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Aberdeen Proving Ground

MARYLAND

A TEST OF RIFLE, CALIBER .223, AR-15

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DEVELOPMENT AND PROOF SERVICES

DPS Report 96

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A TEST OF RIFLE, CALIBER .223, AR-15

Report No. DPS-96

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DEVELOPMENT AND PROOF SERVICES
ABERDEEN PROVING GROUND
MARYLAND

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A TEST OF RIFLE, CALIBER .223, AR-15

Report No. DPS-96

Dates of Test: 21 September to 20 October 1960

ABSTRACT

Three rifles were subjected to the light automatic rifle test and two rifles were subjected to additional accuracy tests. A total of 24,443 rounds were fired. The AR-15 rifle, which has a weight of 6.92 pounds when fully loaded and an over-all length of 38.8 inches, fires Cartridge, Caliber .223. The average velocity of the 55-grain bullet at 78 feet was 3104 feet per second. In the 100-yard bench-rest accuracy test the average mean radius for 10-round targets was 1.5 inches. The average number of rounds fired semiautomatically in one minute in the rate-of-aimed-fire test was 84.2 and the average number of hits obtained on the "E" target at a range of 100 yards was 77.8. During automatic firing in this test, the average number of rounds fired was 128.7, and the average number of hits was 41.3. The average malfunction rate with the rifle held normally was 0.25 per hundred rounds. Only ten parts were broken in firing 18,000 rounds in the endurance test. One of these parts, an extractor spring, was broken during disassembly of the extractor. The AR-15 rifle gave near normal performance in the unlubricated, dust, extreme-cold and rain tests,¹ and it completed the mud test. A cook-off occurred after firing 140 rounds in 54 seconds, but no cook-off occurred in firing 120 rounds in 39 seconds. When fired with a telescopic sight from a bench rest at 100 yards two rifles gave an average mean radius of 1.1 inches for four 10-shot groups from each rifle with each of two lots of ammunition.

¹A modified rain test was conducted, see note on page 14.

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1. INTRODUCTION

The AR-15 rifle was previously tested at this station between 20 March and 21 November 1958. The results of that test are contained in Reference 1. The rifle tested previously was an experimental model produced in a limited quantity. The rifle submitted for this test was mass-produced and it incorporated various minor design changes from the experimental rifle. Teletype ORD 10508 dated 12 September 1960 directs that three AR-15 rifles be subjected to the Standard Light Automatic Rifle Test.

2. DESCRIPTION OF MATERIEL

2.1 Rifle, Caliber .223, AR-15

The AR-15 (Figures 1 through 5) is a lightweight, gas-operated rifle equipped with a 20-round, detachable magazine. The rifle is chambered for Cartridge, Caliber .223. This round, when fired in the AR-15 rifle, gives the 55-grain bullet a muzzle velocity of 3200 feet per second. A plastic stock, in line with the bore to minimize rotation of the rifle about the shoulder during firing, is used in conjunction with a high line of sight and a separate grip. The stock has a rubber butt. A two-piece hand guard of metal and plastic is designed for convenient disassembly and rapid dissipation of heat. Sling swivels and a carrying handle are provided. A lever on the left side above the grip, provides a trigger safety, and semiautomatic and automatic fire. A bolt catch retains the bolt to the rear after the last round has been fired. A charging handle at the rear of the receiver is designed to permit operation while wearing mittens. The trigger guard is hinged to permit the trigger to be operated while wearing mittens. A cover is provided for the ejection port in the receiver. A three-prong muzzle attachment is threaded to the barrel to serve as a flash suppressor, a grenade launcher, and a front support for a bayonet. The lower part of the front sight is machined to form a bayonet lug. Additional accessories include bayonet, bipod, grenade-launching sight, and a telescopic sight.

The bolt locks in a barrel extension, which is permanently assembled to the barrel, by means of seven locking lugs. This design permits the use of a lightweight receiver to house the operating parts. The bolt carrier is a massive part which has a cam cut to accommodate a pin assembled in the bolt for rotating the bolt through 22 degrees for locking and unlocking.

Gas passes through a 0.092-inch-diameter port in the barrel, located 13.2 inches forward of the bolt face (with the bolt in the locked position), and it is directed through an 0.120-inch-inside-diameter tube to the bolt carrier. The bolt carrier is equipped with a tube which fits over the gas tube to direct the gas inside the carrier where it applies a force against the bolt and the carrier. The carrier is forced to the rear 0.035 inch before unlocking of the bolt is completed. Holes in the right side of the carrier permit gas to escape when the bolt has been rotated to the unlocked position. The bolt and carrier then travel to the rear together.

Use is made of the stock to house a large action spring which operates in a direct line with the carrier.

A firing pin, which retains the cam pin in the bolt, is retained in the carrier by another pin. A limited movement of the firing pin is permitted in the carrier. This serves as a safety feature to prevent contact of the pin with the round except when the bolt is in the locked position.

A spring-loaded ejector is located in the bolt. The extractor is reinforced by a rib.

The receiver is in two parts to permit convenient removal of the operating parts. The upper receiver is secured to the barrel assembly by means of a nut and it houses the bolt and carrier assemblies. The upper receiver is designed to provide a carrying handle which also serves as a base for the rear sight and a telescopic sight. Two lugs are provided on the bottom of the upper receiver for attaching the lower receiver by means of pins. The lower receiver houses the firing mechanism, provides a support for the magazine, and serves as a base for the grip and stock. The action spring operates in a tube threaded to the lower receiver. The stock is retained in position by a screw through the butt to the tube. The operating parts can be disassembled with a round, or similar tool, by pushing out the rear pin. This permits the lower receiver to be rotated away from the upper receiver to expose the bolt carrier which can be withdrawn to the rear. The action spring and buffer assembly are retained in the lower receiver extension by means of a spring-loaded plunger. The action spring and buffer assembly can be removed from the tube by depressing a spring-loaded plunger. The upper and lower receivers can be separated by removing the receiver pivot pin.

The firing mechanism uses a hammer which is rotated to the cocked position by the carrier. The forward movement of the hammer is controlled by the disconnect and trigger in semiautomatic fire and by the automatic sear and trigger in automatic fire. When the lever is rotated to the rear position (SAFE) it blocks the trigger, and there is insufficient movement to permit the trigger to disengage the hammer. When the lever is rotated to the downward position (SEMI) sufficient movement of the trigger is permitted to disengage the hammer. When the lever is rotated to the forward position (AUTO) it permits a greater movement of the trigger, but not of the disconnect, than when in the downward position. It also permits the automatic sear to rotate forward to engage a lug on the hammer. The disconnect retains the hammer in the rearward position until the trigger has returned to its forward position in semiautomatic fire. When the hammer is rotated to the rear by the carrier the spring-loaded disconnect engages a lug on the rear of the hammer. When the trigger moves to its forward position the hammer disengages from the disconnect permitting it to rotate forward to engage the trigger. In automatic fire the disconnect has no function. Should the trigger be held to the rear with the lever set for automatic fire the automatic sear will hold the hammer to the rear until the automatic sear is rotated by the carrier on its forward movement. Firing will continue until the trigger is released. When the trigger is permitted to rotate to its forward position the automatic sear will disengage the hammer, and the hammer will rotate forward slightly to contact the trigger. The hammer will remain at the rear until the trigger is again operated. The firing mechanism can be disassembled without special tools.

The automatic sear, trigger and hammer pins are retained in assembly by springs which engage in a circumferential groove in the pin. Use is made of the hammer spring to retain the trigger pin in assembly.

The ejection port cover is spring-loaded so that it is held against the receiver during firing. A catch holds it in the closed position over the port. The catch is disengaged automatically by a cam on the carrier when the carrier moves to the rear.

The barrel has a diameter of 0.65 inch at a point forward of the enlarged chamber section and a minimum diameter of 0.56 inch (excluding the threaded section at the muzzle). The front sight, which also serves as a support for the gas tube, is retained on the barrel by two pins. The front sight post, a truncated cone with a diameter of 0.070 inch at the top, is threaded to the front sight to permit an adjustment for elevation. The post has five notches in its circumference to accommodate a spring-loaded plunger. This permits a movement of the post of 0.0056 inch per notch.

The rear sight is an L-shaped part pivoted on a screw. The sight is spring-loaded to expose one of two 0.078-inch-diameter apertures on the line of fire. A drum attached to the screw permits the rear sight to be adjusted for windage with a round or other suitable tool. The drum has five holes to accept a spring-loaded plunger. This permits an adjustment of the rear sight of 0.0056 inch per hole. This represents an adjustment of one minute of angle per hole. The difference in height between the two apertures is 0.015 inch.

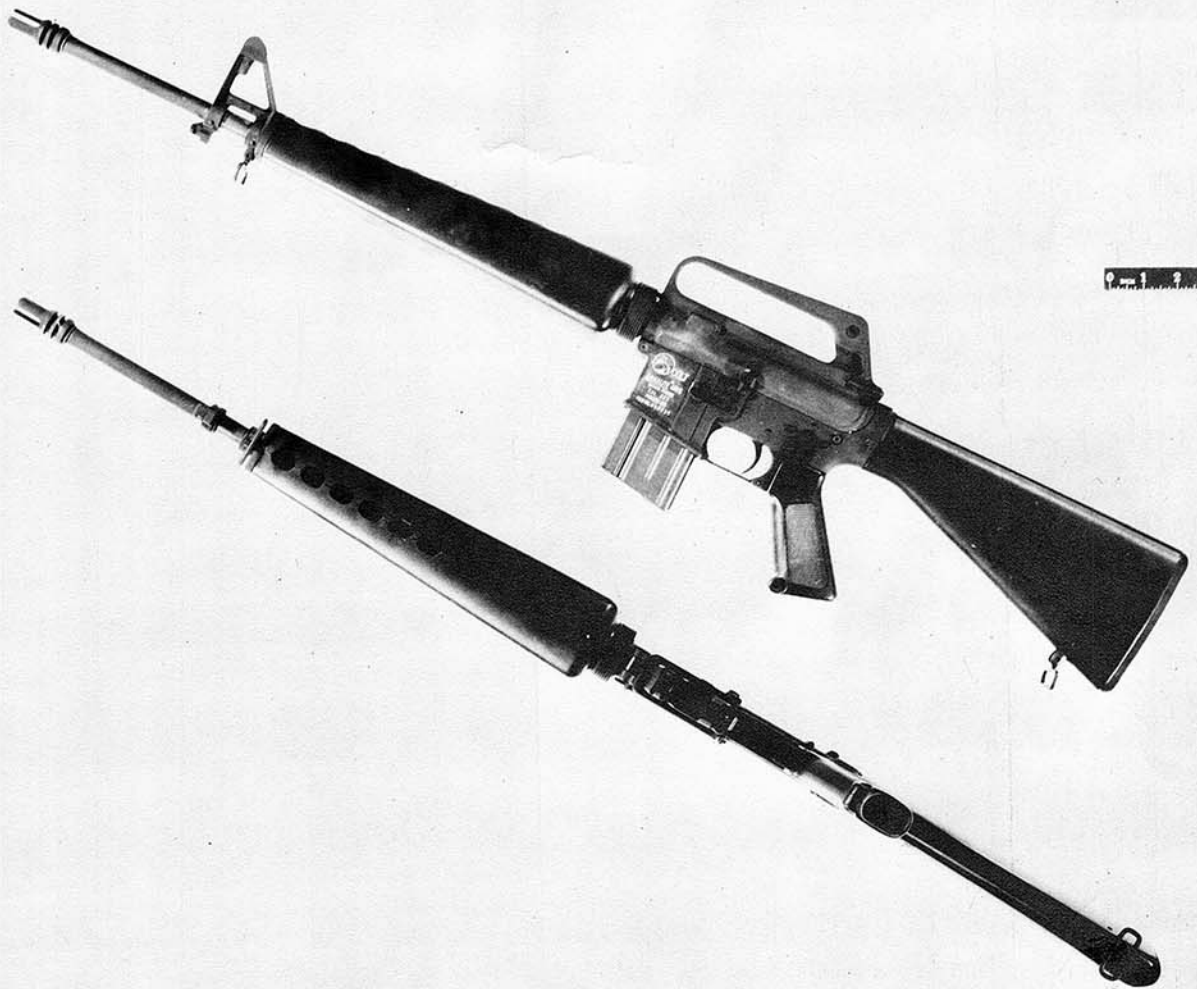
The magazine is retained in the lower receiver by a catch which engages the magazine on the left side. The catch is operated by a button on the right side of the receiver. The magazine can be disengaged without removal of the hand from the grip (right-handed shooter). When the magazine is empty the follower forces the catch up to engage the bolt and retain it at the rear. The bolt may be disengaged from the catch when the magazine has been removed or replaced with one containing rounds by depressing the portion of the catch which extends outside the receiver on the left side or by retracting the charging handle and then releasing it.

The hand guards consist of an aluminum liner attached to a plastic shell by means of ten rivets. The front of the hand guards fit in a yoke positioned on the barrel between the front sight and a shoulder on the barrel and the rear fit in a spring-loaded ring. To disassemble the hand guards from the rifle it is necessary only to retract the ring and rotate each hand guard to the side. Ten elongated holes at the top and six at the bottom of the hand guard are provided for heat dissipation. A coating is applied to the hand guards, stock and grip to provide a dark green color.

Use is made of lightweight and rust-resistant materials in the fabrication of the AR-15 rifle.

No special technique is required to fire the AR-15 rifle.

The bayonet for the AR-15 rifle has an over-all length of 12.1 inches and a blade length of 7.0 inches. The weight of the bayonet is 0.62 pound. The scabbard is 13.0 inches long and weighs 0.32 pound.



8 ABERDEEN PROVING GROUND 8

S18-001-2874-1005-54-2P/ORD-60

21 September 1960

Project T51-2/265. Rifle, Caliber .223, AR-15, Figure 2.
Left side and bottom views.

1204



8 ABERDEEN PROVING GROUND 8

S18-001-2876-1005-54-5P/ORD-60

21 September 1960

Project TS1-2/265. Rifle, Caliber .223, AR-15, Figure 3.
Rifle field stripped.

2204

2.2 Cartridge, Caliber .223

Ten rounds of lot T20L selected at random gave the following weights in grains:

<u>Round No.</u>	<u>Projectile</u>	<u>Propellant</u>	<u>Primed Case</u>	<u>Complete Round</u>
1	54.80	25.42	92.48	172.7
2	54.72	25.45	92.07	172.2
3	54.89	25.40	92.52	172.8
4	55.24	25.74	93.60	174.6
5	54.87	25.71	93.37	173.9
6	54.86	25.35	93.55	173.8
7	54.84	25.61	93.06	173.5
8	54.41	25.46	91.35	171.2
9	54.88	25.59	92.89	173.3
10	54.83	25.59	92.24	172.7
Average	54.83	25.53	92.71	173.1

The length of the round is 2.24 inches. The length of the case is 1.75 inches and the length of the bullet is 0.73 inch. The bullet diameter is 0.224 inch. The diameter of the flash hole in the case is 0.082 inch.

The propellant is an IMR type.

2.3 Lubricant

The lubricant used in all phases of the test where lubricant was used, except the rain and extreme-cold phases, was PL-Special Lubricating Oil General Purpose Preservative, MIL-L-644B. PD 500 oil was used in the extreme-cold phase. Lubriplate was used in the rain test.

