U.S. ARMY COMBAT SYSTEMS TEST ACTIVITY
ABERDEEN PROVING GROUND, MARYLAND 21005-5059
FIRING RECORD

23 June 1987

TECOM Project No. 2-WE-600-004-001,
Special Study; XM4 5.56-MM Carbine
Safety Qualification

Firing Record No.: S-51042
Dates of Test: May 1986 to May 1987
Authority: Letter, TECOM, AMSTE-TE-F,
17 December 1985

W.O. No. 330-32740-30 ar

ITEMS UNDER TEST

Carbine, Caliber 5.56-mm, XM4:

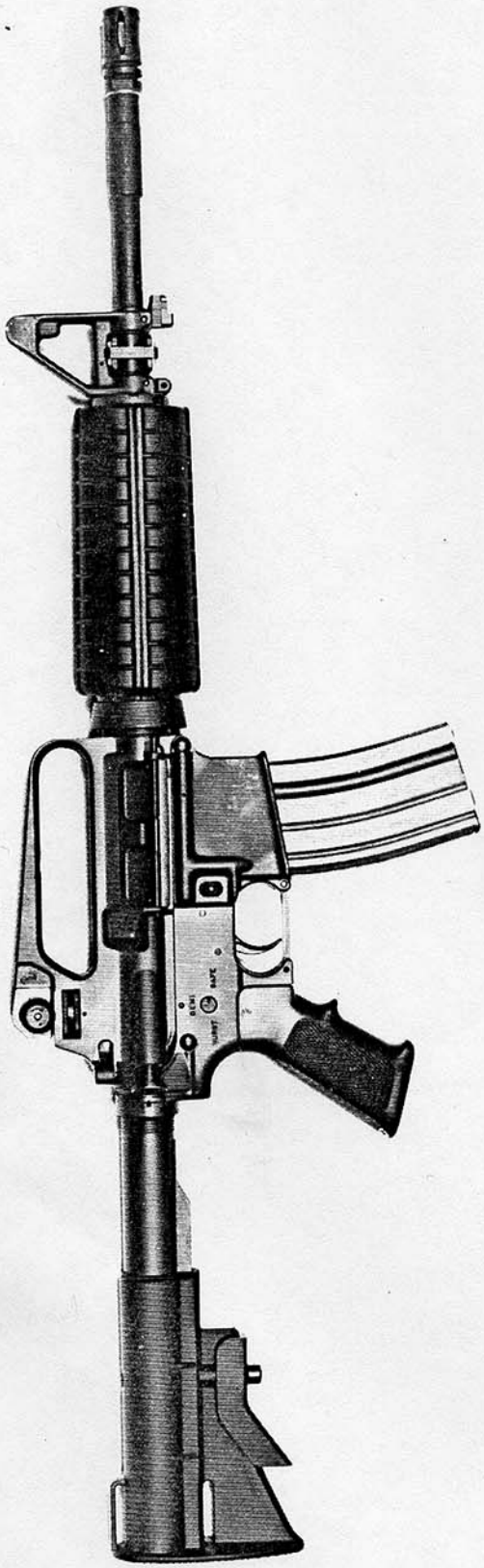
SN	Test No.	SN	Test No.
6153601	1	6153622	9
6153603	2	6153625	10
6153605	3	6153627	11
6153609	4	6153631	12
6153611	5	6153635	13
6153613	6	6153637	14
6153615	7	6153639	15
6153619	8	6153641	16

SUPPORTING FACILITIES AND MATERIALS

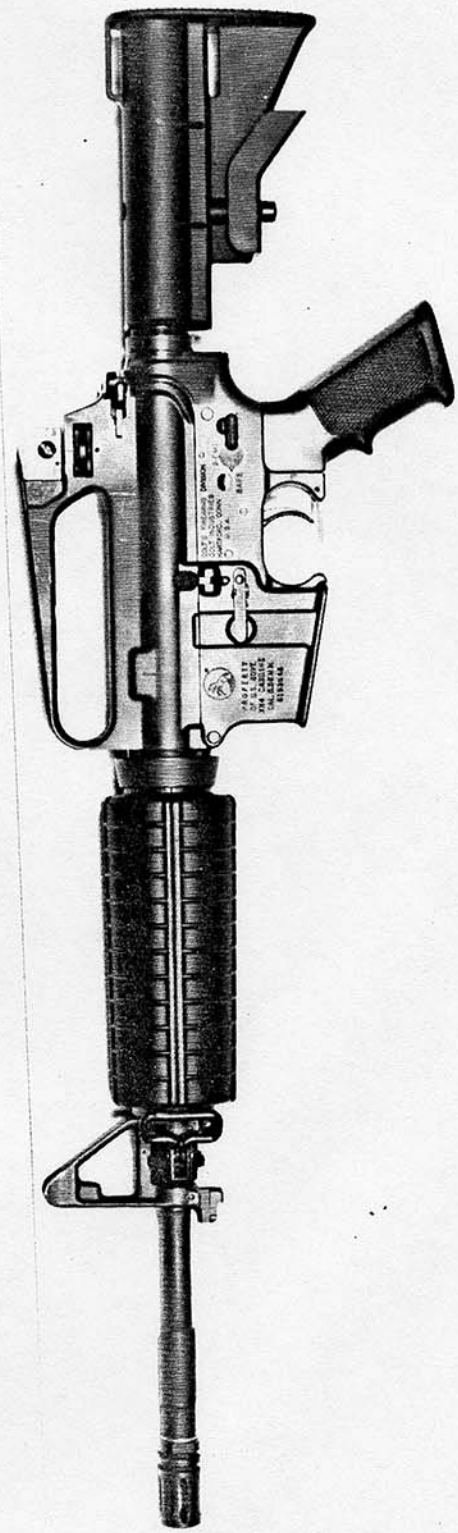
Ammunition:

Cartridge, 5.56-mm ball, M855, lot No. WCC85L030-039.
Cartridge, 5.56-mm tracer, M856, lot No. FNB84E003-011.
Cartridge, 5.56-mm ball, M193, lot No. LC83K002-212.
Cartridge, 5.56-mm, tracer, M196, lot No. LC81M010G-001.
Cartridge, 5.56-mm, blank, M200, lot No. LC81F021052.

The use of trade names in this firing record does not constitute an official endorsement or approval of the use of such commercial hardware or software. This firing record may not be cited for purposes of advertisement.



Right Side View with Stock Extended



Left Side View with Stock Retracted

XM4 Carbine

(Following Page Blank)

DETAILS OF TEST

The objective of this test was to determine if the XM4 carbine is safe to operate and meets the essential characteristics of its Required Operational Capability (ROC) document.

The test program was divided into 11 major subtests. These are listed below.

1. Initial inspection of test weapons and support equipment.
2. Initial dispersion and velocity.
3. Function check before and after component interchange.
4. Component interchange.
5. Accuracy/sight calibration verification.
6. Endurance (10,000 rounds per carbine).
7. Environmental and adverse conditions:
   a. High temperature (+155 °F).
   b. Low temperature (-65 °F).
   c. Icing (+20 °F).
   d. Unlubricated weapon.
   e. Attitudes.
   f. Sand/dust; static and dynamic tests.
   g. Mud.
   h. Simulated rain.
   i. Saltwater immersion.
   j. Chemical compatability.
8. Reliability analysis.
9. Safety and health analysis.
   a. Flash/smoke.
   b. Noise.
   c. Cookoff.

10. Human factors analysis.

11. Logistic supportability analysis.

Detailed procedures for the conduct of the program are contained in the test plan summary (ref 2), appropriate sections of which are appended to the enclosures to this report.

ROUND-BY-ROUND DATA

Pertinent round-by-round data are contained in the enclosures. Any information not presented therein is referenced in this report to data files kept for about 1 year by the test agency.

SUMMARY OF RESULTS

1. Initial Inspection (encl 1).

a. The physical characteristics and condition of the 16 XM4 carbines were determined visually and by measurement. These data are summarized in the following two tables.

TABLE 1-1. CONSOLIDATED PHYSICAL INSPECTION DATA FOR INITIAL INSPECTION OF SIXTEEN XM4 CARBINES

Item No.	Indices	Criterion Limit	Range of Measurements Max	Min	Avg	No. Weapons Met Criterion
1	Weight, lb[a]	6.5 (max)	6.04	6.00	6.02	16
2	Overall length, in.					
	a. Buttstock stowed	NA	30.2	30.1	30.2	-
	b. Buttstock extended	34.0 (max)	33.4	33.4	33.4	16
3	Action spring free length, in.	10.7	11.2	10.8	11.0	16
4	Rear sight adjustment:					
	a. Clicks below 300 m		2	1	1	
	b. Clicks above 800 m		5	2	4	
5	Firing pin protrusion, in.	0.036 (max) 0.028 (min)	0.032	0.030	0.031	16
6	Headspace, in.	1.4706 (max) 1.4646 (min)	1.4656	1.4646	1.4646	16
7	Gas system airflow pressure, psi	NA	3.3	3.0	3.1	-

TABLE 1-1 (CONT'D)

Item No.	Indices	Criterion Limit	Range of Measurements Max	Min	Avg	No. Weapons Met Criterion
8	Trigger pull weight, lb					
	a. Semiautomatic	8.5 (max) 5.5 (min)	10.2	6.8	9.3	2
	b. Controlled burst	Same	10.7	8.8	10.1	0
9	Firing pin indent, in.					
	a. Semiautomatic					
	(1) Inertia	0.008 (max)	0.006	0.004	0.006	16
	(2) Hammer	0.020 (min)	0.023	0.020	0.022	16
	b. Controlled burst					
	(1) Inertia	Same	0.006	0.005	0.005	16
	(2) Hammer	Same	0.023	0.021	0.022	16

[a]Measurements taken with type B handguard. New type C handguard increased by about 1/4 lb. New weights became: Max = 6.22; Min = 6.18; Avg = 6.20.

TABLE 1-2. SUMMARY OF INITIAL INSPECTION RESULTS FOR SIXTEEN XM4 CARBINES VISUALLY INSPECTED

Weapon ID SN	Test No.	Comments
6153601	1	Met MIL-R-63997 requirements except firing pin hole in bolt face was slightly elongated. Lock washer on pistol grip screw missing. The lock washer was installed from spare parts.
6153603	2	Met MIL-R-63997 requirements.
6153605	3	Met MIL-R-63997 requirements except firing pin hole in bolt face was slightly elongated. Spacer washer behind compensator was bent.
6153608	4	Met MIL-R-63997 requirements.
6153611	5	Met MIL-R-63997 requirements except compensator required addition of one spacer washer to allow correct alignment.
6153613	6	Met MIL-R-63997 requirements except automatic sear spring was incorrectly installed. Reinstalled in correct position (lower leg behind selector shaft). Windage knob retaining pin deformed. Compensator slightly out of correct orientation.

TABLE 1-2 (CONT'D)

Weapon ID SN	Test No.	Comments
6153615	7	Met MIL-R-63997 requirements except the proof/magnetic particle inspection mark on bolt body was barely visible.
6153619	8	Met MIL-R-63997 requirements except for traces of rust on steel components of upper receiver and barrel assembly (i.e., forward assist, handguard slip ring, trigger guard hinge pin.
6153622	9	Met MIL-R-63997 requirements except for the same comments as guns No. 7 and 8.
6153625	10	Met MIL-R-63997 requirements except the minimum headspace gauge is a tight fit.
6153627	11	Met MIL-R-63997 requirements.
6153631	12	Met MIL-R-63997 requirements except for traces of rust on front sight and handguard slip ring.
6153635	13	Met MIL-R-63997 requirements except the firing pin hole in bolt face slightly elongated. Automatic sear spring incorrectly assembled. Corrected assembly of this part (see also gun No. 6)
6153637	14	Met MIL-R-63997 requirements except the compensator was slightly off center on axial alignment. Traces of rust on charging handle latch.
6153639	15	Met MIL-R-63997 requirements except for traces of rust on the rear sight base, charging handle latch, and forward assist.
6153641	16	Met MIL-R-63997 requirements except the rear sight did not elevate to an 800 meter setting. Inspection revealed two ball detents in sight base. After removal of extra ball the sight was adjustable throughout its entire adjustment range.

b. Attachments. There are a variety of attachments adaptable to the M16A1 and M16A2 rifles. These include the M7 bayonet, M203 grenade launcher, M15A2 blank firing attachment (BFA), and the Multiple Integrated Laser Engagement System (MILES).

MILES units were not available to allow determination of fit, but are expected to fit, based on information contained in Reference 3. The bayonet fits the carbine as does the BFA. The BFA functions the carbine in a safe

manner when fired with M200 blank cartridges, although there are some potential functioning problems. The M203 grenade launcher receiver attaches to the barrel assembly of the carbine, but the handguard assembly which contains the short range ladder-type sight is not compatible. The full-range sight which clamps onto the upper receiver is compatible. The barrel of the grenade launcher is allowed to travel its full operating distance, but cannot be removed from the launcher while it is attached to the carbine. This is due to interference of the barrel latch of the launcher with the bayonet lug of the carbine front sight base. Removal of a small amount of metal from the latch would allow dismounting of the barrel from the launcher. The carbine upper half handguard fits on the carbine when the launcher is attached.

Standard night sights which attach to the upper receiver of the M16A1/A2 rifles, will attach to the XM4 carbine since the basic upper receiver is the same on all three weapons in the area of sight mounting.

Not specified as a requirement was use of the M261 .22 rim fire subcaliber device, M234 rocket-assisted grenade (RAG) launcher, and muzzle launched rifle grenades (e.g., M29). From all appearances, the M261 adapter should fit into the upper and lower receiver of the carbine. Functioning of the device is by self-contained blow-back operation; therefore, there is no dependence on the carbine's gas system. This should allow correct operation of the device.

Although the RAG launcher and various types of muzzle launched (blank or bullet fired) rifle grenades will attach/fit the carbine, no estimate of their safety or operational reliability can be made without actual testing.

2. Initial Dispersion and Velocity (encl 2).

a. Initial dispersion was scheduled to be fired from a test stand mount provided by the test sponsor/contractor. However, this mount was not available during the test because it was in use at the contractor's range to qualify commercial production weapons. In lieu of the Colt Industries mount, U.S. Army Combat Systems Test Activity (USACSTA) modified a rifle mount from their own inventory. Preliminary tests were made of this mount to establish its characteristics before the start of testing the XM4 carbines. These data are given in Table 2-1. All firing was done with XM4 carbine SN 6153601 (Test No. 1), equipped with interim handguard type B (round type with single heat shield). There were two occurrences of failure-to-eject (FEJ) stoppages during the firing of 206 rounds. These stoppages were not counted against the weapon since this was a preliminary test.

b. Prior to firing for record, the weapons were reconfigured with the new handguard (type C) which is a shortened M16A2 style handguard (eliptical), equipped with dual heat shields. Firings for initial machine rest dispersion, and all other subsequent tests, were conducted with these handguards. Firing consisted of a minimum of three fouling shots followed by five 10-round targets for each weapon. All firing was from one 30-round magazine (No. 100) which was loaded 10 rounds at a time. These data are presented in Table 2-2. The functioning performance data tabulation is given in Table 2-3.

TABLE 2-1. DATA FOR MACHINE REST EVAULATION, FIRED AT 100-YARD RANGE

Test No.	Test Condition	Target Measurements in Inches					
		EH	EV	ES	HSD	VSD	MR
1	Machine rest, weapon with handguards. Barrel supported.	4.94	6.64	7.70	1.65	1.91	2.04
2	Same as test No. 1 except barrel was unsupported.	4.96	4.12	5.71	1.75	1.27	1.89
3	Same as test No. 2 except without handguards.	5.58	4.14	6.04	1.73	1.22	1.76
4	Bench rest, shoulder fired with handguard supported.	3.58	6.10	6.73	1.07	1.83	1.73

EH = Extreme horizontal spread.
ES = Extreme spread.
EV = Extreme vertical spread.
HSD = Horizontal standard deviation.
MR = Mean radius.
VSD = Vertical standard deviation.

TABLE 2-2. INITIAL DISPERSION AND VELOCITY DATA FOR XM4 CARBINES FIRED WITH M855 BALL CARTRIDGES FROM MACHINE REST

Weapon ID		Avg Velocity,[a] ft/s	Avg ES,[b] in.
SN	Test No.		
61 53601	1	[c]2751	5.95
61 53603	2	2776	5.10
61 53605	3	2789	5.23
61 53608	4	2790	7.05
61 53611	5	2796	5.50
61 53613	6	[c]2794	[d]3.15
61 53615	7	2774	[d]4.17
61 53619	8	2784	[d]4.06
61 53622	9	2766	6.38

See footnotes at end of table.

TABLE 2-2 (CONT'D)

Weapon ID SN	Test No.	Avg Velocity,[a] ft/s	Avg ES,[b] in.
6153625	10	2778	[d]3.26
6153627	11	2765	5.42
6153631	12	2785	[d]4.41
6153635	13	[c]2747	4.67
6153637	14	2773	4.70
6153639	15	[c]2787	5.19
6153641	16	2787	5.63
Average		**2778**	4.99

[a]Average of 50 shots. Instrumental velocity was taken at 79.29 ft from the muzzle (54.36 ft to first sensor, 49.86 ft between first and second sensors).
[b]Average of five 10-round targets fired at 100-yard range.
[c]Less than 50 data points recorded due to instrumentation problems.
[d]Meets the criterion of 4.5 in. at 100-yard range. The M16A2 rifle criterion is 4.8 in. at the same range.

ES = Extreme spread.

TABLE 2-3. FUNCTIONING PERFORMANCE DATA FOR INITIAL DISPERSION FIRING OF XM4 CARBINES FIRED FROM MACHINE REST

Weapon ID SN	Test No.	No. of Malfunctions, by Type FFD	FTC	FFR	FEX	FEJ	FBR	Other	Total	Total Rd Fired
6153601	1								0	53
6153603	2								0	66
6153605	3								0	53
6153608	4					12			12	53
6153611	5					1			1	53
6153613	6								0	53
6153615	7								0	53
6153619	8								0	53
6153622	9								0	53
6153625	10								0	53
6153627	11								0	53
6153631	12								0	53
6153635	13								0	53
6153637	14								0	53
6153639	15								0	53
6153641	16								0	53
Total	16	0	0	0	0	13	0	0	13	861

TABLE 2-3 (CONT'D)

FBR = Failure of bolt to remain to rear after firing last round from magazine.
FEJ = Failure to eject.
FEX = Failure to extract
FFD = Failure to feed.
FFR = Failure to fire.
FTC = Failure to chamber.

c. Only 6 of 16 XM4 carbines used during the testing met the 4.5-inch extreme-spread requirement for dispersion when initially fired with M855 ball ammunition during acceptance at the manufacturer's facility. The Colt designed UNIV-162 mount was used. Nine of the same 16 carbines met the requirement with M193 ball cartridges. Only three of the same weapons met the dispersion requirement with both ammunition types. This variation in ammunition/weapon performance suggests that the mount used at the manufacturer's facility produces variable results not representative of the true performance of the carbine when hand held and fired from the shoulder. Dispersion results from machine rest firings of the carbines at APG also show variability which may indicate that the APG mount is not optimized for dispersion firing.

The machine rest used at APG retained the carbine only by the lower receiver extension. This allowed free movement of the upper receiver and barrel assembly. Some carbines were not adversely affected by looseness of the upper and lower receiver, while others were. The limited scope of testing did not allow development and testing of an optimized mount. The mount used did allow relative comparisons among carbines.

In order to validate the ability of the carbine to meet dispersion requirements, the results of accuracy/sight calibration firings (para 5) were analysed. Excluding short range firings which used the large aperture of the sight (see discussion under that subtest), it is apparent that all three carbines satisfied the dispersion requirement, even the one carbine which did not satisfy either Colt or APG machine rest dispersion firings (SN 6153611). This further reinforces the feeling that machine rest design for dispersion firing of weapons of 2-piece construction is not optimized.

3. Initial Function (encl 3).

After completion of initial dispersion firings, each weapon was fired a minimum of 120 rounds to check functioning. Cycle rate averages were recorded for the first two 30-round magazines fired from each carbine. These data are reported in Table 3-1. All firing was from a benchrest with the carbine hand-held, buttstock extended and supported from the gunner's shoulder. The handguard was supported/controlled by a combination of the gunner's hand and/or sandbag support.

TABLE 3-1. INITIAL FUNCTION PERFORMANCE DATA FOR XM4 CARBINES FIRED FROM BENCHREST

Weapon ID SN	Test No.	Average Velocity, ft/s 1 to 30	31 to 60	Average Cyclic Rate, spm 1 to 30	31 to 60	No. Rd Fired	No. Malfunction per Type FFD	UCF	FEJ	Charge to Weapon
6153601	1	-	-	856	850	120	0	0	0	
6153603	2	-	-	865	859	120	0	0	0	
6153605	3	-	-	838	851	120	0	0	0	
6153608	4	-	-	832	844	120	0	0	0	
6153611	5	-	-	844	856	120	0	[a]1	0	1
6153613	6	-	-	876	879	120	0	0	0	
6153615	7	-	-	886	861	120	0	0	0	
6153619	8	-	-	834	835	120	0	0	0	
6153622	9	-	-	854	862	120	0	0	0	
6153625	10	-	-	887	884	120	0	0	[b]1	1
6153627	11	2773	2784	852	846	120	[c]1	0	0	1
6153631	12	2801	2793	828	835	120	0	0	0	
6153635	13	2767	2770	832	839	120	0	0	0	
6153637	14	2774	2779	864	855	120	0	0	0	
6153639	15	2783	2798	840	836	120	0	0	0	
6153641	16	2794	2796	849	871	120	0	0	0	
Total	16	-	-	-	-	1920	1	1	1	3
Mean	-	-	-	852	854	-	-	-	-	-

[a]4-round burst (round 4 to 7).
[b]Round 1 from second magazine (No. 2) in 120-round cycle. Zero degree case orientation.
[c]Round No. 28 from second magazine in 120-round cycle. Bolt override.

FFD = Failure to feed.
FEJ = Failure to eject.
UCF = Uncontrolled fire.

Notes: Instrumental velocity at 77.04 feet (gun to first sensor = 54.36 ft, separation between sensors = 49.86 ft). M855 ball cartridge lot No. WCC85L030-039 used.

4. Interchangeability (encl 4).

a. Interchangeability of XM4 carbine components was determined by subjecting 10 weapons to a test wherein each carbine was fired 120 rounds for function performance, then interchanged and refired 120 rounds for functioning performance and 53 rounds for dispersion. All 10 carbines then continued in other tests in the interchanged configuration.

b. The interchange component groups and group matrix are given in Tables 4-1 and 4-2. The physical characteristics data are in Table 4-3. Cyclic rate; and velocity/dispersion data are in Tables 4-4 and 4-5, respectively, and functioning performance check data are in Table 4-6. It should be noted in subsequent tests, where guns 1 to 10 are used, that the test numbers referenced to the serial numbers refer to the interchanged weapons.

c. Commonality of parts.

Barrel extension. This part of the barrel assembly contains the modified feed ramps (interchangeable only at time of manufacture). The feed ramp angles were changed from 45° to 52° to reduce/eliminate the tendency of having to use the forward assist device to feed and chamber the first and subsequent rounds from a cold weapon at low temperature.

Three-round burst cam. This part was modified (but is interchangeable with the part from the M16A2 rifle) in an effort to eliminate uncontrolled firing of more than three rounds per trigger pull.

TABLE 4-1. GROUPS OF NON-MATING PARTS

Group I	Group II
Takedown Pin Detent (8448585) (2). Receiver, Upper (9390028). Rear Sight Spring Pin (MS16562-103). Magazine Catch Spring (8448637). Trigger (9349117). Front Sight Post (9349056).	Lower Receiver (9390015) and Extension (9390019), Receiver Nut (9390020), and Receiver End Plate (9390021). Barrel and Front Sight Assembly: Barrel (9390007), Barrel Extension (9390030), Barrel Indexing Pin (8448551), Compensator (9349051), Compensator spacer (9349052), Front Sight (9349058), Taper Pin (8448575) (2), Handguard Cap (9390002), Nut Barrel (8448553). Extractor Pin (8448513). Butt Cap Screw (8448627). Ejection Port Cover Assembly (8448525).

