
ROCK ISLAND, ILLINOIS 61201

AMSWE-QA

20 January 1969

SUBJECT: M16A1 Rifle Initial Production Tests and Comparison Test

Commanding General
U. S. Army Test & Evaluation Command
ATTN: AMSTE-BC, Mr. Crider
Aberdeen Proving Ground, Maryland 21005

1. Reference AMSWE-QA letter dated 14 January 1969, subject: M16A1 Rifle Initial Production Test Plan.

2. Updated test plan per referenced letter is also applicable to subject Comparison Test.

3. In addition, request paragraph 3d, 4th sentence of subject letter be changed to read: "Test fire in accordance with the firing schedule in Appendix G, paragraph 2.4 of SAPD-253F."

FOR THE COMMANDER:

C. A. MacLEOD
Chairman, M16A1 Rifle Task Group
Quality Assurance Directorate

CF:
CO, Aberdeen Proving Ground
ATTN: STEAP-MT-TI, Michelson
CO, Rock Island Arsenal
ATTN: SWERI-QA, Ahlberg

COPY/do

287

PTTUZYUW RUCIRRA7889 0872110-UUUU-RUEBEAA.

ZNR UUUUU

P 282115Z MAR 69

1 APR 69
ACTION: MTD
INFO: ISD
Safety

FM CGUSAWECOM ROCK ISLAND ILL

TO RUEBEAA/CGUSATECOM APG ABERDEEN MD

INFO RUEBBNA/CGUSAMC

RUEBEAA/CO APG ABERDEEN MD

ZEN/CO ROCK ISLAND ARSENAL ROCK ISLAND ILL

BT

UNCLAS RI 7889 FROM AMSWE-QA MCARTHUR; FOR AMSTE-BC COL MOLLOY INFO AMCQA-P TINER; STEAP-MT-TI MR. WILSON; SWERI-QA CROSS

SUBJ CLN M16A1 RIFLE INITIAL PRODUCTION TEST (USATECOM PROJECT NO. 8-9-0200-25

1. REFERENCE IS MADE TO AMSWE-QA LTR DTD 14 JAN 69, SUBJ CLN M16A1 RIFLE INITIAL PRODUCTION TEST.

2. THIS COMMAND HAS TAKEN ACTION TO PROVIDE ABERDEEN PROVING GROUND WITH 14 GM RIFLES (12 TEST AND 2 BACK-UP) BY 29 MAR 69 AND 14 H&R RIFLES (12 TEST AND 2 BACK-UP) BY 2 APR 69. IN ADDITION TO MAGAZINES SUPPLIED WITH RIFLES, 120 MAGAZINES WILL BE PROVIDED.

3. IT IS REQUESTED THAT AN ENDURANCE TEST BE CONDUCTED BEGINNING 31 MARCH 69 ON THE ABOVE RIFLES IN ACCORDANCE WITH INITIAL PRODUCTION TEST PLAN, PARA 12, DATED 5 DEC 68 AND REFERENCED LETTER DATED 14 JAN 69. ACCURACY FIRING REQUIRED BY PARA 3G OF REFERENCED LETTER IS NOT REQUIRED.

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PAGE 2 RUCIRRA7889 UNCLAS

4. EIGHT (8) RIFLES OF EACH SET OF 12 TEST RIFLES WILL BE FIRED USING BALL AMMUNITION AND THE REMAINING 4 RIFLES OF EACH SET OF 12 TEST RIFLES WILL BE FIRED USING COMBAT LOAD (4 BALL AND 1 TRACER) AMMUNITION. THE TOTAL ROUNDS TO BE FIRED FROM EACH TEST RIFLE IS 6,000 ROUNDS.

BT

#7889

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

SD: 11 & 22 Apr 69
9 May 69

AMSTE-BC

2 APR 1969

SUBJECT: Initial Production Retest of Endurance Phase for M16A1 Rifles, USATECOM Project No. 8-9-0200-25

Commanding Officer
Aberdeen Proving Ground
ATTN: STEAP-CO-P

1. References:

a. Initial Production Test (IPT) Plan, dated 18 Sep 68, USATECOM Project No. 8-9-0200-25.

b. Inspection Comparison Test (ICT) Plan, dated 5 Dec 68, USATECOM Project No. 8-9-0200-27.

c. Command Briefing on Initial Production Rifles at HQ USAMC on 29 Mar 69 by Project Manager, Rifles.

