

RESEARCH & ENGINEERING
INTRADIVISION
WORK REQUEST REPLY

NO. PECO-G-100-66

DATE: 20 Dec 66

TO: Chief, Program & Control Office

DATE WORK: 6 Apr -

PROCESSED: 13 May 66

FROM: Chief, Test Branch

J. O. A100-4050 ITEM Buffer for 5.56mm, M16M1 Rifle

CONCEPT:

Evaluate buffers for 5.56mm, M16M1, Rifle proposed by Colts Industries.

INTRODUCTION:

When ammunition loaded with WC 846 propellant, commonly referred to as "ball propellant", is used in the M16M1 Rifle, higher cyclic rates of fire are experienced than with CR 8135 propellant (tubular grain). These higher rates are believed to contribute to higher malfunction rates and shortened parts life. These buffers are proposed as a means of reducing the cyclic rates of fire to an acceptable level when firing ammunition loaded with WC 846 propellant.

Failures of Buna N discs at -65°F. in tests of previous submissions resulted in the submission of the four types of buffers discussed in this report.

CONCLUSIONS:

1. The function with the proposed buffers and ball (WC 846) propellant was significantly better than the function with standard buffers and ball (WC 846) propellant.
2. The performance when using the proposed buffers and ball propellant is not as good as the past performance of the M16 Rifle using standard buffers and CR (CR 8135) propellant.
3. The function with the proposed buffers and CR (CR 8135) propellant is not considered significantly changed from the function experienced in previous tests with standard buffers and CR (CR 8135) propellant.
4. The average cyclic rates of fire at -65°F with ball propellant and proposed buffers are within the range considered desirable for good weapon function.

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SWESP 5028

CONCLUSIONS: (Continued)

5. At +155°F the average cyclic rates of fire with the proposed buffers and ball propellant were above the desired range but were significantly below the average obtained with ball propellant and standard buffers.

6. At ambient temperature the cyclic rates of fire with ball propellant and the proposed buffers were slightly higher than the cyclic rates with IMR propellant and standard buffers. The proposed buffers resulted in a significant rate reduction when compared to the standard buffers when the proposed and standard buffers were fired with ball (WC 846) propellant.

7. Of the two buffer types tested at -65°F, ambient and +155°F the Type 2 buffer (Sketch II) is a more simplified design than the Type 3 buffer (Sketch I).

SUMMARY OF CONCLUSIONS:

As intended, the proposed buffers produce a reduction of cyclic rate and a corresponding reduction of malfunction rate when firing ammunition loaded with ball (WC 846) propellant, however the improvement has not reduced the malfunction rate to an entirely acceptable level.

RECOMMENDATIONS:

Further investigation should be made to improve the function of the 5.56mm, XM16E1, Rifle, when using ammunition loaded with WC 846 (Ball) propellant.

TEST ITEMS:

1. Buffers submitted by Colt Industries for XM16E1 Rifles

<u>Buffer Type</u>	<u>Disc Material</u>	<u>Bumper Material</u>	<u>Bumper Configuration</u>	<u>Reference Sketch</u>	<u>Quantity</u>
1	Buna N	Polyurethane	cup	I	3 ea.
2	Buna N	Polyurethane	truncated cone	II	3 ea.
3	Polyurethane	Polyurethane	cup	I	3 ea.
4	Polyurethane	Polyurethane	truncated cone	II	3 ea.

The proposed buffers weigh 0.33 lbs. and the standard buffers weigh 0.12 lbs. The proposed buffers can be expected to reduce the cyclic rate of fire partially by the increase in weight and partially by the compression of the discs during the initial movement of the bolt carrier. The bolt configurations are shown by Sketches I and II. When buffers with truncated cone bumpers were tested, a 0.050" thick washer was placed at the rear of the lower receiver extensions to compensate for an error in the buffers' lengths which resulted in the carrier key striking the lower receiver at end of recoil.

TEST ITEMS: (Continued)

2. Weapons

Six new 5.56mm, XM16E1, Rifles, Serial Nos. 142271, 137841, 141349, 139162, 137714, and 136824.

3. Ammunition

5.56mm, M193 Ball, loaded with CR 8136 (IMR) propellant, Lot Nos. RA 5056, RA 5060, and RA 5062.

5.56mm, M193 Ball, loaded with WC 846 (Ball) propellant, Lot Nos. RA 5175, RA 5176, and WC 6889.

5.56mm, XM196 Tracer, Lot Nos. RA 5019, RA 5025, and RA 5031.

PROCEDURE:

1. Buffer and Magazine Assignments

Two buffers were assigned to each of six new 5.56mm, XM16E1, Rifles. Ten magazines were assigned to each rifle. The numbered buffers as assigned to weapon are as follows:

<u>Rifle</u> <u>Ser. No.</u>	<u>Buffer</u> <u>Type - Ser. No.</u>
142271	1 - 1
	2 - 1
137841	1 - 2
	2 - 2
141349	1 - 3
	2 - 3
139162	3 - 1
	4 - 1
137714	3 - 2
	4 - 2
136824	3 - 3
	4 - 3

2. Function and Rate Check

Each of the six rifles, with standard buffers, was fired 100 rounds at ambient temperature to record the cyclic rate of fire at the start of the test. The ammunition used was M193 Ball, Lot RA 5062 with CR 8136 (IMR) propellant.