3. DETAILS OF TEST

Three rifles were subjected to firing tests, and one was used in the disassembly and assembly test. The procedure for the standard light automatic rifle test follows. Test V was not conducted.

STANDARD LIGHT AUTOMATIC RIFLE TEST

TEST I

EXAMINATION

- a. The rifle will be disassembled and an examination made of all parts.
- b. The number and names of all parts and the types of springs will be recorded.

c. The weight of the complete rifle, component parts & accessories will be recorded.

d. The length of the rifle and other pertinent dimensions will be recorded. Dimensions recorded will include barrel length, sight radius, line of sight above bore, and stock dimensions.

e. The average trigger pull will be determined.

f. The rifle will be photographed in various conditions of disassembly.

TEST II

DISASSEMBLY AND ASSEMBLY

The time and the number and type of tools required for each of the following operations will be recorded:

a. To disassemble the rifle completely.

b. To assemble the rifle after complete disassembly.

c. To dismount the operating parts and magazine mechanism (field strip).

d. To assemble the operating parts and magazine mechanism.

TEST III

ACCURACY

a. Four ten-round targets will be fired at a range of 100 yards from a machine rest or from a bench rest by an expert rifleman.

b. A test will be conducted to investigate the accuracy that can be obtained when the rifle is fired under various conditions similar to those encountered in combat. Three riflemen will each fire the following course at 100 yards with the test rifle:

(1) With sights properly adjusted and with a fouled bore, one 10-round target will be fired from a bench rest.

(2) The rifle will be disassembled (field stripped), cleaned, oiled, and reassembled.

(3) Starting with a cold and oiled bore, one 10-round target will be fired from a bench rest.

(4) One 10-round target will be fired from the prone position using a sling.

(5) One hundred rounds will be fired as rapidly as possible.

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8 ABERDEEN PROVING GROUND 8

S18-001-2873-1005-54-1P/ORD-60

21 September 1960

Project TS1-2/265. Rifle, Caliber .223, AR-15, Figure 6.
Top and right side views.

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(6) Immediately after firing the 100 rounds one 10-round target will be fired from a bench rest.

(7) Another 10-round target will be fired immediately from the prone position using a sling.

c. Three riflemen will each fire ten three-round bursts at a range of 25 yards from the standing position. The course will be repeated from the prone position. A suitable control rifle may be used.

d. Three individuals will fire as many aimed shots as possible in a one-minute period with each semiautomatic and automatic fire. The course will be fired three times per individual and the hits recorded on the E* target at 100 yards.

e. Six individuals will fire a standard qualification course with the rifle.

TEST IV

ENDURANCE

The rifle will be fired 6000 rounds for endurance, firing alternately 100 rounds semiautomatically and 100 rounds automatically. The rifle will be cooled after each 100 rounds. The entire mechanism may be disassembled, cleaned and oiled after each 600 rounds. All malfunctions, breakages and replacement of parts will be recorded. The instrumental velocity will be measured on 20 rounds, before and after the endurance test. Accuracy will be checked before and after the test. In the endurance test 100 rounds will be fired semiautomatically and 100 rounds will be fired automatically under each of the following conditions:

- a. With the rifle held loosely in the hands.
- b. With the rifle held right side up.
- c. With the rifle held left side up.
- d. With the rifle held loosely in the hands at an elevation of 80 degrees.
- e. With the rifle held in a normal manner at an elevation of 80 degrees.
- f. With the rifle held loosely in the hands at a depression of 80 degrees.
- g. With the rifle held in a normal manner at a depression of 80 degrees.

TEST V

FLASH

The cumulative flash from 20 rounds fired semiautomatically in a completely dark range will be recorded photographically by means of 4- by 5-inch

*"E" target is a silhouette target corresponding to a kneeling man (Ref FM-23-5).

camera using a lens opening of f 2.5 and a film having a Weston rating of 100. The camera will be placed at a right angle to the muzzle at a distance of 4.5 feet.

TEST VI

UNLUBRICATED

The rifle will be cleaned in solvent and left in an unlubricated condition. One hundred rounds will then be fired alternating between semiautomatic and automatic fire.

TEST VII

EXTREME COLD

The rifle will be cleaned, lightly oiled, and placed with a loaded magazine in a cold room maintained at -65°F , for a 12-hour period prior to firing. After this period an attempt will be made to fire 20 rounds (or the capacity of the magazine) semiautomatically. If satisfactory functioning is obtained, a similar number of rounds will be fired automatically after an additional two hours.

TEST VIII

DUST

The rifle will be cleaned and lightly oiled. It will be fully loaded and the safety will be placed in the "ON" position. The rifle will then be placed in the dust box and exposed to the dust for one minute top side up and for one minute upside down. The dust mixture, which is made by mixing nine pounds of Grace O Albany sand with one pound of clean silica core sand which passed 100 percent through a 30 mesh sieve, 80 percent through a 50 mesh, and 3.4 percent through a 100 mesh, will be poured at a rate of five pounds per minute through the pourhole while the blower is turned at a handle speed of 60 revolutions per minute. The shooter will attempt to clean the rifle by wiping with his bare hands and by blowing sharply on the congested areas of the action. An attempt will be made to fire 20 rounds (or the capacity of the magazine).

TEST IX

MUD

The rifle will be cleaned, lightly oiled, and the muzzle taped to exclude the mud from the bore. The rifle will be immersed completely in the mud for a period of 15 seconds. The mud mixture is made in the proportion of ten pounds of red clay and two pounds of clean river sand with eight quarts of water. The sand is approximately the same grading as that used in the dust test. The shooter will remove the tape from the muzzle and attempt to clean the rifle by wiping with the bare hands and by blowing on the congested areas of the action. An attempt will be made to fire 20 rounds (or the capacity of the magazine).

TEST X

RAIN

The rifle will be cleaned, lubricated and subjected to spray which is directed over the entire rifle by means of a 1/2-inch pipe having 0.059-inch holes spaced 1/2-inch apart. The pipe will be positioned three feet above the rifle. The following procedure will be used:

a. The rifle, in a horizontal position, will be exposed to the spray for five minutes with the bolt retracted and for five minutes with the bolt closed. The rifle will be loaded when the bolt is closed. After this time the gun will be fired 100 rounds semiautomatically.

b. The procedure in "a" will be repeated, except that the gun will be fired automatically.

c. The procedure in "a" will be repeated, except that the rifle will be exposed to the spray with muzzle up. The rifle will be fired 100 rounds semi-automatically in a horizontal position. Before firing, the muzzle of the rifle will be depressed to permit water accumulating in the bore to run out.¹

d. The procedure in "c" will be repeated except that the gun will be fired automatically.

e. The procedure in "c" will be repeated except that the rifle will be exposed to the spray with muzzle down.

f. The procedure in "e" will be repeated.

TEST XI

COOK-OFF

The rifle will be subjected to a test to determine the minimum number of rounds which may be fired before sufficient heating of the chamber occurs to result in a premature explosion of the cartridge. The firing will be conducted as rapidly as possible employing preloaded magazines. An attempt will be made to bracket the cook-off point in number of rounds fired.

Complete test data are attached as Appendix B. There follows a summary of results.

TEST I (EXAMINATION)

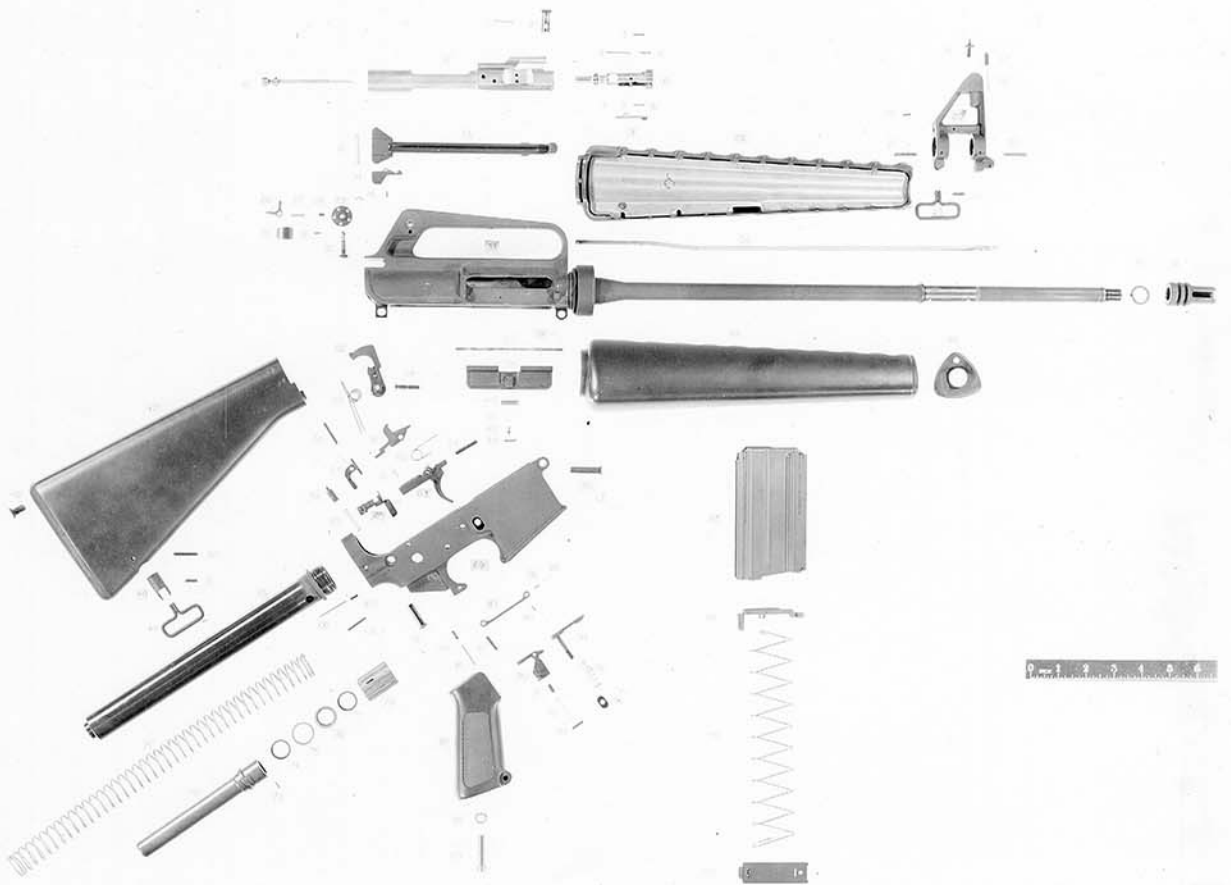
NOMENCLATURE LIST

The names of the parts correspond to the numbers in Figure 5 as follows:

1. Pin, Firing Pin Retaining
2. Pin, Bolt Cam

¹This procedure was modified in this test, in that the bolt was retracted slightly when the muzzle was depressed, to facilitate removal of water from the bore.

3. Pin, Ejector
4. Spring, Ejector
5. Ejector
6. Bolt Assembly composed of:
 - Bolt
 - Ring, Bolt (3)
7. Spring, Extractor
8. Pin, Extractor
9. Extractor
10. Pin, Firing
11. Bolt Carrier and Key Assembly composed of:
 - Carrier, Bolt
 - Key, Bolt Carrier
 - Screw, Socket Head Cap (2)
12. Spring, Charging Handle
13. Handle, Charging
14. Catch, Charging Handle
15. Pin, Charging Handle Catch
16. Post, Front Sight
17. Detent, Front Sight
18. Spring, Front Sight Detent
19. Pin, Gas Tube
20. Sight, Front
- 21 and 22. Pins, Front Sight Taper
23. Hand Guard Assembly LH composed of:
 - Hand Guard, LH
 - Liner, LH
 - Rivets (10)



8 ABERDEEN PROVING GROUND 8

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21 September 1960

Project TS1-2/265. Rifle, Caliber .223, AR-15, Figure 8.5
Rifle disassembled.

24. Swivel, Front
25. Pin, Front Swivel
26. Sight, Rear
27. Spring, Rear Sight Detent
28. Detent, Rear Sight
29. Drum, Rear Sight Windage
30. Spring, Rear Sight
31. Pin, Rear Sight Windage Drum
32. Screw, Rear Sight Windage
33. Barrel and Upper Receiver Assembly composed of:

Barrel

Extension, Barrel

Pin, Barrel Indexing

Nut, Barrel

Receiver, Upper

Ring, Hand Guard Slip

Ring, Hand Guard Snap

Spring, Hand Guard Slip Ring (An assembly not designed for
disassembly.)

34. Tube, Gas
35. Washer, Flash Suppressor Lock
36. Suppressor, Flash
37. Pin, Ejection Port Cover
38. Ring, Ejection Port Cover Pin Retaining
39. Cover, Ejection Port
40. Spring, Ejection Port Cover

41. Spring, Ejection Port Cover Catch
42. Catch, Ejection Port Cover
43. Pin, Ejection Port Cover Catch
44. Hand Guard Assembly RH composed of:
 - Hand Guard, RH
 - Liner, RH
 - Rivets (10)
45. Cap, Hand Guard
46. Screw, Butt Cap
47. Stock
48. Block, Rear Sling Swivel
49. Swivel, Rear Sling
50. Pin, Rear Sling Swivel Base
51. Pin, Rear Sling Swivel
52. Hammer
53. Spring, Hammer
54. Pin, Hammer
55. Pin, Automatic Sear
56. Disconnect
57. Automatic Sear Assembly composed of:
 - Bushing, Automatic Sear
 - Sear, Automatic
 - Spring, Automatic Sear
58. Retainer, Buffer
59. Spring, Buffer Retainer
60. Safety
61. Spring, Disconnect

62. Spring, Trigger
63. Trigger
64. Pin, Trigger
65. Extention, Lower Receiver
66. Spring, Takedown Pin Detent
67. Detent, Takedown Pin
68. Pin, Lower Receiver Extention
69. Receiver, Lower
70. Pin, Receiver Pivot (An assembly not designed for disassembly.)
71. Spring, Action
72. Guide, Action Spring
73. Pin, Buffer
74. Ring, Buffer End
75. Ring, Buffer Outer
76. Ring, Buffer Inner and Ring, Buffer Outer
77. Ring, Buffer End
78. Cap, Buffer
79. Pin, Takedown
80. Detent, Safety
81. Spring, Safety Detent
82. Pin, Trigger Guard Pivot
83. Guard, Trigger
84. Pin, Trigger Guard
85. Plunger, Trigger Guard
86. Spring, Trigger Guard
87. Grip, Pistol
88. Lockwasher

MEASUREMENTS

Over-all length with flash suppressor	38.8
Over-all length without flash suppressor	37.5
Barrel length (face of bolt to muzzle)	20.0
Sight radius	19.8
Line of sight above bore	2.5
Butt to trigger	12.8
Pitch from line of bore	25°
Line of sight to forward end of comb	1.9
Barrel: Rifling	
One turn in	14.0
Number of grooves	6
Number of parts	142
Number of coil springs	15
Number of flat springs	2
Number of torsion springs	4

TEST II (DISASSEMBLY AND ASSEMBLY)

The time given is the average required for two trials by each of three individuals.