TABLE 4-1 (CONT'D)

Group III	Group IV
Bolt (8448510) with Bolt Rings (8448511) (3).	Key and Bolt Carrier Assembly (8448505).
Ejection Port Cover Pin (8448533) and Snap Ring (8448664).	Takedown Detent Spring (8448586) (2).
Front Sight Detent (8448573).	Handguard Slip Ring (8448712).
Trigger Guard Pivot Pin (MS9047-102).	Ejector and Safety Detent Spring (8448516).
Trigger Spring (8448593).	Retainer Buffer (8448582).
Takedown Pin (8448584)	Trigger and Hammer Pin (8448609) (2).
Magazine Catch Button (8449636).	Front Sight Detent Spring (8448574).
Spring Pin (S3158121).	

Group V	Group VI
Spring Buffer Retainer (8448583).	Rear Sight (9349075).
Buttstock Assembly (9390012).	Disconnect Spring (9349166).
Ejection Port Cover Spring (8448532).	Bolt Cam Pin (8448502).
Ejector Pin (MS9047-005).	Bolt Catch (8448628).
	Pistol Grip (8448632).
	Buffer Assembly (9390023).

Group V	Group VI
Magazine Catch (8448638).	Pawl Spring Pin (8448521-2).
Semi Disconnect (9349114)	Index Spring (9349069) (3).
Plunger Assembly (9349085).	Handguard Retaining Spring (8448665).
Rear Sight Base (9349074).	Elevation Spring (9349070).
Pistol Grip Screw (AN501D-416-16).	
Burst Cam (9390031).	
Handguard Spring Assembly (8448555).	

Group VII	Group VIII
Ejector (8448515).	Receiver Pivot Pin (8448621).
Rear Sight Spring (8445836).	Firing Pin (8448503).
Gas Tube Assembly (8448567).	Rear Sight Windage Screw (9349076).
Hammer and Hammer Pin Retainer Assembly (9349110).	Gas Tube Pin (MS9047-035).
Compensator (9349051).	Hand guard Assembly (9390003) (Top Section).
Firing Pin Retaining Pin (8448504).	Bolt Catch Spring (8448633).
Bolt Catch Plunger (8448634).	Automatic Sear Pin (8448599).
Pawl (8448543).	Pawl Detent (8448544).48599).
Spring Pin (MS9047-071).	Compensator Spacer (9349052).
Index Screw (9349065).	Elevation Index (9349066).2).
	Burst Disconnect (9349113).

TABLE 4-1 (CONT'D)

Group IX	Group X
Rear Sight Windage Knob (9349077).	Extractor (8448512) w/Spring Assembly (8448755).
Charging Handle Assembly (8448517).	Trigger Guard Assembly (8448587).
Bolt Catch Pin (MS9047-069)	Handguard Assembly (9390003). (Bottom Section).
Hammer Spring (9349107).	Automatic Sear Assembly (8448595).
Fire Control Selector (8448630).	Action Spring (8448629).
Bolt Spring (8448542).	Fire Control Selector Detent (8448631).
Elevation Knob (9349067).	Plunger Spring (8448540).
	Rear Sight Ball (MS19061-20003) (3).
	Clutch Spring (9349109).

Note: Groupings listed were extracted from MIL-R-63997A(AR) for the M16A2 rifle and modified to XM4 carbine component descriptions where necessary. Staked assemblies were not separated in this test.

TABLE 4-2. INTERCHANGEABILITY MATRIX

Original Weapon No.	Tray Number/New Weapon No.[a]									
	1	2	3	4	5	6	7	8	9	10
	Parts Group									
1	1	2	3	4	5	6	7	8	9	10
2	2	3	4	5	6	7	8	9	10	1
3	3	4	5	6	7	8	9	10	1	2
4	4	5	6	7	8	9	10	1	2	3
5	5	6	7	8	9	10	1	2	3	4
6	6	7	8	9	10	1	2	3	4	5
7	7	8	9	10	1	2	3	4	5	6
8	8	9	10	1	2	3	4	5	6	7
9	9	10	1	2	3	4	5	6	7	8
10	10	1	2	3	4	5	6	7	8	9

[a]New weapon/barrel number can be found by tracing group No. 2 from the original weapon number line to the new weapon column (e.g., original No. 5 becomes new No. 8).

TABLE 4-3. CONSOLIDATED MEASUREMENT DATA FOR XM4 CARBINES AFTER COMPONENT INTERCHANGE

Weapon ID		Firing Pin Protrusion, in.	Firing Pin Indent[a]	Headspace, in.	Semiautomatic Trigger Pull, lb
SN	Test No.				
6153601	2	0.030	0.020	1.4646	9.0
6153603	1	.030	.021	1.4646	8.2
6153605	10	.032	.020	1.4646	9.2
6153608	9	.032	.020	1.4646	8.0
6153611	8	.031	.021	1.4646	9.2
6153613	7	.031	.020	1.4646	9.2
6153615	6	.033	.020	1.4646	11.0
6153619	5	.030	.020	1.4646	8.7
6153622	4	.032	.022	1.4646	9.2
6153625	3	.031	.020	1.4646	9.0
Criteria limits	Min	.028	.020	1.4647	5.5
	Max	.036	[b] -	1.4706	8.5

[a]Only hammer fall indent measured.
[b]Inertia indent measurements not taken. Criterion is 0.008 inch.

TABLE 4-4. CONSOLIDATED CYCLIC RATE OF FIRE DATA FOR XM4 CARBINES FIRED AFTER COMPONENT INTERCHANGE

Burst No.	Cyclic Rate, SPM, by Weapon Serial and (Test) Numbers				
	6153601(2)	6153603(1)	6153605(10)	6153608(9)	6153611(8)
1	887	840	864	895	865
10	916	893	909	949	918
Avg	901	875	884	922	893
11	852	840	826	870	848
20	919	916	927	947	923
Avg	895	884	887	917	889
	6153613(7)	6153615(6)	6153619(5)	6153622(4)	6153625(3)
1	833	892	866	852	848
10	879	933	895	889	912
Avg	855	907	882	869	894
11	816	864	844	811	848
20	896	947	904	902	932
Avg	858	897	878	861	894

TABLE 4-5. CONSOLIDATED VELOCITY AND DISPERSION DATA FOR XM4 CARBINES FIRED AFTER COMPONENT INTERCHANGE[a]

Weapon ID			Avg	Average Extreme Spread Measurements[c]		
	Test No.		Vel[b],			
SN	Old	New	ft/s	in.	cm	mils
6153601	1	2	2774	5.24	13.32	1.46
6153603	2	1	2764	5.60	14.24	1.56
6153605	3	10	2756	4.26	10.81	1.18
6153608	4	9	2773	5.51	13.99	1.53
6153611	5	8	2775	5.16	13.10	1.43
6153613	6	7	2786	3.87	9.83	1.08
6153615	7	6	2778	4.39	11.16	1.22
6153619	8	5	2778	4.99	12.67	1.39
6153622	9	4	2772	7.12	18.08	1.98
6153625	10	3	2768	3.94	10.01	1.09

[a]All firings are from machine rest.
[b]Average of 50 shots. Instrumental point was 78 feet.
[c]Average of five 10-round targets fired at 100 yard-ranges.

Note: Barrel and lower receiver were from the same weapon after interchange.

TABLE 4-6. CONSOLIDATED FUNCTIONING PERFORMANCE CHECK DATA FOR XM4 CARBINES FIRED AFTER COMPONENT INTERCHANGE

Weapon ID	Test	No. Rd	No.		
SN	No.	Fired	Malfunction	MRBS	MRBOMF
6153601	2	120	0	-	-
6153603	1	120	0	-	-
6153605	10	120	0	-	-
6153608	9	120	0	-	-
6153611	8	120	0	-	-
6153613	7	120	0	-	-
6153615	6	120	0	-	-
6153619	5	120	0	-	-
6153622	4	120	0	-	-
6153625	3	120	0	-	-

MRBOMF = mean rounds between operational mission failures.
MRBS = mean rounds between stoppages.

5. Accuracy/Sight Calibration (encl 5).

a. Three XM4 carbines were used in this test, each had previously been used in the interchange and unlubricated weapon tests. Table 5-1 characterizes the weapons and their prior cumulative number of rounds fired.

TABLE 5-1. WEAPON IDENTIFICATION

Weapon ID			Previous	Dispersion (ES)[b], in.	
	Test No.		Rd	Before	After
SN	Old	New	Fired[a]	Interchange	Interchange
6153611	5	8	1493	5.50	5.16
6153613	6	7	1493	3.15	3.87
6153615	7	6	1493	4.17	4.39

[a]Each carbine was fired 53 rounds for initial dispersion, 120 rounds each for initial function and interchange tests, and 1200 rounds for the unlubricated weapon firings.
[b]The extreme spread (ES) data for barrels is obtained from machine rest firings before and after interchange testing. Refer to Tables 2-2 and 4-5.

b. Each weapon was initially zeroed at 25 meters using the short range (large) aperture. Sight elevation was set at 300 meters minus one click. Next, the 300-meter range was fired with the long range (small) aperture. Sight elevation was set on 300 meters. A shot group center-of-impact shift to the right occurred as a result of changing apertures. All carbines were then rezeroed at 300 meters before commencing the sight calibration test. The M855 cartridge lot No. WCC85L030-039 was used throughout this test.

The test schedule consisted of bench rest firing three 10-round targets per range and weapon.

The range conditions during the test are given in Table 5-2.

TABLE 5-2. RANGE CONDITIONS

Dates of Firing, Dec 1986	Range, m	Wind Velocity, km/hr	Temp, °C	Sky Condition
15	300	4 to 8	35 to 49	Scattered clouds
16	200	0 to 2	32 to 44	Scattered clouds
16	100	0 to 2	32 to 44	Scattered clouds
16	25	0 to 2	32 to 44	Scattered clouds

TABLE 5-2 (CONT'D)

Dates of Firing, Dec 1986	Range, m	Wind Velocity, km/hr	Temp, °C	Sky Condition
17	400	1 to 6	39 to 49	Overcast
17	500	1 to 6	39 to 49	Overcast
17	600	1 to 6	39 to 49	Overcast
18	700	0 to 3	43 to 45	Overcast
[a]19	800	17	44 to 48	Clear
22	800	0 to 8	28 to 39	Clear

[a]Refired on 22 December 1986 due to excessive wind conditions.

The consolidated dispersion and accuracy data are listed in Table 5-3. Table 5-4 is the computed estimate of the number of hits on an E silhouette as a result of firing at the nine different ranges. A visual display of the composite data from Table 5-4 is shown in Figure 5-1.

Functioning performance information for the three carbines used in this subtest is shown in Table 5-5.

TABLE 5-3. XM4 CARBINE ACCURACY DATA (ALL MEASUREMENTS ARE GIVEN IN MILS)

Weapon SN	Weapon No.	Range, m	Rd	HCI	VCI	HSD	VSD	EHS	EVS	ES	MR	RSD	
6153615	6	25	30	-2.18	-0.17	0.67	0.83	2.64	3.12	3.23	0.98	1.07	-
		100	30	-1.35	1.58	.43	.46	1.67	1.87	2.01	.54	0.63	
		200	30	-1.73	1.10	.33	.64	1.31	2.34	2.55	.64	0.72	
		300	30	-0.22	-0.16	.25	.37	1.00	1.65	1.67	.38	0.44	-
		400	30	0.16	0.11	.30	.28	1.24	1.05	1.41	.37	0.41	-
		500	30	0.15	0.07	.35	.29	1.26	1.19	1.53	.41	0.45	
		600	30	0.42	0.07	.30	.30	1.35	1.51	1.65	.36	0.42	
		700	30	-0.17	0.12	.35	.41	1.50	1.72	1.97	.46	0.54	-
		800	30	-0.70	-0.50	.46	.51	1.66	2.13	2.68	.59	0.68	-
		[a]800	30	-1.45	-0.04	.50	.48	1.57	1.60	1.82	.65	0.69	
6153613	7	25	30	-1.92	-0.99	.52	.51	2.16	2.16	2.30	.63	0.73	-
		100	30	-1.48	1.91	.48	.61	1.89	2.11	2.55	.70	0.78	-
		200	30	-1.34	1.60	.36	.40	1.60	1.71	1.77	.48	0.54	
		300	30	-0.12	-0.10	.28	.33	1.02	1.34	1.52	.39	0.43	
		400	30	0.03	0.06	.29	.34	1.22	1.91	1.91	.37	0.45	
		500	30	0.16	0.16	.31	.36	1.38	1.84	1.89	.40	0.48	-
		600	30	0.06	0.07	.35	.28	1.53	1.19	1.51	.40	0.45	-
		700	30	-0.33	0.08	.30	.50	1.37	1.74	2.04	.50	0.58	
		800	30	-0.77	-0.84	.45	.46	1.83	1.95	2.24	.57	0.64	
		[a]800	30	-1.36	-0.38	.41	.59	1.36	2.16	2.19	.64	0.72	-
6153611	8	25	30	-1.78	-0.28	.58	.52	2.44	2.04	2.56	.69	0.78	-
		100	30	-1.71	2.10	.51	.53	1.66	1.96	2.11	.69	0.74	-
		200	30	-1.62	2.05	.40	.59	1.68	3.01	3.02	.59	0.72	-
		300	30	-0.20	0.06	.31	.31	1.54	1.23	1.64	.39	0.44	
		400	30	-0.20	0.37	.40	.25	1.84	1.06	1.89	.39	0.47	
		500	30	0.04	0.25	.33	.31	1.12	1.51	1.66	.39	0.45	
		600	30	-0.10	0.45	.30	.43	1.19	1.82	1.84	.48	0.53	-
		700	30	-0.49	0.06	.35	.58	1.23	2.15	2.24	.62	0.68	-
		800	30	-0.22	-0.12	.44	.53	1.70	2.33	2.43	.60	0.69	-
		[a]800	30	-1.69	0.19	.49	.43	2.12	2.07	2.37	.55	0.66	-

[a]The first 800-meter range firings per carbine were conducted under high cross-wind conditions. This range was refired under ideal low wind conditions. Those data are in the first 800-meter data entry.

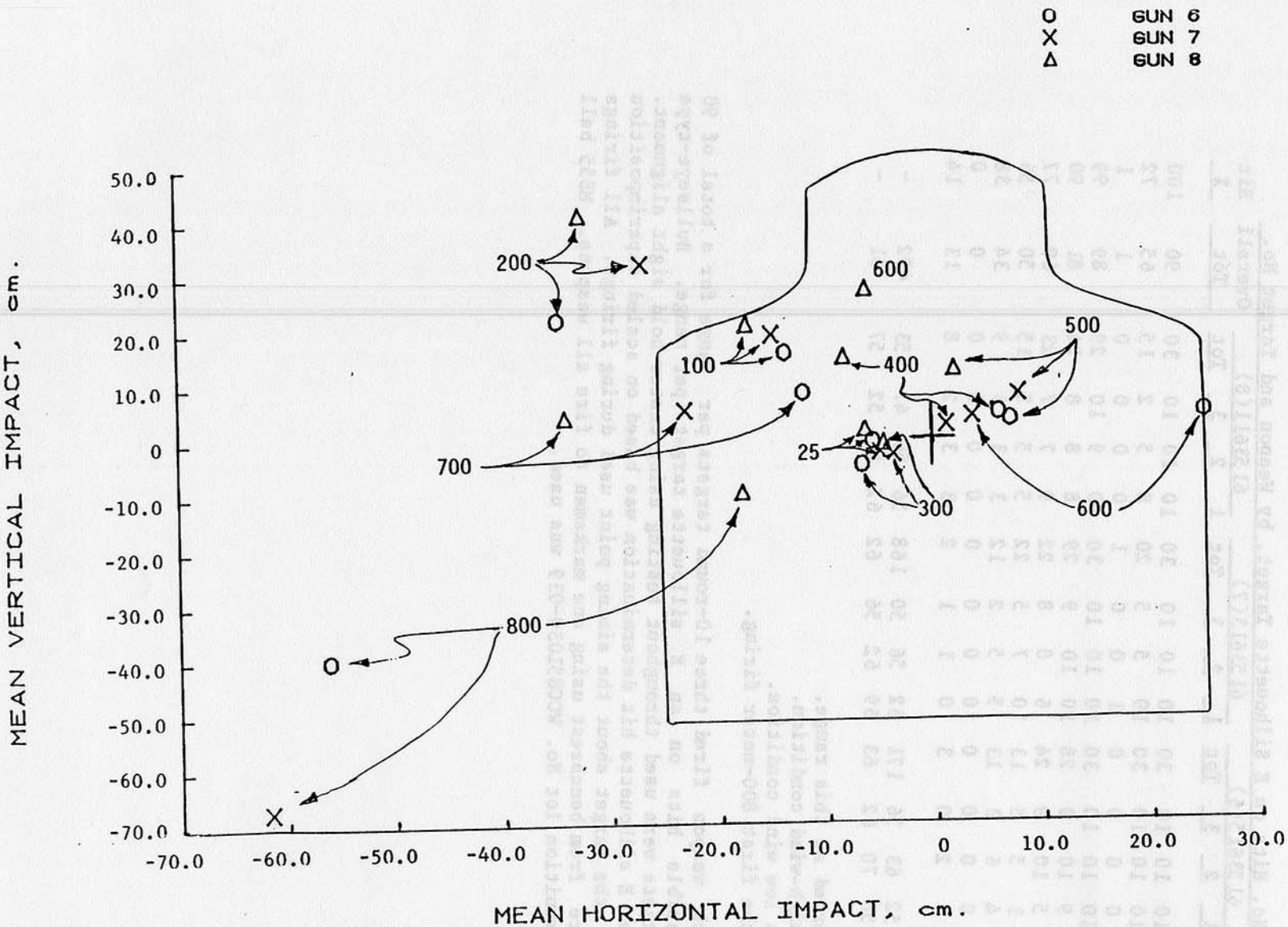
COV = Covariance of the horizontal and vertical components of the impacts.
EHS = Extreme horizontal spread (maximum horizontal distance).
ES = Extreme spread (maximum distance between all possible pairs of impacts).
EVS = Extreme vertical spread (maximum vertical distance).
HCI = Horizontal center of impact.
HSD = Horizontal standard deviation (dispersion).
MR = Mean radius (average radial distance from CI to impact point).
RSD = Radial standard deviation = square root (HSD**2+VSD**2).
VCI = Vertical center of impact.
VSD = Vertical standard deviation (dispersion)

TABLE 5-4. ESTIMATE OF HITS ON E SILHOUETTE TARGETS FOR XM4 CARBINES FIRING M855 BALL AMMUNITION

Range, m	No. Hits on E Silhouette Target, by Weapon and Target No. 615361 5(6) 1	2	3	Tot	615361 3(7) 1	2	3	Tot	615361 1(8) 1	2	3	Tot	Overall Tot	Hit %
25	10	10	10	30	10	10	10	30	10	10	10	30	90	100
100	10	10	10	30	10	5	5	20	8	5	2	15	65	72
200	0	0	0	0	1	0	0	1	0	0	0	0	1	1
[a]300	10	10	10	30	10	10	10	30	10	9	10	29	89	99
400	9	10	9	28	10	10	9	29	8	8	8	24	81	90
500	5	10	9	24	6	8	8	22	9	7	7	23	69	77
600	3	5	5	13	10	7	5	22	5	5	5	15	50	56
700	4	6	3	13	5	5	2	12	3	3	3	9	34	38
[b]800	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[c]800	1	2	0	3	0	1	1	2	3	3	2	8	13	14
Totals	52	63	56	171	62	56	50	168	56	50	47	153	492	-
[d]Hit%	58	70	62	63	69	62	56	62	62	56	52	57	61	-

eapons zeroed at this range.
ired in high-wind condition.
efired in low wind condition.
xcludes the first 800-meter firing.

tes: Each weapon fired three 10-round targets per range for a total of 90 possible hits on an E sillouette target per range. Bullseye-type targets were used throughout testing using center-hold sight alignment. The E silhouette hit determination was based on scaled superimposition of the target about the aiming point used during firings. All firings were from benchrest using one marksman to fire all weapons. M855 ball ammunition lot No. WCC85L030-039 was used.



CENTER OF IMPACTS OVER 3- 10 ROUND TARGETS
FOR EACH OF THREE GUNS - ORIGINAL IMPACTS
(VALUES ADJACENT TO IMPACTS INDICATE RANGE TO TARGET)

Figure 5-1. Composite data.

TABLE 5-5. CONSOLIDATED FUNCTIONING PERFORMANCE DATA FOR XM4 CARBINES FIRED IN THE ACCURACY/SIGHT CALIBRATION TEST

Weapon ID		No Malfunctions, by Type							Charge to
SN	Test No.	FFD	FTC	FFR	FEX	FEJ	FBR	OTH	Weapon
6153611	8	0	0	0	0	0	0	0	0
6153613	7	0	0	0	0	2	0	0	2
6153615	6	0	0	0	0	0	0	0	0
Totals	–	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**2**

R = Failure of bolt to remain to rear after firing last round from magazine.
J = Failure to eject.
X = Failure to extract.
) = Failure to feed.
R = Failure to fire.
C = Failure to chamber.

Endurance (encl 6).

The 10,000-round endurance test was fired on each of five XM4 carbines, ter completion of the interchange test. Firing was done in 1200-round phases th scheduled maintenance after completion of each phase. There were ten 0-round firing cycles within each test phase except the last (No. 9). In at phase, three full cycles plus a partial cycle of 40 rounds were fired. apon cooling occurred after each 120 rounds fired. The firing schedule for is test is shown in Table 6-1.

TABLE 6-1. FIRING SCHEDULE

No. Rd Fired	Firing Sequence	Mode of Fire
30	1	3-round controlled bursts
30	2	3-round controlled bursts
30	3	Semiautomatic
30	4	Semiautomatic

Cyclic rates of fire were recorded for all automatic controlled bursts red. Additionally, three 10-round targets per carbine were fired as the rst 30 rounds after each scheduled (1200-round) maintenance. Firing was in e semiautomatic mode with the weapon machine-rest mounted. The range of ring was 100 yards. Instrumental velocity, recorded at 78 feet from the zzle, was concurrently taken during targeting. Barrel bore measurements and roat erosion wear gauging were done after each 1200 rounds fired.

Table 6-2 summarizes function performance data. Velocity and dispersion ısurements are reported in Tables 6-3 through 6-7. Cyclic-rate data are ›orted in Tables 6-8 through 6-10.

TABLE 6-2. CONSOLIDATED FUNCTIONING PERFORMANCE DATA FOR XM4 CARBINES FIRED IN THE ENDURANCE TEST

Weapon ID	Test	No. Malfunctions, by Type							Charge to
SN	No.	FFD	FTC	FFR	FEX	FEJ	FBR	OTH	Weapon
6153601	2	45	0	1	0	0	0	1	7
6153603	1	19	3	0	0	0	0	0	8
6153619	5	43	0	1	0	5	0	2	12
6153622	4	9	0	0	0	32	0	1	7
6153625	3	11	2	0	2	1	0	1	7
Totals	-	127	5	2	2	38	0	5	41
[a]6153622	4	0	0	3	0	0	0	2	NA

ired 1215 rounds after tightening of loose carrier key. Test to confirm the ause of FEJ stoppages experienced during the first 10,000-round test. Test equested by sponsor and concurred by TECOM.

R = Failure of bolt to remain to rear after firing last round from magazine.
J = Failure to eject.
X = Failure to extract.
) = Failure to feed.
R = Failure to fire.
C = Failure to chamber.

TABLE 6-3. CONSOLIDATED VELOCITY AND DISPERSION DATA FOR XM4 CARBINE SN 6153601 (TEST NO. 2) FIRED FOR ENDURANCE

Test Interval, Rd	Avg Vel[a], ft/s	Average Extreme Spread Measurement[b] in.	cm	mil[c]
Initial[d]	2751	5.95		
Initial[e]	2774	5.24	13.32	**1.46**
1200	2795	6.59	16.74	**1.83**
2400	2764	3.91	9.92	**1.08**
3600	2780	6.28	15.96	**1.75**
4800	2758	6.24	15.86	**1.73**

e footnotes at end of table.