PROCEDURE: (Continued)

3. Function Tests at -65°F.

The weapon-buffer combinations and ammunition were conditioned for six hours at -65°F. Each combination was fired 1,000 rounds with each of three types of 5.56mm ammunition, CR 8136 (EMR) propellant, MC 846 (Ball) propellant and XM196 tracer. The weapons were allowed to cool after each 100 rounds. The firing schedule was as follows:

a. Normal Hold, Shoulder Fire

- (1) 100 rounds, semiautomatic
- (2) 100 rounds, spasmodic (3 or 4 round bursts)
- (3) 100 rounds, full automatic (20 round bursts)

b. Loose Hold, Hip Fire

- (1) 50 rounds, semiautomatic
- (2) 50 rounds, full automatic
- (3) 50 rounds, semiautomatic, rotated 90° right
- (4) 50 rounds, full automatic, rotated 90° right
- (5) 50 rounds, semiautomatic, rotated 90° left
- (6) 50 rounds, full automatic, rotated 90° left

c. Normal Hold, Shoulder Fire

- (1) 100 rounds, semiautomatic
- (2) 100 rounds, spasmodic (3 or 4 round bursts)
- (3) 100 rounds, full automatic (20 round bursts)

4. Selection of Two Buffer Types for Further Testing

At the completion of the test at -65°F, the test data summarized in Table VII was made available to representatives of Colt Industries who selected the two buffer types which in their opinion were worthy of further tests. Type 2 and Type 3 buffers were selected by the Colt representatives and those buffers were subjected to the following tests:

PROCEDURE: (Continued)

5. Function Test at +155°F.

a. The six rifles, ammunition and the selected test buffers, (Type 2 buffers, Sketch II with buna "N" discs) and (Type 3 buffers, Sketch I with polyurethane discs) were conditioned for six hours at +155°F. Each buffer-rifle combination was fired 1,000 rounds with each of two types of 5.56mm, M193 Ball ammunition; CR 6136 (IMR) propellant and WC 846 (Ball) propellant.* The weapons were allowed to cool after each 100 rounds. The firing schedule in paragraph 3 was followed.

b. Due to the poor performance of the rifles when using ammunition with WC 846 (Ball) propellant, each rifle was subjected to a 1,000 round function check at +155°F, with standard buffers.

6. Function Tests at Ambient Temperatures

a. A 600 round weapon performance test was conducted at ambient temperature using type 2 and type 3 buffers with each of two types of ammunition,* CR 6136 (IMR) propellant and WC 846 (Ball) propellant. The weapons were cooled after each 100 rounds. The firing schedule for the test was as follows:

(1) Normal Hold, Shoulder Fire

- (a) 100 rounds, semiautomatic
- (b) 100 rounds, spasmodic (3 or 4 round bursts)
- (c) 100 rounds, full automatic (20 rounds bursts)

(2) Loose Hold, Hip Fire

- (a) 40 rounds, semiautomatic
- (b) 40 rounds, full automatic
- (c) 40 rounds, semiautomatic, rotated 90° right
- (d) 40 rounds, full automatic, rotated 90° right
- (e) 40 rounds, semiautomatic, rotated 90° left
- (f) 40 rounds, full automatic, rotated 90° left

(3) Normal Hold, Shoulder Fire

60 rounds, full automatic

* Non-availability of XM196 tracer ammunition precluded the use of tracer ammunition in test at +155°F and at ambient temperature.

PROCEDURE: (Continued)

5. Function Test at +155°F.

a. The six rifles, ammunition and the selected test buffers, (Type 2 buffers, Sketch II with buna "N" discs) and (Type 3 buffers, Sketch I with polyurethane discs) were conditioned for six hours at +155°F. Each buffer-rifle combination was fired 1,000 rounds with each of two types of 5.56mm, M193 Ball ammunition; CR 8136 (DM) propellant and WC 846 (Ball) propellant.* The weapons were allowed to cool after each 100 rounds. The firing schedule in paragraph 3 was followed.

b. Due to the poor performance of the rifles when using ammunition with WC 846 (Ball) propellant, each rifle was subjected to a 1,000 round function check at +155°F, with standard buffers.

6. Function Tests at Ambient Temperatures

a. A 500 round weapon performance test was conducted at ambient temperature using type 2 and type 3 buffers with each of two types of ammunition,* CR 8136 (DM) propellant and WC 846 (Ball) propellant. The weapons were cooled after each 100 rounds. The firing schedule for the test was as follows:

(1) Normal Hold, Shoulder Fire

- (a) 100 rounds, semiautomatic
- (b) 100 rounds, spasmodic (3 or 4 round bursts)
- (c) 100 rounds, full automatic (20 rounds bursts)

(2) Loose Hold, Hip Fire

- (a) 40 rounds, semiautomatic
- (b) 40 rounds, full automatic
- (c) 40 rounds, semiautomatic, rotated 90° right
- (d) 40 rounds, full automatic, rotated 90° right
- (e) 40 rounds, semiautomatic, rotated 90° left
- (f) 40 rounds, full automatic, rotated 90° left

(3) Normal Hold, Shoulder Fire

60 rounds, full automatic

* Non-availability of XM196 tracer ammunition precluded the use of tracer ammunition in test at +155°F and at ambient temperature.

PROCEDURE: (Continued)

6. Function Tests at Ambient Temperatures (Continued)

b. The six rifles with standard buffers were each subjected to a 600 round weapon performance test, as a check on the test buffers. The ammunition was loaded with WC 846 (Ball) propellant.

c. Due to the poor performance in the 600 round performance test with the standard buffer using ammunition with WC 846 (Ball) propellant, the performance test was repeated with the standard buffer using ammunition loaded with CR 8136 (JBR) propellant, as a check on the standard buffer.