2. From reference 1c, it was directed that this command conduct a retest of the endurance phase to confirm that the malfunctions of "failure of bolt to remain rearward (FBR)" for the General Motors (GM) weapons and the "double feeds (DF)" in the Harrington and Richardson (H&R) weapons, as well as Colt weapons, have been corrected. It is requested that CO APG conduct the endurance phase of the IPT, ref 1a, in the same manner as before except for the following:

a. Delete accuracy phase.

b. Magnaglo at beginning, after 3000 rounds and after 6000 rounds.

c. Of the 12 weapons from each producer, fire 8 with all ball and 4 with 4 ball/1 tracer mix.

d. Measure cyclic rates from the shoulder at beginning and every 1000 rounds thereafter (during first automatic burst after cleaning).

e. Test will consist of firing a total of 6000 rounds through each weapon.

AMSTE-BC 2 APR 1969

SUBJECT: Initial Production Retest of Endurance Phase for M16A1 Rifles, USATECOM Project No. 8-9-0200-25

f. Inspect, as a minimum, the bolt catch and bolt lugs for each weapon. USAWECOM personnel are being made available to assist in making these measurements.

3. Fourteen weapons from each of three producers have been provided of which 12 of each are to be tested. This retest is to be conducted in two phases, with a minimum of six weapons in the first phase, and the remaining weapons in the second phase. The two spares may be used for parts as necessary. Utilize the current USATECOM Project No. 8-9-0200-25 for this task. Additional funds in the amount of $50,000 should be available by 2 Apr 69.

4. A tabulation in chart form showing the specific malfunctions for each weapon is to be provided this command on 11 Apr for the first phase and a consolidated chart for all weapons on 22 Apr for the second phase. During the test, a daily telephonic report is required. The IPT final report due this command on 9 May 69 will include the results of this retest.

FOR THE COMMANDER:

C. J. MOLLOY, JR.
Colonel, GS
Dir, Inf Mat Test

Copies furnished:
CG USAMC ATTN: AMCQA-P, AMCPMSO-RS
CG USAWECOM ATTN: AMSWE-QA
Project Manager, Rifles, USAWECOM
CO APG ATTN: STEAP-MT-TI

AMSTE-BC (5 Mar 69) 1st Ind
SUBJECT: Initial Production Test of Harrington & Richardson M16A1 Rifles (USATECOM Project No 8-9-0200-25)

HQ, US Army Test and Evaluation Command, Aberdeen Proving Ground, Md. 21005

TO: Commanding General, US Army Weapons Command, ATTN: AMSWE-QA

1. Relative to definitions of shortcoming and deficiency, the final decision concerning the appropriate category depends both on the nature of and degree of loss of operational capability.

2. This command agrees that the specific defect is a deficiency but considers it a manufacturing or quality control problem rather than a design flaw. To assure emphasis on corrective action it will be changed from "shortcoming". A demonstration of corrective action is required, regardless of the category, prior to 31 Mar 69, since the defect is considered a bar to suitability release. EPR (K-2)-3 is considered in the same malfunction category as (K-2)-21.

3. It is requested that this command be provided copies of all correspondence concerning the EPR's and corrective action thereon, for inclusion in the final reports.