TABLE 6-3 (CONT'D)

Test Interval, Rd	Avg Vel[a], ft/s	Average Extreme Spread Measurement[b] in.	cm	mil[c]
6000	2740	8.51	21.60	2.36
7200	2752	7.63	19.38	2.12
8400	2715	7.59	19.28	2.11
9600	2721	7.43	18.88	2.06
Average[f]	2755	6.60	16.77	1.83
Extreme spread[f]	80	4.60	11.68	1.28

nstrumental velocity at 78 feet.
riterion is 4.5 inches, maximum.
.5 in. = 1.25 mils - XM4 carbine criterion.
.8 in. = 1.33 mils - M16A1/A2 rifle criterion (new).
.0 in. = 1.94 mils - M16A1/A2 rifle OCONUS rejection criterion (used).
.0 in. = 2.49 mils - M16A1/A2 rifle CONUS rejection criterion (used).
nitial inspection data taken from Table 2-2 before interchange.
nitial data taken from Table 4-3 of the interchange test.
omputed data recorded after interchange.

tes: Refer to Enclosure 6 for detailed data.

TABLE 6-4. CONSOLIDATED VELOCITY AND DISPERSION DATA FOR XM4 CARBINE SN 6153603 (TEST NO. 1) FIRED FOR ENDURANCE

Test Interval, Rd	Avg IV,[a] ft/s	Average Extreme Spread Measurement[b] in.	cm	mil[c]
Initial[d]	2776	5.10	-	-
Initial[e]	2764	5.60	14.24	**1.56**
1200	2810	5.76	14.64	**1.60**
2400	2796	6.22	15.80	**1.73**
3600	2777	5.66	14.36	**1.57**
4800	2783	9.38	23.82	2.60
6000	2761	7.40	18.79	2.05
7200	2745	7.32	18.59	2.03
8400	2726	7.11	18.06	1.97
9600	2717	8.88	22.56	2.47
Average[f]	2764	7.04	17.87	1.95
Extreme spread[f]	93	3.78	9.58	1.04

e footnotes at end of table.

TABLE 6-4 (CONT'D)

ıstrumental velocity at 78 feet.
:iterion is 4.5 inches, maximum.
.5 in. = 1.25 mils - XM4 carbine criterion.
.8 in. = 1.33 mils - M16A1/A2 rifle criterion (new).
.0 in. = 1.94 mils - M16A1/A2 rifle OCONUS rejection criterion (used).
.0 in. = 2.49 mils - M16A1/A2 rifle CONUS rejection criterion (used).
ıitial inspection data taken from Table 2-2 before interchange.
ıitial data taken from Table 4-3 of the interchange test.
›mputed data recorded after interchange.

:es: Refer to Enclosure 6 for detailed data.

TABLE 6-5. CONSOLIDATED VELOCITY AND DISPERSION DATA FOR XM4 CARBINE SN 6153619 (TEST NO. 5) FIRED FOR ENDURANCE

Test Interval, Rd	Avg IV,[a] ft/s	Average Extreme Spread Measurement[b] in.	cm	mil[c]
Initial[d]	2784	4.06	10.31	1.13
Initial[e]	2778	4.99	12.67	**1.39**
1200	2799	6.50	16.50	**1.80**
2400	2783	6.28	15.96	**1.74**
3600	2787	9.66	24.54	2.68
4800	2762	10.60	26.91	2.94
6000	2749	7.42	18.84	2.06
7200	2748	12.33	31.32	3.42
8400	2717	10.40	26.42	2.89
9600	2709	10.41	26.45	2.89
Average[f]	2759	8.73	22.18	2.42
Extreme spread[f]	90	7.34	18.65	2.03

nstrumental velocity at 78 feet.
riterion is 4.5 inches, maximum.
.5 in. = 1.25 mils - XM4 carbine criterion.
.8 in. = 1.33 mils - M16A1/A2 rifle criterion (new).
.0 in. = 1.94 mils - M16A1/A2 rifle OCONUS rejection criterion (used).
.0 in. = 2.49 mils - M16A1/A2 rifle CONUS rejection criterion (used).
nitial inspection data taken from Table 2-2 before interchange.
nitial data taken from Table 4-3 of the interchange test.
omputed data recorded after interchange.

tes: Refer to Enclosure 6 for detailed data.

TABLE 6-6. CONSOLIDATED VELOCITY AND DISPERSION DATA FOR XM4 CARBINE SN-6153622 (TEST NO. 4) FIRED FOR ENDURANCE

Test Interval, Rd	Avg IV,[a] ft/s	Average Extreme Spread Measurement[b] in.	cm	mil[c]
Initial[d]	2766	6.38	16.21	1.77
Initial[e]	2772	7.12	18.08	1.98
1200	2786	8.18	20.79	2.27
2400	2757	9.01	22.88	2.50
3600	2753	11.83	30.04	3.28
4800	2740	13.79	35.04	3.83
6000	2686	12.78	32.46	3.55
7200	2733	15.34	38.97	4.26
8400	2698	16.76	42.56	4.65
9600	2694	8.88	22.57	2.47
Average[f]	2735	11.52	29.27	3.20
Extreme spread[f]	100	9.64	24.48	2.67

nstrumental velocity at 78 feet.
riterion is 4.5 inches maximum.
.5 in. = 1.25 mils - XM4 carbine criterion.
.8 in. = 1.33 mils - M16A1/A2 rifle criterion (new).
.0 in. = 1.94 mils - M16A1/A2 rifle OCONUS rejection criterion (used).
.0 in. = 2.49 mils - M16A1/A2 rifle CONUS rejection criterion (used).
nitial inspection data taken from Table 2-2 before interchange.
nitial data taken from Table 4-3 of the interchange test.
omputed data recorded after interchange.

tes: Refer to Enclosure 6 for detailed data.

TABLE 6-7. CONSOLIDATED VELOCITY AND DISPERSION DATA FOR XM4 CARBINE SN 6153625 (TEST NO. 3) FIRED FOR ENDURANCE

Test Interval, Rd	Avg IV,[a] ft/s	Average Extreme Spread Measurement[b] in.	cm	mil[c]
Initial[d]	2778	3.26	8.28	0.91
Initial[e]	2768	3.94	10.01	**1.09**
1200	2794	5.86	14.90	**1.63**
2400	2779	6.03	15.33	**1.67**

e footnotes at end of table.

TABLE 6-7 (CONT'D)

Test Interval, Rd	Avg IV,[a] ft/s	Average Extreme Spread Measurement[b] in.	cm	mil[c]
3600	2777	6.46	16.42	**1.79**
4800	2761	11.64	29.57	3.23
6000	2710	9.02	22.92	2.51
7200	2752	12.85	32.65	3.57
8400	2711	14.07	35.74	3.91
9600	2707	10.13	25.73	2.81
Average[f]	2751	8.89	22.59	2.47
Extreme spread[f]	87	10.13	25.73	2.82

nstrumental velocity at 78 feet.
riterion is 4.5 inches, maximum.
.5 in. = 1.25 mils - XM4 carbine criterion.
.8 in. = 1.33 mils - M16A1/A2 rifle criterion (new).
.0 in. = 1.94 mils - M16A1/A2 rifle OCONUS rejection criterion (used).
.0 in. = 2.49 mils - M16A1/A2 rifle CONUS rejection criterion (used).
nitial inspection data taken from Table 2-2 before interchange.
nitial data taken from Table 4-3 of the interchange test.
omputed data recorded after interchange.

tes: Refer to Enclosure 6 for detailed data.

TABLE 6-8. CONSOLIDATED CYCLIC RATES OF FIRE DATA FOR XM4 CARBINES FIRED IN THE ENDURANCE TEST

Test Phase No.	Magazine Sequence	Average Cyclic Rate of Fire, spm, by Cyclic No. 1	2	3	4	5	6	7	8	9	10	Avg
		XM4 Carbine SN 6153601 (2)										
I	1	886	862	872	871	872	869	875	871	**857**	**859**	869
	2	889	882	882	888	880	877	885	881	871	877	881
II	1	900	884	892	883	875	872	879	883	878	876	882
	2	898	899	882	888	866	864	879	870	878	869	879
III	1	896	876	902	866	838	825	848	834	828	792	850
	2	884	892	900	863	851	842	835	839	840	815	856
IV	1	871	854	818	825	825	823	824	821	812	790	827
	2	872	862	842	821	828	814	810	818	813	808	829

TABLE 6-8 (CONT'D)

Test Phase No.	Magazine Sequence	Average Cyclic Rate of Fire, spm, by Cyclic No. 1	2	3	4	5	6	7	8	9	10	Avg
		XM4 Carbine SN 6153601 (2)										
V	1	877	864	843	826	819	809	794	806	805	801	824
	2	884	853	828	814	809	818	795	798	766	788	815
VI	1	943	929	924	911	910	917	915	908	900	897	915
	2	946	932	930	913	908	926	922	922	912	912	922
VII	1	943	933	926	919	910	902	902	902	903	875	912
	2	950	948	943	922	921	898	920	918	901	896	922
VIII	1	932	918	907	912	915	918	898	888	885	895	907
	2	935	907	909	916	916	900	901	900	905	908	910
IX	1	924	926	914	912							919
	2	931	924	929	-							925
		XM4 Carbine SN 615603 (1)										
I	1	-	853	844	860	852	862	851	847	848	851	852
	2	872	862	854	857	870	862	859	868	852	873	863
II	1	900	875	878	862	860	866	868	873	870	881	873
	2	901	906	848	873	841	859	879	884	878	860	873
III	1	917	910	801	918	886	890	896	892	883	878	887
	2	923	920	810	915	877	877	885	885	880	884	886
IV	1	908	909	920	903	892	891	887	889	888	860	895
	2	909	903	912	903	894	877	879	875	877	864	889
V	1	913	916	890	897	889	876	862	864	865	856	883
	2	917	905	909	894	878	900	861	850	868	852	883
VI	1	-	907	893	880	899	868	885	894	878	867	886
	2	924	894	890	847	918	871	897	895	894	883	891
VII	1	931	932	912	904	914	887	880	885	888	868	900
	2	939	932	918	920	916	896	895	899	892	888	910
VIII	1	916	893	883	875	875	878	855	864	857	858	875
	2	915	901	875	868	875	886	875	864	872	872	880
IX	1	-	911	906	890							902
	2	928	892	906	-							909

TABLE 6-8 (CONT'D)

Test Phase No.	Magazine Sequence	Average Cyclic Rate of Fire, spm, by Cyclic No. 1	2	3	4	5	6	7	8	9	10	Avg
		XM4 Carbine SN 6153619 (5)										
I	1	853	822	**828**	859	825	856	836	**827**	**815**	**822**	834
	2	846	825	835	860	830	831	831	831	813	**830**	833
II	1	854	818	806	803	**788**	**785**	**792**	**769**	787	785	799
	2	842	843	**784**	**763**	789	793	789	**784**	772	**775**	793
III	1	852	821	893	798	782	793	801	700	**773**	**767**	798
	2	845	839	883	806	796	793	791	795	**768**	785	810
IV	1	920	911	886	888	866	869	862	881	868	875	883
	2	919	913	893	889	872	874	870	859	860	883	883
V	1	916	910	918	907	883	882	860	847	851	841	882
	2	920	905	897	901	886	890	866	858	854	846	882
VI	1	897	889	888	882	869	862	855	876	851	859	873
	2	894	886	880	885	875	854	866	870	872	844	873
VII	1	924	919	893	889	869	868	850	852	871	842	878
	2	925	917	911	886	876	858	864	850	854	825	877
VIII	1	881	874	855	836	850	859	827	817	815	826	844
	2	895	870	841	816	841	830	830	811	829	829	839
IX	1	882	882	883	855							876
	2	889	866	894	-							883
		XM4 Carbine XN 6153622 (4)										
I	1	869	846	836	859	843	860	**854**	**852**	**834**	845	850
	2	861	850	**830**	853	852	840	852	846	845	840	847
II	1	894	889	893	880	888	880	876	874	870	873	882
	2	898	899	882	870	882	879	869	859	868	877	878
III	1	897	894	853	874	859	880	856	857	854	854	868
	2	888	884	854	877	868	857	860	843	846	853	863

TABLE 6-8 (CONT'D)

Test Phase No.	Magazine Sequence	Average Cyclic Rate of Fire, spm, by Cyclic No. 1	2	3	4	5	6	7	8	9	10	Avg
		XM4 Carbine SN 6153622 (4)										
IV	1	883	873	852	857	848	856	855	850	853	850	858
	2	890	876	869	859	856	843	841	837	852	867	859
V	1	899	882	878	869	858	849	858	838	846	833	861
	2	901	888	881	873	861	876	842	839	841	836	864
VI	1	892	871	854	839	844	839	827	851	824	827	847
	2	881	864	852	848	836	840	834	841	826	837	846
VII	1	878	882	865	848	856	853	845	843	840	818	853
	2	890	878	863	848	856	839	840	834	826	821	850
VIII	1	870	916	835	833	833	841	802	806	807	**795**	834
	2	864	925	828	814	818	815	790	816	800	806	828
IX	1	836	836	851	802							831
	2	838	828	822	-							829
		XM4 Carbine SN 6153625 (3)										
I	1	884	860	869	867	843	859	**840**	**845**	**835**	811	851
	2	890	870	883	876	824	866	862	861	846	829	861
II	1	882	851	837	842	834	838	837	856	851	847	848
	2	880	866	853	842	820	832	834	841	834	**823**	842
III	1	865	862	870	877	861	882	883	879	882	848	871
	2	866	880	885	860	853	864	874	867	870	845	866
IV	1	893	900	897	894	893	889	885	884	883	868	889
	2	895	898	882	898	885	880	882	866	882	873	884
V	1	919	911	913	895	916	910	892	874	880	874	898
	2	929	917	901	910	897	901	902	893	896	889	904
VI	1	-	915	916	900	900	892	887	891	879	873	895
	2	931	923	921	925	904	897	902	896	876	886	906
VII	1	936	933	926	918	912	910	889	892	885	878	908
	2	950	948	928	927	934	924	903	900	891	905	921
VIII	1	935	847	922	916	924	923	895	895	890	887	903
	2	942	835	931	919	941	929	914	908	906	911	914
IX	1	-	930	930	898							919
	2	938	937	922	-							931

TABLE 6-9. FIRST BURST (3 ROUNDS) CYCLIC RATES OF FIRE BELOW 700 SPM FOR XM4 CARBINES FIRED IN THE ENDURANCE TEST

est hase No.	Weapon No.	Average Cyclic Rate of Fire, spm, by Cyclic No. 1	2	3	4	5	6	7	8	9	10	Total
I	1	-	-	-	-	-	-	694	695	650	636	4
	2	-	-	-	-	-	-	-	-	674	640	2
	3	-	-	-	-	-	-	648	637	611	688	4
	4	-	-	[a]685	-	-	-	699	695	626	-	4
	5	-	-	695	-	-	-	-	677	525	[b]583	5
II	1	-	-	-	-	-	-	-	-	-	-	0
	2	-	-	-	-	-	-	-	-	-	-	0
	3	-	-	-	-	-	-	-	-	-	[b]694	1
	4	-	-	-	-	-	-	-	-	-	-	0
	5	-	-	[a]698	[a]686	-	689	640	[c]695	-	[a]675	8
III	1	-	-	-	-	-	-	-	-	[d]642	655	3
	2	-	-	-	-	-	-	-	-	-	-	0
	3	-	-	-	-	-	-	-	-	-	-	0
	4	-	-	-	-	-	-	-	-	-	-	0
	5	-	-	-	-	-	-	-	-	-	-	0
III	1	-	-	-	-	-	-	-	-	-	-	0
	2	-	-	-	-	-	-	-	-	-	-	0
	3	-	-	-	-	-	-	-	-	-	-	0
	4	-	-	-	-	-	-	-	-	-	699	1
	5	-	-	-	-	-	-	-	-	-	-	0

econd magazine.
irst magazine rate. Second magazine rate was 631.
irst magazine, first burst. Second burst was 684. Second magazine rate as 665.
irst magazine. Second magazine rate was 658.

TABLE 6-10. CONSOLIDATED CYCLIC RATE OF FIRE DATA FOR SPECIAL STUDY OF XM4 CARBINE NO. 4 AFTER COMPLETION OF ENDURANCE TEST

Test Phase No.	Magazine Sequence	Average Cyclic Rate of Fire, spm, by Cyclic No. 1	2	3	4	5	6	7	8	9	10	Avg
X	1	888	887	856	901	868	912	882	906	915	897	891
	2	882	884	857	910	868	908	904	904	823	892	883

Environmental/Adverse Conditions (encl 7).

a. High temperature. Three XM4 carbines were each fired a total of 0 rounds at +155 °F. Operator level maintenance of the weapons was done ry 1200 rounds, at +155 °F. M855 ball cartridges were used in this test, No. WCC85L030-039.

The firing schedule used was the same as for the endurance test (see le 6-1).

Test results are presented in Table 7-1 for functioning performance. le 7-2 gives the cyclic rate data and 7-3 further defines cyclic rate ctuations in the carbines. Refer to Enclosure 7 for detailed data.

TABLE 7-1. CONSOLIDATED FUNCTIONING PERFORMANCE DATA FOR XM4 CARBINES FIRED IN A HIGH TEMPERATURE ENVIRONMENT (+155 °F)

Test Phase[a]	No. Test Cycles	No. Malfunctions by Type							Charge to Weapon
		FFD	FTC	FFR	FEX	FEJ	FBR	OTH	
XM Carbines SN 6153627 (11)									
1	10	4	4	0	0	0	0	0	3
2	10	10	3	0	7	1	0	0	2
3	10	19	7	0	9	1	0	0	0
Subtotal	**30**	**33**	**14**	**0**	**16**	**2**	**0**	**0**	**5**
XM4 Carbine SN 6153631 (12)									
1	10	2	0	0	0	1	0	0	2
2	10	0	0	0	0	0	0	0	0
3	10	6	0	0	0	0	0	0	1
Subtotal	**30**	**8**	**0**	**0**	**0**	**1**	**0**	**0**	**3**

e footnotes at end of table.

TABLE 7-1 (CONT'D)

Test Phase[a]	No. Test Cycles	No. Malfunctions by Type FFD	FTC	FFR	FEX	FEJ	FBR	OTH	Charge to Weapon
		XM4 Carbine SN 6153635 (13)							
1	10	2	0	0	0	7	1	0	4
2	10	1	0	0	0	2	1	0	2
3	10	0	0	0	0	9	0	0	0
Subtotal	**30**	**3**	**0**	**0**	**0**	**18**	**2**	**0**	**6**
Overall Total	30	44	14	0	16	21	2	0	12

eapon conditioned with bolt retracted and latched to rear by the bolt stop ith weapon empty. Selector set on SAFE and dust cover open for all test hases.

R = Failure of bolt to remain to rear after firing last round from magazine.
J = Failure to eject.
X = Failure to extract.
D = Failure to feed.
R = Failure to fire.
C = Failure to chamber.
H = Other specified type.

TABLE 7-2. CONSOLIDATED CYCLIC RATE OF FIRE DATA FOR XM4 CARBINES FIRED AT +155 °F TEMPERATURE

Phase No.	Weapon ID SN	Test	Rd No.	Average Cyclic Rate, spm, by Cycle No.[a] 1	2	3	4	5	6	7	8	9	10	Avg
I	6153627	11	1 to 30	[b] -	[b] -	[b] -	**863**	846	[c]826	838	842	[c]**775**	[c]801	827
	6153631	12		[b] -	[b] -	820	829	[c]818	**811**	827	**834**	[c]813	[c]816	821
	6153635	13		[b] -	[b] -	[c]**859**	826	[c]832	[c]832	[c]831	820	**790**	[c]808	825
	6153627	11	31 to 60	[b] -	[b] -	[b] -	**880**	[c]863	[c]848	[c]857	870	[c]**797**	[c]802	845
	6153631	12		[b] -	[b] -	[c]856	**880**	874	[c]858	866	868	[c]**834**	[c]851	861
	6153635	13		[b] -	[b] -	[c]**887**	[c]877	[c]861	864	869	[c]857	**841**	844	862
II	6153627	11	1 to 30	[c]**906**	879	887	879	[c]875	**848**	861	881	[c]872	[c]857	874
	6153631	12		873	[c]859	[c]**880**	860	[c]856	828	[c]849	[c]847	**811**	[c]838	850
	6153635	13		**900**	886	892	868	[c]860	823	850	819	788	[c]**769**	846
	6153627	11	31 to 60	911	909	**914**	[c]891	[c]903	[c]**879**	[c]903	[c]884	886	[c]887	897
	6153631	12		[c]**902**	885	902	883	887	858	873	873	[c]**851**	865	880
	6153635	13		[c]922	[c]909	**924**	893	[c]885	854	878	[c]866	836	[c]**824**	879
III	6153627	11	1 to 30	[c]**929**	910	[c]908	913	[c]904	[b] -	903	[c]**874**	879	875	899
	6153631	12		[c]**911**	886	[c]902	897	828	[c]856	[c]853	**815**	[c]846	816	861
	6153635	13		**858**	827	[c]812	[c]810	[c]781	791	[c]763	[c]758	782	[c]**738**	792
	6153627	11	31 to 60	934	925	933	**939**	[c]929	[c]915	931	**898**	908	[c]909	922
	6153631	12		931	**933**	[c]920	928	840	[c]889	884	**808**	880	[c]841	885
	6153635	13		[c]**872**	850	837	[c]836	825	819	810	**756**	[c]811	780	820

[a]Average of ten 3-round bursts except as noted by footnote [c].
[b]No data available.
[c]Less than ten 3-round bursts in the average.

Note: Bold face numbers indicate maximum and minimum rates within each ten- cycle group of rates.

TABLE 7-3. XM4 CARBINE CYCLIC RATES EXCEEDING 940 SPM DURING HIGH TEMPERATURE TESTING AT +155 °F

apon o.	Phase No.	Cycle No.	Magazine Sequence	Cycle Rate spm by Burst No. in 120-Rd Cycle 1	2	3	4	5	6	7	8	9	10
11	I	4	2	-	-	-	-	-	-	-	-	-	948
	II	3	1	-	-	-	-	-	-	-	-	-	942
		2	2	-	-	-	-	-	-	-	-	-	969
		3	2	-	-	-	-	-	-	-	-	-	956
		5	2	-	-	-	-	-	-	-	-	-	947
	III	1	1	-	-	-	-	-	-	942	942	948	958
		2	1	-	-	-	-	-	-	-	-	943	944
		4	1	-	-	-	-	-	-	-	947	943	963
		7	1	-	-	-	-	-	-	-	-	-	950
		1	2	-	-	-	943	-	-	943	-	-	967
		2	2	-	-	-	-	946	941	-	-	-	941
		3	2	-	-	-	-	-	-	-	958	-	959
		4	2	-	-	-	-	-	959	944	993	965	960
		5	2	-	-	-	-	-	-	-	-	942	-
		6	2	-	-	-	-	-	-	-	945	941	-
		7	2	-	-	-	-	-	944	964	961	947	960
		9	2	-	-	-	-	-	-	-	-	-	945
12	I	-	-	-	-	-	-	-	-	-	-	-	-
	II	1	2	-	-	-	-	-	-	-	-	-	942
	III	3	1	-	-	-	-	-	-	-	-	-	945
		1	2	-	-	-	-	-	-	950	961	-	953
		3	2	-	-	-	-	-	-	-	-	-	955
		4	2	-	-	-	-	-	-	968	959	-	-
13	I	-	-	-	-	-	-	-	-	-	-	-	-
	II	2	1	-	-	-	-	-	-	-	-	-	953
		3	1	-	-	-	-	-	-	-	-	-	949
		4	1	-	-	-	-	-	-	-	-	-	943
		1	2	-	-	-	-	-	-	-	948	948	956
		2	2	-	-	-	-	-	-	-	-	-	977
		3	2	-	-	-	-	-	941	951	-	-	974
	III	-	-	-	-	-	-	-	-	-	-	-	-

b. Low temperature. The three XM4 carbines that were used for high mperature testing were cleaned, inspected and then lubricated with low mperature lubricant conforming to MIL-L-14107B. Testing was divided into ree 1200-round phases to assess performance differences due to between-firing orage conditions. The 1200-round scheduled direct support level maintenance the carbines was done outside the environmental chamber with a 6-hour nimum reconditioning period at temperature before firing of the next phase. e firing schedule used during endurance testing was also used in this test ee table 6-1).