RESULTS:

1. Function and Rate Check

No malfunctions occurred when the six 5.56mm, XM16E1, Rifles were fired with Ball ammunition with CR 8136 propellant to record the cyclic rate of fire at the start of the test. The average cyclic rate of fire for each weapon was as follows:

<u>Weapon</u>	<u>Cyclic Rate (Avg. of 5 Rates of 20 Rounds Each)</u>
142271	795 cycles per min.
137841	723 " " "
141349	625 " " "
139162	795 " " "
137714	815 " " "
136834	823 " " "

All rifles were considered acceptable for use in this test.

2. Function Tests at -65°F

The results of the test firing at -65°F with the test buffers are listed in Table VII. The malfunction rates at -65°F with the test buffers was as follows:

<u>Buffer Type</u>	<u>Malfunction Rate per 1000 Rounds</u>		
	<u>CR 8136 Propellant</u>	<u>WC 846 Propellant</u>	<u>XM196 Tracer</u>
1	13.3	4.0	2.0
2	12.7	4.7	1.0
3	6.7	5.7	2.3
4	3.0	14.0	1.3

The majority of the malfunctions were the bolt partially overriding the feeding round, also the bolt failing to remain open after the last round fired. The cyclic rates of fire obtained at -65°F are listed in Table VII.

RESULTS: (Continued)

3. Function Tests at +155°F

The results obtained when the two selected types of test buffers (type 2 and type 3) were tested at +155°F are listed in Table VIII. The malfunction rate was excessive with both types of test buffers (type 2 and type 3) when used with ammunition having WC 846 propellant. The malfunction rate with type 3 buffer was significantly lower than with type 2. When the firing was repeated with the standard buffer using ammunition having WC 846 propellant, the malfunction rate was significantly higher than with both types of test buffers. The malfunction rates at +155°F were as follows:

<u>Buffer Type</u>	<u>Malfunction Rate per 1000 Rounds</u>	
	<u>Type of Ammunition</u>	
	<u>CR 8136 Propellant</u>	<u>WC 846 Propellant</u>
2	1.3	33.3
3	1.0	27.0
Std.	(not fired)	69.7

The majority of the malfunctions were: The bolt partially overriding the feeding round, also, the bolt failing to remain open after the last round fired. The probable cause of malfunctions was the cyclic rate in excess of 850 shots per minute. The cyclic rates of fire obtained at +155°F are listed in Table VIII.

4. Function Tests at Ambient Temperature

The results of the 600 round weapon performance tests at ambient temperature with the two selected types of test buffers and the standard buffers are listed in Table IX. The malfunction rate was excessive with both types of test buffers when used with ammunition having WC 846 propellant. The malfunction rate with type 3 buffers was slightly higher than with type 2 buffers. When the performance test was conducted with standard buffers WC 846 using ammunition having WC 846 propellant, the malfunction rate was significantly higher than with both types of test buffers. The malfunction rate was significantly lower when the performance test was repeated to check the standard buffer using ammunition having CR 8136 propellant. The malfunction rates were as follows:

<u>Buffer Type</u>	<u>Malfunction Rate per 1000 Rounds</u>	
	<u>Type of Ammunition</u>	
	<u>CR 8136 Propellant</u>	<u>WC 846 Propellant</u>
2	2.3	10.3
3	1.7	13.0
Std.	2.0	46.8

RESULTS: (Continued)

4. Function Tests at Ambient Temperature (Continued)

The increase of malfunction rate with standard buffers and CR 8136 (IMR) propellant may be attributable in part to the wearing of components caused by the extensive firing of the test weapons prior to this phase of the test program. The total numbers of rounds on each rifle ranged from 11020 to 11600 rounds. Tables I through VI are included to show the history of the weapons.

5. Stoppages

The total number of stoppages* are listed in Table X. The number of stoppages with the standard buffer during firing at +155°F and ambient temperatures with ammunition loaded with WC 846 (Ball) propellant is significantly greater than with the test buffers. No comparison can be made for -65°F since standard buffers were not fired at -65°F.

* A stoppage is counted when the rifle ceased firing, the magazine still contained ammunition, and immediate action was required to resume firing.

TABLE I

TEST SEQUENCE

Weapon No. 1: Rifle, 5.56mm, XM106E1, Serial No. 142271

<u>Test Date</u>	<u>Buffer Type No.</u>	<u>Test Condition</u>	<u>Rounds Fired</u>	<u>Ammunition Propellant Types</u>	<u>Ammo Lot No.</u>
7 Apr	Std	Ambient	100	Ball - IIR	RA 5052
8 Apr	1-1	- 55°F	1000	Ball - Ball	WCC 6089
9 Apr	1-1	- 65°F	700 300	Tracer - IIR	RA 5019 RA 5031
11 Apr	1-1	- 65°F	1000	Ball - IIR	RA 5060
13 Apr	2-1	- 65°F	1000	Tracer - IIR	RA 5038
14 Apr	2-1	- 65°F	500 500	Ball - Ball	WCC 6089 RA 5175
15 Apr	2-1	- 65°F	300 700	Ball - IIR	RA 5060 RA 5056
23 Apr	2-1	+ 155°F	1000	Ball - IIR	RA 5056
27 Apr	2-1	+ 155°F	1000	Ball - Ball	RA 5176
28 Apr	Std	+ 155°F	1000	Ball - Ball	RA 5176
2 May	2-1	Ambient	600	Ball - IIR	RA 5056
3 May	2-1	Ambient	600	Ball - Ball	RA 5176
9 May	Std	Ambient	600	Ball - Ball	RA 5176
13 May	Std	Ambient	600	Ball - IIR	RA 5050
Total Rounds			11,900		