Number of tools required to disassemble rifle	5
Time required to disassemble rifle	7 min 49 sec
Number of tools required to assemble rifle after disassembly	5
Time required to assemble rifle after disassembly	19 min 17 sec
Number of tools required to dismount operating parts and magazine	b
Time required to dismount operating parts and magazine	5 sec
Number of parts required to assemble operating parts	b
Time required to assemble operating parts and magazine	6 sec

TEST III (ACCURACY)

Legend:

MR - Mean Radius	EHD - Extreme Horizontal Deviation
MVD - Mean Vertical Deviation	ES - Extreme Spread
MHD - Mean Horizontal Deviation	CI - Center of Impact
EVD - Extreme Vertical Deviation	

Bench-Rest Accuracy

The averages for four 10-shot targets fired from a bench rest at a range of 100 yards are given in inches.

<u>Rifle No.</u>	<u>MR</u>	<u>MVD</u>	<u>MHD</u>	<u>EVD</u>	<u>EHD</u>	<u>ES</u>
614	1.3	0.8	0.8	3.2	3.5	4.2
682	1.7	1.2	0.9	5.0	3.9	5.5
835	1.4	1.0	0.7	4.5	2.9	5.0
Average	1.5	1.0	0.8	4.2	3.4	4.9

^aAngle between a normal to the line of bore and a line extending across butt.
^bNo tool is required, but it was found convenient to use a tool to start or position the takedown pin.

- 89. Screw, Pistol Grip
- 90. Catch, Bolt
- 91. Plunger, Bolt Catch
- 92. Spring, Bolt Catch
- 93. Pin, Bolt Catch
- 94. Plate, Magazine Catch
- 95. Spring, Magazine Catch
- 96. Button, Magazine Catch
- 97. Tube, Magazine Assembly composed of:
 - Box
 - Retainer, Magazine Floor Plate
 - Rivets (3)
- 98. Follower, Magazine
- 99. Spring, Magazine
- 100. Plate, Magazine Floor

WEIGHTS AND MEASUREMENTS

Weights and measurements are averages for rifles number 614, 682 and 835.

Weights are given in pounds and measurements in inches.

WEIGHTS

Rifle without magazine or sling (with flash suppressor)	6.24
Empty magazine	0.18
One round of ammunition	0.0248
Magazine capacity (rounds)	^a 20
Rifle with loaded magazine	6.92
Recoiling parts	^b 0.98
Stock	0.50
Hand guards	0.69
Flash suppressor and washer	0.10
Trigger pull (average of 5 trials for each rifle)	8.7

^a21 rounds can be inserted but the magazine was loaded with a maximum of 20 in this test.

^bIncludes bolt assembly, bolt carrier assembly, buffer assembly and action spring.

Combat Accuracy

The averages for five targets, each fired under a different condition at a range of 100 yards, for each rifle are given in inches.

<u>Rifle No.</u>	<u>Mean From Normal CI</u>	<u>MR</u>	<u>ES</u>	<u>Extreme Shot to Normal CI</u>
614	3.2	1.9	6.2	5.9
682	5.3	2.2	8.0	8.9
835	3.5	2.6	11.4	9.5
Average	4.0	2.2	8.5	8.1

Automatic Accuracy

The averages for ten three-round bursts by each of three shooters at a range of 25 yards are given in inches.

<u>Firing Position</u>	<u>Mean for Shots Fired Automatically^a</u>	<u>30-Shot Target</u>			
		<u>Mean From Aiming Point</u>	<u>EV</u>	<u>EH</u>	<u>ES</u>
Prone	34.2	22.1	49.9	20.0	52.1
Standing	68.9	45.6	103.0	40.9	110.0

^aThe first shot in each burst is considered a semiautomatically-fired shot.

Rate of Aimed Fire

The average number of shots fired and number of hits obtained on the "E" target at a range of 100 yards in one minute (three trials by each of three riflemen) are given below. Firing was from the prone position.

<u>Type Fire</u>	<u>No. of Shots Fired</u>	<u>No. of Bursts</u>	<u>No. of Hits Obtained</u>
Semiautomatic	84.2	---	77.8
Automatic	128.7	26	41.3

In the rate-of-aimed-fire test the shooter attempted to fire four bursts per magazine in the automatic-fire phase.

An asbestos glove was worn by the shooter in the combat-accuracy and rate-of-aimed-fire tests because the rifle was found to be uncomfortable to hold by the hand guards after firing 130 rounds at a rapid rate.

The vibration of the action spring could be felt on the face during firing.

Test phase III, e, was not conducted because the error of the individual is a large factor in the scores produced and, therefore, data generated in this phase are of little value unless a control weapon is used.

TEST IV (ENDURANCE)

	<u>Rifle Number</u>		
	<u>614</u>	<u>682</u>	<u>835</u>
Number of broken or damaged parts replaced during firing cycles	2	2	^b 5
Number of broken or damaged parts replaced between firing cycles	0	0	1

^bThe extractor spring was broken during disassembly.

MALFUNCTIONS PER HUNDRED ROUNDS

Rifle held loosely in hands	0.5	0.0	0.5
Rifle held right side up	1.0	1.0	0.0
Rifle held left side up	0.0	0.0	0.0
Rifle held at an elevation of 80°	0.25	0.0	0.0
Rifle held at a depression of 80°	0.0	1.0	0.25
Rifle held normally	0.22	0.41	0.11
Average velocity loss in firing 6000 rounds (feet per second)	148	154	176
Average accuracy before test (MR at 100 yards)	1.3	1.7	1.4
Average accuracy after test (MR at 100 yards)	2.6	2.0	2.3

Rifle number 835 gave poorer endurance performance than the other two rifles in this test; there was a greater loss in velocity, and a greater number of parts were broken. The bore on rifle number 835 showed much greater wear than the other rifles after the endurance test, and it appears probable that this rifle was fired a large number of rounds before it was submitted for this test.

Only the bolt and bolt-carrier assemblies were removed from the rifle and cleaned after each 600-round firing cycle in the endurance test. The chamber was cleaned with a brush after each firing cycle, but the bore was not cleaned during the endurance test. No stoppages occurred which could be attributed to a lack of maintenance in this test.

TEST VI (UNLUBRICATED)

A total of 100 rounds were fired in each rifle (50 rounds were fired semiautomatically and 50 rounds were fired automatically) after the rifle had been cleaned in solvent and left in an unlubricated condition.

<u>Rifle Number</u>	<u>Number of Malfunctions</u>	<u>Remarks</u>
614	1	The bolt failed to remain at the rear after the last round in magazine.
682	0	
835	0	

TEST VII (EXTREME COLD)

Twenty rounds were fired semiautomatically in each rifle after an exposure of 12 hours to a temperature of -65°F, and 20 rounds were fired automatically after an additional exposure of 2 hours.

<u>Rifle Number</u>	<u>Number of Malfunctions</u>	<u>Remarks</u>
614	0	
682	0	
835	0	

TEST VIII (DUST)

Ten rounds were fired semiautomatically, and 10 were fired automatically from each rifle after exposure to the dust.

<u>Rifle Number</u>	<u>Number of Malfunctions</u>	<u>Remarks</u>
614	0	
682	2	A failure to feed occurred because the magazine was not latched and a failure to extract occurred (partial rim shear of case).
835	0	

TEST IX (MUD)

<u>Rifle Number</u>	<u>Number of Rounds Fired</u>	<u>Type Fire</u>	<u>Number of Malfunctions</u>	<u>Remarks</u>
614	10	Semiautomatic	0	
614	10	Automatic	6	The bolt carrier lacked energy to lock the bolt on 3 occasions, 2 failures to feed, and 1 failure to eject.
682	10	Semiautomatic	2	The trigger failed to go forward on 2 occasions.
682	10	Automatic	2	The bolt carrier lacked energy to lock the bolt on 2 occasions.
682	10	Semiautomatic	5	The trigger failed to go forward on 4 occasions, and 1 failure to feed occurred.
682	10	Semiautomatic ^a	9	The bolt carrier lacked energy to lock the bolt on 2 occasions; the bolt failed to remain at the rear after the last round in the magazine on 1 occasion; and 6 failures of the trigger to go forward occurred.

^aIt was attempted to fire automatically but the lever could not be rotated to the AUTO position.

<u>Rifle Number</u>	<u>Number of Rounds Fired</u>	<u>Type Fire</u>	<u>Number of Malfunctions</u>	<u>Remarks</u>
835	13	Semiautomatic	1	The trigger failed to go forward on 1 occasion.
835	7	Automatic	1	The bolt carrier lacked energy to lock the bolt on 1 occasion.
835	14	Semiautomatic	9	The bolt carrier lacked energy to lock the bolt on 5 occasions, and 4 failures to feed occurred.
835	6	Automatic	9	The bolt carrier lacked energy to lock the bolt on 7 occasions, and 2 failures to feed occurred.

Twenty additional rounds were fired in rifles number 682 and 835 at the request of a representative.

TEST X (RAIN)

Each rifle was fired 600 rounds alternating between semiautomatic and automatic fire.

<u>Rifle Number</u>	<u>Number of Malfunctions</u>	<u>Remarks</u>
614	1	The bolt failed to lock fully on the first round from the magazine with muzzle up.
682	1	As above.
835	9	The bolt failed to lock fully on the first round from the magazine with muzzle up on 1 occasion; on 7 occasions the bolt failed to remain at the rear after firing the last round in a magazine; and on one occasion the trigger pin partially disassembled causing the rifle to fire automatically.

TEST XI (COOK-OFF)

<u>Rifle Number</u>	<u>Number of Rounds Fired</u>	<u>Time for Firing^a</u>	<u>Results</u>
614	140	1 min 15 sec	No cook-off. A faulty bolt catch caused several stoppages.
614	160	50 sec	A cook-off occurred in 18 seconds.

^aTime from firing first round to chambering of cook-off round.

<u>Rifle Number</u>	<u>Number of Rounds Fired</u>	<u>Time for Firing^a</u>	<u>Results</u>
682	140	54 sec	A cook-off occurred in 51 seconds.
835	120	39 sec	No cook-off.

SPECIAL ACCURACY TESTS

Several additional tests were conducted at a range of 100 yards to further investigate the accuracy of the AR-15 rifle. Complete data are included in Appendix B. There follows a summary of results. Average measurements for four ~~10~~-round targets are given in inches.

<u>Rifle No.</u>	<u>MR</u>	<u>MVD</u>	<u>MHD</u>	<u>EVD</u>	<u>EHD</u>	<u>ES</u>
------------------	-----------	------------	------------	------------	------------	-----------

Fired from a bench rest with lot U14F using a telescopic sight.

689	1.0	0.6	0.8	2.2	2.7	3.0
645	1.2	0.7	0.8	3.4	3.5	4.2
Average	1.1	0.65	0.8	2.8	3.1	3.6

Fired from a bench rest with lot T20L using a telescopic sight.

689	1.2	0.9	0.7	3.9	3.2	5.1
645	1.0	0.6	0.7	2.6	2.8	3.6
Average	1.1	0.75	0.7	3.25	3.0	4.35

Fired from a machine rest with lot U14F.

689	1.2	0.9	0.7	3.4	2.9	4.3
645	1.0	0.7	0.7	2.8	2.6	3.2
Average	1.1	0.8	0.7	3.1	2.75	3.75

Fired from a machine rest using lot T20L.

689	1.2	0.8	0.8	3.8	4.0	5.2
645	1.4	0.9	0.9	4.6	4.2	5.8
Average	1.3	0.85	0.85	4.2	4.1	5.5

The average difference in center of impact when firing with and without the bayonet was 1.8 inches at 100 yards.

^aTime from firing first round to chambering of cook-off round.

SUBMITTED:

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REFERENCE

1. Moore, L.F. "A Test of Rifle, Caliber .22, AR-15; Rifle, Lightweight Military, Caliber .224; and Pertinent Ammunition." Fifty-Seventh Report on Ordnance Project No. TS2-2015. February 1959. Aberdeen Proving Ground.

OBSERVERS

<u>DATE</u>	<u>NAME</u>	<u>REPRESENTING</u>
19 to 21 Sept. 1960	Mr. W. B. Butler	Code A
19 Sept. to 10 Oct. 1960	Mr. W. L. Deibel	Code B
19 Sept. to 1 Oct. 1960	Mr. A. J. Gunther	Code A
19 Sept. 1960	Mr. R. N. McDonald	Code C
19 to 21 Sept. 1960	Mr. G. H. Rockerfeller	Code C
19 to 21 Sept. 1960	Mr. E. M. Stoner	Code D
22 to 26 Sept. 1960	Mr. G. A. Gustafson	Eglin Air Force Base, Florida
23 to 27 Sept. 1960	Mr. W. B. Butler	Code A
23 to 26 Sept. 1960	Mr. G. H. Rockerfeller	Code C
23 to 26 Sept. 1960	Mr. E. M. Stoner	Code D
26 Sept. 1960	Mr. R. N. McDonald	Code C
28 Sept. to 10 Oct. 1960	Mr. E. M. Stoner	Code D
29 Sept. 1960	S/Sgt. R. L. Farris	Lackland Air Force Base, Texas
29 Sept. to 1 Oct. 1960	Lt. R. G. Gorey	Lackland Air Force Base, Texas
1 to 8 Oct. 1960	S/Sgt. R. L. Farris	Lackland Air Force Base, Texas
3 to 8 Oct. 1960	Mr. W. B. Butler	Code A
4 Oct. 1960	Mr. R. N. McDonald	Code C
6 to 10 Oct. 1960	Mr. A. J. Gunther	Code A
6 Oct. 1960	Mr. G. H. Rockerfeller	Code C
7 and 8 Oct. 1960	Lt. R. G. Gorey	Lackland Air Force Base, Texas
7 Oct. 1960	Lt. Col. J. F. Landers	CONARC Liaison Officer

APPENDICES

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APPENDIX A
Directive Teletype

COPY/v1

NNNN

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UNCLAS ORD 10508 FOR D&PS COL DUBIA FROM ORDT'S CARTEN

1. CONFIRMING DISCUSSIONS BETWEEN MR. BONKEMEYER AND COL DUBIA, AR-15 CALIBER .223 RIFLES AND AMMUNITION WILL BE SUBMITTED TO YOUR STATION IN THE IMMEDIATE FUTURE BY COOPER-MACDONALD, INC. REQUEST FINAL ENGINEERING TEST OF THIS WEAPON BE CONDUCTED DURING THE SAME PERIOD THAT SIMILAR TESTS ARE BEING CONDUCTED ON THE AR-10 7.62MM RIFLE. REQUEST AMMUNITION PERFORMANCE TRIALS PREVIOUSLY CONDUCTED WITH THE AR-15 RIFLES ALSO BE INCLUDED.