Functioning performance data are listed in Table 7-4.

Analysis of failures-to-initiate-firing within the first 30 rounds fired
m a cold-conditioned carbine are presented in Table 7-5, cyclic rate data
displayed in Table 7-6, with further analysis in Table 7-7. Refer to
closure 7 for detailed data.

TABLE 7-4. CONSOLIDATED FUNCTIONING PERFORMANCE DATA FOR XM4 CARBINES FIRED IN A LOW TEMPERATURE ENVIRONMENT (-65 °F)

Test Phasea	No. Test Cycles	No. Malfunctions by Type							Charge to Weapon
		FFD	FTC	FFR	FEX	FEJ	FBR	OTH	
XM Carbines SN 6153627 (11)									
1	10	0	7	8	0	0	0	0	1
2	10	6	3	4	0	0	0	0	2
3	10	3	5	15	0	0	0	6	2
Subtotal	**30**	**9**	**15**	**27**	**0**	**0**	**0**	**6**	**5**
XM4 Carbine SN 6153631 (12)									
1	10	6	0	4	0	0	0	0	1
2	10	6	2	1	0	0	0	1	2
3	10	6	3	6	0	0	0	6	2
Subtotal	**30**	**18**	**5**	**11**	**0**	**0**	**0**	**7**	**5**
XM4 Carbine SN 6153635 (13)									
1	10	1	0	2	0	0	6	0	1
2	10	9	1	3	0	2	7	0	3
3	10	4	7	7	0	0	5	5	1
Subtotal	**30**	**14**	**8**	**12**	**0**	**2**	**18**	**5**	**5**
Overall total	30	41	28	50	0	2	18	18	15

ase 1 = Weapon fully loaded, first cartridge from magazine fully chambered. Safety ON. Dust cover closed.
ase 2 = Weapon fully loaded, bolt closed on empty chamber, safety ON, dust cover closed.
ase 3 = Weapon fully loaded, bolt fully retracted and latched on bolt stop, safety ON. Dust cover closed.

R = Failure of bolt to remain to rear after firing last round from magazine.
J = Failure to eject.
X = Failure to extract.
) = Failure to feed.
R = Failure to fire.
C = Failure to chamber.
H = Other (specified).

TABLE 7-5. XM4 CARBINE FREQUENCY OF FAILURE TO INITIATE FIRING IN FIRST 30 ROUNDS AT -65 °F TEMPERATURE

Phase No.	Weapon No.	Number of Failures, by 120-Round Firing Cycle 1	2	3	4	5	6	7	[a]8	9	10	Total
I	11	0	0	0	1	1	1	2	0	6	0	11
	12	0	1	0	0	0	2	1	1	0	0	5
	13	1	0	1	0	0	0	0	0	0	0	2
	Total	**1**	**1**	**1**	**1**	**1**	**3**	**3**	**1**	**6**	**0**	**18**
II	11	0	0	1	1	1	1	2	1	3	1	11
	12	0	0	1	2	1	1	2	0	1	1	9
	13	0	2	1	1	1	2	4	1	1	2	15
	Total	**0**	**2**	**3**	**4**	**3**	**4**	**8**	**2**	**5**	**4**	**35**
III	11	0	0	1	3	3	1	5	4	4	4	25
	12	0	1	0	2	2	2	2	2	2	2	15
	13	0	1	0	2	2	1	3	3	3	4	19
	Total	**0**	**2**	**1**	**7**	**7**	**4**	**10**	**9**	**9**	**10**	**59**
I to III	11	0	0	2	5	5	3	9	5	13	5	47
	12	0	2	1	4	3	5	5	3	3	3	29
	13	1	3	2	3	3	3	7	4	4	6	36
Overall Total		**1**	**5**	**5**	**12**	**11**	**11**	**21**	**12**	**20**	**14**	[b]112

[a] perator-level maintenance performed prior to firing cycle No. 8.
[b] efer to Enclosure 7 for specific stoppage types.

TABLE 7-6. FIRST BURST CYCLIC RATES FOR XM4 CARBINES FIRED AT -65 °F TEMPERATURE

Cycle No.[a]	Cyclic Rate, Spm, by Weapon No. and Rounds in Firing Cycle: Weapon No. 11 1 to 3	Weapon No. 11 31 to 33	Weapon No. 12 1 to 3	Weapon No. 12 31 to 33	Weapon No. 13 1 to 3	Weapon No. 13 31 to 33
	Phase I					
1	[b] -	[b] -	[b] -	[b] -	[b] -	[b] -
2	554	743	537	679	525	752
3	[b] -	715	585	731	493	716
4	656	781	630	765	594	774
5	641	738	608	752	576	[b] -
6	[b] -	726	620	749	611	741
7	631	727	632	687	483	749
8	606	726	671	769	644	781
9	505	735	496	734	475	740
10	[b] -	731	486	717	573	740

:e footnotes at end of table.

TABLE 7-6 (CONT'D)

Cyclic Rate, Spm, by Weapon No. and Rounds in Firing Cycle

Cycle No.[a]	Weapon No. 11		Weapon No. 12		Weapon No. 13	
	1 to 3	31 to 33	1 to 3	31 to 33	1 to 3	31 to 33
Phase II						
1	b -	791	696	764	763	805
2	658	791	612	781	658	825
3	626	781	596	771	526	798
4	603	780	588	768	542	796
5	534	771	537	766	521	770
6	582	771	584	749	386	767
7	606	723	606	728	640	752
8	592	703	584	661	609	733
9	602	696	559	685	535	755
10	538	684	483	710	568	722
Phase III						
1	b -	801	710	780	756	784
2	b -	749	560	809	524	787
3	609	b -	649	747	534	784
4	649	774	589	766	565	767
5	112	754	611	770	589	740
6	601	752	593	746	539	746
7	604	709	600	732	710	722
8	654	715	543	717	620	713
9	565	727	502	695	439	696
10	511	718	518	688	432	690

ach firing cycle consists of 120 rounds. The first two 30-round magazine i.e., rounds 1 to 30 and 31 to 60) were fired in 3-round controlled burst ode.

o data available.

TABLE 7-7. NUMBER OF 3-ROUND BURSTS BELOW 700 SPM RATE FOR XM4 CARBINES FIRED AT -65 °F TEMPERATURE

Cycle No.[a]	No. Bursts, by Weapon No. and Round Interval in Cycle: Weapon No. 11, 1 to 30	Weapon No. 11, 31 to 60	Weapon No. 12, 1 to 30	Weapon No. 12, 31 to 60	Weapon No. 13, 3 to 30	Weapon No. 13, 31 to 60	Total
Phase I							
1	[b]-	[b]-	[b]-	[b]-	[b]-	[b]-	[b]-
2	5	0	4	1	5	0	15
3	[c] 8	0	5	0	5	0	18
4	[c] 3	0	4	0	3	0	10
5	[c] 2	0	[c] 4	0	[c] 2	[c]0	8
6	[c] 4	0	[c] 4	[c]0	4	0	12
7	[c] 3	0	[c] 3	1	3	0	10
8	3	0	1	0	5	0	9
9	[c] 2	0	6	0	4	0	12
10	2	0	5	0	6	0	13
Totals	**32**	**0**	**36**	**2**	**37**	**0**	**107**
Phase II							
1	[b]-	0	1	0	0	0	[b] 1
2	3	0	4	0	[c] 3	0	10
3	4	0	4	0	4	0	12
4	5	0	4	0	3	0	12
5	5	0	5	0	4	0	14
6	5	0	5	0	5	0	15
7	[c] 5	0	5	0	[c] 4	0	14
8	9	1	9	2	8	1	30
9	5	5	8	2	7	0	27
10	8	3	[c] 7	0	[c] 6	0	24
Total	**49**	**9**	**52**	**4**	**44**	**1**	**159**
Phase III							
1	[c] 0	0	[c] 0	0	0	0	0
2	[b]-	0	[c] 4	[c]0	5	0	[b] 9
3	3	[c]0	3	[c]0	3	0	9
4	3	0	[c] 4	[c]0	5	0	12
5	2	0	[c] 3	0	[c] 3	0	8
6	5	0	[c] 5	0	6	0	16
7	4	0	[c] 6	1	[c] 6	0	17
8	[c] 5	0	[c] 6	0	[c] 7	0	18
9	[c] 6	0	[c] 7	1	[c] 6	1	21
10	[c] 7	1	7	1	[c] 7	[c]2	25
Total	[b]35	**1**	**45**	**3**	**48**	**3**	**135**

e footnotes at end of table.

TABLE 7-7 (CONT'D)

ach firing cycle consists of 120 rounds. The first two 30-round magazines i.e. rounds 1-30 and 31-60) were fired in 3-round controlled burst mode.
) data available in one firing cycle.
stimated, based on extrapolation of missing data point values. Refer to ndividual burst rate data contained in Enclosure 7.

c. Icing (+20 °F). Three XM4 carbines were used in this test. Each apon was fully loaded before icing. The selector was set on SAFE, the dust ver closed, a loaded magazine inserted, and the muzzle cap in place. An ice yer approximately 0.2 inch thick was applied to all exterior exposed surfaces the three carbines. After 24 hours of conditioning, each carbine was fired) rounds (three additional uniced, but temperature-conditioned and loaded gazines were assigned per weapon). The first two magazines were fired in round controlled bursts; the last two magazines were fired in the niautomatic mode. Test results were given in Table 7-8 for functioning rformance and Table 7-9 for cyclic rates of fire. Figure 11-5 and 11-6 ncl 11) show materiel damage sustained as a result of testing.

All operating controls of the carbines were found to be inoperable after ing iced over. The selector, bolt stop, trigger, magazine latch, and arging handle all had to be hammered free of the ice before they would erate. The adjustable buttstock could be extended after being iced over in e stowed position, but required ice removal from the lower receiver extension fore being retracted if iced over in an extended position.

TABLE 7-8. CONSOLIDATED FUNCTIONING PERFORMANCE DATA FOR XM4 CARBINES FIRED IN AN ICE ENVIRONMENT (+20 °F)

Weapon ID		No. Malfunctions, by Type							Charge to
SN	Test No.	FFD	FTC	FFR	FEX	FEJ	FBR	OTH	Weapon
6153627	11	0	0	2	0	0	1	3	6
6153631	12	0	1	0	0	0	1	2	3
6153635	13	0	0	5	0	0	0	2	6
Totals	-	**0**	**1**	**7**	**0**	**0**	**2**	**7**	**15**

R = Failure of bolt to remain to rear after firing last round from magazine.
J = Failure to eject.
X = Failure to extract.
D = Failure to feed.
R = Failure to fire.
C = Failure to chamber.

TABLE 7-9. CYCLIC RATE OF FIRE DATA
FOR ICING TEST (+20 F)

apon o.	Magazine Sequence	Cyclic Rate, SPM, by Burst[a] 1	2	3	4	5	6	7	8	9	10	Avg
.1	1	[b]848	873	867	884	865	878	896	890	885	-	-
	2	872	862	881	879	879	874	895	880	874	-	-
.2	1	[c]851	[c]840	843	858	867	854	871	878	[c]878	-	-
	2	861	859	865	867	865	869	874	886	871	[c]880	870
.3	1	[c]862	851	844	847	861	860	878	865	876	881	862
	2	873	875	877	879	884	878	877	887	881	896	881

ired in controlled 3-round bursts, except as noted.
our-round burst.
wo-round burst.

d. Attitudes. The three carbines previously used for accuracy testing re cleaned, inspected, and relubricated with cleaner/lubricant/preservative LP) in preparation for this test.

Functioning performance data are tabulated in Table 7-10. Table 7-11 iresses cyclic rates of fire. Refer to Enclosure 7 for detailed data.

TABLE 7-10. CONSOLIDATED FUNCTIONING PERFORMANCE DATA FOR XM4 CARBINES FIRED IN VARIOUS ALTITUDES AND ORIENTATIONS

Weapon ID SN	Test No.	No. Malfunctions, by Type FFD	FTC	FFR	FEX	FEJ	FBR	OTH	Charge to Weapon
6153611	8	10	0	2	0	0	0	0	2
6153613	7	10	0	3	0	1	0	0	4
6153615	6	6	0	0	0	0	0	0	0
Totals	-	**26**	**0**	**5**	**0**	**1**	**0**	**0**	**6**

R = Failure of bolt to remain to rear after firing last round from magazine.
J = Failure to eject.
X = Failure to extract.
D = Failure to feed.
R = Failure to fire.
C = Failure to chamber.

TABLE 7-11. CONSOLIDATED CYCLIC RATE DATE FOR XM4 CARBINES FIRED IN THE ATTITUDES TEST

Burst No.	Cycle-1 TSU-N, 0°			Cycle-2 TSU-N, -80°			Cycle-3 TSU-N, +80°			Cycle-4 TSU-L, +80°		
	6	7	8	6	7	8	6	7	8	6	7	8
1	875	865	911	815	784	846	824	726	825	784	725	785
10	936	909	936	908	869	906	871	862	901	913	860	940
Avg	**907**	**888**	**921**	**901**	**832**	**888**	**882**	**813**	**875**	**871**	**804**	**868**
11	890	856	880	902	819	874	868	792	824	854	767	908
20	961	930	958	956	876	924	947	887	909	935	-	921
Avg	**925**	**893**	**923**	**934**	**845**	**906**	**916**	**842**	**893**	**901**	**809**	**895**
21	913	882	933	913	850	909	901	843	870	908	790	891
30	973	943	968	990	911	947	977	-	988	965	-	950
Avg	**939**	**907**	**941**	**951**	**881**	**935**	**939**	**869**	**908**	**932**	**858**	**914**
31	914	887	936	841	873	938	913	846	907	909	831	891
40	973	941	981	1012	925	994	914	942	992	-	946	-
Avg	**955**	**924**	**958**	**972**	**904**	**971**	**940**	**896**	**961**	**960**	**870**	**932**

Burst No.	Cycle-5 TSU-L, -80°			Cycle-6 TSU-L, 0°			Cycle-7 RSU-N, 0°			Cycle-8 LSU-N,) 0°		
	6	7	8	6	7	8	6	7	8	6	7	8
1	769	684	-	809	727	823	854	820	890	829	795	832
10	908	861	-	900	848	876	927	898	956	910	891	917
Avg	**873**	**801**	**-**	**872**	**822**	**867**	**893**	**863**	**925**	**874**	**847**	**879**
11	872	792	-	854	763	820	880	837	873	846	824	866
20	920	873	-	926	857	874	949	927	953	942	914	923
Avg	**899**	**828**	**-**	**889**	**820**	**846**	**916**	**879**	**912**	**894**	**863**	**900**
21	904	817	-	887	800	878	904	836	889	874	851	870
30	964	909	-	924	891	882	978	917	967	955	924	965
Avg	**940**	**858**	**-**	**906**	**838**	**848**	**940**	**892**	**927**	**916**	**900**	**928**
31	914	829	-	871	802	824	914	881	886	880	874	936
40	-	925	-	965	892	907	999	961	988	977	936	994
Avg	**954**	**894**	**-**	**923**	**856**	**868**	**968**	**926**	**947**	**942**	**917**	**961**

Burst No.	Cycle-9 USD-N, 0°			Cycle-10 RSU-L, 0°			Cycle-11 LSU-L, 0°			Cycle-12 USD-L, 0°		
	6	7	8	6	7	8	6	7	8	6	7	8
1	777	752	795	771	737	779	-	-	844	774	757	773
10	884	873	886	893	849	872	-	-	890	889	850	882
Avg	**843**	**825**	**857**	**850**	**804**	**852**	**-**	**-**	**880**	**857**	**810**	**862**
1	801	794	804	-	755	813	-	-	-	798	732	769
20	927	888	904	-	884	907	-	-	-	922	879	901
Avg	**864**	**841**	**856**	**-**	**830**	**865**	**-**	**-**	**-**	**875**	**809**	**860**
21	860	825	827	-	795	858	-	-	836	845	787	851
30	959	909	922	-	912	976	-	-	919	964	916	956
Avg	**906**	**863**	**876**	**-**	**866**	**916**	**-**	**-**	**883**	**910**	**853**	**899**

TABLE 7-11 (CONT'D)

Burst No.	Cycle-9 USD-N, 0°			Cycle-10 RSU-L, 0°			Cycle-11 LSU-L, 0°			Cycle-12 USD-L, 0°		
	6	7	8	6	7	8	6	7	8	6	7	8
31	864	821	855	-	843	871	-	-	885	797	797	868
40	980	953	973	-	956	946	-	-	940	957	917	972
Avg	**921**	**894**	**916**	**-**	**904**	**926**	**-**	**-**	**909**	**912**	**873**	**938**

:es: Averages are for ten 3-round bursts. Degrees specified are muzzle elevation/depression indices. N and L refer to NORMAL shoulder fired hold on weapon and LOOSE hand hold only on weapon. TSU = top-side-up, RSU = right-side-up, LSU = left-side-up, and USD = up-side-down. The guns were cleaned and lubricated at the start of testing and again before firing trial No. 7.

e. Sand/dust. Sand and dust testing was divided into two parts. The :st part was the static dust test. In that test the three weapons were fully ıded, safed, and environmentally sealed (i.e., dust cover closed and muzzle) installed). The carbines were conditioned in the blowing dust environment pounds of dust dispensed into the dust box in a 1-minute time internal) in e top-side-up position. The weapons were inverted and the conditioning peated for one more minute. After removal from the dust environment, each apon was fired 120 rounds without any attempt at cleaning. After completion the static dust test, each weapon was thoroughly cleaned and relubricated. e dynamic dust test was fired in four 120-round cycles. The weapons were)led, but not cleaned, until the total 600 rounds were fired or unscheduled intenance became mandatory. All four loaded magazines were dust conditioned)ng with the weapons.

The functioning performance and cyclic rate data for the static dust test e reported in Tables 7-12 and 7-13, respectively. Dynamic dust testing is llated in Tables 7-14 and 7-15 for functioning performance and cyclic rate, spectively.

TABLE 7-12. CONSOLIDATED FUNCTIONING PERFORMANCE DATA FOR XM4 CARBINES FIRED IN THE STATIC DUST TEST

Weapon ID		No. Malfunctions, by Type							Charge to
SN	Test No.	FFD	FTC	FFR	FEX	FEJ	FBR	OTH	Weapon
6153637	14	1	0	0	0	0	0	0	0
6153639	15	4	0	0	0	0	0	0	2
6153641	16	0	0	0	0	0	0	0	0
Total	-	**5**	**0**	**0**	**0**	**0**	**0**	**0**	**2**

R = Failure of bolt to remain to rear after firing last round from magazine.
J = Failure to eject.
X = Failure to extract.
) = Failure to feed.
R = Failure to fire.
C = Failure to chamber.

TABLE 7-13. CONSOLIDATED CYCLIC RATE DATA FOR XM4 CARBINES FIRED IN THE STATIC DUST TEST

Burst No.	Cyclic Rate, spm, by Weapon No.		
	14	15	16
1	750	627	765
10	845	804	870
Avg	798	758	828
11	706	667	741
20	834	814	863
Avg	790	767	816
21	779	733	729
30	851	844	842
Avg	817	799	787
31	812	707	747
40	881	870	884
Avg	**842**	**813**	**820**

TABLE 7-14. CONSOLIDATED FUNCTIONING PERFORMANCE DATA FOR WEAPONS FIRED IN THE DYNAMIC DUST TEST

Weapon ID		No. Malfunctions, by Type							Charge to
SN	Test No.	FFD	FTC	FFR	FEX	FEJ	FBR	OTH	Weapon
					XM4 Carbines				
6153637	14	11	0	0	0	6	0	0	9
6153639	15	15	0	0	0	0	1	0	9
6153641	16	22	0	0	0	1	1	1	15
Total	-	**48**	**0**	**0**	**0**	**7**	**2**	**1**	**33**
					M16A2 Rifle[a]				
6041351	8M	20	0	0	0	0	0	0	4

.6A2 rifle fired for comparison to evaluate ejection/extraction problems ith carbines.

R = Failure of bolt to remain to rear after firing last round from magazine.
J = Failure to eject.
X = Failure to extract.
) = Failure to feed.
R = Failure to fire.
C = Failure to chamber.

TABLE 7-15. CONSOLIDATED CYCLIC RATE DATA FOR WEAPONS FIRED IN THE DYNAMIC DUST TEST

Burst No.	XM4 Carbine First Test 14	XM4 Carbine First Test 15	XM4 Carbine First Test 16	XM4 Carbine Retest 14	M16A2 Rifle 8M	Burst No.	XM4 Carbine First Test 14	XM4 Carbine First Test 15	XM4 Carbine First Test 16	XM4 Carbine Retest 14	M16A2 Rifle 8M
1	852	843	834	883	854	101	-	664	600	685	650
10	912	917	915	944	891	110	-	831	778	903	842
Avg	**881**	**885**	**888**	**914**	**870**	**Avg**	**-**	**781**	**689**	**807**	**766**
11	762	749	747	822	703	111	-	682	550	601	656
20	905	888	873	925	868	120	-	862	800	887	860
Avg	**847**	**846**	**836**	**893**	**815**	**Avg**	**-**	**786**	**718**	**826**	**791**
21	739	760	691	811	663	121	-	728	689	749	655
30	867	895	859	935	878	130	-	834	795	810	812
Avg	**811**	**840**	**812**	**889**	**797**	**Avg**	**-**	**812**	**761**	**793**	**757**
31	621	726	601	789	694	131	-	658	590	623	643
40	894	898	922	945	886	140	-	802	759	807	815
Avg	**791**	**834**	**811**	**891**	**825**	**Avg**	**-**	**750**	**699**	**726**	**752**
41	-	815	822	825	739	141	-	440	448	656	671
50	-	878	886	907	799	150	-	796	764	792	832
Avg	**-**	**867**	**852**	**885**	**787**	**Avg**	**-**	**687**	**664**	**738**	**767**
51	-	710	619	754	656	151	-	530	567	696	664
60	-	850	824	909	841	160	-	790	762	808	852
Avg	**-**	**803**	**758**	**850**	**782**	**Avg**	**-**	**711**	**672**	**773**	**772**
61	-	630	567	734	557	161	-	653	625	726	667
70	-	837	811	933	839	170	-	842	805	847	788
Avg	**-**	**798**	**746**	**859**	**745**	**Avg**	**-**	**816**	**752**	**816**	**762**
71	-	668	604	798	625	171	-	628	582	529	620
80	-	890	833	940	875	180	-	816	749	836	804
Avg	**-**	**810**	**761**	**888**	**801**	**Avg**	**-**	**755**	**653**	**748**	**746**
81	-	814	729	818	728	181	-	499	539	589	663
90	-	870	853	902	810	190	-	810	764	832	821
Avg	**-**	**855**	**814**	**875**	**781**	**Avg**	**-**	**732**	**655**	**756**	**742**
91	-	693	654	746	644	191	-	553	532	560	618
100	-	839	769	875	833	200	-	832	796	851	835
Avg	**-**	**793**	**722**	**829**	**759**	**Avg**	**-**	**740**	**706**	**760**	**755**

f. Mud. Mud testing consisted of immersing each weapon in the mud
:ture for 1 minute. The carbine were fully loaded, safed, dust cover closed,
muzzle cap in place. Buttstocks were either stowed or extended before
ıersion. After withdrawl from the mud, the buttstocks were operated (i.e.,
ended/stowed) and then extended for firing. Firing occurred without
ıntenance until completion of 120 rounds per carbine. The last three
;azines per weapon were not immersed in the mud.

The functioning performance data for the mud test are shown in Table 7-16.
.lic rate data are presented in Table 7-17.