Propellant Types:

IIR - CR 8136 tubular grain propellant
 Ball - WC 846 Ball propellant

Ammunition Types:

Tracer - XM106
 Ball - M193

TABLE II

TEST SUMMARY

Weapon No. 2: Rifle, 5.56mm, XM16E1, Serial No. 137041

<u>Test Date</u>	<u>Buffer Type No.</u>	<u>Test Condition</u>	<u>Rounds Fired</u>	<u>Ammunition Propellant Types</u>	<u>Ammo Lot No.</u>
7 Apr	Std	Ambient	100	Ball - IMR	BA 5002
8 Apr	1-2	- 65°F	1000	Ball - Ball	WOC 6000
13 Apr	1-2	- 65°F	1000	Tracer - IMR	BA 5005
18 Apr	2-2	- 65°F	1000	Ball - IMR	BA 5056
19 Apr	2-2	- 65°F	1000	Ball - Ball	BA 5176
20 Apr	2-2	- 65°F	1000	Tracer - IMR	BA 5025
22 Apr	1-2	- 65°F	1000	Ball - IMR	BA 5056
23 Apr	2-2	+ 155°F	1000	Ball - IMR	BA 5056
25 Apr	2-2	+ 155°F	1000	Ball - Ball	BA 5176
26 Apr	Std	+ 155°F	1000	Ball - Ball	BA 5176
2 May	2-2	Ambient	600	Ball - IMR	BA 5056
3 May	2-2	Ambient	600	Ball - Ball	BA 5176
9 May	Std	Ambient	600	Ball - Ball	BA 5176
11 May	Std	Ambient	600	Ball - IMR	BA 5000
Total Rounds			11,500		

Propellant Types:

IMR - CR 8136 tubular grain propellant
 Ball - WC 846 Ball propellant

Ammunition Types:

Tracer - XM196
 Ball - M193

TABLE III

TEST SEQUENCE

Weapon No. 3: Rifle, 5.56mm, XM16M1, Serial No. 141349

<u>Test Date</u>	<u>Buffer Type No.</u>	<u>Test Condition</u>	<u>Rounds Fired</u>	<u>Ammunition Propellant Types</u>	<u>Ammo Lot No.</u>
7 Apr	Std	Ambient	100	Ball - IMR	RA 5062
9 Apr	2-3	- 65°F	200 800	Tracer - IMR	RA 5031 RA 5019
11 Apr	2-3	- 65°F	1000	Ball - IMR	RA 5060
14 Apr	2-3	- 65°F	500 500	Ball - Ball	RA 5175 WCC 6089
16 Apr	1-3	- 65°F	300 700	Tracer - IMR	RA 5031 RA 5019
18 Apr	1-3	- 65°F	1000	Ball - IMR	RA 5056
19 Apr	1-3	- 65°F	1000	Ball - Ball	RA 5175
26 Apr	2-3	+ 135°F	1000	Ball - IMR	RA 5056
27 Apr	2-3	+ 135°F	1000	Ball - Ball	RA 5176
28 Apr	Std	+ 135°F	1000	Ball - Ball	RA 5176
2 May	2-3	Ambient	600	Ball - IMR	RA 5056
3 May	2-3	Ambient	600	Ball - Ball	RA 5176
9 May	Std	Ambient	600	Ball - Ball	RA 5176
13 May	Std	Ambient	600	Ball - IMR	RA 5056
Total Rounds			11,500		

Propellant Types:

IMR - CR 8136 tubular grain propellant
 Ball - WC 846 Ball propellant

Ammunition Types:

Tracer - XM196
 Ball - M193

TABLE IV

TEST RESULTS

Weapon No. 4: Rifle, 5.56mm, XM16E1, Serial No. 139182

<u>Test Date</u>	<u>Buffer Type No.</u>	<u>Test Condition</u>	<u>Rounds Fired</u>	<u>Ammunition Propellant Types</u>	<u>Ammo Lot No.</u>
7 Apr	Std	Ambient	100	Ball - IMR	RA 5052
7 Apr	2-1	Ambient	80	Ball - Ball	WCC 6089
7 Apr	4-1	Ambient	40	Ball - Ball	WCC 6089
9 Apr	4-1	- 65°F	300 700	Tracer - Ball	RA 5031 RA 5019
11 Apr	4-1	- 65°F	1000	Ball - IMR	RA 5050
13 Apr	4-1	- 65°F	500 500	Ball - Ball	WCC 6089 RA 5175
15 Apr	3-1	- 65°F	300 700	Tracer - Ball	RA 5031 RA 5019
19 Apr	3-1	- 65°F	1000	Ball - Ball	RA 5175
22 Apr	3-1	+ 65°F	1000	Ball - IMR	RA 5056
23 Apr	3-1	+ 155°F	1000	Ball - IMR	RA 5056
25 Apr	3-1	+ 155°F	1000	Ball - Ball	RA 5175
29 Apr	Std	+ 155°F	1000	Ball - Ball	RA 5176
2 May	3-1	Ambient	600	Ball - IMR	RA 5056
9 May	Std	Ambient	600	Ball - Ball	RA 5176
13 May	Std	Ambient	600	Ball - IMR	RA 5050
Total Rounds			11,020		