2. REQUEST YOUR STATION MAKE AVAILABLE TO THE COMPANY FACILITIES FOR DEMONSTRATION OF AR-15 RIFLES TO INTERESTED MILITARY PERSONNEL. DATE FOR THIS DEMONSTRATION IS TENTATIVELY SCHEDULED FOR 26 SEPTEMBER 1960. GENERAL LE MAY, DCS, USAF, AND LT GEN TRUDEAU, CRD, ARE EXPECTED TO ATTEND, ALONG WITH OTHER REPRESENTATIVES OF AIR FORCE AND ARMY

BT

CFN 10508 1. 15 223 7.62 15 2. 15 26 1960

12/1958Z

APPENDIX B

Test Data

Disassembly and Assembly Tests

Dates of Test: 19 October 1960

Time and tools required to disassemble rifle as illustrated in photograph S18-001-2877-1005-54-4P/ORD-60:

- Tools required:
1. Punch, 0.055-inch
 2. Punch, 0.090-inch
 3. Punch, 0.106-inch
 4. Screwdriver, 1/4-inch blade
 5. Hammer, 1/4-pound brass

<u>Trial No.</u>	<u>Individual</u>			<u>Average</u>
	<u>Crowther</u>	<u>Eller</u>	<u>Hendricks</u>	
1	8 min, 57 sec	7 min, 27 sec	8 min, 44 sec	8 min, 23 sec
2	7 min, 30 sec	6 min, 58 sec	7 min, 19 sec	7 min, 16 sec
Average	8 min, 14 sec	7 min, 12 sec	8 min, 2 sec	7 min, 49 sec

Time and tools required to assemble rifle after disassembly:

- Tools required:
1. Punch, 0.055-inch
 2. Punch, 0.090-inch
 3. Punch, 0.106-inch
 4. Screwdriver, 1/4-inch blade
 5. Hammer, 1/4-pound brass

<u>Trial No.</u>	<u>Individual</u>			<u>Average</u>
	<u>Crowther</u>	<u>Eller</u>	<u>Hendricks</u>	
1	19 min, 1 sec	19 min, 52 sec	21 min, 5 sec	19 min, 59 sec
2	18 min, 44 sec	19 min, 4 sec	17 min, 59 sec	18 min, 36 sec
Average	18 min, 52 sec	19 min, 28 sec	19 min, 32 sec	19 min, 17 sec

Time and tools required to dismount the operating parts and magazine, as illustrated in photograph S18-001-2876-1005-54-5P/ORD-60:

Tools required: No tool is required but it was found convenient to use a tool to start the takedown pin.

<u>Trial No.</u>	<u>Individual</u>			<u>Average</u>
	<u>Crowther</u>	<u>Eller</u>	<u>Hendricks</u>	
1	6 sec	5 sec	4 sec	5 sec
2	6 sec	5 sec	4 sec	5 sec
Average	6 sec	5 sec	4 sec	5 sec

Time and tools required to assemble the operating parts and magazine.

Tools required: No tool is required but it was found convenient to use a tool to position the takedown pin.

<u>Trial No.</u>	<u>Individual</u>			<u>Average</u>
	<u>Crowther</u>	<u>Eller</u>	<u>Hendricks</u>	
1	6 sec	5 sec	7 sec	6 sec
2	6 sec	6 sec	5 sec	6 sec
Average	6 sec	6 sec	6 sec	6 sec

Function Reports

Legend:

A = Automatic.

S = Semiautomatic.

FF = Failure to feed.

FJ = Failure to eject.

FX = Failure to extract.

SS = Single shot.

BCE = Bolt catch engaged before last round in rifle was fired.

BLE = Bolt carrier lacked energy to lock bolt (other than first round).

FBC = Failure of bolt to lock fully on first round from magazine.

FBR = Failure of bolt to remain at rear after firing last round.

FFR = Failure to fire.

FIF = Failure of trigger to go forward.

F2R = Fired two or more rounds with one rearward movement of trigger.

SAT = Satisfactory.

<u>Time</u>	<u>No. Rds Fired</u>	<u>Total No. of Rds Fired on Test</u>	<u>Type Fire</u>	<u>Function</u>	<u>Remarks</u>
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Rifle, Caliber .223, AR-15, Number 614
Cartridge, Caliber .223, Lot U14F

The rifle was inspected, and the weights and measurements were recorded.

ACCURACY TESTS

100-Yard Bench-Rest Accuracy Test

21 September 1960

The rifle was field stripped and lubricated.

1047	16	16	S	SAT	Sighting shots fired by Hendricks.
1052 to 1106	40	56	S	SAT	Fired by Hendricks from a bench-rest.

100-Yard Combat-Accuracy Test

1417	10	66	S	SAT	Fired by Hendricks from a bench-rest.
1524	10	76	S	SAT	Fired by Hendricks from a bench-rest.
1532	10	86	S	SAT	Fired by Hendricks from prone position with sling and asbestos glove.
1539	100	186	A	SAT	Fired by Davis. 2 perforations in firing pin indent in primer.
1540	10	196	S	SAT	Fired by Hendricks from a bench-rest.
1544	10	206	S	SAT	Fired by Hendricks from prone position with sling and asbestos glove.

22 September 1960

25-Yard Automatic-Accuracy Test

0825	3	209	S	SAT	Fouling shots.
1530 to 1556	30	239	A	SAT	Fired by Hendricks from standing position.

<u>Time</u>	<u>No. Rds Fired</u>	<u>Total No. of Rds Fired on Test</u>	<u>Type Fire</u>	<u>Function</u>	<u>Remarks</u>
23 September 1960					
0851	3	242	S	SAT	Fouling shots.
1246 to 1259	30	272	A	SAT	Fired by Hendricks from prone position with sling. 1 perforation in firing pin indent in primer.
<u>100-Yard Rate-Of-Aimed-Fire Test</u>					
1515 to 1516	80	352	S	SAT	Fired by Hendricks from prone position with sling and asbestos glove.
26 September 1960					
0930 to 0931	126	478	A	SAT	Fired by Hendricks from prone position with sling and asbestos glove. 1 small leak in primer joint. 1 perforation in firing pin indent in primer.
1040 to 1041	99	577	S	SAT	Fired by Hendricks from prone position with sling and asbestos glove.
1145 to 1146	140	717	A	1-FBC	Fired by Hendricks from prone position with sling and asbestos glove. 3 perforations in firing pin indent in primer.
1345 to 1346	88	805	S	SAT	Fired by Hendricks from prone position with sling and asbestos glove. A small sheet metal screw approximately 1/4-inch long fell out of the hand guard.
1440 to 1441	139	944	A	SAT	Fired by Hendricks from prone position with sling and asbestos glove. 2 perforations in firing pin indent in primer.

<u>Time</u>	<u>No. Rds Fired</u>	<u>Total No. of Rds Fired on Test</u>	<u>Type Fire</u>	<u>Function</u>	<u>Remarks</u>
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ENDURANCE TEST

Velocity Test

27 September 1960

The rifle was disassembled, cleaned and lubricated.

1137	3	947	S	SAT	Fouling shots.
1138 to 1143	22	969	S	SAT	

Rifle held normally.

1505	100	1069	S	SAT	
1532	100	1169	A	SAT	Cyclic rate 769 rounds per minute.

28 September 1960

Fired with the rifle held loosely in the hands.

0930	100	1269	S	SAT	
1019	100	1369	A	1-FFR	Light firing pin indent in primer. 1 perforation in primer.

Fired with the rifle held right side up.

1058	100	1469	S	2-FPC	
1143	100	1569	A	SAT	

The rifle was disassembled, cleaned and lubricated. Fired with the rifle held left side up.

1356	100	1669	S	SAT	
1444	100	1769	A	SAT	1 perforation in firing pin indent in primer.

29 September 1960

Fired with the rifle held loosely at a depression of 80°.

0915	100	1869	S	SAT	
1000	100	1969	A	SAT	

<u>Time</u>	<u>No. Rds Fired</u>	<u>Total No. of Rds Fired on Test</u>	<u>Type Fire</u>	<u>Function</u>	<u>Remarks</u>
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Fired with the rifle held normally at a depression of 80°.

1052	100	2069	S	SAT	
1126	100	2169	A	SAT	

The rifle was disassembled, cleaned and lubricated. Fired with the rifle held loosely at an elevation of 80°.

1339	100	2269	S	SAT	
1413	100	2369	A	1-BCE	2 perforations in firing pin indent in primer. The bolt catch was disassembled. The spring was stretched.

Fired with the rifle held normally at an elevation of 80°.

1442	100	2469	S	SAT	
1503	100	2569	A	SAT	

Fired with the rifle held normally.

1518	100	2669	S	SAT	
1539	100	2769	A	SAT	

30 September 1960

The rifle was disassembled, cleaned and lubricated.

1001	100	2869	S	SAT	
1049	100	2969	A	SAT	
1124	100	3069	S	SAT	
1240	100	3169	A	SAT	
1322	100	3269	S	SAT	
1349	100	3369	A	1-FBR	

The rifle was disassembled, cleaned and lubricated.

1418	100	3469	S	SAT	
1455	100	3569	A	SAT	
1524	100	3669	S	1-FX	The extractor was broken. It was repaired.

1 October 1960

0856	100	3769	A	SAT	
0914	100	3869	S	SAT	
0933	100	3969	A	SAT	

<u>Time</u>	<u>No. Rds Fired</u>	<u>Total No. of Rds Fired on Test</u>	<u>Type Fire</u>	<u>Function</u>	<u>Remarks</u>
The rifle was disassembled, cleaned and lubricated. The firing pin was broken. It was replaced.					
1027	100	4069	S	SAT	
1055	100	4169	A	SAT	1 perforation in firing pin indent in primer.
1142	100	4269	S	SAT	
1240	100	4369	A	SAT	
1305	100	4469	S	SAT	
1325	100	4569	A	SAT	

The rifle was disassembled, cleaned and lubricated.

1410	100	4669	S	1-FF	
1426	100	4769	A	SAT	1 perforation in firing pin indent in primer.
1446	100	4869	S	SAT	
1510	100	4969	A	SAT	
1531	100	5069	S	1-FBC	
1550	100	5169	A	1-BCE	

3 October 1960

The rifle was disassembled, cleaned and lubricated. The extractor spring was broken. It was replaced.

1115	100	5269	S	1-FBR	
1134	100	5369	A	SAT	
1253	100	5469	S	SAT	
1324	100	5569	A	SAT	
1350	100	5669	S	1-FFR	No indentation in primer on failure to fire.
1408	100	5769	A	SAT	

The rifle was disassembled, cleaned and lubricated.

1448	100	5869	S	1-FBR	
1503	100	5969	A	SAT	
1518	100	6069	S	SAT	
1534	100	6169	A	SAT	
1550	100	6269	S	SAT	

4 October 1960

0941	100	6369	A	SAT	
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<u>Time</u>	<u>No. Rds Fired</u>	<u>Total No. of Rds Fired on Test</u>	<u>Type Fire</u>	<u>Function</u>	<u>Remarks</u>
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The rifle was disassembled, cleaned and lubricated.

1055	100	6469	S	SAT	
1126	100	6569	A	1-BCE	
1151	100	6669	S	SAT	
1244	100	6769	A	SAT	
1304	100	6869	S	SAT	
1332	100	6969	A	1-BCE	Cyclic rate 749 rounds per minute. The firing pin was broken. It was replaced. 1 perforation in firing pin indent in primer.

The rifle was disassembled, cleaned and lubricated.

100-Yard Bench-Rest Accuracy Test

1442	3	6972	S	SAT	Fouling shots.
1444 to 1457	40	7012	S	SAT	Fired by Hendricks from a bench-rest.

5 October 1960

The rifle was disassembled and inspected. It was observed that there was moderate wear at the breech. All ten rivets in the left hand guard were broken.

Velocity Test

1057	3	7015	SS	SAT	Fouling shots.
1059 to 1112	26	7041	SS	SAT	

EXTREME COLD TEST

The rifle was disassembled, cleaned, lubricated and subjected to a temperature of -65° F for a 12-hour period. The trigger was broken. It was not replaced.

6 October 1960

0843	20	7061	S	SAT	
1053	20	7081	A	SAT	

<u>Time</u>	<u>No. Rds Fired</u>	<u>Total No. of Rds Fired on Test</u>	<u>Type Fire</u>	<u>Function</u>	<u>Remarks</u>
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UNLUBRICATED TEST

The rifle was disassembled, cleaned in solvent, and left in an unlubricated condition. The broken trigger pin was replaced.

1344	50	7131	S	SAT	
1348	50	7181	A	1-FBR	

DUST TEST

The rifle was disassembled, cleaned and lubricated.

1511	10	7191	S	SAT	
1512	10	7201	A	SAT	

MUD TEST

The rifle was disassembled, cleaned and lubricated.

7 October 1960

1009	10	7211	S	SAT	
1010 to 1014	10	7221	A	3-BLE 2-FF 1-FJ	It was difficult to retract the operating parts. The butt of the rifle was forced against the ground while applying a force to the charging handle on several occasions to retract the operating parts. The magazine was removed and two rounds which were ejected as the result of stoppages, were inserted. The magazine was difficult to insert in the receiver.

RAIN TEST

The rifle was disassembled, cleaned and lubricated with lubriplate.

8 October 1960

The rifle was subjected to the spray in a horizontal position.

<u>Time</u>	<u>No. Rds Fired</u>	<u>Total No. of Rds Fired on Test</u>	<u>Type Fire</u>	<u>Function</u>	<u>Remarks</u>
1030	160	8121	A	1-FBR	Time from firing first round to loading of cook-off round 50 sec. A cook-off occurred in 18 sec.

The rifle was inspected.
 The stock was cracked for 2 inches forward of the butt at the heel.
 The lower receiver was worn slightly at the point of contact with the bolt catch.
 The profile of the firing pin was pitted.
 The follower on all magazines was dented at the point of contact with bolt.

Rifle, Caliber .223, AR-15 Number 645
 Cartridge, Caliber .223, Lot UL4F

ACCURACY TESTS

100-Yard Bench-Rest Accuracy Test

5 October 1960

The rifle was field stripped and lubricated.
 A 3 x 25 power telescope sight was mounted on the rifle for the bench-rest accuracy test.
 A target (with 10-inch center) was used for an aiming point.

1330	7	7	S	SAT	Sighting shots.
1337 to 1345	20	27	S	SAT	Fired by Hendricks from a bench-rest.

An ISU fifty-meter small bore rifle target (with a 4.5-inch bull's-eye) was used for an aiming point.

1430	5	32	S	SAT	Sighting shots.
1432 to 1556	40	72	S	SAT	Fired by Hendricks from a bench-rest.

Cartridge, Caliber .223, Lot T20L

1510 to 1528	40	112			Fired by Hendricks from a bench-rest.
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<u>Time</u>	<u>No. Rds Fired</u>	<u>Total No. of Rds Fired on Test</u>	<u>Type Fire</u>	<u>Function</u>	<u>Remarks</u>
<u>100-Yard Machine-Rest Accuracy Test</u>					
Cartridge, Caliber .223, Lot U14F					
1905	10	122	SS	SAT	Settling shots.
1925 to 2005	40	162	SS.	SAT	
Cartridge, Caliber .223, Lot T20L					
2015 to 2055	40	202	SS	SAT	

SPECIAL TESTS

100-Yard Bench-Rest Accuracy Test

6 October 1960

A target (with a 10-inch center) was used for an aiming point.

1326	7	209	S	SAT	Sighting shots.
1330 to 1335	10	219	S	SAT	Fired by Perrin from a bench-rest.
1338 to 1342	10	229	S	SAT	Fired by Perrin from a bench-rest with bayonet attached.
1515 to 1520	10	239	S	SAT	Fired by Perrin from a bench-rest with modified hand guards.
1522 to 1527	10	249	S	SAT	Fired by Perrin from a bench-rest without hand guards.
7 October 1960					
1049	3	252	S	SAT	Sighting shots fired by Perrin.
1050 to 1055	20	272	S	SAT	Fired by Perrin from a bench-rest with the flash suppressor attached.
1105 to 1110	20	292	S	SAT	Fired by Perrin from a bench-rest with the flash suppressor removed.
1120	4	296	S	SAT	Fired by Perrin from a bench-rest with flash suppressor attached to determine if center of impact was affected by previous removal of flash suppressor.