TABLE 7-16. CONSOLIDATED FUNCTIONING PERFORMANCE DATA FOR XM4 CARBINES FIRED IN THE MUD TEST

Weapon ID		No. Malfunctions, by Type							Charge to
SN	Test No.	FFD	FTC	FFR	FEX	FEJ	FBR	OTH	Weapon
6153637	14	0	3	0	0	0	0	0	3
6153639	15	0	1	0	0	0	0	0	1
6153641	16	0	6	0	0	0	0	0	4
Totals	-	**0**	**10**	**0**	**0**	**0**	**0**	**0**	**8**

ı = Failure of bolt to remain to rear after firing last round from magazine.
J = Failure to eject.
ı = Failure to extract.
) = Failure to feed.
ı = Failure to fire.
ɔ = Failure to chamber.

TABLE 7-17. CONSOLIDATED CYCLIC RATE DATA FOR XM4 CARBINES FIRED IN THE MUD TEST

	Cyclic Rate, spm, by Weapon No.		
No.	14	15	16
1	841	841	852
10	802	804	881
Avg	802	796	846
11	740	707	794
20	738	759	825
Avg	719	742	793
21	677	706	716
30	731	792	774
Avg	699	734	734
31	690	685	644
40	695	783	697
Avg	664	733	668

g. Simulated rain. The rain test consists of six 10-minute conditioning eriods, starting with horizontal (top-side-up), then muzzle-up, and then ızzle-down. Each conditioning period is broken into two smaller intervals; ıe with bolt open, magazine inserted, and dust cover open, followed by fully ɔading the carbine, safing it, and closing the dust cover. These two 5-minute ɔnditioning periods are followed by alternating the firing of 120 rounds in ɔntrolled 3-round bursts and semiautomatic modes. The total iring/conditioning periods were at least 1 hour which produced an average aterfall rate of 24 inches/hour.

The test data are presented in Tables 7-18 and 7-19 for functioning erformance and cyclic rate, respectively.

TABLE 7-18. CONSOLIDATED FUNCTIONING PERFORMANCE DATA FOR XM4 CARBINES FIRED IN THE SIMULATED RAIN TEST

Weapon ID		No. Malfunctions, by type							Charge to
SN	Test No.	FFD	FTC	FFR	FEX	FEJ	FBR	OTH	Weapon
6153636	14	2	0	0	0	0	0	0	0
6153639	15	0	0	0	0	0	0	0	0
6153641	16	0	0	0	0	0	0	0	0

BR = Failure of bolt to remain to rear after firing last round from magazine.
EJ = Failure to eject.
EX = Failure to extract.
FD = Failure to feed.
FR = Failure to fire.
TC = Failure to chamber.

TABLE 7-19. CONSOLIDATED CYCLIC RATE DATA FOR XM4 CARBINES FIRED IN A SIMULATED RAIN ENVIRONMENT

Burst	Cyclic Rate, spm, by Test Weapon and Phase No.								
	Phase I			Phase II			Phase III		
No.	14	15	16	14	15	16	14	15	16
1	822	862	868	578	630	705	596	634	627
10	868	860	875	782	792	808	727	722	750
Avg	**856**	**856**	**864**	**712**	**740**	**759**	**672**	**672**	**697**
11	836	818	835	703	714	703	649	624	627
20	865	838	835	769	784	757	708	731	790
Avg	**841**	**814**	**822**	**725**	**743**	**738**	**678**	**669**	**691**
21	816	797	822	741	706	-	658	633	636
30	844	834	884	772	754	814	714	710	795
Avg	**830**	**816**	**825**	**729**	**734**	**-**	**685**	**673**	**699**
31	808	794	781	740	700	656	611	647	620
40	837	860	877	775	788	817	710	780	803
Avg	**816**	**815**	**820**	**743**	**722**	**743**	**656**	**691**	**700**

h. Saltwater immersion. This test was conducted over a period of days. Each weapon and its assigned magazines were immersed for 1 minute in 5% solution of salt water. The carbines and 120 rounds were then fired. The ring sequence throughout testing was two 30-round magazines fired in 3-round ntrolled-burst mode followed by two other full magazines fired niautomatically. Four other 120-round firings per weapon were done on the ird, fifth, ninth and tenth test day. No scheduled maintenance was performed ring this test. Unscheduled maintenance was done when necessary to allow mpletion of testing. Functioning performance data are given in Table 7-20. ble 7-21 presents the cyclic rate data.

TABLE 7-20. CONSOLIDATED FUNCTIONING PERFORMANCE DATA FOR XM4 CARBINES FIRED IN THE SALTWATER IMMERSION TEST

Weapon ID		No. Malfunctions, by Type							Charge to
Serial No.	Test No.	FFD	FTC	FFR	FEX	FEJ	FBR	OTH	Weapon
6153637	14	5	0	0	2	2	0	0	4
6153639	15	5	0	0	4	0	0	0	4
6153641	16	11	3	1	3	0	0	0	7
Total	-	**21**	**3**	**1**	**9**	**2**	**0**	**0**	**15**

R = Failure of bolt to remain to rear after firing last round from magazine.
J = Failure to eject.
X = Failure to extract.
) = Failure to feed.
R = Failure to fire.
C = Failure to chamber.

TABLE 7-21. CONSOLIDATED CYCLIC RATE DATA FOR XM4 CARBINES FIRED IN THE SALTWATER IMMERSION TEST

Test Day	Burst No.	Cyclic Rate, spm, by Weapon No. 14	15	16
1	1	829	833	878
	10	881	895	899
	Avg	**867**	**876**	**876**
	11	843	864	878
	20	861	907	886
	Avg	**860**	**873**	**876**
3	21	796	798	735
	30	869	897	872
	Avg	**844**	**850**	**818**
	31	829	848	817
	40	899	902	874
	Avg	**854**	**868**	**842**

TABLE 7-21 (CONT'D)

Test Day	Burst No.	Cyclic Rate, spm, by Weapon No. 14	15	16
5	41	720	751	623
	50	856	894	849
	Avg	**831**	**854**	**799**
	51	789	808	772
	60	860	871	882
	Avg	**830**	**841**	**839**
9	61	612	633	559
	70	880	885	817
	Avg	**803**	**818**	**745**
	71	780	813	604
	80	868	880	839
	Avg	**824**	**845**	**773**
10	81	608	661	558
	90	844	865	818
	Avg	**794**	**813**	**750**
	91	795	833	791
	100	844	852	843
	Avg	**819**	**830**	**801**

i. Unlubricated. Testing of unlubricated XM4 carbines was done on three apons. Each was fired in 120-round cycles using the endurance-test schedule, ble 6-1. Each weapon and its assigned magazines were detail-disassembled, mpletely degreased, and dried before reassembly and firing. Ball M855 munition (lot No. WCC85L030-039) was used throughout testing. The resultant nctioning data are presented in Table 7-22. Cyclic-rate-of-fire information e contained in Table 7-23.

TABLE 7-22. CONSOLIDATED FUNCTION PERFORMANCE DATA FOR XM4 CARBINES FIRED IN THE UNLUBRICATED WEAPON TEST

Weapon ID SN -	Test No.	No. Malfunctions, by Type FFD	FTC	FFR	FEX	FEJ	FBR	OTH	Charge to Weapon
6153611	8	209	4	0	0	1	0	3	184
6153613	7	104	4	0	0	14	0	8	107
6153615	6	35	2	0	0	0	0	1	21

R = Failure of bolt to remain to rear after firing last round from magazine.
J = Failure to eject.
X = Failure to extract.
D = Failure to feed.
R = Failure to fire.
C = Failure to chamber.

TABLE 7-23. CONSOLIDATED CYCLIC RATE OF FIRE FOR XM4 CARBINES FIRED IN THE UNLUBRICATED WEAPON TEST

120-Rd Cycle No.	Burst No.	Cyclic Rate, spm, by Weapon 6	7	8	Cycle No.	Burst No.	Cyclic Rate, spm, by Weapon 6	7	8
1	1	-	703	730	6	101	**581**	-	-
	10	-	810	869		110	925	845	832
	Avg	-	756	811		Avg	757	778	815
	11	746	**614**	**616**		111	744	717	-
	20	874	824	885		120	937	896	893
	Avg	837	740	802		Avg	872	828	828
2	21	**653**	**447**	565	7	121	**618**	-	-
	30	859	820	866		130	878	846	865
	Avg	806	716	797		Avg	746	789	810
	31	757	**506**	-		131	706	715	-
	40	881	864	878		140	919	869	876
	Avg	838	713	789		Avg	825	815	816
3	41	**606**	-	-	8	141	**658**	-	-
	50	869	862	845		150	899	882	855
	Avg	802	755	804		Avg	757	822	796
	51	**663**	-	658		151	756	-	742
	60	887	801	863		160	909	848	892
	Avg	819	684	808		Avg	864	779	835
4	61	**610**	-	-	9	161	**586**	-	-
	70	861	825	858		170	915	814	-
	Avg	729	781	807		Avg	838	777	-
	71	736	710	-		171	754	**682**	573
	80	899	882	869		180	919	861	880
	Avg	840	812	789		Avg	865	799	812
5	81	**615**	-	-	10	181	**536**	-	-
	90	887	873	839		190	886	837	880
	Avg	802	794	804		Avg	825	782	819
	91	671	-	692		191	781	-	775
	100	912	897	858		200	923	863	869
	Avg	838	820	806		Avg	867	797	837

otes: Bold face numbers indicate rates below 700 spm, averages are for ten cycles.

j. Chemical compatibility. This test was conducted with two new sets of andguards and buttstocks from the spare parts. One set of handguards and a uttstock were immersed in DS-2 (per MIL-D-50030G, ref 6). The other set was mmersed in STB (Super Tropical Bleach). Immersion time was 24 hours with both hemicals. After immersion, the test items were removed and allowed to drain or 24 hours. After draining, the handguards and buttstocks were flushed with ater to remove the decontamination agents and were then visually inspected. he visual inspection of DS-2 treated components revealed no structural or osmetic damage. These parts were installed on an XM4 carbine without ncident.

The STB treated components revealed no structural damage, but the aluminum loy handguard liners were etched by the bleach. Their structural integrity s not compromised, however. Attachment of these handguards and buttstock to e carbine was accomplished without incident. Since the structural integrity the parts was not compromised, the firing of 120 rounds on each component s not required.

Reliability (encl 8).

a. Reliability analysis by subtest was computed and is presented in ble 8-2, based on the tabulation given in Table 8-1.

TABLE 8-1. CONSOLIDATED PERFORMANCE DATA FOR XM4 CARBINES

Subtest ID		Tot	No. Rd	Unscored Malfa		Chargeable (Scored) Totalsb			
No.	Title	Wpn	Fired	Tot	Rateh	Malf	Stp	MRBSd	MRBOMFe
	Initial Inspection	16	206	2	9.7	0	0	-	-
	Initial Disp/ Velocity	16	861	13	15.1	0	0	-	-
	Initial Function	16	1,920	3	1.6	1	2	960	-
	Interchange	10	1,200	0	-	0	0	-	-
	Accy and Sight Calibration	3	1,072	2	1.9	0	2	536	-
	Endurance	5	50,000	179	3.6	c 2	39	1,282	25,000
a	High Temp	3	10,800	68	6.3	0	14	771	-
b	Low Temp	3	10,800	157	14.5	0	14	771	-
c	Icing	3	360	15	41.7	1	13	28	-
d	Attitudes	3	4,320	32	7.4	0	6	720	-
e(1)	Static Dust	3	360	5	13.9	0	2	180	-
e(2)	Dynamic Dust	3	1,920	67	34.9	1	32	60	-
f	Mud	3	360	10	27.8	0	8	45	-
g	Rain	3	2,160	2	0.9	0	0	-	-
h	Saltwater Immersion	3	1,800	36	20.0	0	15	120	-
i	Unlubricated	3	3,600	385	106.9	12	300	12	-
a	Flash	2	336	0	-	0	0	-	-
b	Smoke	2	240	0	-	0	0	-	-
c	Noise	1	10	0	-	0	0	-	-
d	Cookoff	1	9,992	8	0.8	0	8	1,249	-
Total:	All subtest		102,317	984	9,6	c16	455	225	51,158
Total:	Less unlubricated weapon test		98,717	599	6.1	c 4	155	637	49,358

e footnotes on next page.

TABLE 8-1 (CONT'D)

)tal of all unscored test incidents.
ased on scoring criteria (ref 2) incidents scored as chargeable to the
eapon.
wo malfunctions chargeable as operational mission failures.
RBS = Mean rounds between stoppages. Minimum acceptable MRBS is 600 rounds.
RBOMF = Mean round between operational mission failure. Minimum acceptable
RBOMF is 3800 rounds.
aseline value for comparing performance by subtest for MRBS and MRBOMF.
nformational firings. Data used only to evaluate effects of adverse
)nditions on weapon operation.
alfunction rate per 1000 rounds fired based on total number of all unscored
est incidents.

lf Tot = Malfunction total.
= Stoppage.
t Wpn = Total weapon.

TABLE 8-2. RELIABILITY ANALYSIS

Subtest ID No.	No. Rd Fired	Chargeable No. of Stoppages	MRBS, Rd Point Estimate	MRBS, Rd Lower 90% Conf. Limit	Is 600-Rd MRBS Criterion Level Met?[b]	Does Subtest MRBS Differ from Endurance MRBS? (α=0.10)	Chargeable No. of Mission Failures	MRBOMF, Rd Point Estimate	MRBOMF, Rd Lower 90% Conf. Limit	Is 3800-Rd MRBOMF Criterion Level Met?	Does Subtest MRBOMF Differ from Endurance MRBOMF? (α=0.10)
1	206	0	[a] -	89.5	[c] -	No	0	[a] -	89.5	[c] -	No
2	861	0	[a] -	373.9	[c] -	No	0	[a] -	373.9	[c] -	No
3	1,920	2	960.0	360.7	No	No	0	[a] -	833.8	[c] -	No
4	1,200	0	[a] -	521.2	[c] -	No	0	[a] -	521.2	[c] -	No
5	1,072	2	536.0	201.4	No	No	0	[a] -	465.6	[c] -	No
6	50,000	39	1,282.1	1,035.4	Yes	-	2	25,000	9,394.4	Yes	-
7a	10,800	14	771.4	536.6	No	No	0	[a] -	4,690.4	Yes	No
7b	10,800	14	771.4	536.6	No	No	0	[a] -	4,690.4	Yes	No
7c	360	13	27.7	19.0	No	Yes	0	[a] -	156.3	[c] -	No
7d	4,320	6	720.0	410.2	No	No	0	[a] -	1,876.2	[c] -	No
7e(1)	360	2	180.0	67.6	No	Yes	0	[a] -	156.3	[c] -	No
7e(2)	1,920	32	60.0	47.4	No	Yes	0	[a] -	833.8	[c] -	No
7f	360	8	45.0	27.7	No	Yes	0	[a] -	156.3	[c] -	No
7g	2,160	0	[a] -	938.1	Yes	No	0	[a] -	938.1	[c] -	No
7h	1,800	15	120.0	84.5	No	Yes	0	[a] -	781.7	[c] -	No
7i	3,600	300	12.0	11.1	No	Yes	0	[a] -	1,563.5	[c] -	No
9a	336	0	[a] -	145.9	[c] -	No	0	[a] -	145.9	[c] -	No
9b	240	0	[a] -	104.2	[c] -	No	0	[a] -	104.2	[c] -	No
9c	10	0	[a] -	4.3	[c] -	No	0	[a] -	4.3	[c] -	No
9d	9,992	8	1,249.0	768.9	Yes	No	0	[a] -	4,339.5	Yes	No
Total - all subtests	102,317	445	224.9	211.6	No		2	51,158.5	19,224.1	Yes	
Total - less unlubricated	98,717	155	636.9	573.3	[d]No		2	49,358.5	18,547.1	Yes	

[a]When there are no stoppages and/or no mission failures, the respective point estimates cannot be calculated.
[b]If the lower 90% confidence limit on MRBS or MRBOMF exceeds the respective criterion limit, the criterion is statistically not met.
[c]Insufficient sample size to address criterion. Minimum sample sizes to address MRBS and MRBOMF are 1382 rounds and 8750 rounds, respectively.
[d]Criterion is based on use of the point estimate which exceeds and therefore meets the minimum 600-MRBS requirement.

MRBS = Mean rounds between stoppages.
MRBOMF = Mean rounds between operational mission failures.

b. Barrel life estimates will vary dependent upon the means available to make that determination. Four indices were used to make life assessments in this test. They were throat erosion measurement using barrel wear gauge No. 8448496, average projectile velocity loss relative to the new-barrel velocity, loss of projectile stability as evidenced by projectile yaw exceeding 15 degrees, and increases in dispersion beyond the 7.0-inch OCONUS and 9.0-inch CONUS rejection limits for M16A1 and M16A2 rifles fired with ball ammunition. Based on these factors, the barrel life experienced during testing was extremely variable, when using one of the four rejection criteria which rendered the earliest indication of barrel unserviceability. The accompanying Table 8-3 graphically demonstrates the variability of this estimate, when viewed using alternative indices to make the serviceability determination.

TABLE 8-3. CONSOLIDATED BARREL LIFE DATA FOR XM4 CARBINES

Weapon ID			Rounds to Failure Occurrence					
							Avg Disp (ES), Measurement, in.	
Serial No.	Test No. Orig	Test No. New[a]	Total No. Rd	Throat Erosion	Vel, fps	M855 Yaw	> 7.0	> 9.0
6153601	1	2	10,000	10,000	9600 +	9600 +	4800 +	9600 +
6153603	2	1	10,000	7,200 +	9600 +	9600 +	3600 +	9600 +
6153605	3	10						
6153608	4	9						
6153611	5	8						
6153613	6	7						
6153615	7	6						
6153619	8	5	10,000	8,400 +	9600 +	9600 +	2400 +	2400 +
6153622	9	4	10,000	8,400 +	9600 +	9600 +	0 +	1200 +
6153625	10	3	10,000	8,400 +	9600 +	9600 +	3600 +	3600 +
6153627	11	-						
6153631	12	-						
6153635	13	-						
6153637	14	-						
6153639	15	-						
6153641	16	-						
	S1	-	2,000					
	S2	-	2,000					
	S3	-	2,000					
	S4	-	2,000					

[a]After interchange test.

Note: S1 to S4 test numbers designate spare barrels. Barrels orignally assigned to weapons are numbered 1 to 16.

c. The failure to extract and/or eject stoppages which occurred throughout testing occurred unexpectedly. The frequency (see table 8-4), due to causes other than apparent part failures, was much greater than expected from other M16-type weapons (i.e., M16A1, M16A2 and M231). Investigation of the ejection failures resulted in establishing that the primary cause was loose bolt carrier key screws. Although the staking of the screws (visually inspected) appeared to be correct, the screws were loose beneath the dual staking. Since the torque applied to each screw cannot be checked after staking, there is no positive means other than quality control checks at time of part manufacture. This problem must continue to be monitored during Initial Production and Inspection Comparison Tests. Also, a review of M16A1 and M16A2 rifle production tests should be made to see if the loose-carrier-key problem is prevalant in those weapons. If it is determined that the problem is peculiar only to the carbine, then the fix applied to the M231 port firing weapon to correct the same problem with that weapon should be used. That fix consisted of going from No. 8 to 10 size screws which were drilled and pinned after torquing.

Extraction failures in the XM4 carbine were observed during high temperature testing, in the dynamic phase of sand/dust testing, and in the saltwater immersion test.

Firing of the same lot of ammunition (WCC headstamp) from an M16A2 rifle showed no signs of the case rim shear found when firing the carbine. Also, firing ammunition marked with LC headstamp produced instances of rim shear in the carbine. This indicates higher extraction forces may be present in the carbine than in the M16A2 rifle. Additional testing is required to verify this observation. Other factors such as tolerance stack-up must also be investigated since there is an indication that some complete bolt/extractor assemblies produce better performance than others. Variations in cartridge case hardness gradient may also be a contributing factor. Early development problems experienced with LC made cases, when used to produce M855 and M856 ammunition, required hardness changes in the case head region because of the higher average operating pressure of those rounds.

TABLE 8-4. CONSOLIDATION OF FAILURE-TO-EJECT (FEJ) AND FAILURE-TO-EXTRACT (FEX) STOPPAGE DATA

Subtest ID		Weapon ID		No. Stoppages, by type	
Test No.	Title	Serial No.	Test No.	FEX	FEJ
1	Initial Inspection	6153601	1	0	2
1	Initial Inspection	6153608	4	0	12
2	Initial Disp/ Velocity	6153611	5		1
3	Initial Function	6153625	10	0	1
4	Interchange	None	-	-	-

TABLE 8-4 (CONT'D)

Subtest ID		Weapon ID		No. Stoppages, by type	
Test No.	Title	Serial No.	Test No.	FEX	FEJ
5	Accy and Sight Calib	6153613	7	0	2
6	Endurance	6153619	5	0	5
6	Endurance	6153622	4	0	32
6	Endurance	6153625	3	2	1
7	High Temp	6153627	11	9	1
7	High Temp	6153631	12	0	1
7	High Temp	6153635	13	0	18
7	Low Temp	6153627	11	0	0
7	Low Temp	6153631	12	0	0
7	Low Temp	6153635	13	0	2
7	Icing	6153627	11	0	0
7	Icing	6153631	12	0	0
7	Icing	6153635	13	0	0
7	Attitudes	6153611	8	0	0
7	Attitudes	6153613	7	0	1
7	Attitudes	6153615	6	0	0
7	Static Dust	6153637	14	0	0
7	Static Dust	6153639	15	0	0
7	Static Dust	6153641	16	0	0
7	Dynamic Dust	6153637	14	0	[a] 8
7	Dynamic Dust	6153639	15	0	0
7	Dynamic Dust	6153641	16	1	1
7	Dynamic Dust M16A2 Rifle	6041351	8M	0	0
7	Mud	6153637	14	0	0
7	Mud	6153639	15	0	0
7	Mud	6153641	16	0	0
7	Rain	6153637	14	0	0
7	Rain	6153639	15	0	0
7	Rain	6153641	16	0	0
7	Saltwater	6153637	14	2	2
7	Saltwater	6153639	15	0	4
7	Saltwater	6153641	16	3	0
7	Unlubricated	6153611	8	0	1
7	Unlubricated	6153613	7	0	14
7	Unlubricated	6153615	6	0	0
9	Flash	6153603	1	0	0
9	Flash	6153608	9	0	0
9	Smoke	6153603	1	0	0
9	Smoke	6153608	9	0	0
9	Noise	6153608	9	0	0
9	Cookoff	6153605	10	0	[b] 1
Total	-	-		17	110

[a] Six more during retest.
[b] M200 blank cartridge.

d. The presence of first-round failures to strip rounds from the magazine during low temperature testing was reduced by the change in feed ramp angle. There is, however, an apparent increase in feeding stoppages (BOB types) due to this change, when firing the carbine at high temperature. Since the same weapons, magazines and ammunition lot were used (first at high temperature, then low temperature), the results of both tests should have been similar with respect to BOB-type feeding stoppages. A review of cyclic rate data for both tests shows an average reduction in shots per minute at low temperature. It is believed that the steeper feed ramp angle of the XM4 carbine causes uncontrolled rise of the bullet nose as it moves up the feed ramp. This in turn creates the increased BOB-type feeding stoppages observed in the high temperatures test. Further testing is necessary to confirm this observation and ultimately assess the benefits of the 52 degree feed ramp angle for use in M16 type weapons. It is to be noted that although there was an increase in a certain type of stoppage, the overall performance of the carbine at high and low temperature was still acceptable (i.e., MRBS >600 rd; MRBOMF >3800 rd).

e. Firing of the carbine with muzzle elevated and depressed at a high angle (±80 degrees) showed a constant tendency to increase first-round failures to strip the cartridge from the magazine during +80 degree elevation firings. These failures were initially attributed to the magazines, however, the same magazines, when subsequently used during -80 and 0 degree elevation firings did not produce that type of stoppage in any meaningful quantity. This also proved that any adverse effects created by cumulative rounds fired (e.g. reduced lubrication and fouling) was not a primary factor in contributing to the first round stoppages.

f. The XM4 carbine, like other M16-rifle type weapons, is subject to increases in the number of stoppages when lubrication is absent. This condition also develops to a lesser degree during simulated-rain testing which tends to wash lubrication off of the weapon components. Both these conditions are corrected by relubrication of the weapon.