Propellant Types:

- IMR - CR 8136 tubular grain propellant
- Ball - WC 846 Ball propellant

Ammunition Types:

- Tracer - XM196
- Ball - M193

TABLE VTEST SEQUENCE

Weapon No. 5: Rifle, 5.56mm, XM16E1, Ser. No. 137714

<u>Test Date</u>	<u>Buffer Type No.</u>	<u>Test Condition</u>	<u>Rounds Fired</u>	<u>Ammunition and Propellant Types</u>	<u>Asset Lot No.</u>
7 Apr	Std	Ambient	120	Ball-IMR	RA 5062
7 Apr	2-2	Ambient	40	Ball-Ball	WCC 6009
7 Apr	4-2	Ambient	40	Ball-Ball	WCC 6009
8 Apr	3-2	-45°F.	1,000	Ball-Ball	WCC 6009
13 Apr	3-2	-55°F.	1,000	Tracer-IMR	RA 5025
13 Apr	4-2	-45°F.	300	Ball-IMR	RA 5060
15 Apr	4-2	-65°F.	700	Ball-IMR	RA 5056
16 Apr	4-2	-65°F.	1,000	Tracer-IMR	RA 5031
18 Apr	3-2	-65°F.	1,000	Ball-IMR	RA 5056
19 Apr	4-2	-65°F.	1,000	Ball-Ball	RA 5176
25 Apr	3-2	+155°F.	1,000	Ball-Ball	RA 5176
26 Apr	3-2	+155°F.	1,000	Ball-IMR	RA 5056
29 Apr	Std	+155°F.	1,000	Ball-Ball	RA 5176
2 May	3-2	Ambient	600	Ball-IMR	RA 5056
3 May	3-2	Ambient	600	Ball-Ball	RA 5176
9 May	Std	Ambient	600	Ball-Ball	RA 5176
11 May	Std	Ambient	600	Ball-IMR	RA 5056
Total Rounds,			11,600		

Propellant Types:

- IMR - CR 8136 tubular grain propellant
- Ball - WC 846 B 11 propellant

Ammunition Types:

- Tracer - XM196
- B-11 - M193

TABLE VI
TEST SUMMARY

Weapon No. 6: Rifle, 5.56mm, XM1061, Serial No. 136624

<u>Test Date</u>	<u>Buffer Type No.</u>	<u>Test Condition</u>	<u>Rounds Fired</u>	<u>Ammunition Propellant Types</u>	<u>Ammo Lot No.</u>
7 Apr	Std	Ambient	100	Ball - IMR	RA 5062
7 Apr	2-3	Ambient	20	Ball - Ball	WCC 6069
7 Apr	4-3	Ambient	20	Ball - Ball	WCC 6069
8 Apr	3-3	- 65°F	1000	Ball - Ball	WCC 6069
9 Apr	3-3	- 65°F	300 700	Tracer - Ball	RA 5031 RA 5019
11 Apr	3-3	- 65°F	1000	Ball - IMR	RA 5060
15 Apr	4-3	- 65°F	200 300	Ball - IMR	RA 5060 RA 5056
20 Apr	4-3	- 65°F	1000	Ball - Ball	RA 5176
21 Apr	4-3	- 65°F	1000	Tracer - IMR	RA 5025 RA 5019
26 Apr	3-3	+ 155°F	1000	Ball - IMR	RA 5056
27 Apr	3-3	+ 155°F	1000	Ball - Ball	RA 5176
29 Apr	Std	+ 155°F	1000	Ball - Ball	RA 5176
2 May	3-3	Ambient	600	Ball - IMR	RA 5056
3 May	3-3	Ambient	600	Ball - Ball	RA 5176
9 May	Std	Ambient	600	Ball - Ball	RA 5176
11 May	Std	Ambient	600	Ball - IMR	RA 5060
Total Rounds			11,540		

Propellant Types:

- IMR - CR 8136 tubular grain propellant
- Ball - WC 846 Ball propellant

Ammunition Types:

- Tracer - XM196
- Ball - M193

TABLE VII

SUMMARY OF FIRING AT -65°F

Weapon: 5.56mm, XM16E1, Rifle

Ammunition	Rifle No.	Buffer Type & No.	Malfunctions	Cyclic Rate of Fire		
				Normal Hold	Loose Hold	
5.56mm, M193 Ball Propellant - CR8136 (IMR) RA5056 RA5060	142271	1-1	2 POR, 3 BFH, 1 MF, 1 BFR	653	674	
	137841	1-2	8 POR, 5 FF, 1 BFR	671	631	
	141349	1-3	4 POR, 5 FJ, 2 IS, 2 BFH, 7 BFR	653	682	
	142271	2-1	1 BFH	744	769	
	137841	2-2	19 POR, 5 FF, 4 BFH, 3 BFR	684	701	
	141349	2-3	2 POR, 4 BFH	712	710	
	139162	3-1	1 RS, 3 BFR	714	710	
	137714	3-2	5 POR, 1 BFH, 2 RS, 3 FF, 1 BFR	664	685	
	136824	3-3	2 POR, 1 FF, 1 MF	686	687	
	139162	4-1	1 POR, 4 BFR	724	715	
	137714	4-2	1 POR, 1 RS	728	722	
	136824	4-3	1 MF, 2 BFR	741	744	
	5.56mm, M193 Ball Propellant WCC46 (Ball) RA5176 WCC6089	142271	1-1	1 POR	735	732
		137841	1-2	4 POR	710	687
141349		1-3	1 BC, 1 BFR, 5 FJ	716	734	
142271		2-1	1 POR, 1 MF, 9 BFR	784	800	
137841		2-2	None	739	744	
141349		2-3	1 POR, 2 BFR	784	803	
139162		3-1	1 POR, 4 BFR	772	770	
137714		3-2	3 POR, 1 BFH, 1 BFR	719	746	
136824		3-3	1 POR, 2 BC, 2 MF, 2 BFR	733	723	
139162		4-1	1 POR, 4 BFR	798	800	
137714		4-2	1 RS, 16 BFR	788	817	
136824		4-3	2 POR, 18 BFR	807	827	
5.56mm, XM196 Tracer RA5019 RA5025 RA5031		142271	1-1	None	685	679
		137841	1-2	2 POR, 1 BFR	658	655
	141349	1-3	2 BFR	691	695	
	142271	2-1	None	722	721	
	137841	2-2	2 POR, 1 FJ	732	707	
	141349	2-3	None	701	697	
	139162	3-1	2 POR	726	736	
	137714	3-2	None	687	700	
	136824	3-3	2 POR, 2 RS, 1 BFR	696	704	
	139162	4-1	2 POR	738	734	
	137714	4-2	2 POR	720	732	
	136824	4-3	None	769	761	

Malfunction Code:

- POR - Bolt overrode base of feeding round.
- BFH - Bolt carrier failed to rotate bolt into locked position.
- BFR - Bolt failed to remain to the rear after last round fired.
- IS - Feeding round failed to completely strip from magazine.
- RS - Feeding round stubbed.
- FJ - Fired case failed to eject.
- BC - Bolt caught on bolt stop before magazine was empty.
- FF - Failure to feed (bolt closed on empty chamber).
- MF - Misfire

TABLE VIII

SUMMARY OF FIRING AT +155°F

Weapon: 5.56mm, XM16E1, Rifle

Ammunition	Rifle No.	Buffer Type & No.	Malfunctions	Cyclic Rate of Fire Avg. (SPM)	
				Normal Hold	Loose Hold
5.56mm, M193 Ball Propellant CR9135 (IMR) RA5056	142271	2-1	1 BFH	702	705
	137841	2-2	3 POR	681	632
	141349	2-3	None	766	766
	139162	3-1	1 FX, 1 POR	715	684
	137714	3-2	None	760	757
	136824	3-3	2 POR	691	677
5.56mm, M193 Ball Propellant WC846 (Ball) RA5176	142271	2-1	12 BFH, 27 POR, 1 FJ, 9 BFR	915	940
	137841	2-2	18 POR, 1 BFH, 2 BFR	896	912
	141349	2-3	21 POR, 6 BFH, 1 FJ, 1 RS, 16 BFR	953	961
	139162	3-1	4 POR, 2 FJ, 7 BFR	860	870
	137714	3-2	11 POR, 1 BFH, 1 FJ, 23 BFR	890	905
	136824	3-3	16 POR, 8 BFH, 3 FJ, 11 BFR	903	914
	142271	Std	12 POR, 9 MF, 11 FJ, 29 BFR	947	959
	137841	Std	26 POR, 8 MF, 2 BFH, 9 FJ, 37 BFR	962	969
	141349	Std	8 POR, 9 FJ, 36 BFR	951	961
	139162	Std	11 POR, 23 FJ, 2 BFH, 12 MF, 32 BFR	970	972
137714	Std	18 POR, 6 FJ, 4 BFH, 1 FX, 2 MF, 36 BFR	982	988	
136824	Std	15 POR, 13 FJ, 3 BFH, 7 MF, 37 BFR	992	1003	

Malfunction Code:

- POR - Bolt overrode base of feeding round.
- BFH - Bolt carrier failed to rotate bolt into locked position.
- BFR - Bolt failed to remain to the rear after last round fired.
- RS - Feeding round stubbed.
- FJ - Fired case failed to eject.
- FX - Fired case remained in chamber.
- BFH - Hammer failed to latch on sear.
- MF - Misfire

TABLE IX

SUMMARY OF 600 RD. WEAPON PERFORMANCE TEST - AMBIENT TEMP.