FOR THE COMMANDER:

wd incl

GOODWIN MORROW
Acting Director
Inf Mat Test Dir

Copy furnished: (w/b ltr)
CO APG ATTN: STEAP-MT-TI

DEPARTMENT OF THE ARMY
HEADQUARTERS, UNITED STATES ARMY WEAPONS COMMAND
ROCK ISLAND ARSENAL
ROCK ISLAND, ILLINOIS 61201

S - 14 Mar 69

AMSWE-QA

5 March 1969

SUBJECT: Initial Production Test of Harrington & Richardson M16A1 Rifles (USATECOM Project No 8-9-0200-25)

Commanding General
U. S. Army Test & Evaluation Command
ATTN: AMSTE-BC, Mr. Crider
Aberdeen Proving Ground, Maryland 21005

1. Reference Equipment Performance Report (EPR) No (K-2)-21 (inclosed) dated 19 February 1969, item: Selector Lever P/N 91959 (class - shortcoming).

2. In view of the incident description cited on referenced EPR, it is felt that the incident class should be changed from shortcoming to a deficiency. This is due to the fact that description specifies that the rifle is inoperative.

3. It is requested that this Command, ATTN: AMSWE-QA, be provided by 14 March 1969, U. S. Army Test & Evaluation Command's position with reference to the above suggestion.

FOR THE COMMANDER:

1 Incl
as

C. A. MacLEOD
Chairman, M16A1 Rifle Task Group
Quality Assurance Directorate

CF:
CO, Aberdeen Proving Ground
ATTN: STEAP-MT-TI w/o incl

APPENDIX III - REFERENCES

1. USATECOM Test Directive, 18 October 1968, Form 1028, Initial Production Test of M16A1 Rifles.

2. USATECOM Test Directive, 31 December 1968, Form 1028, Quality Assurance (Inspection Comparison) Test of M16A1 Rifles.

3. Letter with Memorandum, STEAP-MT-TI to AMSTE-BC, 10 January 1969, Test Objectives, Reporting and Classification for IP and IC Tests of M16A1 Rifles.

4. First Indorsement, AMSTE-BC to AMSWE-QA, 5 March 1969, Initial Production Test of Code B M16A1 Rifles.

5. Letter, AMSWE-QA to AMSTE-BC, 5 March 1969, Initial Production Test of Code B M16A1 Rifles.

6. USATECOM Pamphlet on Definitions and Identifications of Malfunctions for 5.56-MM Weapons; Allan Wilson, November 1968.

7. TM 9-1005-249-12, Operator and Organizational Manual for the M16A1 Rifle, August 1968.

8. TM 9-1005-249-34, Direct and General Support Manual for the M16A1 Rifle, August 1968.

9. USAWECOM Comparison Test Plan for Rifle, 5.56-MM, M16A1, 5 December 1968.

10. USAWECOM Initial Production Test Plan for Rifle, 5.56-MM, 18 September 1968.

11. TT No. 7889, AMSWE-QA to AMSTE-BC, 28 March 1969, M16A1 Rifle Initial Production Test.

12. Letter, AMSTE-BC to STEAP-CO-P, 2 April 1969, Initial Production Retest of M16A1 Rifles.

13. Small Arms Purchase Description for Rifle, 5.56-MM, M16 and M16A1, No. SAPD-253F, 22 November 1968.

14. Equipment Performance Report No. (K-2)-1, 13 June 1968, USATECOM Project No. 8-8-0230-05.

15. DPS-2662 (Addendum), Displacement-Time Study of Redesigned Buffer for M16A1 Rifle, Allan Wilson, May 1968.

16. DPS-2662, Final Report on Product Improvement Test of Redesigned Buffer for M16A1 Rifle, Lloyd Staley, January 1968.

17. USATECOM Test Procedure TECP 700-700, IP 20-20, 11 April 1966.

18. Letter, AMCPM-RS to AMSTE-BC, 18 April 1969, Initial Production Test of M16A1 Rifles.

APPENDIX IV - DISTRIBUTION LIST

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COMBINED INITIAL PRODUCTION AND INSPECTION COMPARISON TEST OF M16A1 RIFLES

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Final Report - 25 January to 15 May 1969

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Allan Wilson

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11. SUPPLEMENTARY NOTES

None

12. SPONSORING MILITARY ACTIVITY

13. ABSTRACT

A combined initial production and inspection comparison test of M16A1 rifles was conducted at Aberdeen Proving Ground by the Materiel Test Directorate between 25 January and 15 May 1969. Thirty-five rifles from each of two new producers as well as 35 rifles from the original producer were subjected to inspection, accuracy, endurance, displacement-time, and environmental tests. As functioning deficiencies were encountered with rifles from all producers, an endurance retest was conducted which demonstrated reliable performance and identified certain critical production problems which were primarily responsible for the earlier failures.