<u>Time</u>	<u>No. Rds Fired</u>	<u>Total No. of Rds Fired on Test</u>	<u>Type Fire</u>	<u>Function</u>	<u>Remarks</u>
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Rifle, Caliber .223, AR-15, Number 682

Cartridge, Caliber .223, Lot U14F

The rifle was inspected, and the weights and measurements were recorded.

ACCURACY TESTS

100-Yard Bench-Rest Accuracy Test

21 September 1960

The rifle was field stripped and lubricated.

1223	12	12	S	SAT	Sighting shots fired by Davis.
1236 to 1253	40	52	S	SAT	Fired by Davis from a bench-rest.

100-Yard Combat-Accuracy Test

22 September 1960

0840	3	55	S	SAT	Fouling shots.
0910	10	65	S	SAT	Fired by Davis from a bench-rest.
0930	10	75	S	SAT	Fired by Davis from a bench-rest.
0935	10	85	S	SAT	Fired by Davis from prone position with sling and asbestos glove.
0944	100	185	A	SAT	Fired by Hendricks.
0945	10	195	S	SAT	Fired by Davis from a bench-rest.
0947	10	205	S	SAT	Fired by Davis from prone position with sling and asbestos glove.

25-Yard Automatic-Accuracy Test

23 September 1960

0852	3	208	S	SAT	Fouling shots.
1014 to 1027	30	238	A	SAT	Fired by Davis from standing position.

<u>Time</u>	<u>No. Rds Fired</u>	<u>Total No. of Rds Fired on Test</u>	<u>Type Fire</u>	<u>Function</u>	<u>Remarks</u>
1347 to 1402	30	268	A	SAT	Fired by Davis from prone position with sling.
<u>100-Yard Rate-of-Aim-Fire Test</u>					
1534 to 1535	79	347	S	1-FBC	Fired by Davis from prone position with sling and asbestos glove.
26 September 1960					
0955 to 0956	140	487	A	SAT	Fired by Davis from prone position with sling and asbestos glove.
1105 to 1106	80	567	S	SAT	Fired by Davis from prone position with sling and asbestos glove.
1255 to 1256	133	700	A	SAT	Fired by Davis from prone position with sling and asbestos glove. 1 perforation in firing pin indent.
1400 to 1401	81	781	S	SAT	Fired by Davis from prone position with sling and asbestos glove.
1500 to 1501	120	901	A	SAT	Fired by Davis from prone position with sling and asbestos glove. 1 perforation in firing pin indent.

ENDURANCE TEST

Velocity Test

27 September 1960

The rifle was disassembled, cleaned and lubricated.

1300	3	904	S	SAT	Fouling shots
1305 to 1309	20	924	S	SAT	
1512	100	1024	S	SAT	
1542	100	1124	A	SAT	Cyclic rate 765 rounds per minute.

28 September 1960

Fired with the rifle held loosely in the hands.

0952	100	1224	S	SAT	
1026	100	1324	A	SAT	

Fired with the rifle held right side up.

1114	100	1424	S	1-FFR	Light firing pin indent in primer.
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<u>Time</u>	<u>No. Rds Fired</u>	<u>Total No. of Rds Fired on Test</u>	<u>Type Fire</u>	<u>Function</u>	<u>Remarks</u>
1248	100	1524	A	1-FFR	No indentation in primer of failure to fire. 1 perforation in firing pin indent in primer.

The rifle was disassembled, cleaned and lubricated.
Fired with the rifle held left side up.

1418	100	1624	S	SAT
1456	100	1724	A	SAT

29 September 1960

Fired ~~with~~ the rifle held loosely at a depression of 80°.

0933	100	1824	S	SAT
1012	100	1924	A	SAT

Fired with the rifle held normally at a depression of 80°.

1107	100	2024	S	SAT	
1134	100	2124	A	4-BCE	The bolt catch was dis- assembled and the spring was stretched.

The rifle was disassembled, cleaned and lubricated.
Fired with the rifle held loosely at an elevation of 80°.

1357	100	2224	S	SAT
1422	100	2324	A	SAT

Fired with the rifle held normally at an elevation of 80°.

1449	100	2424	S	SAT
1505	100	2524	A	SAT

Fired with the rifle held normally.

1528	100	2624	S	SAT
1542	100	2724	A	SAT

30 September 1960

The rifle was disassembled, cleaned and lubricated.

1038	100	2824	S	SAT
1055	100	2924	A	SAT

<u>Time</u>	<u>No. Rds Fired</u>	<u>Total No. of Rds Fired on Test</u>	<u>Type Fire</u>	<u>Function</u>	<u>Remarks</u>
1131	100	3024	S	SAT	
1250	100	3124	A	SAT	
1331	100	3224	S	SAT	
1356	100	3324	A	SAT	

The rifle was disassembled, cleaned and lubricated.

1448	100	3424	S	SAT	
1513	100	3524	A	1-FF	The round jumped out of the magazine.
1540	100	3624	S	1-FFR	The firing pin was broken. It was replaced.

1 October 1960

0809	100	3724	A	SAT	
0920	100	3824	S	SAT	
0940	100	3924	A	SAT	

The rifle was disassembled, cleaned and lubricated.

1109	100	4024	S	SAT	
1127	100	4124	A	SAT	
1140	100	4224	S	1-FBC 1-FX	The extractor was broken. It was replaced.
1300	100	4324	A	SAT	
1316	100	4424	S	SAT	
1332	100	4524	A	1-FF	

The rifle was disassembled, cleaned and lubricated.

1438	100	4624	S	1-FBR	
1454	100	4724	A	SAT	
1514	100	4824	S	SAT	
1538	100	4924	A	4-BCE	The bolt catch was disassembled and the spring was stretched.
1555	100	5024	S	1-FBC	

3 October 1960

0858	100	5124	A	1-FF	The failure to feed occurred on the last round in the magazine.
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<u>Time</u>	<u>No. Rds Fired</u>	<u>Total No. of Rds Fired on Test</u>	<u>Type Fire</u>	<u>Function</u>	<u>Remarks</u>
The rifle was disassembled, cleaned and lubricated.					
1121	100	5224	S	SAT	
1245	100	5324	A	1-FF 1-FBR	The failure to feed occurred on the last round in the magazine.
1304	100	5424	S	SAT	
1327	100	5524	A	1-BCE	
1350	100	5624	S	SAT	
1411	100	5724	A	1-FF	
The rifle was disassembled, cleaned and lubricated.					
1445	100	5824	S	SAT	
1509	100	5924	A	1-FBR	
1526	100	6024	S	1-BCE	
1545	100	6124	A	SAT	
4 October 1960					
0950	100	6224	S	SAT	
1012	100	6324	A	SAT	
The rifle was disassembled, cleaned and lubricated.					
1115	100	6424	S	SAT	The rear sling swivel pin disassembled permitting the sling swivel to fall off.
1140	100	6524	A	SAT	
1247	100	6624	S	SAT	The charging handle came unlatched and contacted the shooter's face on several occasions.
1312	100	6724	A	SAT	
1345	100	6824	S	SAT	
1430	100	6924	A	1-BCE	Cyclic rate 746 rounds per minute.

The rifle was disassembled, cleaned and lubricated.

100-Yard Bench-Rest Accuracy Test

5 October 1960

0905	3	6927	S	SAT	Fouling shots.
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<u>Time</u>	<u>No. Rds Fired</u>	<u>Total No. of Rds Fired on Test</u>	<u>Type Fire</u>	<u>Function</u>	<u>Remarks</u>
0906 to 0922	40	6967	S	SAT	Fired by Davis from a bench-rest. On one occasion the cocking lever came unlatched.

The rifle was disassembled and inspected.

It was observed that seven rivets in the left hand guard, and two in the right hand **guard** were broken. There was moderate **wear** at the breech.

Velocity Test

1127	3	6970	SS	SAT	Fouling shots.
1128 to 1130	20	6990	SS	SAT	

EXTREME-COLD TEST

The rifle was disassembled, cleaned, lubricated and subjected to a temperature of -65°F for a 12-hour period.

6 October 1960

0849	20	7010	S	SAT
1059	20	7030	A	SAT

UNLUBRICATED TEST

The rifle was disassembled, cleaned in solvent, and left in an unlubricated condition.

1438	50	7080	S	SAT
1440	50	7130	A	SAT

DUST TEST

The rifle was disassembled, cleaned and lubricated.

7 October 1960

0930	10	7140	S	1-FF	The failure to feed occurred because the magazine was not latched.
				1-FX	The rim of the case was partly sheared.

<u>Time</u>	<u>No. Rds Fired</u>	<u>Total No. of Rds Fired on Test</u>	<u>Type Fire</u>	<u>Function</u>	<u>Remarks</u>
0932	10	7150	A	SAT	A crack approximately two inches long was noticed in the stock at the heel.

MUD TEST

The rifle was disassembled, cleaned and lubricated.

1307	10	7160	S	2-FTF	The trigger returned to the forward position on each occasion but the shooter made two attempts to fire.
1308	10	7170	A	2-BLE	The bolt locked on one occasion after a stoppage when the shooter hit the butt with his hand.

At the request of a representative an additional 20 rounds were loaded in a magazine, not subjected to the mud, and fired.

1312 to 1313	10	7180	S	1-FF 4-FTF	
1314 to 1315	10	7190	S	2-BLE 6-FTF 1-FBR	It was attempted to fire automatically but the lever could not be rotated to the Auto position.

RAIN TEST

The rifle was disassembled, cleaned and lubricated with Lubriplate.

8 October 1960

The rifle was subjected to the spray in a horizontal position.

1249 to 1252	100	7290	S	SAT	
1301 to 1302	100	7390	A	SAT	

The rifle was subjected to the spray with the muzzle up. The muzzle was depressed and the bolt was retracted slightly to permit water in the bore to run out before firing. The rifle was fired in a horizontal position.

<u>Time</u>	<u>No. Rds Fired</u>	<u>Total No. of Rds Fired on Test</u>	<u>Type Fire</u>	<u>Function</u>	<u>Remarks</u>
1323 to 1326	100	7490	S	SAT	
1337 to 1338	100	7590	A	1-FBC	The bolt failed to lock fully on the first round from a magazine with the rifle suspended in a vertical position.

The rifle was subjected to the spray with muzzle down. It was fired in a horizontal position.

1349 to 1351	100	7690	S	SAT	
1401 to 1402	100	7790	A	SAT	

The rifle was disassembled, cleaned and inspected.

COOK-OFF TEST

10 October 1960

Weather for this test: Temperature 65°F. Density 1.006. Wind NE, 4 mph.

1037	140	7930	A	1-FFR 1-FF	Time from firing first round to loading of cook-off round 54 sec. A cook-off occurred in 51 sec. A punch-out in primer resulted on cook-off round.
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The rifle was inspected.

All of the rivets (10) in the left hand guard were missing.

The lower receiver was worn slightly at the point of contact with the bolt catch.

The bolt catch was worn slightly at the point of contact with the bolt.

The follower on all magazines was dented at the point of contact with bolt.

Rifle, Caliber .223, AR15 Number 689

Cartridge, Caliber .223, Lot U14F

<u>Time</u>	<u>No. Rds Fired</u>	<u>Total No. of Rds Fired on Test</u>	<u>Type Fire</u>	<u>Function</u>	<u>Remarks</u>
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ACCURACY TESTS

100-Yard Bench-Rest Accuracy Test

5 October 1960

The rifle was field stripped and lubricated.
 A 3 x 25 power telescopic sight was mounted on the rifle for the bench-rest accuracy test.
 An ISU fifty-meter smallbore rifle target with a 4.5-inch bull's-eye was used for an aiming point.

1544	3	3	S	SAT	Sighting shots.
1546 to 1605	40	43	S	SAT	Fired by Hendricks from a bench-rest.

Cartridge, Caliber .223, Lot T20L

1620 to 1641	40	83	S	SAT	Fired by Hendricks from a bench-rest.
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100-Yard Machine-Rest Accuracy Test

Cartridge, Caliber .223, Lot U14F

2110	10	93	SS	SAT	Settling shots.
2115 to 2155	40	133	SS	SAT	

Cartridge, Caliber .223, Lot T20L

2200 to 2240	40	173	SS	SAT	
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SPECIAL TESTS

100-Yard Bench-Rest Accuracy Test

6 October 1960

Cartridge, Caliber .223, Lot T20L

1410	6	179	S	SAT	Sighting shot.
1415 to 1420	10	189	S	SAT	Fired by Perrin from a bench-rest.
1421 to 1426	10	199	S	SAT	Fired by Perrin from a bench-rest with bayonet attached.

<u>Time</u>	<u>No. Rds Fired</u>	<u>Total No. of Rds Fired on Test</u>	<u>Type Fire</u>	<u>Function</u>	<u>Remarks</u>
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Rifle, Cartridge .223, AR-15 Number 835

Cartridge, Caliber .223, Lot U14F

The rifle was inspected, and the weights and measurements were recorded.

ACCURACY TESTS

100-Yard Bench-Rest Accuracy Test

21 September 1960

The rifle was field stripped and lubricated.

1332	10	10	S	SAT	Sighting shots fired by Perrin.
1349 to 1403	40	50	S	SAT	Fired by Perrin from a bench-rest.

100-Yard Combat-Accuracy Test

22 September 1960

0842	3	53	S	SAT	Fouling shots.
0948	10	63	S	SAT	Fired by Perrin from a bench-rest.
1128	10	73	S	SAT	Fired by Perrin from a bench-rest.
1130	10	83	S	SAT	Fired by Perrin from prone position with sling and asbestos glove.
1138	100	183	A	SAT	Fired by Hendricks.
1139	10	193	S	SAT	Fired by Perrin from a bench-rest.
1140	10	203	S	SAT	Fired by Perrin from prone position with sling and asbestos glove. The two groups fired with a hot barrel were large. The rifle was cooled and a ten-shot bench-rest target was fired to determine if heat was the cause of the large group.
1315	10	213	S	SAT	Fired by Perrin from a bench-rest.

<u>Time</u>	<u>No. Rds Fired</u>	<u>Total No. of Rds Fired on Test</u>	<u>Type Fire</u>	<u>Function</u>	<u>Remarks</u>
<u>25-Yard Automatic-Accuracy Test</u>					
23 September 1960					
0854	3	216	S	SAT	Fouling shots.
1038 to 1050	30	246	A	SAT	Fired by Perrin from a standing position.
1430 to 1441	30	276	A	SAT	Fired by Perrin from prone position with sling.

100-Yard Rate-of-Aimed-Fire Test

1554 to 1555	80	356	S	SAT	Fired by Perrin from prone position with sling and asbestos glove.
26 September 1960					
1015 to 1016	120	476	A	SAT	Fired by Perrin from prone position with sling and asbestos glove.
1125 to 1126	89	565	S	SAT	Fired by Perrin from prone position with sling and asbestos glove.
1320 to 1321	120	685	A	SAT	Fired by Perrin from prone position with sling and asbestos glove. 1 per- foration in firing pin indent in primer.
1420 to 1421	82	767	S	SAT	Fired by Perrin from prone position with sling and asbestos glove.
1525 to 1526	120	887	A	SAT	Fired by Perrin from prone position with sling and asbestos glove.