Weapon: 5.56mm, XM16E1, Rifle

Ammunition	Rifle No.	Buffer Type & No.	Malfunctions	Cyclic Rate of Fire Avg. (RPM)	
				NORMAL Hold	LOOSE Hold
5.56mm, M193 Ball Propellant, CR8136 (HR) RA 5036	142271	2-1	3 BFR	737	677
	137841	2-2	1 FCR	720	650
	141349	2-3	3 BFR	779	735
	139162	3-1	2 BFR	738	707
	137714	3-2	2 RS	735	689
	136824	3-3	1 BFR	758	706
5.56mm, M193 Ball Propellant, WC846 (Ball) RA 5176	142271	2-1	5 BFR	886	935
	137841	2-2	14 FCR, 1 BFR	837	879
	141349	2-3	3 FCR, 1 FFI, 7 BFR	913	911
	139162	3-1	1 FCR, 8 BFR	844	854
	137714	3-2	1 FCR, 1 RS, 12 BFR	851	875
	136824	3-3	7 FCR, 1 FJ, 8 BFR	886	915
	142271	Std	21 FJ, 1 FCR, 4 MF, 13 BFR	835	776
	137841	Std	23 FCR, 3 BFR, 4 MF, 2 FJ, 11 BFR	945	928
	141349	Std	6 FCR, 9 FJ, 21 BFR	952	919
	139162	Std	7 FCR, 21 MF, 2 FJ, 21 BFR	959	899
137714	Std	13 FCR, 5 FJ, 25 MF, 1 BFR, 23 BFR	970	984	
	136824	Std	9 FCR, 12 FJ, 6 MF, 18 BFR	989	966
5.56mm, M193 Ball Propellant, CR8136 (HR) RA 5056	142271	Std	None	769	731
	137841	Std	2 FCR	839	775
	141349	Std	3 FCR	835	860
	139162	Std	1 BFR	816	807
	137714	Std	2 RS, 3 BFR	836	874
	136824	Std	1 BFR	871	833

Malfunction Code:

- FCR - Bolt overrode base of feeding round.
- BFR - Bolt carrier failed to rotate bolt into locked position.
- BFR - Bolt failed to remain to rear after last round fired.
- RS - Feeding round stalled.
- FJ - Fired case failed to eject.
- MF - Misfire

TABLE X
STOPPAGES

Malfunctions which occurred with ammunition still remaining in weapon.

Weapon: Rifle, 5.56mm, XM16E1

Ammo	Weapon Ser. No.	Buffer	Number of Stoppages		
			@ -65°F	@ +155°F	@ Ambient
5.56mm M163 Ball RA 5056 RA 5060 (I M)	142271	1-1	5 + 1 MF		
	137841	1-2	13		
	141349	1-3	13		
	142271	2-1	1	1	0
	137841	2-2	28	3	1
	141349	2-3	6	0	0
	139162	3-1	1	2	0
	137714	3-2	11	0	2
	136824	3-3	3 + 1 MF	2	0
	139162	4-1	1		
	137714	4-2	2		
	136824	4-3	1+MF		
	142271	Std			0
	137841	Std			2
	141349	Std			3
139162	Std			0	
137714	Std			2	
136824	Std			0	
5.56mm M163 Ball RA 5175 WCC 0000 RA 5176 (Ball)	142271	1-1	1		
	137841	1-2	4		
	141349	1-3	6		
	142271	2-1	1 + 1 MF	40	0
	137841	2-2	0	19	14
	141349	2-3	1	29	4
	139162	3-1	1	6	1
	137714	3-2	4	13	2
	136824	3-3	3 + 2 MF	27	3
	139162	4-1	1		
	137714	4-2	1		
	136824	4-3	2		
	142271	Std		23 + 9 MF	22 + 4 MF
	137841	Std		37 + 8 MF	28 + 4 MF
	141349	Std		17	15
	139162	Std		36 + 12 MF	9 + 21 MF
	137714	Std		29 + 2 MF	19 + 25 MF
	136824	Std		31 + 7 MF	21 + 6 MF

TABLE X (Continued)