9. Safety and Health.

a. This test consisted of firing tests for flash and smoke, noise, and cookoff. Also included were observations relating the effects on personnel safety and health of using the XM4 carbines.

b. Weapon-function performance during the firing tests is listed in Table 9-1. Visual representations of muzzle flash were recorded photographically for single shots, single 3-round controlled bursts and ten cumulative 3-round controlled bursts. This testing encompassed both M855 ball and M856 tracer cartridges fired from the carbine with and without its compensator installed and with new and used barrels. The flash suppressor effectively controls muzzle flash. Figures 9-1 through 9-12 show the results.

c. Testing for smoke obscuration of a target and position disclosure at the firing position is photographically reported in Figures 9-13 to 9-16, using the same weapon barrels used in the muzzle flash test. Smoke obscuration/detection was observed to be comparable to firings with M16A1/M16A2 weapons.

d. Noise levels were measured at the shooter's ear position and at other locations surrounding the firing position. These data are reported in Table 9-2. Results show that XM4 carbine and M16A2 rifle noise both are within curve X of MIL-STD-1474B which requires single hearing protection.

e. Cookoff of ammunition suitable for firing in the XM4 carbine (i.e., M855 ball, M856 tracer, M193 ball, M196 tracer, and M200 blank) was determined for each of these cartridges. Each cartridge type was fired from a new barrel attached to the same lower receiver assembly of the weapon. Cookoff data are report in Table 9-3. All rounds (i.e., M193, M196, M855, M56, and M200) met the minimum 150-round no-cookoff criterion. All ammunition types functioned the XM4 carbine with a minimum of stoppages. Inspection of each gas tube of the upper receiver and barrel assemblies used for cookoff testing (fired 2000 rd each) revealed complete absence of fouling of the tube in all except the one used with M200 blank ammunition. Partial constriction of the gas tube was caused by accretion of combustion residue from the propellant. This hard fouling was greatest at the breech end of the tube and decreased in thickness after reaching one half the tube length toward the muzzle end. There was no evidence of constrictive fouling in the tube at the point of entry of the gasses from the barrel/front sight base. Functioning of the carbine during 2000 rounds firing was not degraded, but if the accretion of fouling continues as more rounds are fired, the weapon would eventually be rendered inoperable. The extent of fouling throughout the tube prevents complete cleaning out by drilling or other means. The fouling sample that was drilled out for analysis was hard to remove by that means. It is believed that firing of ball ammunition would not self-clean the gas tube of this contamination. Although the XM4 carbine is safe to use with M200 blanks and modified M15A2 BFA (change of gas port orifice from 0.059 to 0.089 in. diameter in the BFA), functioning of the carbine may eventually be degraded as fouling accretion closes of the flow of propellant gases necessary to operate the weapon mechanism. The causes of this problem require additional evaluation in order to correct the situation.

TABLE 9-1. CONSOLIDATED FUNCTION PERFORMANCE DATA FOR XM4 CARBINES FIRED IN THE FLASH AND SMOKE, NOISE, AND COOKOFF TESTS

Weapon ID		No. Malfunction, by Type							Charge to Weapon
SN	Test No.	FFD	FTC	FFR	FEX	FEJ	FBR	OTH	
Flash Test									
6153603	1	0	0	0	0	0	0	0	0
6153608	9	0	0	0	0	0	0	0	0
Smoke Test									
6153603	1	0	0	0	0	0	0	0	0
6153608	9	0	0	0	0	0	0	0	0
Noise Test									
6153608	9	0	0	0	0	0	0	0	0
Cookoff Test									
6153605	10	5	0	2	0	1	0	0	8

FBR = Failure of bolt to remain to rear after firing last round from magazine.
FEJ = Failure to eject.
FEX = Failure to extract.
FFD = Failure to feed.
FFR = Failure to fire.
FTC = Failure to chamber.

-MUZZLE FLASH TEST-

(XM4 Carbine)

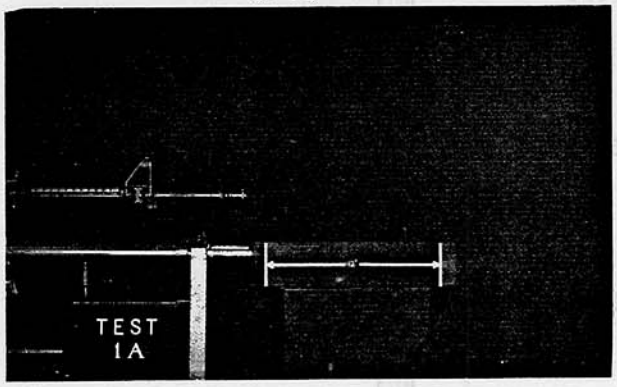
SINGLE SHOT WITH FLASH SUPPRESSOR

(M855 BALL)

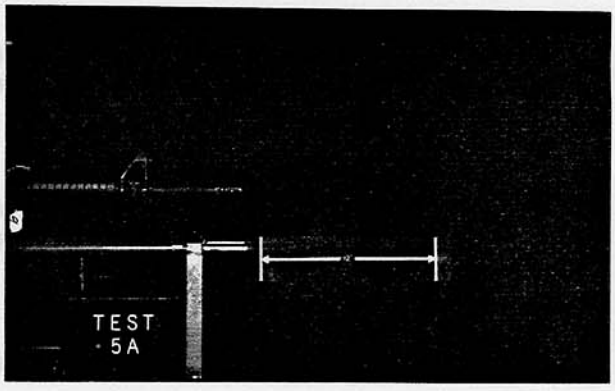
6153603
Old Barrel

6153608
New Barrel

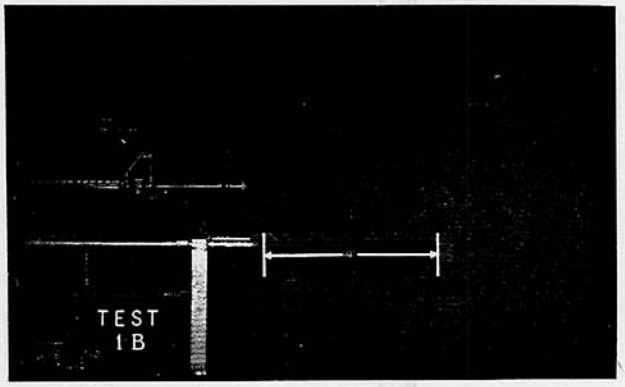
(1-A)



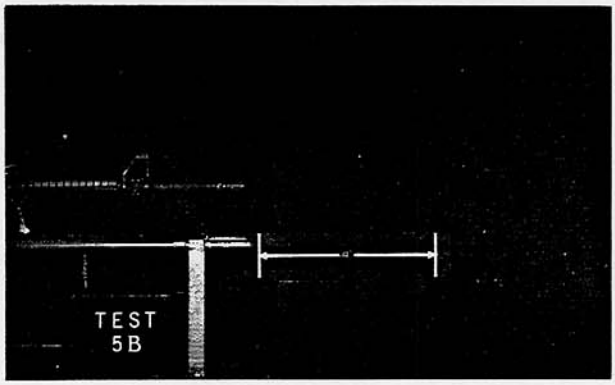
(5-A)



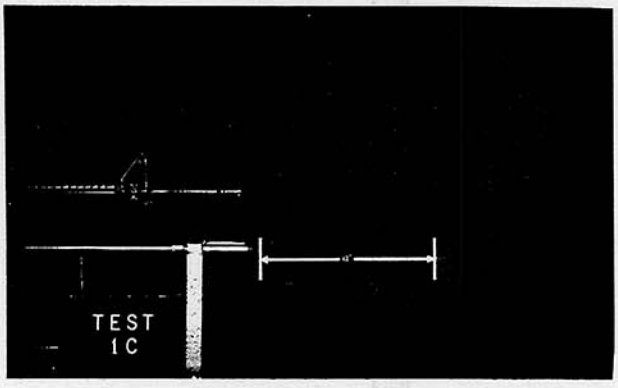
(1-B)



(5-B)



(1-C)



(5-C)

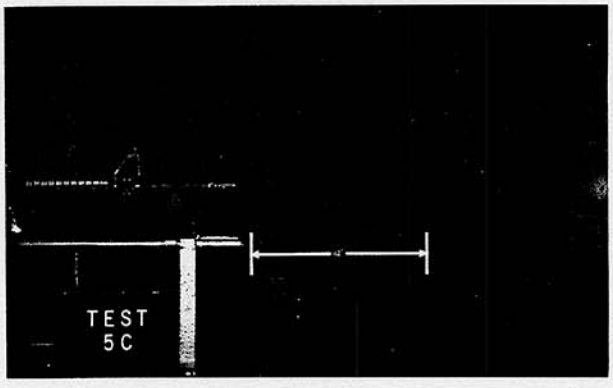


Figure 9-1. Flash Test.

-MUZZLE FLASH TEST-

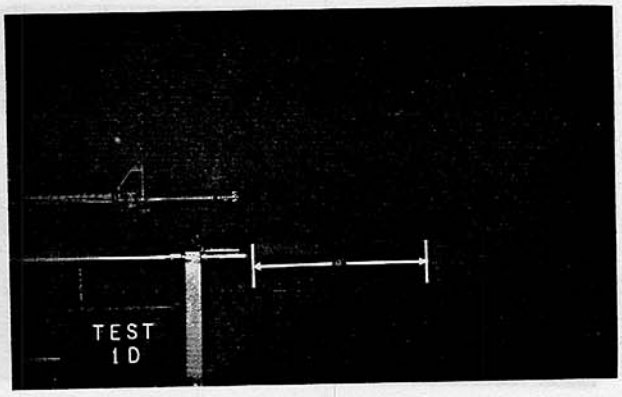
(XM4 Carbine)

ONE BURST OF 3 ROUND WITH FLASH SUPPRESSOR
(M855 BALL)

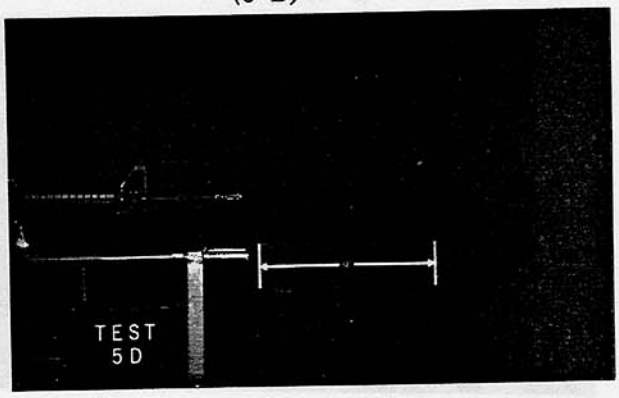
6153603
Old Barrel

6153608
New Barrel

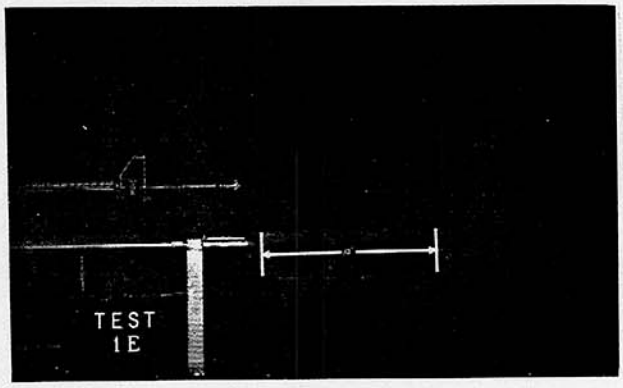
(1-D)



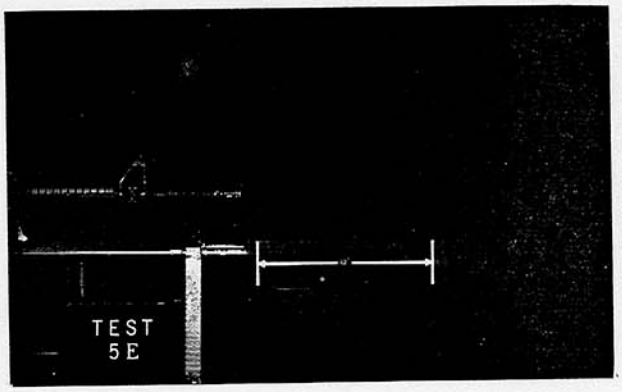
(5-D)



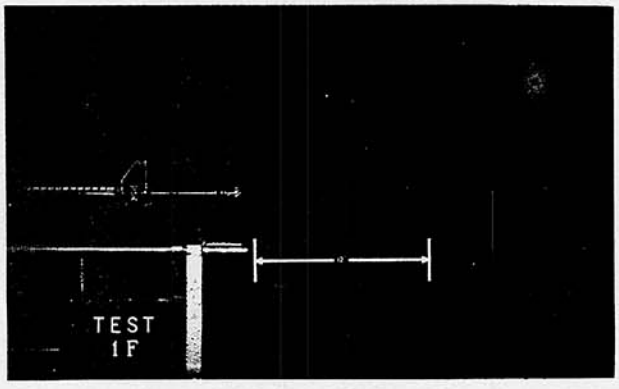
(1-E)



(5-E)



(1-F)



(5-F)

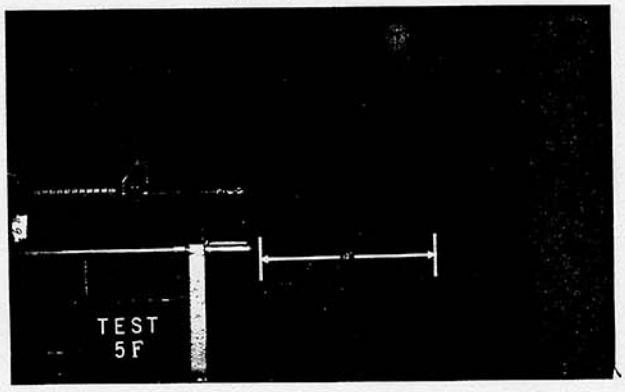


Figure 9-2. Flash Test.

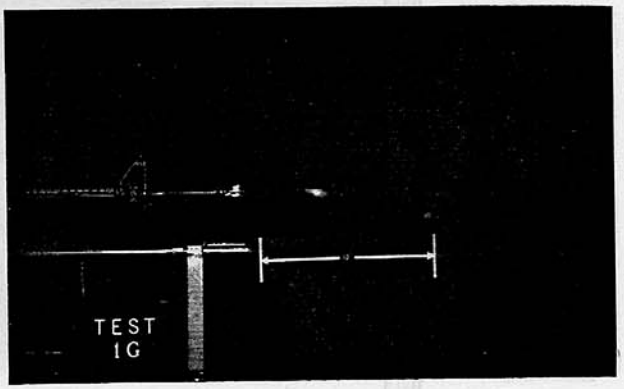
-MUZZLE FLASH TEST-

(XM4 Carbine)

TEN BURSTS OF 3 ROUNDS EACH WITH FLASH SUPPRESSOR
(M855 BALL)

6153603
Old Barrel

(1-G)



6153608
New Barrel

(5-G)

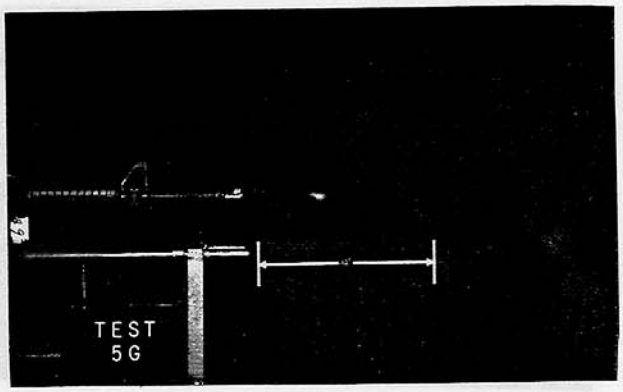


Figure 9-3. Flash Test.

-MUZZLE FLASH TEST-

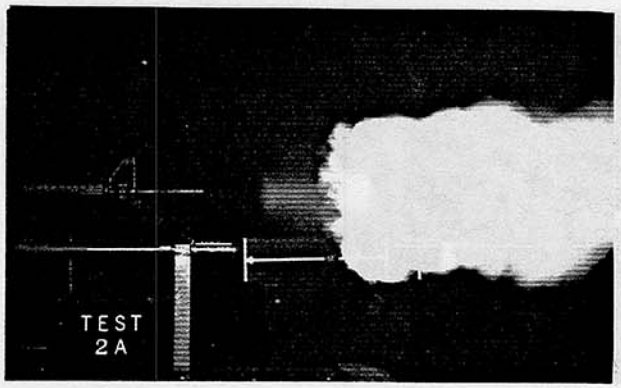
(XM4 Carbine)

SINGLE SHOT WITHOUT FLASH SUPPRESSOR
(M855 BALL)

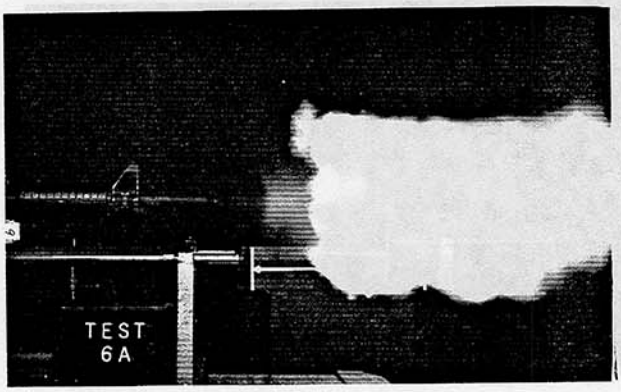
6153603
Old Barrel

6153608
New Barrel

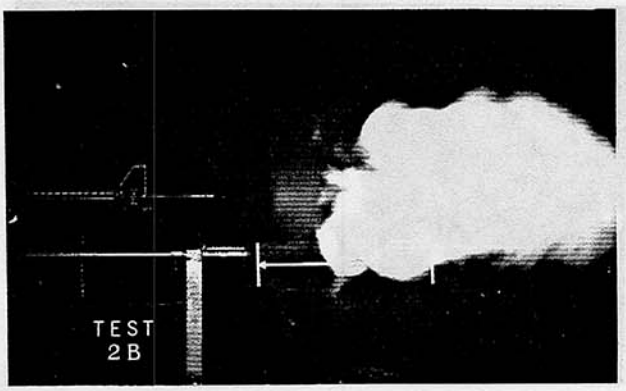
(2-A)



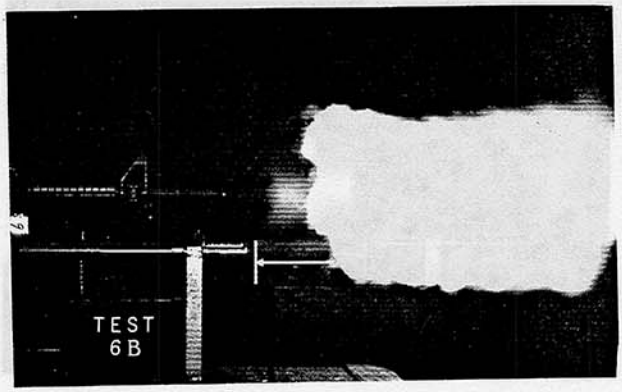
(6-A)



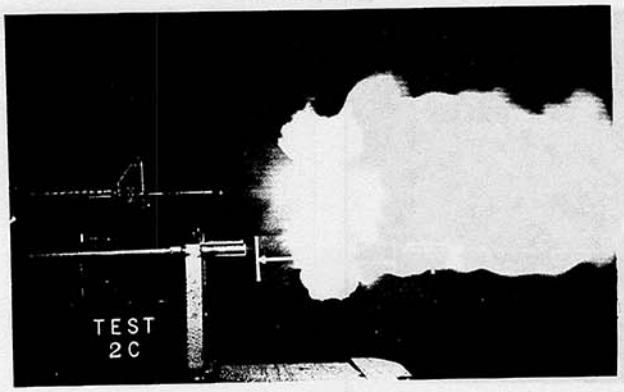
(2-B)



(6-B)



(2-C)



(6-C)

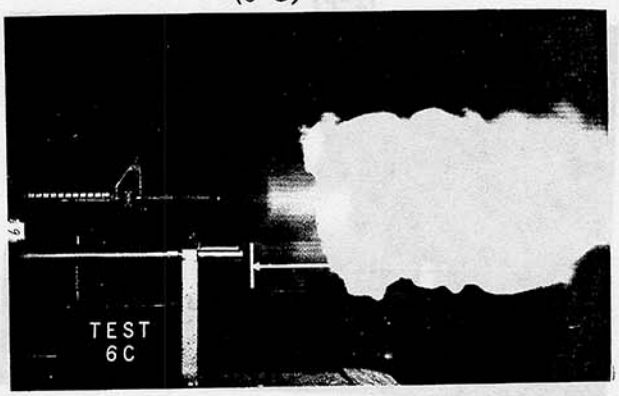


Figure 9-4. Flash Test.

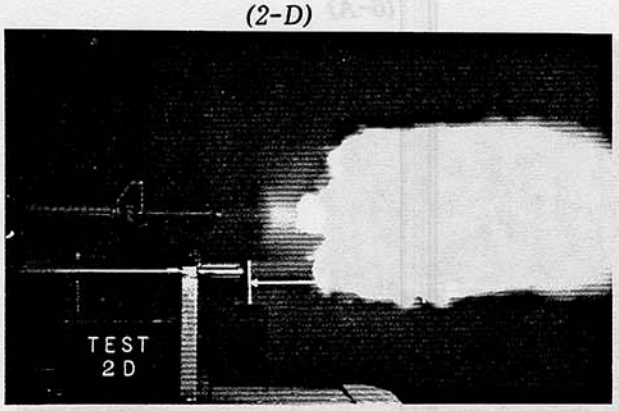
-MUZZLE FLASH TEST-

(XM4 Carbine)

ONE BURST OF 3 ROUNDS WITHOUT FLASH SUPPRESSOR
(M855 BALL)

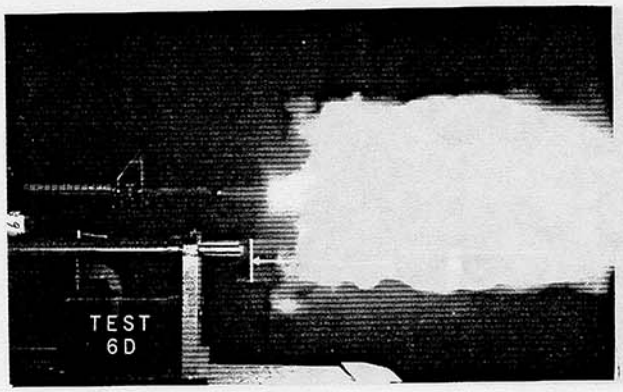
6153603
Old Barrel

(2-D)

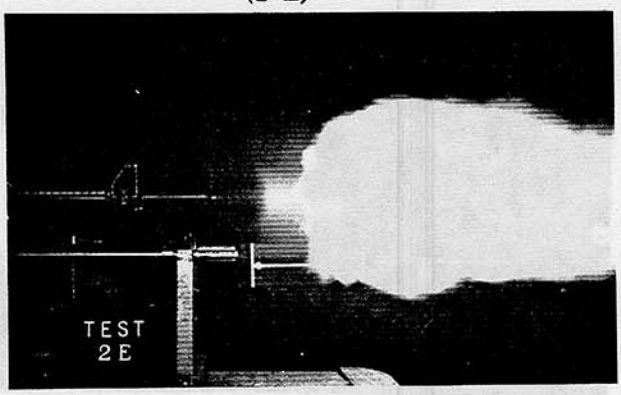


6153608
New Barrel

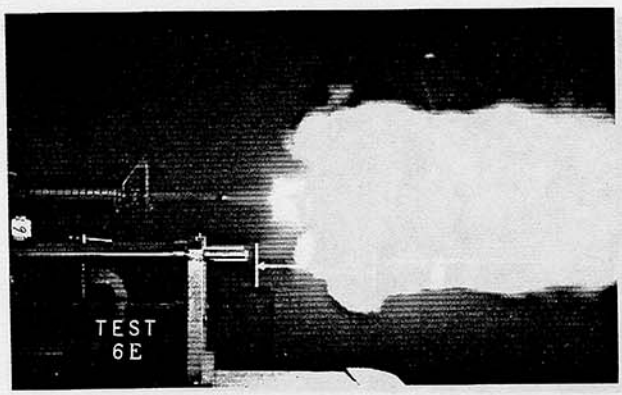
(6-D)



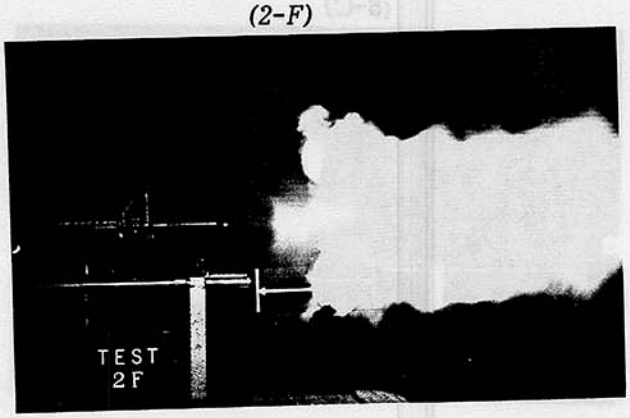
(2-E)



(6-E)



(2-F)



(6-F)

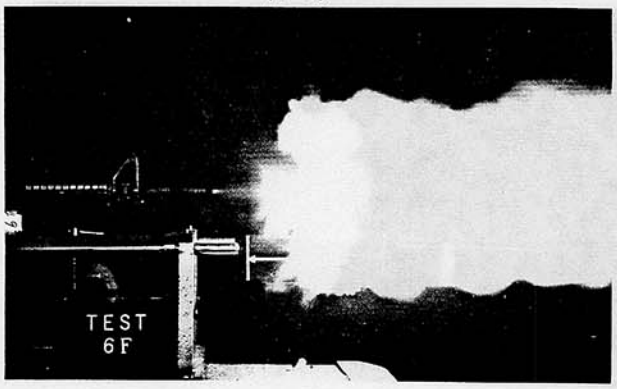


Figure 9-5. Flash Test.