ENDURANCE TEST

Velocity Test

<u>Time</u>	<u>No. Rds Fired</u>	<u>Total No. of Rds Fired on Test</u>	<u>Type Fire</u>	<u>Function</u>	<u>Remarks</u>
27 September 1960					
The rifle was disassembled, cleaned and lubricated.					
1318	3	890	S	SAT	Fouling shots.
1319 to 1324	20	910	S	SAT	
1520	100	1010	S	SAT	
1548	100	1110	A	SAT	Cyclic rate 805 rounds per minute.

28 September 1960

Fired with the rifle held loosely in the hands.

1005	100	1210	S	1-FFR	Light firing pin indent in primer.
1034	100	1310	A	SAT	

Fired with the rifle held right side up.

1138	100	1410	S	SAT	
1258	100	1510	A	SAT	

The rifle was disassembled, cleaned and lubricated.
Fired with the rifle held left side up.

1430	100	1610	S	SAT	
1503	100	1710	A	SAT	

29 September 1960

Fired with the rifle held loosely at a depression of 80°.

0947	100	1810	S	SAT	
1021	100	1910	A	SAT	

Fired with the rifle held normally at a depression of 80°.

1118	100	2010	S	SAT	
1147	100	2110	A	1-FFR	The firing pin was broken It was replaced.

The rifle was disassembled, cleaned and lubricated.
Fired with the rifle held loosely at an elevation of 80°.

1405	100	2210	S	SAT	
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<u>Time</u>	<u>No. Rds Fired</u>	<u>Total No. of Rds Fired on Test</u>	<u>Type Fire</u>	<u>Function</u>	<u>Remarks</u>
1433	100	2310	A	SAT	The bolt catch was dis- assembled and the spring was stretched.

Fired with the rifle held normally at an elevation of 80°F.

1453	100	2410	S	SAT
1515	100	2510	A	SAT

Fired with rifle held normally.

1532	100	2610	S	SAT
1543	100	2710	A	SAT

30 September 1960

The rifle was disassembled, cleaned and lubricated.

1041	100	2810	S	SAT
1101	100	2910	A	SAT
1137	100	3010	S	SAT
1256	100	3110	A	SAT
1339	100	3210	S	SAT
1402	100	3310	A	SAT

The rifle was disassembled, cleaned and lubricated.

1511	100	3410	S	SAT
1528	100	3510	A	SAT
1547	100	3610	S	SAT

1 October 1960

0858	100	3710	A	SAT
0927	100	3810	S	SAT
0957	100	3910	A	1-FFR The firing pin was broken. It was replaced.

The rifle was disassembled, cleaned and lubricated.

1119	100	4010	S	SAT
1133	100	4110	A	SAT
1158	100	4210	S	SAT
1250	100	4310	A	SAT
1314	100	4410	S	SAT
1329	100	4510	A	SAT

The rifle was disassembled, cleaned and lubricated.

1439	100	4610	S	SAT
1457	100	4710	A	SAT
1522	100	4810	S	SAT

<u>Time</u>	<u>No. Rds Fired</u>	<u>Total No. of Rds Fired on Test</u>	<u>Type Fire</u>	<u>Function</u>	<u>Remarks</u>
1544	100	4910	A	SAT	
1600	100	5010	S	SAT	

3 October 1960

0905	100	5110	A	SAT	
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The rifle was disassembled, cleaned and lubricated.
The firing pin was broken. It was replaced.

1133	100	5210	S	SAT	
1253	100	5310	A	SAT	
1325	100	5410	S	SAT	
1342	100	5510	A	SAT	
1402	100	5610	S	SAT	
1420	100	5710	A	1-BCE	

The rifle was disassembled, cleaned and lubricated.
The bolt catch was disassembled and the spring was stretched.

1503	100	5810	S	SAT	
1522	100	5910	A	SAT	
1539	100	6010	S	SAT	

4 October 1960

0945	100	6110	A	SAT	
1000	100	6210	S	SAT	
1025	100	6310	A	2-FFR	

The firing pin was broken.
It was replaced. The
extractor lip was broken.
It was caught between face
of bolt and base of round
causing the second failure
to fire. The extractor
spring was broken during
disassembly. The extractor
and the extractor spring
were replaced. 1 perforation
in firing pin indent in
primer.

The rifle was disassembled, cleaned and lubricated.

1143	100	6410	S	SAT	
1255	100	6510	A	1-FJ	The charging handle came unlatched.
1314	100	6610	S	SAT	
1351	100	6710	A	SAT	

<u>Time</u>	<u>No. Rds Fired</u>	<u>Total No. of Rds Fired on Test</u>	<u>Type Fire</u>	<u>Function</u>	<u>Remarks</u>
1435	100	6810	S	SAT	
1505	100	6910	A	SAT	Cyclic rate 796 rounds per minute.

The rifle was disassembled, cleaned and lubricated.

100-Yard Bench-Rest Accuracy Test

1532	3	6913	S	SAT	Fouling shots.
1534 to 1552	40	6953	S	SAT	Fired by Perrin from a bench-rest.

5 October 1960

The rifle was disassembled and inspected.

It was observed that there was heavy wear at the breech and light roughness in grooves especially at breech. One rivet was broken in left hand guard.

Velocity Test

1138	3	6956	SS	SAT	Fouling shots.
1139 to 1144	21	6977	SS	SAT	

EXTREME-COLD TEST

The rifle was disassembled, cleaned, lubricated and subjected to a temperature of -65°F for a 12-hour period.

6 October 1960

0856	20	6997	S	SAT
1105	20	7017	A	SAT

UNLUBRICATED TEST

The rifle was disassembled, cleaned in solvent, and left in an unlubricated condition.

The firing pin was broken. It was replaced.

1438	50	7067	S	SAT
1440	50	7117	A	SAT

DUST TEST

The rifle was disassembled, cleaned and lubricated.

<u>Time</u>	<u>No. Rds Fired</u>	<u>Total No. of Rds Fired on Test</u>	<u>Type Fire</u>	<u>Function</u>	<u>Remarks</u>
7 October 1960					
0938	10	7127	S	SAT	
0938	10	7137	A	SAT	

MUD TEST

The rifle was disassembled, cleaned and lubricated.

1331	13	7150	S	1-FTF	
1332	7	7157	A	1-BLE	

At the request of a representative 20 additional rounds were loaded in a magazine, not subjected to the mud, and fired.

1333 to 1335	14	7171	S	5-BLE 4-FF	
1335 to 1338	6	7177	A	2-FF 7-BLE	

RAIN TEST

The rifle was disassembled, cleaned and lubricated with Lubriplate.

8 October 1960

The rifle was subjected to the spray in a horizontal position.

1428 to 1432	100	7277	S	1-FBR 1-F2R	The trigger pin partially disassembled and caused the rifle to fire automatically on one occasion. The pin was repositioned.
1442	100	7377	A	2-FBR	1 perforation in firing pin indent in primer.

The rifle was subjected to the spray with the muzzle up. The muzzle was depressed and the bolt was retracted slightly to permit water in the bore to run out before firing. It was fired in a horizontal position.

1459 to 1503	100	7477	S	1-FBC 1-FBR	The bolt failed to lock fully on the first round from a magazine with the rifle suspended in a vertical position. 1 perforation in firing pin indent in primer.
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<u>Time</u>	<u>No. Rds Fired</u>	<u>Total No. of Rds Fired on Test</u>	<u>Type Fire</u>	<u>Function</u>	<u>Remarks</u>
1514 to 1515	100	7577	A	2-FBR	
The rifle was subjected to the spray with muzzle down. It was fired in a horizontal position.					
1525 to 1528	100	7677	S	SAT	
1538 to 1539	100	7777	A	1-FBR	1 perforation in firing pin indent in primer.

The rifle was disassembled, cleaned and inspected.

COOK-OFF TEST

10 October 1960

Weather for this test: Temperature 66°F. Density 1.004. Wind NE, 4 mph.

1047	120	7897	A	2-FBR	Time from firing first round to loading of cook-off round 39 sec. No cook-off.
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The rifle was inspected.
 Two rivets were missing from the left hand guard.
 The profile of the firing pin was pitted.
 The lower receiver was worn slightly at the point of contact with the bolt catch.
 The follower on all magazines was dented at the point of contact with bolt.

RATE-OF-AIMED-FIRE TEST

Dates: 23 and 26 September 1960
 Range: 100 yards
 Target: E
 Wind: N to NE, 3 to 7 mph
 Temperature: 60 to 68°F
 Rifle: Caliber .223, AR15

Fired From: Prone position with sling.
 Direction of Fire: S
 Sky Condition: Overcast

An asbestos glove was worn on the hand supporting the hand guard.

Number of shots fired automatically and number of hits obtained in one minute.

<u>Rifleman</u>	<u>Trial No.</u>	<u>No. of Rds Fired</u>	<u>No. of Hits Obtained</u>	<u>Malfunctions</u>
Hendricks with rifle No. 614	1	126	35	0
	2	140	37	1
	3	139	50	0
Average		135	41	
Davis with rifle No. 682	1	140	55	0
	2	133	59	0
	3	120	45	0
Average		131	53	
Perrin with rifle No. 835	1	120	27	0
	2	120	32	0
	3	120	32	0
Average		120	30	
Average for 3 shooters		128.7	41.3	

RATE-OF-AIMED-FIRE TEST

Dates: 23 and 26 September 1960
 Range: 100 yards
 Target: E
 Wind: NNE to NE, 4 to 7 mph.
 Temperature: 61 to 72°F.
 Rifle: Caliber .223, AR15

Fired From: Prone position with sling.
 Direction of Fire: S
 Sky Condition: Scattered to overcast

An asbestos glove was worn on the hand supporting the hand guard.

Number of shots fired semiautomatically and number of hits obtained in one minute.

<u>Rifleman</u>	<u>Trial No.</u>	<u>No. of Rds Fired</u>	<u>No. of Hits Obtained</u>	<u>No. of Malfunctions</u>
Hendricks with rifle No. 614.	1	80	78	0
	2	99	89	0
	3	88	78	0
Average		89	81	
Davis with rifle No. 682	1	79	75	0
	2	80	79	0
	3	81	77	0
Average		80	77	
Perrin with rifle No. 835	1	80	76	0
	2	89	75	0
	3	82	74	0
Average		84	75	
Average for 3 shooters		84.2	77.8	

ACCURACY TEST

DATE: 21 September 1960
 RANGE: 100 yards
 DIRECTION OF FIRE: S
 FIRED FROM: Bench rest
 RIFLE: Caliber .223, AR-15
 CARTRIDGE: Caliber .223, Lot U14F
 TARGET: A (with 10-inch bull's-eye)

WIND: NE to E, 5 to 10 mph
 SKY CONDITION: Overcast
 TEMPERATURE: 68 to 70°F

Target measurements are given in inches.

RIFLEMAN	TARGET NO.	GROUP CENTER FROM TARGET CENTER	MR	MVD	MHD	EVD	EHD	ES
G. Hendricks AR-15, No. 614	1		0.9	0.4	0.7	1.9	2.6	2.7
	2		1.4	1.0	0.8	4.0	3.4	4.5
	3		1.6	0.8	1.2	3.2	5.9	5.9
	4		1.3	1.1	0.5	3.7	2.2	3.8
		Average		1.3	0.8	0.8	3.2	3.5
D. Davis AR-15, No. 682	1		1.9	1.5	0.9	7.0	3.5	7.2
	2		1.6	1.0	1.1	3.0	4.2	4.5
	3		1.2	0.8	0.7	3.7	3.4	3.8
	4		2.0	1.4	0.9	6.4	4.6	6.5
		Average		1.7	1.2	0.9	5.0	3.9
D. Perrin AR-15, No. 835	1		1.9	1.4	1.0	6.2	3.4	6.3
	2		1.0	0.6	0.7	2.1	2.2	2.6
	3		1.0	0.7	0.5	2.9	2.2	3.1
	4		1.5	1.2	0.7	6.9	3.7	7.8
		Average		1.4	1.0	0.7	4.5	2.9
		Average for all targets	1.5	1.0	0.8	4.2	3.4	4.9

COMBAT-ACCURACY TEST

DATE: 21 and 22 September 1960
 RANGE: 100 yards
 DIRECTION OF FIRE: S
 RIFLE: Caliber .223, AR-15
 CARTRIDGE: Caliber .223, Lot U14F
 TARGET: A (with 10-inch bull's-eye)

WIND: NE to ENE, 4 to 10 mph
 SKY CONDITION: Scattered to overcast
 TEMPERATURE: 63 to 71°F

All target data are given in inches.
 Target number 1 = Normal bench-rest group.
 Target number 2 = Bench-rest group starting with a cold and oiled bore.
 Target number 3 = Normal prone group.
 Target number 4 = Bench-rest group with a hot barrel.
 Target number 5 = Prone group with a hot barrel.

Target No.	MR	MVD	MHD	EVD	EHD	ES	Group Center From Aiming Point		Measurements from Center of Group No. 1			
							V	H	Group Center		Mean	ES
							V	H	V	H		
Rifleman: G. Hendricks, AR-15, Number 614												
1	1.7	0.9	1.2	4.9	5.0	6.4	+0.1	-0.8			1.7	6.4
2	1.9	0.7	1.6	3.3	7.2	7.2	+0.4	-0.2	+0.2	+0.6	1.9	4.2
3	1.7	1.3	1.0	3.9	3.0	4.7	-3.0	-0.7	-3.1	+0.1	3.4	4.8
4	2.0	1.2	1.3	5.8	4.0	5.9	+0.2	+1.4	+0.1	+2.2	2.7	4.8
5	2.1	1.2	1.6	3.6	6.0	6.9	-5.2	+2.5	-5.3	+3.4	6.4	9.2
Average	1.9	1.1	1.3	4.3	5.0	6.2	-1.5	+0.4	-1.8	+1.3	3.2	5.9
Rifleman: D. Davis, AR-15, Number 682												
1	1.9	1.5	1.1	7.0	4.2	7.5	+0.4	-0.1			1.9	7.5
2	2.2	1.9	0.6	7.3	2.4	7.4	+0.2	0.0	-0.2	+0.2	2.2	4.6
3	2.4	1.5	1.6	6.4	5.3	7.3	-6.1	+2.0	-6.4	+2.1	7.0	9.7
4	2.0	1.7	0.7	6.5	4.0	7.6	-4.2	+1.6	-4.6	+1.7	5.2	7.2
5	2.6	1.8	1.1	9.9	4.2	10.0	-8.4	+4.3	-8.8	+4.4	10.0	15.4
Average	2.2	1.7	1.0	7.4	4.0	8.0	-3.6	+1.6	-4.0	+1.7	5.3	8.9
Rifleman: M. Perrin, AR-15, Number 835												
1	1.7	1.4	0.8	6.0	3.6	6.9	+0.2	+1.4			1.7	6.9
2	1.8	1.2	1.2	5.0	4.5	6.5	+1.8	0.0	+1.6	+1.4	2.5	6.1
3	1.8	1.2	1.1	4.4	6.5	6.5	-3.9	+2.6	-4.1	+1.2	4.4	7.6
4	3.6	1.6	3.0	7.6	18.4	19.5	+1.2	+1.3	+1.0	-0.2	3.6	10.9
5	4.1	3.0	2.6	15.2	12.6	17.7	-3.6	+0.9	-3.8	-0.5	5.5	15.9
Average	2.6	1.7	1.7	7.6	9.1	11.4	-0.9	+1.2	-1.1	+0.4	3.5	9.5
Average for all targets												
	2.2	1.5	1.3	6.4	6.0	8.5	-0.2	+1.1	-2.3	+1.1	4.0	8.1

AUTOMATIC ACCURACY TEST

DATE: 23 September 1960

RANGE: 25 yards

RIFLE: Caliber .223, AR-15, Number 614

CARTRIDGE: Caliber .223, Lot U14F

FIRING POSITION: Prone (without sling) RIFLEMAN: G. Hendricks

Fired in three-round bursts. Measurements are given in inches.