DD FORM 1 NOV 65 1473 REPLACES DD FORM 1473, 1 JAN 64, WHICH IS OBSOLETE FOR ARMY USE.

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14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
M16A1 rifle Initial production test Bolt-catch design Bolt-lug configuration						

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USATECOM PROJECT NOS. 8-9-0200-25
8-9-0200-27

FINAL REPORT ON COMBINED INITIAL PRODUCTION AND INSPECTION COMPARISON TEST OF M16A1 RIFLES

Report No. APG-MT-3247

CODE SHEET

Code A - Hydramatic Div, General Motors

Code B - Harrington and Richardson Arms Corp.

Code C - Colt Firearms Co.

Code D - G. G. Greene Co. (manufacturer of magazine filler guides)

Code E - Cadillac Gage Co. (Stoner '63 Rifle)

(This code sheet is to be removed from this report when loaned or otherwise distributed outside the Department of Defense.)

(CODE SHEET CONTINUED)

APG Rifle No.	Manufacturer Serial No.	APG Rifle No.	Manufacturer Serial No.	APG Rifle No.	Manufacturer Serial No.
A1	3000170	B1	2000538	C1	1324069
A2	3000192	B2	2000555	C2	1324880
A3	3000194	B3	2000630	C3	1338881
A4	3000195	B4	2000635	C4	1339260
A5	3000200	B5	2000639	C5	1339345
A6	3000202	B6	2000642	C6	1339828
A7	3000206	B7	2000660	C7	1340716
A8	3000207	B8	2000666	C8	1341028
A9	3000208	B9	2000667	C9	1341211
A10	3000210	B10	2000673	C10	1342697
A11	3000239	B11	2000680	C11	1343907
A12	3000240	B12	2000681	C12	1343913
A13	3000241	B13	2000693	C13	1344159
A14	3000248	B14	2000694	C14	1344252
A15	3000252	B15	2000697	C15	1344318
A16	3000253	B16	2000699	C16	1344508
A17	3000255	B17	2000702	C17	1344865
A18	3000256	B18	2000709	C18	1344978
A19	3000257	B19	2000710	C19	1345014
A20	3000258	B20	2000713	C20	1345250
A21	3000266	B21	2000725	C21	1345582
A22	3000267	B22	2000727	C22	1345665
A23	3000269	B23	2000761	C23	1346135
A24	3000270	B24	2000791	C24	1346173
A25	3000271	B25	2000812	C25	1346545
A26	3000272	B26	2000813	C26	1346546
A27	3000279	B27	2000859	C27	1346601
A28	3000280	B28	2000905	C28	1346860
A29	3000282	B29	2000909	C29	1347416
A30	3000286	B30	2000929	C30	1347476
A31	3000287	B31	2000948	C31	1347528
A32	3000289	B32	2000959	C32	1347994
A33	3000290	B33	2000961	C33	1348141
A34	3000295	B34	2000972	C34	1348380
A35	3000297	B35	2000992	C35	1348506
A36	3008902	B36	2001805	C36	1397320
A37	3008990	B37	2002024	C37	1399557
A38	3009535	B38	2002034	C38	1409717
A39	3009541	B39	2002053	C39	1444566
A40	3009581	B40	2002156	C40	1445688
A41	3009615	B41	2002336	C41	1459124
A42	3009672	B42	2002471	C42	1460814
A43	3009747	B43	2002481	C43	1461109
A44	3009935	B44	2002657	C44	1461522
A45	3009953	B45	2002699	C45	1464568
A46	3010019	B46	2002930	C46	1466707
A47	3000023	B47	2003388	C47	1467712
A48	3000032	B48	2003528	C48	1471223
A49	3010303	B49	2003654	C49	1471478