-MUZZLE FLASH TEST-

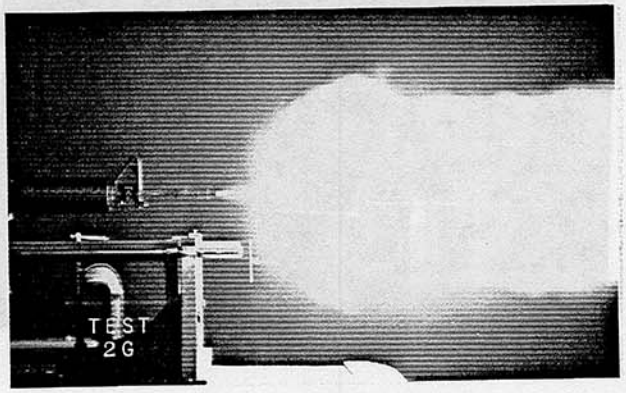
(XM4 Carbine)

TEN BURSTS OF 3 ROUNDS EACH WITHOUT FLASH SUPPRESSOR
(M855 BALL)

6153603
Old Barrel

6153608
New Barrel

(2-G)



(6-G)

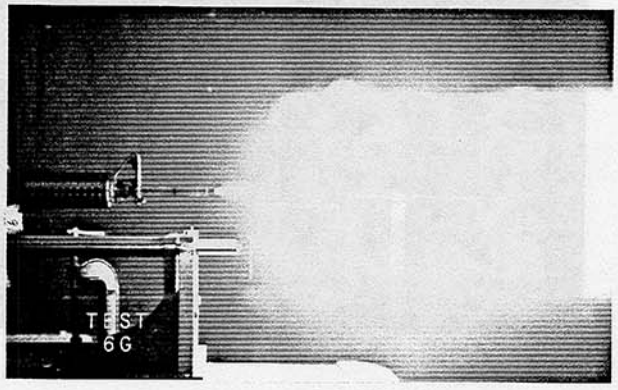


Figure 9-6. Flash Test.

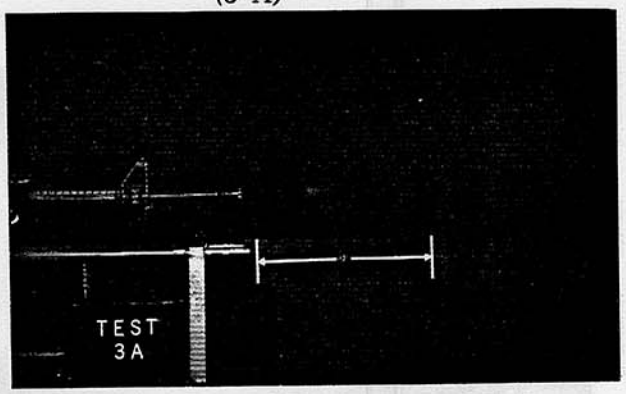
-MUZZLE FLASH TEST-

(XM4 Carbine)

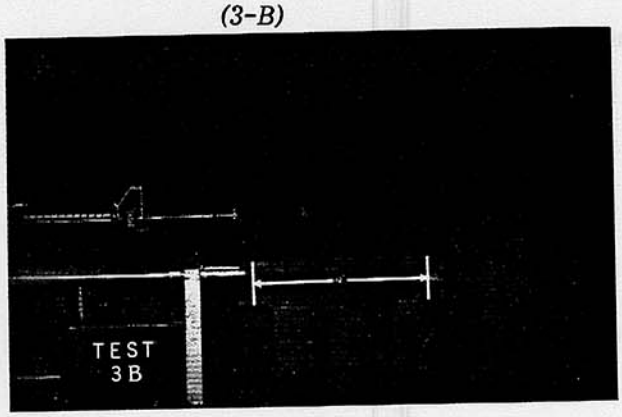
SINGLE SHOT WITH FLASH SUPPRESSOR
(M856 TRACER)

6153603
Old Barrel

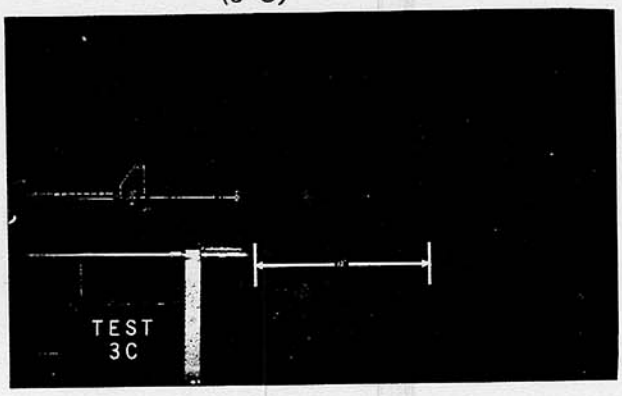
(3-A)



(3-B)

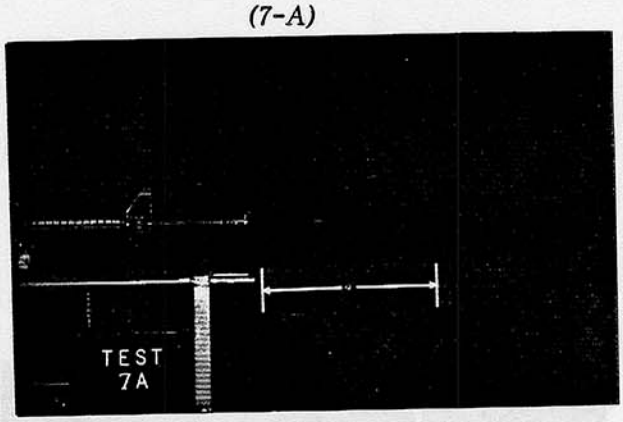


(3-C)

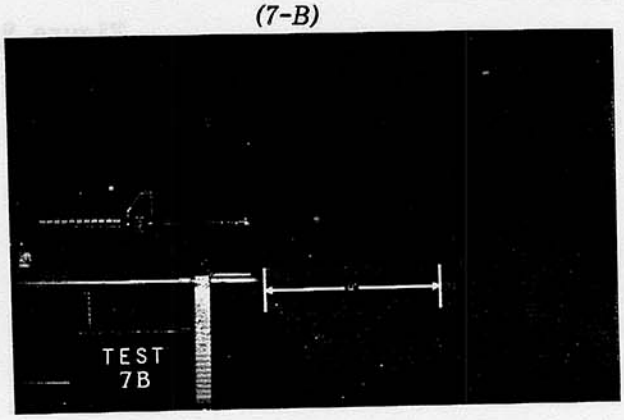


6153608
New Barrel

(7-A)



(7-B)



(7-C)

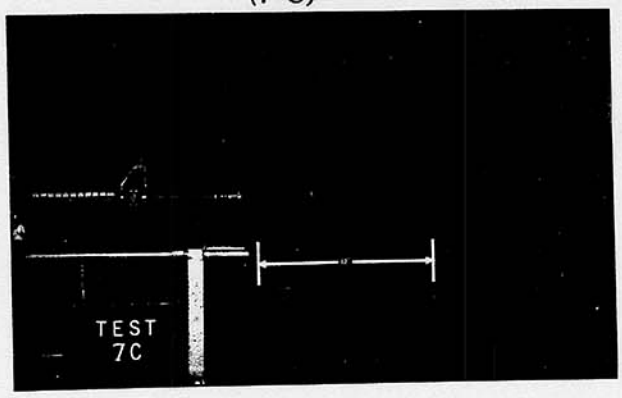


Figure 9-7. Flash Test.

-MUZZLE FLASH TEST-

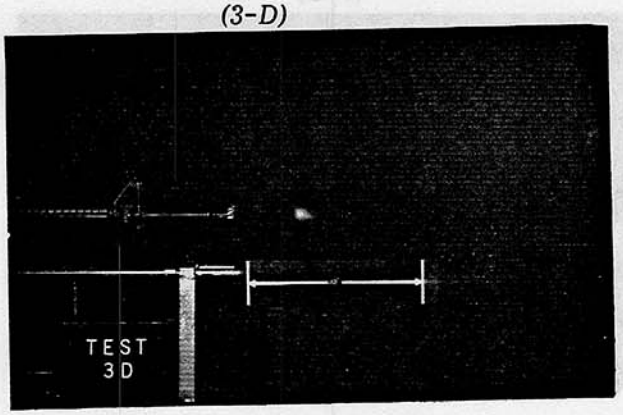
(XM4 Carbine)

ONE BURST OF 3 ROUNDS WITH FLASH SUPPRESSOR
(M856 TRACER)

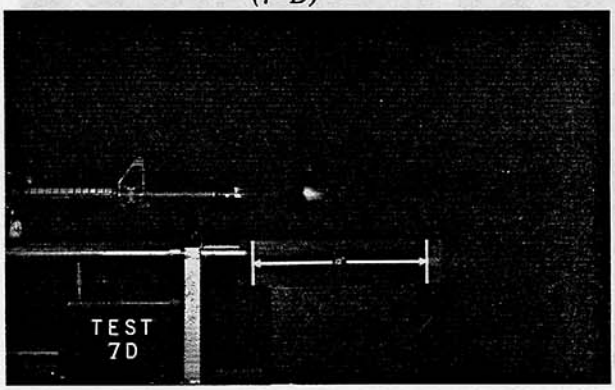
6153603
Old Barrel

6153608
New Barrel

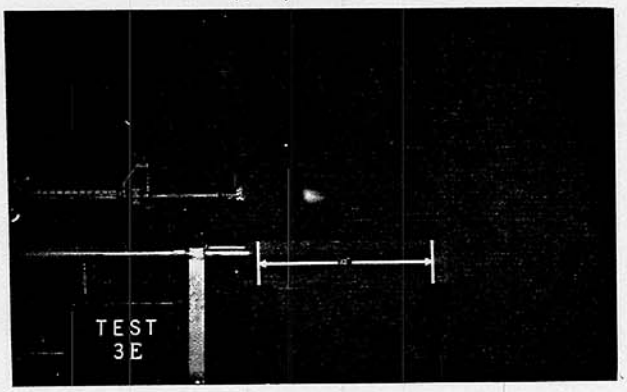
(3-D)



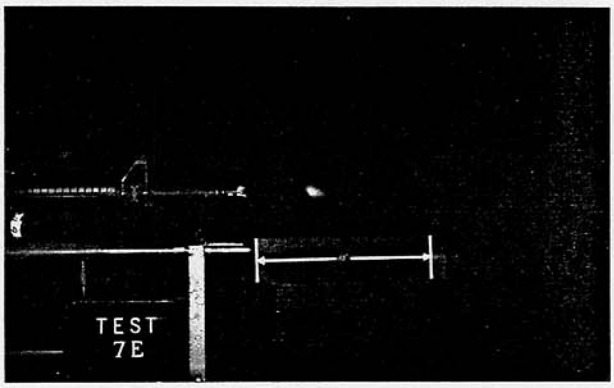
(7-D)



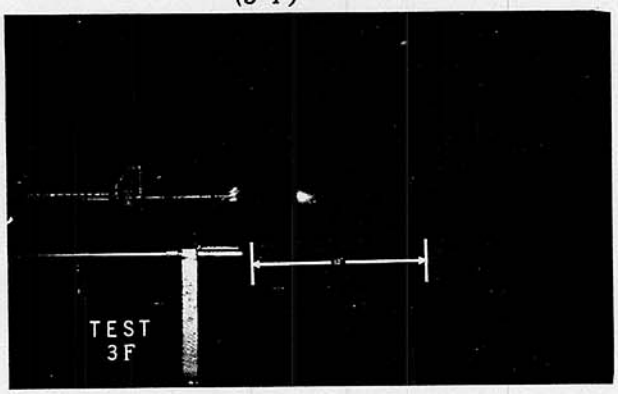
(3-E)



(7-E)



(3-F)



(7-F)

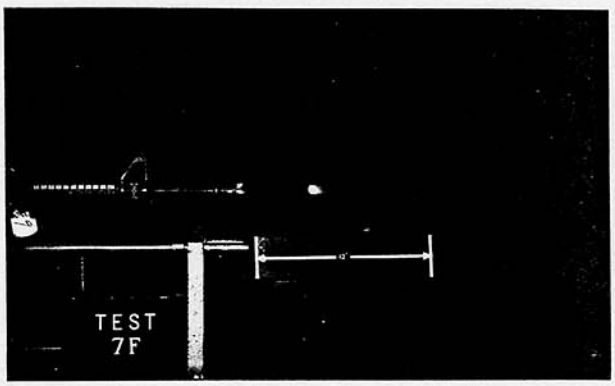


Figure 9-8. Flash Test.

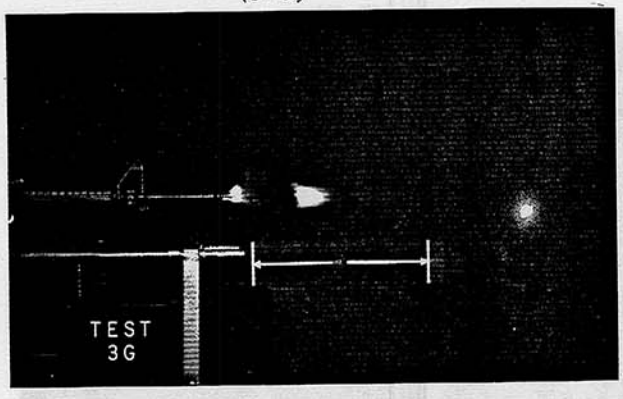
-MUZZLE FLASH TEST-

(XM4 Carbine)

TEN BURSTS OF 3 ROUNDS EACH WITH FLASH SUPPRESSOR
(M856 TRACER)

6153603
Old Barrel

(3-G)



6153608
(New Barrel)

(7-G)

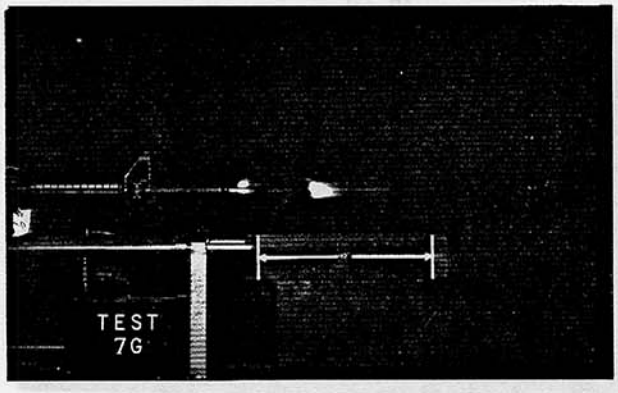


Figure 9-9. Flash Test.

-MUZZLE FLASH TEST-

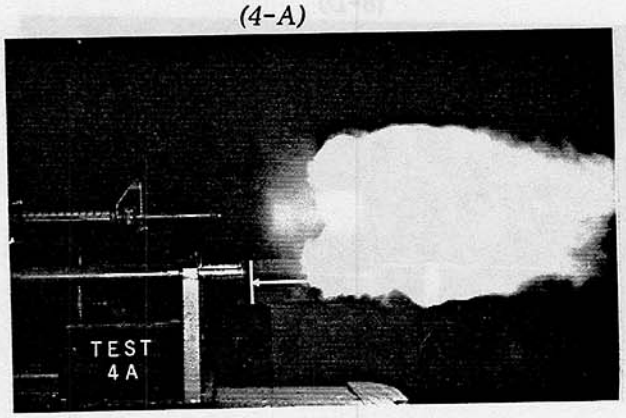
(XM4 Carbine)

SINGLE SHOT WITHOUT FLASH SUPPRESSOR
(M856 TRACER)

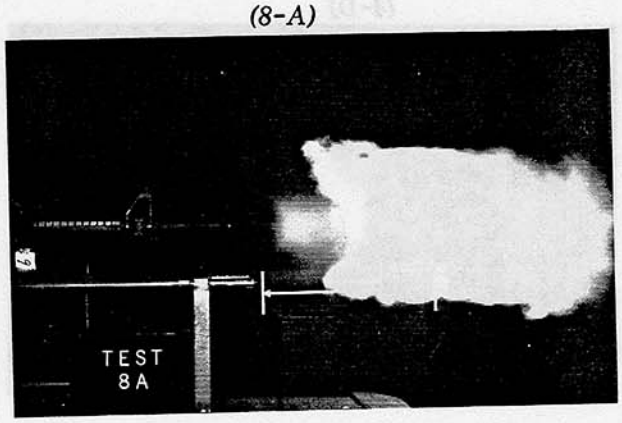
6153603
Old Barrel

6153608
New Barrel

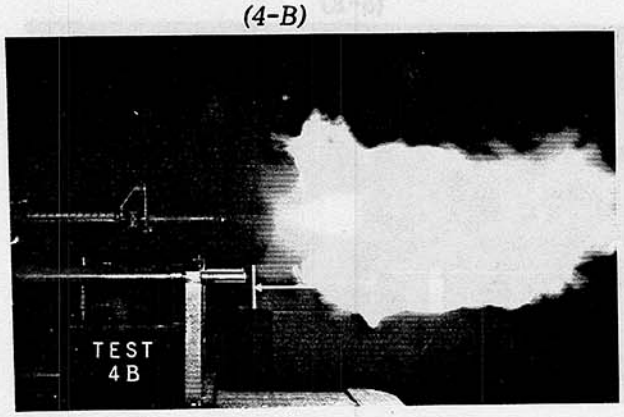
(4-A)



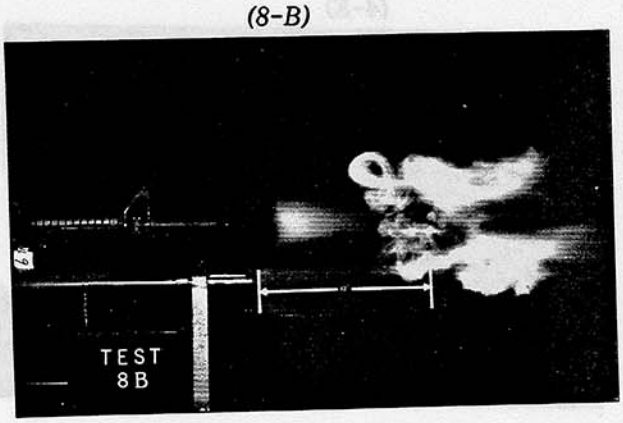
(8-A)



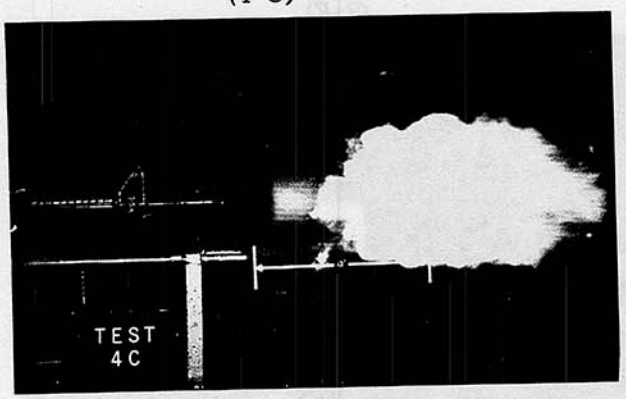
(4-B)



(8-B)



(4-C)



(8-C)

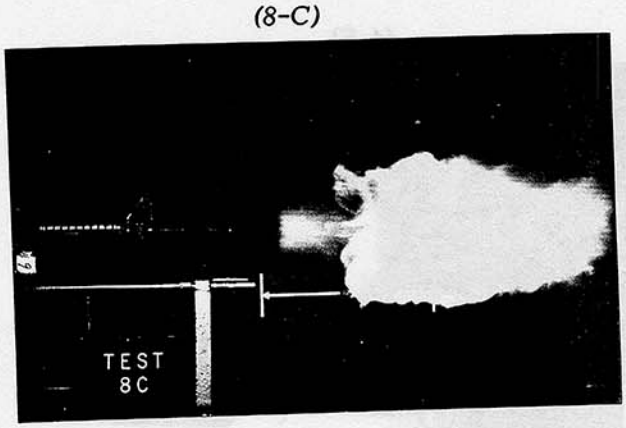


Figure 9-10. Flash Test.