Burst No.	Distance From Aiming Point to First Shot		Distance From Aiming Point to Second Shot		Distance From Aiming Point to Third Shot	
	<u>Vertical</u>	<u>Horizontal</u>	<u>Vertical</u>	<u>Horizontal</u>	<u>Vertical</u>	<u>Horizontal</u>
1	-2.0	-0.8	+24.3	+11.4	+21.6	+17.9
2	-2.6	+0.1	+24.2	+12.0	+34.3	+19.2
3	-2.0	+0.3	+21.6	+6.2	+29.0	+7.2
4	-2.2	+0.4	+15.7	+8.4	+20.5	+9.9
5	-2.0	+0.1	+13.7	+8.0	+21.5	+13.9
6	-2.0	-0.1	+14.8	+5.3	+18.6	+6.2
7	-2.3	+0.4	+21.0	+9.9	+26.9	+10.8
8	-1.7	+0.9	+17.9	+7.9	+25.4	+8.3
9	-1.6	+0.9	+19.2	+8.1	+26.2	+8.6
10	-2.2	-0.1	+19.3	+10.0	+22.3	+13.7
Average	-2.06	+0.21	+19.17	+8.72	+24.63	+11.57
30-shot group		Mean From Aiming Point		<u>EV</u>	<u>EH</u>	<u>ES</u>
		16.9		36.9	20.0	41.5

Mean for shots fired automatically (from center of impact of first shot in each burst) 26.1

AUTOMATIC ACCURACY TEST

DATE: 23 September 1960

RANGE: 25 yards

RIFLE: Caliber .223, AR-15, Number 682

CARTRIDGE: Caliber .223, Lot U14F

FIRING POSITION: Prone (without sling)

RIFLEMAN: D. Davis

Fired in three-round bursts. Measurements are given in inches.

Burst No.	Distance from Aiming Point to first shot		Distance from Aiming Point to second shot		Distance from Aiming Point to third shot	
	Vert	Hor	Vert	Hor	Vert	Hor
1	-3.0	-0.5	+27.2	-3.0	+27.8	-6.5
2	-3.0	+0.4	+29.5	-8.0	+41.4	-7.2
3	-3.4	+1.1	+26.5	+0.9	+36.5	+9.3
4	-3.3	+0.1	+22.1	-2.0	+34.3	+7.5
5	-2.4	+1.1	+27.1	+0.5	+34.6	+12.0
6	-2.7	+0.3	+29.9	-2.5	+49.3	+3.3
7	-3.2	+0.7	+26.6	+4.8	+35.5	+13.3
8	-2.3	+1.1	+29.6	-2.2	+41.7	-2.2
9	-2.4	+0.3	+27.9	+1.7	+33.2	+9.4
10	-1.1	+0.8	+26.3	-2.7	+38.9	+2.9
Average	-2.68	+0.54	+27.27	-1.25	+37.32	+4.18

30-shot group	Mean From Aiming Point	<u>EV</u>	<u>EH</u>	<u>ES</u>
	22.8	52.7	21.3	52.8

Mean for shots fired automatically (from center of impact of first shot in each burst) 35.4

AUTOMATIC ACCURACY TEST

DATE: 23 September 1960

RANGE: 25 yards

RIFLE: Caliber .223, AR-15, Number 835

CARTRIDGE: Caliber .223, Lot U14F

FIRING POSITION: Prone (without sling)

RIFLEMAN: M. Perrin

Fired in three-round bursts. Measurements are given in inches.

Burst No.	Distance from Aiming Point to first shot		Distance from Aiming Point to second shot		Distance from Aiming Point to third shot	
	<u>Vert</u>	<u>Hor</u>	<u>Vert</u>	<u>Hor</u>	<u>Vert</u>	<u>Hor</u>
1	-1.9	-0.7	+33.4	-0.6	+48.4	-3.5
2	-2.4	+0.3	+27.9	+2.0	+40.6	+0.9
3	-3.0	+0.2	+30.6	+3.8	+45.2	+3.7
4	-3.2	+0.7	+29.4	+3.8	+42.1	+4.5
5	-2.7	+0.7	+40.9	+11.4	+56.8	+15.3
6	-2.6	-0.1	+33.7	+9.5	+46.9	+10.4
7	-3.1	+0.2	+34.1	+3.2	+46.8	+6.7
8	-1.9	+0.4	+29.6	+3.4	+39.4	+8.5
9	-2.0	+0.1	+32.2	+0.9	+39.5	+3.4
10	-2.3	0.0	+27.9	+0.5	+41.4	+5.4
Average	-2.51	+0.18	+31.97	+3.79	+44.71	+5.53

30-shot group	Mean From <u>Aiming Point</u>	<u>EV</u>	<u>EH</u>	<u>ES</u>
	26.7	60.0	18.7	61.9

Mean for shots fired automatically (from center of impact of first shot in each burst)
41.2

AUTOMATIC ACCURACY TEST

DATE: 22 September 1960

RANGE: 25 yards

RIFLE: Caliber .223, AR-15, Number 614

CARTRIDGE: Caliber .223, Lot U14F

FIRING POSITION: Standing

RIFLEMAN: G. Hendricks

Fired in three-round bursts. Measurements are given in inches.

Burst No.	Distance from Aiming Point to first shot		Distance from Aiming Point to second shot		Distance from Aiming Point to third shot	
	<u>Vert</u>	<u>Hor</u>	<u>Vert</u>	<u>Hor</u>	<u>Vert</u>	<u>Hor</u>
1	-3.9	-0.5	+36.6	+9.4	+95.3	+43.5
2	-1.9	+0.6	+42.7	+11.2	+98.6	+44.4
3	-3.5	-0.2	+39.3	+ 8.0	+99.2	+41.9
4	-3.2	+0.6	+40.8	+ 7.9	+96.4	+36.6
5	-2.6	-0.7	+39.3	+ 7.2	+96.5	+40.7
6	-2.5	+0.2	+42.4	+ 2.1	+99.1	+29.1
7	-1.8	-0.4	+40.1	+ 4.0	+95.5	+31.6
8	-3.1	-0.4	+42.4	+ 6.6	+105.4	+41.4
9	-3.1	+0.9	+38.5	+ 8.5	+91.8	+38.6
10	-2.4	+0.6	+44.3	+10.8	+104.5	+44.3
Average	-2.80	+0.07	+40.64	+ 7.57	+ 98.23	+39.21

30-shot group	<u>Mean From Aiming Point</u>	<u>EV</u>	<u>EH</u>	<u>ES</u>
	50.0	109.3	45.1	116.9

Mean for shots fired automatically (from center of impact of first shot in each burst)

76.2

AUTOMATIC ACCURACY TEST

DATE: 23 September 1960

RANGE: 25 yards

RIFLE: Caliber .223, AR-15, Number 682

CARTRIDGE: Caliber .223, Lot U14F

FIRING POSITION: Standing

RIFLEMAN: D. Davis

Fired in three-round bursts. Measurements are given in inches.

Burst No.	Distance from Aiming Point to first shot		Distance from Aiming Point to second shot		Distance from Aiming Point to third shot	
	Vert	Hor	Vert	Hor	Vert	Hor
1	-0.3	+1.2	+41.7	+14.0	+100.3	+37.1
2	-1.6	+1.2	+43.6	+ 7.6	+106.2	+31.9
3	+1.1	+2.0	+43.2	+ 9.5	+102.5	+33.5
4	0.0	+2.4	+40.2	+ 6.8	+101.2	+34.6
5	-3.1	+1.1	+42.6	+10.2	+115.5	+42.0
6	-0.6	+2.4	+39.4	+ 5.7	+100.8	+35.7
7	-1.0	+2.5	+42.8	+13.7	+101.0	+46.2
8	-2.0	+1.4	+43.0	+14.1	+107.9	+45.3
9	-2.0	+1.6	+45.0	+13.3	+116.9	+48.2
10	+0.5	+2.0	+42.6	+11.6	+118.3	+45.1
Average	-0.90	+1.78	+42.41	+10.65	+107.06	+39.96

30-shot group	Mean From Aiming Point	EV	EH	ES
	53.7	121.9	47.2	129.8

Mean for shots fired automatically (from center of impact of first shot in each burst)

79.7

AUTOMATIC ACCURACY TEST

DATE: 23 September 1960

RANGE: 25 yards

RIFLE: Caliber .223, AR-15 Number 835

CARTRIDGE: Caliber .223, Lot U14F

FIRING POSITION: Standing

RIFLEMAN: M. Perrin

Fired in three-round bursts. Measurements are given in inches.

Burst No.	Distance from Aiming Point to first shot		Distance from Aiming Point to second shot		Distance from Aiming Point to third shot	
	<u>Vert</u>	<u>Hor</u>	<u>Vert</u>	<u>Hor</u>	<u>Vert</u>	<u>Hor</u>
1	-1.1	-0.4	+22.8	+9.2	+66.4	+28.2
2	-2.9	+0.1	+25.7	+8.4	+70.7	+21.5
3	-3.3	+0.6	+22.8	+7.8	+68.5	+18.9
4	-2.5	-0.3	+25.4	+9.1	+74.4	+29.4
5	-2.4	-0.7	+19.7	+8.2	+59.4	+23.5
6	-1.9	+0.7	+24.6	+8.0	+71.4	+20.8
7	-3.0	-0.3	+23.0	+8.3	+67.7	+21.3
8	-2.4	-0.7	+23.3	+8.2	+66.6	+24.7
9	-1.7	-1.0	+24.1	+5.3	+65.8	+20.4
10	-2.4	+0.4	+22.7	+6.2	+69.4	+18.5
Average	-2.36	-0.16	+23.41	+7.87	+68.03	+22.72

30-shot group	<u>Mean From Aiming Point</u>	<u>EV</u>	<u>EH</u>	<u>ES</u>
	33.1	77.7	30.4	83.2

Mean for shots fired automatically (from center of impact of first shot in each burst) 50.7

ACCURACY TEST

DATE: 4 and 5 October 1960
 FIRED FROM: Bench-rest
 WIND: N to NNE, 0 to 4 mph

RANGE: 100 yards
 DIRECTION OF FIRE: S
 SKY CONDITION: Clear to
 Overcast
 TEMPERATURE: 55 to 62°F

CARTRIDGE: Caliber .223, Lot U14F
 RIFLE: Caliber .223, AR-15
 TARGET: A (with 10-inch bull's eye)

Target measurements are given in inches.

<u>Rfileman</u>	<u>Target No.</u>	<u>MR</u>	<u>MVD</u>	<u>MHD</u>	<u>EVD</u>	<u>EHD</u>	<u>ES</u>
D. Davis AR-15 No. 682	1	1.9	1.4	1.1	4.1	4.8	5.5
	2	1.8	1.5	0.7	6.5	2.7	6.7
	3	2.0	1.2	1.3	4.5	5.6	5.9
	4	2.4	1.6	1.3	6.6	5.8	7.3
	Average	2.0	1.4	1.1	5.4	4.7	6.4
M. Perrin AR-15 No. 835	1	2.6	1.4	1.9	7.5	11.0	11.5
	2	2.3	1.4	1.4	5.3	7.7	7.9
	^a 3	3.1	2.2	1.9	9.4	9.5	12.5
	^a 4	1.3	0.8	0.8	4.5	4.7	6.2
	Average	2.3	1.4	1.5	6.7	8.2	9.5
G. Hendricks AR-15 No. 614	1	1.1	0.9	0.6	3.9	2.3	3.9
	2	2.2	2.0	0.5	12.3	1.9	12.3
	^a 3	5.6	4.1	3.6	21.3	21.2	29.9
	4	1.6	0.7	1.3	3.4	4.9	5.5
	Average	2.6	1.9	1.5	10.2	7.6	12.9

^aOne bullet keyhole.

ACCURACY TEST

DATE: 5 October 1960

RANGE: 100 yards

FIRED FROM: Bench-rest

DIRECTION OF FIRE: S

WIND: SSW, 0 to 4 mph

SKY CONDITION: Broken

TEMPERATURE: 67 to 68° F

CARTRIDGE: Caliber .223, Lot U14F

RIFLE: Caliber .223, AR-15 (with 3X telescopic sight)

RIFLEMAN: G. Hendricks

Target measurements are given in inches.

<u>Rifle</u>	<u>Target No.</u>	<u>MR</u>	<u>MVD</u>	<u>MHD</u>	<u>EVD</u>	<u>EHD</u>	<u>ES</u>
AR-15 No. 689	1	1.1	0.5	0.8	2.1	3.1	3.1
	2	1.0	0.7	0.7	2.5	2.7	3.2
	3	1.2	0.6	1.0	2.2	3.4	3.6
	4	0.8	0.5	0.5	1.8	1.7	2.1
	Average	1.0	0.6	0.8	2.2	2.7	3.0
AR-15 No. 645	1	1.1	0.8	0.7	3.1	3.1	4.0
	2	1.2	0.6	0.9	3.3	3.7	4.1
	3	1.2	0.8	0.7	4.0	3.6	4.0
	4	1.2	0.7	0.8	3.2	3.7	4.8
	Average	1.2	0.7	0.8	3.4	3.5	4.2

ACCURACY TEST

DATE: 5 October 1960
FIRED FROM: Bench-rest
WIND: SSW, 0 to 4 mph
TEMPERATURE: 67 to 68° F

RANGE: 100 yards
DIRECTION OF FIRE: S
SKY CONDITION: Broken

CARTRIDGE: Caliber .223, Lot T20L
RIFLE: Caliber .223, AR-15 (with 3X telescopic sight)
RIFLEMAN: G. Hendricks

Target measurements are given in inches.

<u>Rifle</u>	<u>Target No.</u>	<u>MR</u>	<u>MVD</u>	<u>MHD</u>	<u>EVD</u>	<u>EHD</u>	<u>ES</u>
AR-15 No. 689	1	1.2	0.8	0.8	2.4	3.3	3.4
	2	1.5	1.4	0.4	7.6	2.2	7.9
	3	1.1	0.7	0.8	2.7	3.6	4.3
	4	1.0	0.6	0.7	2.9	3.7	4.8
	Average	1.2	0.9	0.7	3.9	3.2	5.1
AR-15 No. 645	1	0.9	0.6	0.5	2.4	2.0	3.1
	2	1.4	0.8	1.0	2.9	4.4	4.7
	3	1.0	0.3	0.9	1.8	3.2	3.2
	4	0.8	0.7	0.4	3.4	1.7	3.5
	Average	1.0	0.6	0.7	2.6	2.8	3.6

ACCURACY TEST

DATE: 5 October 1960

RANGE: 100 yards inclosed

FIRE FROM: Cradle, Universal for Rifle
Accuracy Firing assembled to
a V-block mounted on a F.A.
machine rest.

CARTRIDGE: Caliber .223, Lot U14F

RIFLE: Caliber .223, AR-15

RIFLEMAN: G. Hendricks

Target measurements are given in inches.