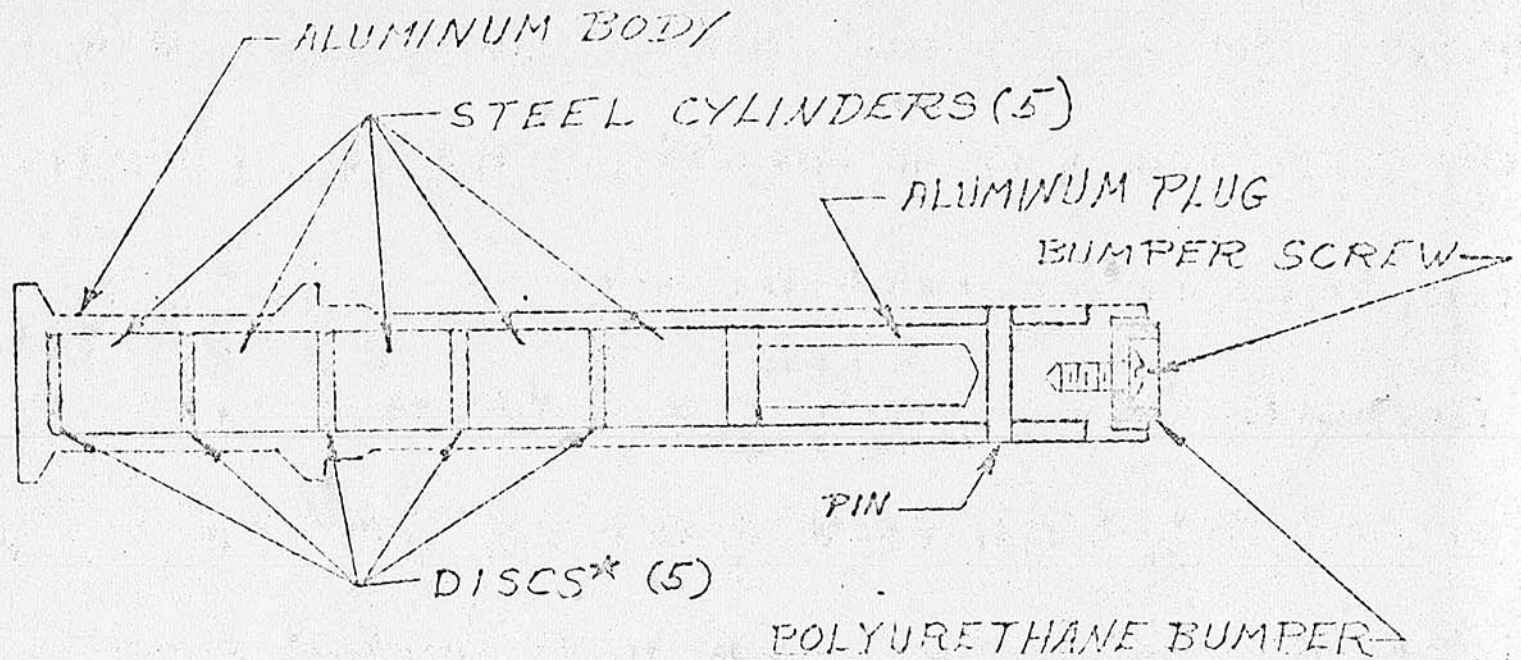
STOPPAGES

Malfunctions which occurred with ammunition still remaining in weapon.

Weapon: Rifle, 5.56mm, XM10E1

<u>Ammo</u>	<u>Weapon Ser. No.</u>	<u>Buffer</u>	<u>Number of Stoppages</u>		
			<u>@ -65°F</u>	<u>@ +155°F</u>	<u>@ Ambient</u>
5.56mm	142271	1-1	0		
M196 Tracer	137841	1-2	3		
EA 5031	141349	1-3	0		
EA 5019	142271	2-1	0		
EA 5025	137841	2-2	3		
	142271	2-3	0		
	139162	3-1	2		
	137714	3-2	0		
	136824	3-3	4		
	139162	4-1	2		
	137714	4-2	2		
	136824	4-3	0		

PROPOSED BUFFER

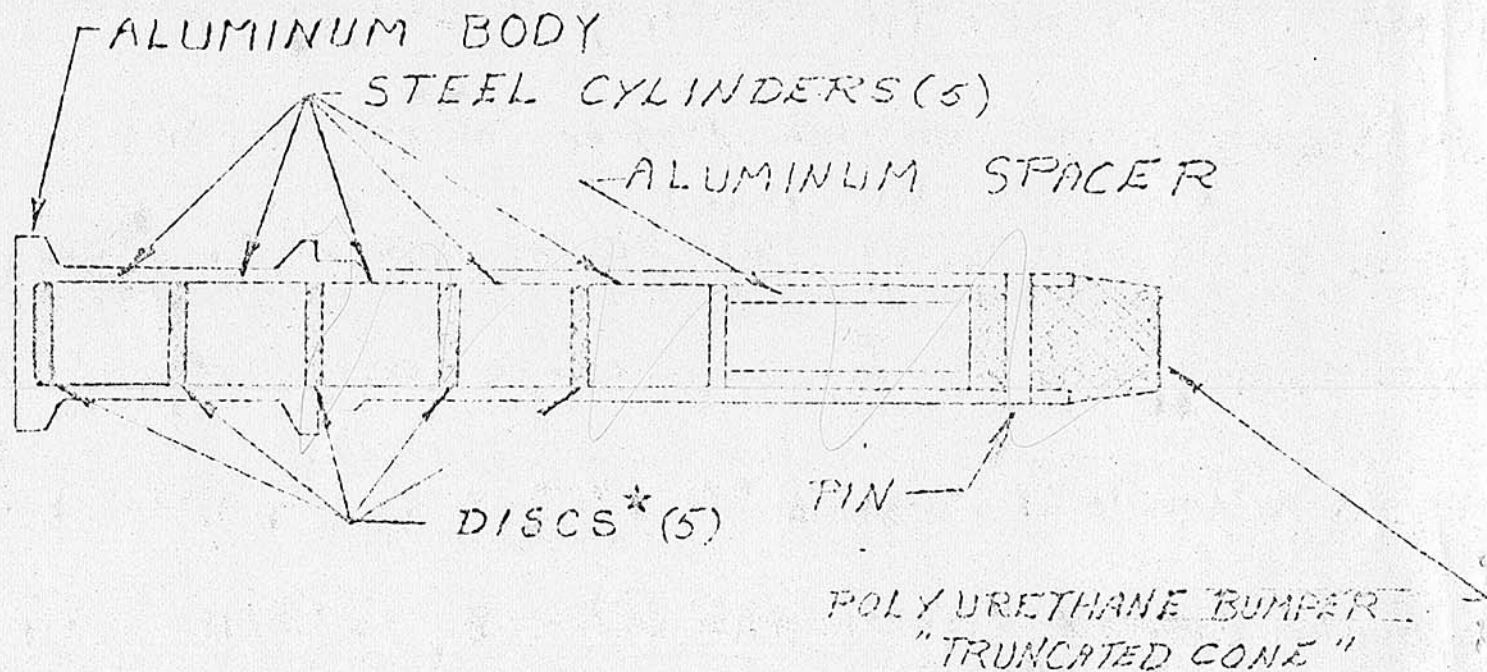


* DISC MATERIAL:
TYPE 1 BUFFERS - BUNA - N
TYPE 3 BUFFERS - POLYURETHANE

SECTION VIEW

SKETCH I

PROPOSED BUFFER



* DISC MATERIAL:

TYPE 2 BUFFERS - BUNA-N

TYPE 4 " - POLYURETHANE

SECTION VIEW

SKETCH II