-MUZZLE FLASH TEST-

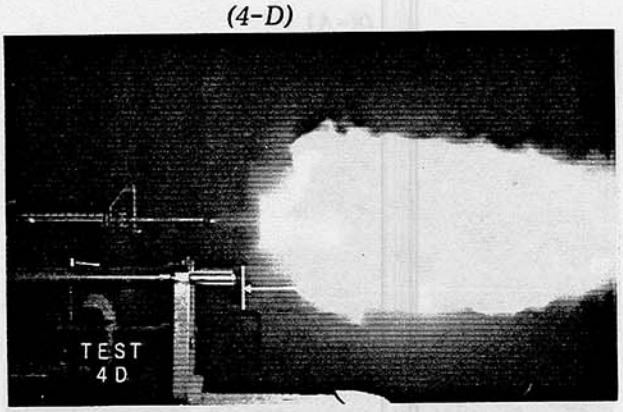
(M856 Carbine)

ONE BURST OF 3 ROUNDS WITHOUT FLASH SUPPRESSOR
(M856 TRACER)

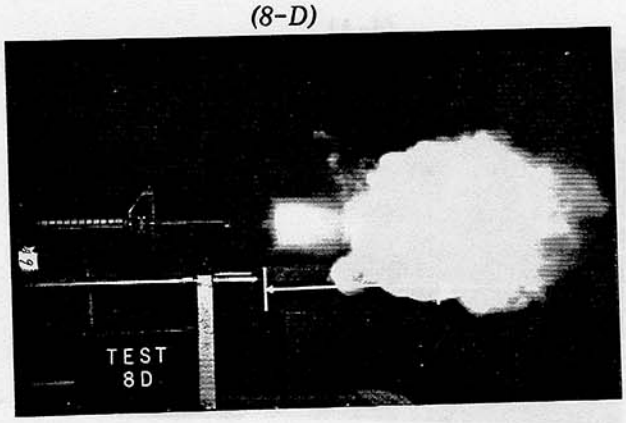
6153603
Old Barrel

6153608
New Barrel

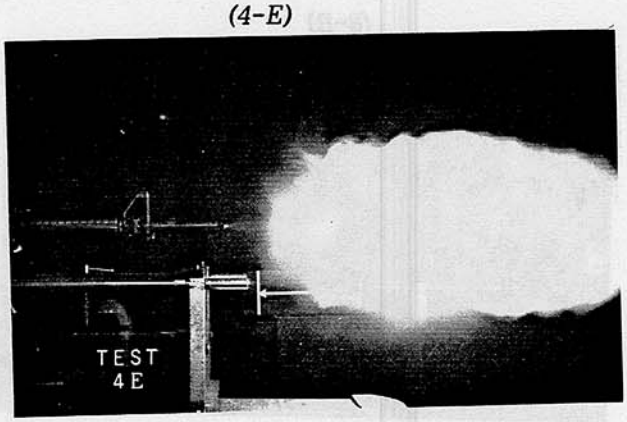
(4-D)



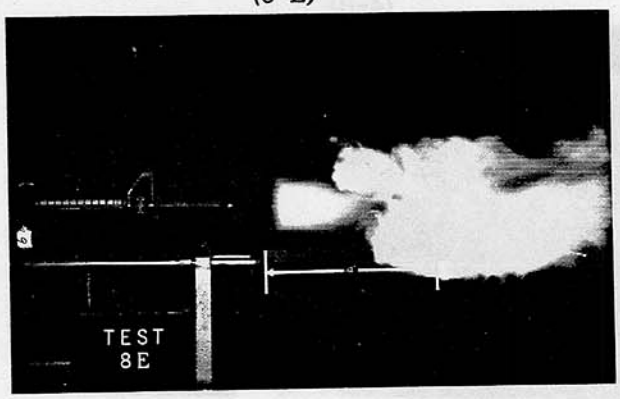
(8-D)



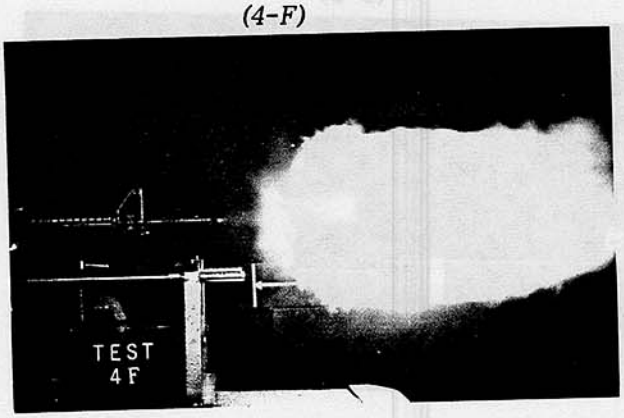
(4-E)



(8-E)



(4-F)



(8-F)

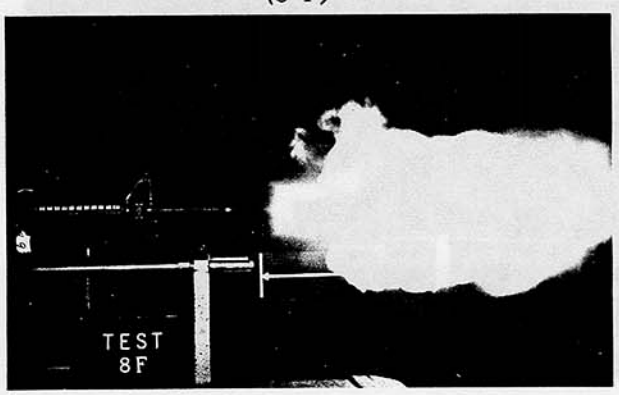


Figure 9-11. Flash Test.

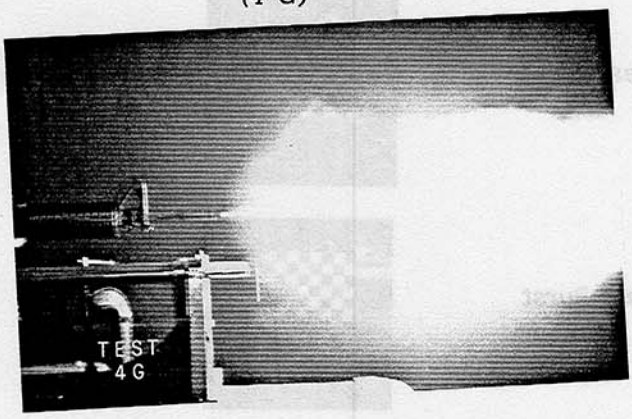
-MUZZLE FLASH TEST-

(XM4 Carbine)

TEN BURSTS OF 3 ROUNDS EACH WITHOUT FLASH SUPPRESSOR
(M856 TRACER)

6153603
Old Barrel

(4-G)



6153608
New Barrel

(8-G)

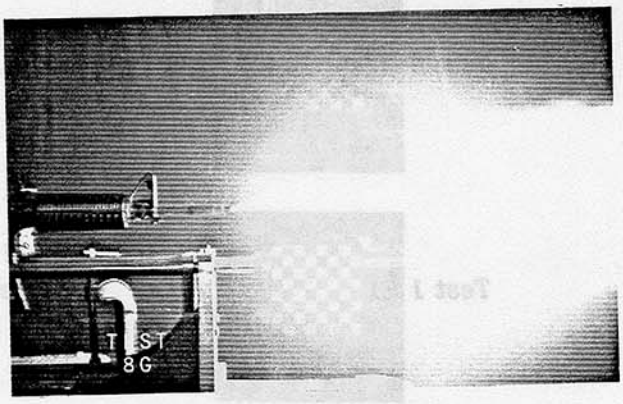


Figure 9-12. Flash Test.

-SMOKE TEST-

(XM4 Carbine)

VIEWED FROM SHOOTERS POSITION

(M855 BALL)

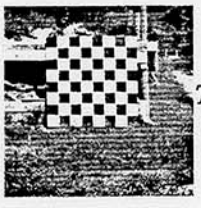
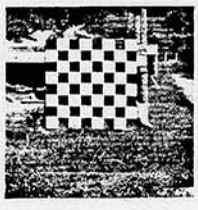
6153603 Old Barrel		*6153608 New Barrel*
Test 0 	*Prior To Test*	 *Test 0*
Test 1 	*After One 3 Round Burst*	 *Test 1*
Test 4 	*After Four 3 Round Burst*	 *Test 4*
Test 7 	*After Seven 3 Round Burst*	 *Test 7*
Test 10 	*After Ten 3 Round Burst*	 *Test 10*

Figure 9-13. Smoke Test.

-SMOKE TEST-

(XM4 Carbine)

VIEWED FROM SHOOTERS POSITION
(M856 TRACER)

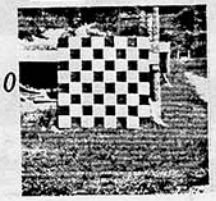
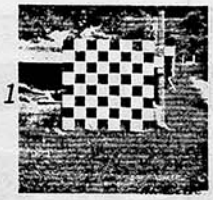
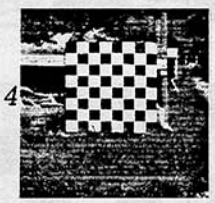
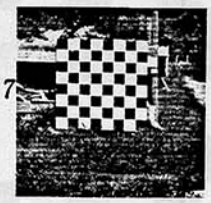
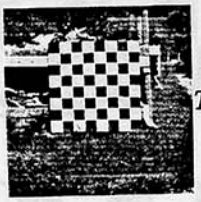
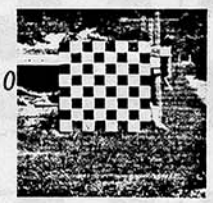
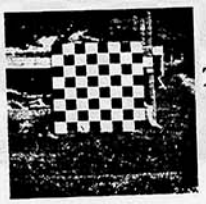
6153603 Old Barrel		*6153608 New Barrel*
Test 0 	*Prior To Test*	 *Test 0*
Test 1 	*After One 3 Round Burst*	 *Test 1*
Test 4 	*After Four 3 Round Burst*	 *Test 4*
Test 7 	*After Seven 3 Round Burst*	 *Test 7*
Test 10 	*After Ten 3 Round Burst*	 *Test 10*

Figure 9-14. Smoke Test.

-SMOKE TEST-

(XM4 Carbine)

VIEWED FROM TARGET POSITION
(M855 BALL)

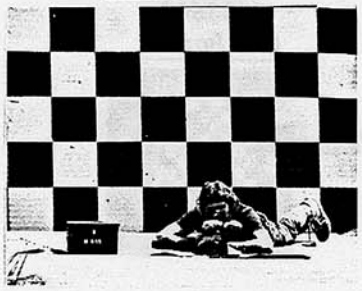
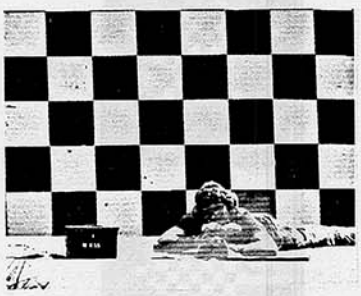
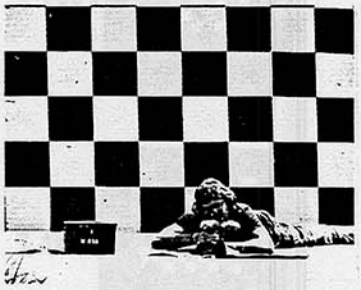
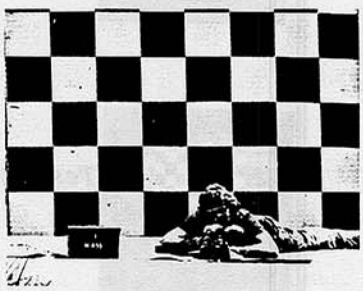
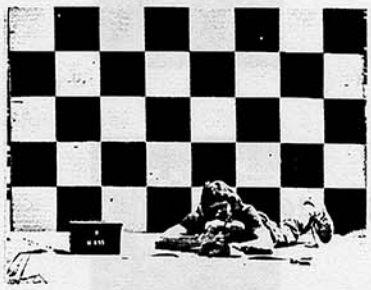
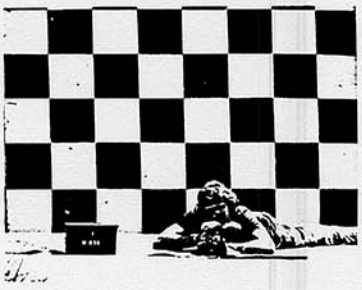
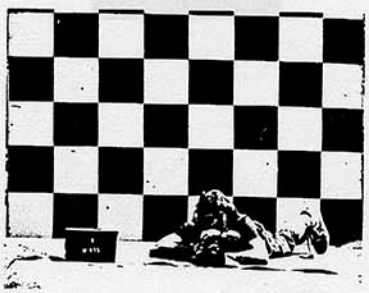
	6153603 Old Barrel		*6153608 New Barrel*	
Test 0		*Prior To Test*		*Test 0*
Test 1		*After One 3 Round Burst*		*Test 1*
Test 4		*After Four 3 Round Burst*		*Test 4*
Test 7		*After Seven 3 Round Burst*		*Test 7*
Test 10		*After Ten 3 Round Burst*		*Test 10*

Figure 9-15. Smoke Test.

-SMOKE TEST-

(XM4 Carbine)

VIEWED FROM TARGET POSITION

(M856 TRACER)

6153603 Old Barrel		*6153608 New Barrel*
Test 0	*Prior To Test*	*Test 0*
Test 1	*After One 3 Round Burst*	*Test 1*
Test 4	*After Four 3 Round Burst*	*Test 4*
Test 7	*After Seven 3 Round Burst*	*Test 7*
Test 10	*After Ten 3 Round Burst*	*Test 10*



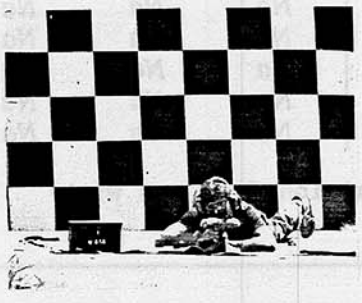
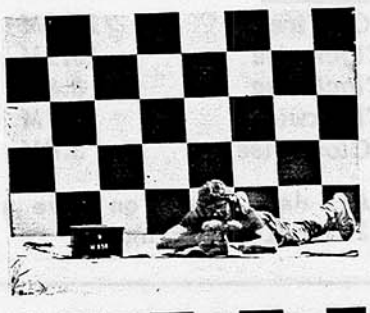
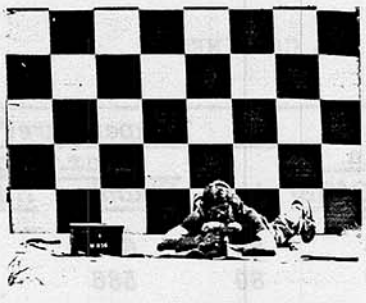
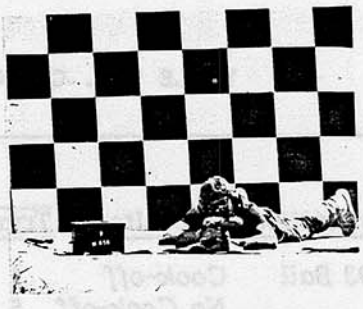
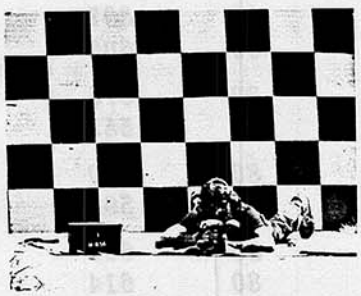
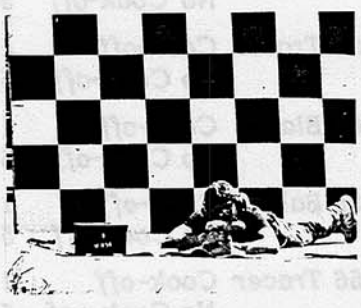
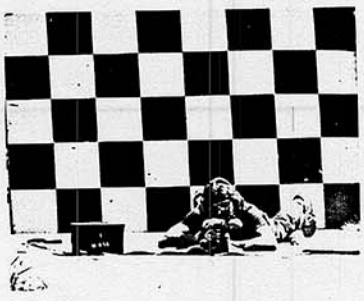
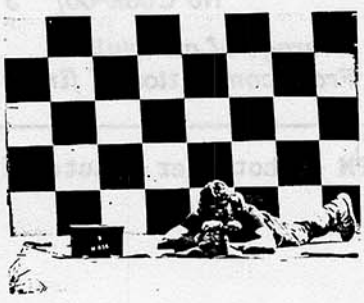









Figure 9-16. Smoke Test.

TABLE 9-2. CONSOLIDATED NOISE TEST DATA FOR XM4 CARBINES

	Sensor Distance	Average Peak Level(dB) Maximum	Minimum	Average	Average Duration (ms) Maximum	Minimum	Average
Prone Position							
RH Shooter's Left Ear	0.79M	157.5	156.0	156.8	5.6	5.4	5.5
5M to Right of Muzzle	5M	145.0	142.0	143.7	5.7	4.0	5.1
5M to Rear of Muzzle	5M	139.0	136.5	137.9	6.5	5.8	6.2
Standing, Underarm Position							
RH Shooter's Left Ear	0.81M	156.0	153.0	154.9	4.3	3.6	3.9
140-db Range							
Line-Of-Fire	15.0M	140.0	139.0	139.5	Na	Na	Na
30° Clockwise	13.1M	140.0	138.0	138.9	Na	Na	Na
60° Clockwise	8.8M	141.0	140.0	140.5	Na	Na	Na
90° Clockwise	6.4M	141.0	139.0	139.7	Na	Na	Na
120° Clockwise	3.8M	141.0	139.5	140.2	Na	Na	Na

(a) All data based on five single shots of M855 ball ammunition from gun with 293 prior firings.

TABLE 9-3. CONSOLIDATED COOKOFF TEST DATA FOR XM4 CARBINES

		Conditioning			Time, min		Temperature(°F)		
								Max. Avg.(a)	
Ammunition	Results	Trials	Rounds	SMP(a)	Fire(a)	Cook-Off(b)	Amb.	Chamber	Handguard
M193 Ball	Cook-off	1	180	73	2.5	1.5	80	650	175
	No Cook-off	5	170	75	2.2	NA	80	586	156
M196 Tracer	Cook-off	1	190	89	2.1	1.3	80	607	165
	No Cook-off	5	180	88	2.0	NA	80	600	158
M200 Blank	Cook-off	1	170	86	2.0	1.0	80	575	175
	No Cook-off	5	160	85	1.9	NA	80	552	172
M855 Ball	Cook-off	1	200	87	2.3	2.4	80	630	208
	No Cook-off	5	190	78	2.4	NA	80	595	178
M856 Tracer	Cook-off	1	100	91	2.2	1.2	80	650	202
	No Cook-oof	5	190	87	2.2	NA	80	614	200

(a) Average of all trials
(b) From completion of firing

SPM - Shots Per Minute effective firing rate.

10. Human Factors.

The XM4 carbine was evaluated for compatibility with the shooter. The resultant observations are grouped into seven major listings.

a. Targeting and accuracy (semiautomatic firing).

(1) The short-range (large) aperture of the rear-sight assembly degrades the shooter's ability to accurately align the sights. This problem can adversely affect hits on target when relying on rear sight movements to precisely change shot group placement (ref tables 5-3, 5-4 and fig. 5-1).

(2) Heat distortion (mirage) from the barrel and handguard caused by firing, bias the shooter's ability to accurately align the sights on target at long range (300 meters or more) after firing more than 10 to 20 rounds, when the carbine is fired on windless days.

(3) The configuration of the telescoping buttstock was generally acceptable. In some instances, the shooter's face, when in contact with the top, front end of the buttstock (when extended) was slightly pinched between the buttstock and lower receiver extension. However this was not considered a significant problem. The well defined checking of the butt surface of the stock could be felt on the shooter's shoulder, when firing with light clothing (T-shirt). This was not a significant problem.

(4) No controlled burst firing for accuracy and dispersion was done. Firing the carbine in the 3-round burst mode during endurance testing showed no perceived difference in controllability between the carbine and the M16A2 rifle, although any actual difference will have to be determined by testing.

b. Operating controls. All the adjustments found on the XM4 carbine are those used on the M16A2 rifle, except for the adjustable buttstock, which is simple to operate.

c. Heat transfer. The type C handguard is configured in a manner similar to that of the M16A2 rifle. Although shorter, the handguard contains a dual liner to retard heat transfer, to the shooter's hand. Under normal continuous firing of 120 rounds or less at an effective rate of about 85 shots per minute (used during this test program), gunners did not register unfavorable comments about excessive heat generation. During the cookoff test, the monitored temperatures indicated that as firing quantities exceeded 120 rounds, the resultant temperature on the external surface of the handguards would cause discomfort (ref table 9-3). This observation is valid for any of the M16 type weapons (i.e., M16A1, M16A2, M231).

d. Flash and smoke. The generation of muzzle flash was controlled by the muzzle break compensator of the carbine. Smoke generation from propellant gases was not excessive from the shooter's point of view.

Observation of daylight trace from the M856 cartridge was no different when fired from the XM4 carbine, than when previously tested in the M16A2

e. Noise. The perceived noise from firing the carbine was not different from that of the M16A2 rifle, even though the barrel is shorter. Both weapons require single hearing protection when being shoulder fired.

f. Use in adverse conditions environments:

(1) Rain and mud. Use in these environments is enhanced by the positive grip surfaces on the handguard, pistol grip, and butt of the stock. They help control the otherwise slippery weapon.

(2) Saltwater immersion, sand/dust. Lack of a maintenance equipment stowage compartment on the carbine would degrade weapon use in the event corrosion/fouling in the chamber of the barrel caused stuck cases/rounds. Several failure-to-extract stoppages occurred during these tests, where a cleaning rod was required to dislodge the rim-sheared case and a chamber cleaning brush was used to remove the fouling in the chamber before proper weapon operation could be restored. An alternate means of on-person stowage of the maintenance kit should be devised to give the user the opportunity to correctly maintain the carbine.

g. Determination of sustained rates and maximum rates of fire was not addressed in this test. It is understood that this information was obtained during operational tests by the US Marine Corps. The main concern in firing at a sustained rate is the eventual intrusion into the ammunition cookoff zone of the weapon. Occurrence of cookoff with the XM4 carbine is not considered a hazard to the shooter as long as the breech is locked and the weapon is pointed in a safe direction. The only evidence of a cookoff (other than inadvertant firing) is a perforated primer which is not a safety hazard in this weapon. Cookoff with the breech unlocked for whatever reason will cause permanent weapon damage and possible personnel injury. Based on cookoff test data for firing at 3-round burst rates (CB mode) of 85 spm, there is a reasonable likelihood that cookoff will occur after firing more than 150 rounds at either 45 spm (SA mode) or 90 spm (CB mode). This is predicted on starting the firing with a weapon that is at ambient range temperature. Any accumulated temperature increase on the weapon (as a result of previous firings) at the start of a new firing sequence, reduces the number of rounds fired before entering the cookoff zone.

11. Logistic Supportability.

a. The draft technical publications available as part of the test support package were generally satisfactory. Review comments are made in Enclosure 11.

b. Maintenance activities associated with the XM4 carbine are the same as those associated with M16A1 and M16A2 rifles. There were no types of unscheduled maintenance actions with the carbine that have not previously occurred with the other weapon types.

The amount of time to complete maintenance actions on the XM4 carbine was estimated to equal that of the M16A2 rifle at all echelons from operator through DS/GS since component design and assembly are basically the same. Table 11-1 and 11-2 lists the parts replaced and the number of rounds on those parts at time of replacement/repair. Parts failures are shown in Figures 11-1

through 11-6. Information relating to the disassembly and reassembly of the lower receiver extension are in Table 11-3. The effects of compression on the small springs used in the rear sight assembly are covered in Table 11-4. Information on long-term use of 30-round magazines is discussed in Table 11-5.

TABLE 11-1. XM4 CARBINE PARTS REPLACED DUE TO PART BREAKAGE

Part Name	NSN	Part No.	SMR Code	Qty Rep	Part Life, Rd[a]
Ring, bolt[b]	1005-00-992-7287	8448511	PAFZZ		10,165(10) 6,293(3) 3,773(12) 2,333(16)
Extractor, cartridge	1005-00-992-7288	8448512	PAOZZ	1	7,683(3)
Key and bolt carrier assembly	-	8448505	AFFFF	[c]1	3,773(13)
Bolt assembly	1005-00-992-7285	8448509	PAFZZ	1	6,427(1)
Spring assembly, extractor	1005-00-760-3768	8448755	PAOZZ	1	8,614(3)
Wrench, torque adaptor	-	62420	-	[d]1	[e]24

[a]Number in ( ) is assigned weapon number.
[b]Weapons were operating in a normal manner at time of replacement during scheduled maintenance.
[c]Part replaced during high temperature test to correct loose key problem. The part could have been repaired. It was not charged as an operational mission failure.
[d]Spanner pin broken. Part repaired by local fabrication of a new heat treated pin.
[e]Used to remove 16 lock nuts and reassembly of eight others before spanner pin failure.

TABLE 11-2. XM4 CARBINE PARTS DAMAGED AS A RESULT OF TESTING THAT WERE REPAIRED OR CONTINUED IN USE TO COMPLETION OF TESTING

Part Name	NSN	Part No.	SMR Code	Qty Rep	Part Life, Rd[a]
Bolt	-	8448510	XAFZZ	[b]1	10,766(1)
				[c]1	2,573(11)
Key and bolt carrier assembly	-	8448505	AFFFF	1	6,306(2)
				[d]1	2,453(14)
				1	10,293(4)
				1	3,893(5)
				1	6,400(5)
Buttstock assembly	1005-01-135-493	9390012	AFFFF	[e]1	7,373(11)
				1	2,813(15)

See footnotes on next page.