<u>Rifle No.</u>	<u>Target No.</u>	<u>MR</u>	<u>MVD</u>	<u>MHD</u>	<u>EVD</u>	<u>EHD</u>	<u>ES</u>
AR-15 No. 689	1	1.3	1.2	0.5	4.1	2.1	4.4
	2	1.5	1.2	0.9	5.3	4.6	7.0
	3	1.0	0.6	0.6	2.6	2.2	2.7
	4	0.9	0.5	0.7	1.5	2.8	3.0
	Average		1.2	0.9	0.7	3.4	2.9
AR-15 No. 645	1	0.9	0.6	0.6	2.0	1.9	2.4
	2	1.2	0.6	1.0	2.7	3.2	3.3
	3	1.2	1.0	0.5	4.1	2.2	4.1
	4	0.9	0.5	0.6	2.2	2.9	3.2
	Average		1.0	0.7	0.7	2.8	2.6

ACCURACY TEST

DATE: 5 October 1960

RANGE: 100 yards inclosed

FIRED FROM: Cradle, Universal for Rifle
Accuracy Firing assembled
to a V-block, mounted on a
F.A. machine rest.

CARTRIDGE: Caliber .223, Lot T20L

RIFLE: Caliber .223, AR-15

RIFLEMAN: G. Hendricks

Target measurements are given in inches.

<u>Rifle No.</u>	<u>Target No.</u>	<u>MR</u>	<u>MVD</u>	<u>MHD</u>	<u>EVD</u>	<u>EHD</u>	<u>ES</u>
AR-15 No. 689	1	2.1	1.6	1.2	7.1	8.3	11.0
	2	1.1	0.7	0.8	3.0	3.0	4.1
	3	1.1	0.5	0.8	2.7	3.3	3.4
	4	0.7	0.6	0.4	2.3	1.5	2.3
	Average		1.2	0.8	0.8	3.8	4.0
AR-15 No. 645	1	1.3	0.9	0.8	2.9	3.2	3.5
	2	1.4	1.1	0.8	5.2	3.5	5.9
	3	1.9	1.1	1.3	7.8	8.1	10.7
	4	1.0	0.6	0.7	2.4	2.1	3.2
	Average		1.4	0.9	0.9	4.6	4.2

ACCURACY TEST TO DETERMINE EFFECT OF FLASH SUPPRESSOR ON RIFLE

DATE: 7 October 1960
 FIRED FROM: Bench-rest
 WIND: NW, 9 mph
 TEMPERATURE: 63°F
 CARTRIDGE: Caliber .223, Lot T20L
 RIFLE: Caliber .223, AR-15, Number 645 (with
 3X telescopic sight)
 RIFLEMAN: M. Perrin

RANGE: 100 yards
 DIRECTION OF FIRE: S
 SKY CONDITION: Clear

Target measurements are given in inches.

	Group Center From Aiming Point	<u>MR</u>	<u>MVD</u>	<u>MHD</u>	<u>EVD</u>	<u>EHD</u>	<u>ES</u>
With Suppressor	0.6R 2.6B	1.1	0.7	0.8	2.6	3.9	4.2
With Suppressor	0.7R 2.9B	1.1	0.6	0.8	2.8	3.0	3.7
Average	0.6R 2.8B	1.1	0.6	0.8	2.7	3.4	4.0
Without Suppressor	3.2L 8.1A	1.6	1.0	0.9	4.3	4.1	4.3
Without Suppressor	2.5L 7.8A	1.5	1.0	0.8	4.2	4.3	4.5
Average	2.8L 8.0A	1.6	1.0	0.8	4.2	4.2	4.4

ACCURACY TEST TO DETERMINE EFFECT OF BAYONET ON RIFLE

DATE: 6 October 1960
FIRED FROM: Bench-rest
WIND: SW, 9 mph
TEMPERATURE: 71° F

RANGE: 100 yards
DIRECTION OF FIRE: S
SKY CONDITION: Overcast

CARTRIDGE: Caliber .223, Lot T20L
RIFLE: Caliber .223, AR-15 (with 3X telescopic sight)
RIFLEMAN: M. Perrin

Target measurements are given in inches.

<u>Group Center from</u> <u>Aiming Point</u>	<u>MR</u>	<u>MVD</u>	<u>MHD</u>	<u>EVD</u>	<u>EHD</u>	<u>ES</u>
Rifle No. 645 without bayonet						
0.7R 3.1B	1.3	0.7	0.9	3.0	3.0	3.6
Rifle No. 645 with bayonet						
1.2R 4.8B	1.1	0.7	0.7	3.3	2.7	3.4
Rifle No. 689 without bayonet						
2.1R 0.9B	1.2	0.5	0.9	3.0	3.7	3.8
Rifle No. 689 with bayonet						
3.5R 2.2B	1.4	0.8	0.9	5.3	3.1	6.1

ACCURACY TEST

To Determine Effect of Hand Guards

DATE: 6 October 1960
 FIRED FROM: Bench-rest
 WIND: SW, 10 mph
 TEMPERATURE: 71°F
 CARTRIDGE: Caliber .223, Lot T20L
 RIFLE: Caliber .223, AR-15 Number 645 (with 3X Telescope sight)
 RIFLEMAN: M. Perrin

RANGE: 100 yards
 DIRECTION OF FIRE: S
 SKY CONDITION: Overcast

Target measurements are given in inches.

Group Center
 From Aiming
Point

MR MVD MHD EVD EHD ES

Fired with modified hand guards (the hand guards were relieved slightly at the points of contact with cap and ring).

0.7R 2.4B 1.0 0.7 0.5 3.4 2.1 3.5

Fired without hand guards (magazine resting on bench).

2.0R 8.1B 1.3 0.6 1.0 2.2 4.3 4.5

VELOCITY TESTS

Time Started: 1137
Rifle, Caliber .223, AR-15

Time Completed: 1324

Date: 27 September 1960

Previous Rounds on Test: Rifle No. 614 - 947
Rifle No. 682 - 904
Rifle No. 835 - 890

Ammunition Temperature: 70°F
Density: 0.995 to 0.998
Chronograph Type: Counter

Range Temperature: 70°F
Initiator Type: Lumiline Screens

Instrumental Velocity, fps at 78 feet

Velocity

Cartridge, Caliber .223, Lot U14F.

<u>Round Number</u>	<u>Rifle No. 614</u>	<u>Rifle No. 682</u>	<u>Rifle No. 835</u>
1	3090	3115	3129
2	3043	3135	3098
3	3086	3060	3073
4	3069	3073	3085
5	3109	3117	3088
6	3094	3069	3133
7	3062	3085	3098
8	3117	3111	3143
9	3088	3141	3143
10	3104	3081	3129
11	3096	3143	3100
12	3129	3081	3135
13	3079	3053	3096
14	3137	3075	3096
15	3090	3135	3141
16	3106	3085	3083
17	3109	3106	3127
18	3141	3119	3153
19	3147	3094	3079
20	3143	3129	3096
Average	3102	3100	3111
Maximum	3147	3143	3153
Minimum	3043	3053	3073
Ex. Var.	104	90	80
Mean Var.	22.2	24.8	23.2

VELOCITY TESTS

Time Started: 1059
Rifle, Caliber .223, AR-15

Time Completed: 1144 Date: 5 October 1960

Previous Rounds on Test: Rifle No. 614 - 7015
Rifle No. 682 - 6970
Rifle No. 835 - 6956

Ammunition Temperature: 70°F Range Temperature: 67°F
Density: 1.010 to 1.019
Chronograph Type: Counter Initiator Type: Lumiline Screens

Instrumental Velocity, fps at 78 feet

Velocity

Cartridge, Caliber .223, Lot U14F

<u>Round Number</u>	<u>Rifle No. 614</u>	<u>Rifle No. 682</u>	<u>Rifle No. 835</u>
1	2921	2962	2998
2	2933	2953	2957
3	2941	2927	2926
4	2915	2964	2929
5	2969	2950	2976
6	2952	2912	2887
7	2904	2959	2894
8	2959	2936	2939
9	2921	2957	3034
10	2955	2959	2955
11	2989	2960	2987
12	2889	2939	2966
13	2998	2959	2978
14	2933	2927	2952
15	2914	2934	2955
16	3012	2941	2989
17	3003	2953	2941
18	2983	2950	2892
19	3001	2969	2646
20	2999	2914	2899
Average	2954	2946	2935
Maximum	3012	2969	3034
Minimum	2889	2912	2646
Ex. Var.	123	57	388
Mean Var.	32.2	14.0	47.2

APPENDIX C

Velocity, Pressure and Penetration Data from Reference 1.

The code letters used in these data sheets do not correspond with those used in the list of observers.

VELOCITY TEST

Time Started: 1050	Date: 20 May 1958
Time Completed: 1342	Density: 1.008 to 1.001
Rifle, Caliber .22, AR15	Chronograph Type: Counter
Previous Rounds on Test: Rifle No. 10 - 1854	Initiator Type: Lumiline
Rifle No. 14 - 1566	Screens
Ammunition Temperature °F: 70	Instrumental Velocity, fps
Range Temperature °F: 64 to 67	at 78 feet

Rd' No.	Velocity	Velocity	Velocity	Velocity
Cartridge, Caliber .224 "Code A"		Cartridge, Caliber .222 Special		
E2, Lot 49 NB72		"Code B", Lot N270		
	<u>Rifle No. 10</u>	<u>Rifle No. 14</u>	<u>Rifle No. 10</u>	<u>Rifle No. 14</u>
1	3104	3040	3032	3043
2	3125	3036	2971	3012
3	3106	3054	3051	3007
4	3094	3109	2966	2999
5	3106	3075	2999	2971
6	3108	3069	3027	2964
7	3088	3043	3001	3021
8	3106	2999	3003	3008
9	3085	3041	2967	3051
10	3027	3047	3023	3028
11	3083	3040	2994	2967
12	3098	3092	3067	3018
13	3056	3115	3040	2996
14	3034	3032	3001	3045
15	3058	3053	2983	3016
16	3125	3086	2973	3038
17	3060	3121	2998	2943
18	3043	3064	3071	3001
19	3115	3121	3007	3045
20	3058	3113	3023	3129
Avg	3084	3068	3010	3015
Max	3125	3121	3071	3129
Min	3027	2999	2966	2943
Ex Var	98	122	105	186
Mean Var	25.3	29.4	25.5	28.3

Time Started: 1328
 Time Completed: 1347
 Rifle, Caliber .22, AR15
 Previous Rounds on Test: Rifle No. 10 6900
 Rifle No. 14 6610
 Ammunition Temperature °F: 70
 Range Temperature °F: 72 to 74

Date: 16 June 1958
 Density: 0.981 to 0.987
 Chronograph Type: Counter
 Initiator Type: Lumiline
 Screens
 Instrumental Velocity, fps at
 78 feet.

Rifle No. 10		Rifle No. 14	
<u>Rd No.</u>	<u>Velocity</u>	<u>Velocity</u>	<u>Velocity</u>
Cartridge, Caliber .224 "Code A"E2, Lot 49NB72			
1	3045	-	2973
2	2978	-	2999
3	2990	-	3005
4	3003	-	2974
5	3021	-	2943
6	3008	-	2987
7	3036	-	2967
8	3007	-	2978
9	3051	-	2994
10	2994	-	2987
11	3005	-	2974
12	3040	-	2969
13	2992	-	2959
14	2985	-	2966
15	3016	-	3005
16	3032	-	2969
17	2985	-	2999
18	3049	-	3023
19	3007	-	3021
20	3028	-	3012
Avg	3014	-	2985
Max	3051	-	3023
Min.	2978	-	2943
Ex Var	73	-	80
Mean Var	19.6	-	18.0

PRESSURE TEST

Time Started: 1307
 Time Completed: 1527
 Universal Receiver No.: 127
 Previous Rounds on Test: 0
 Ammunition Temperature °F: 70
 Range Temperature °F: 84 to 81
 Barrel No. 9

Date: 16 July 1958
 Density: 0.960 to 0.967
 Chronograph Type: Counter
 Initiator Type: Lumiline
 Screens
 Instrumental Velocity, fps at
 78 feet; Pressure, psi.

Rd No. Velocity Pressure
 Cartridge, Caliber .224 "Code A"
 E2, Lot No. 49N872

Velocity Pressure
 Cartridge, Caliber .222 Special,
 "Code B", Lot No. N270.

1	3056	46,800
2	3054	47,000
3	3067	48,300
4	3062	46,200
5	3077	49,000
6	3075	49,300
7	3075	49,100
8	3054	49,300
9	3053	47,100
10	3064	49,300
11	3060	47,700
12	3060	48,700
13	3090	51,200
14	3047	47,900
15	3028	45,500
16	3094	50,400
17	3090	48,100
18	3066	48,000
19	3067	47,100
20	3094	52,600
Avg	3067	48,460
Max	3094	52,600
Min.	3028	45,500
Ex Var	66	7,100
Mean Var	12.9	1,336

2999	44,400
3012	42,900
3016	45,600
2992	41,800
3019	44,100
3066	49,000
2998	41,900
3041	47,500
3036	44,700
3067	46,700
3043	46,100
3047	46,700
3064	46,300
3053	46,900
2998	46,300
3058	47,200
3008	43,900
3038	45,200
3010	43,000
2999	43,900
3028	45,205
3067	49,000
2992	41,800
75	7,200
23.1	1,625

Time Started: 1242
 Time Completed: 1349
 Universal Receiver No.: 127
 Previous Rounds on Test: 73

Ammunition Temperature °F: +160
 Range Temperature °F: 75
 Barrel No.: 9

Date: 21 July 1958
 Density: 0.994
 Chronograph Type: Counter
 Initiator Type: Lumiline
 Screens

Instrumental Velocity, fps at 78
 feet; Pressure, psi.

Rd No. Velocity Pressure
 Cartridge, Caliber .224 "Code A"
 E2, Lot No. 49NB72

1	3159	50,600
2	3133	47,800
3	3119	47,700
4	3135	50,500
5	3115	47,600
6	3131	50,500
7	3125	49,700
8	3100	47,700
9	3131	48,400
10	3125	49,600
11	3161	51,400
12	3153	50,500
13	3141	49,900
14	3141	48,300
15	3109	50,600
16	3141	48,600
17	3157	48,800
18	3149	48,800
19	3123	46,600
20	3149	47,900
Avg	3135	49,100
Max	3159	51,400
Min	3100	46,600
Ex Var	59	4800
Mean Var	13.8	1162

Velocity Pressure
 Cartridge, Caliber .222, Special
 "Code B", Lot No. N270

3094	47,100
3071	46,200
3113	47,700
3100	47,500
3117	47,800
3108	45,600
3085	43,700
3102	46,500
3109	46,400
3041	42,100
3111	47,200
3060	47,400
3106	45,700
3115	46,100
3169	49,200
3147	49,400
3113	46,600
3115	46,900
3108	43,700
3111	45,200
3105	46,400
3169	49,400
3041	42,100
128	7300
18.0	1290

Time Started: 1309
 Time Completed : 1411
 Universal Receiver No.: 127
 Previous Rounds on Test: 113

Ammunition Temperature °F: -65
 Range Temperature °F: 74
 Barrel No. : 9

Date: 22 July 1958
 Density: 0.983
 Chronograph Type: Counter
 Initiator Type: Lumiline
 Screens
 Instrumental Velocity, fps at
 78 feet; Pressure, psi.

<u>Rd No.</u>	<u>Velocity</u>	<u>Pressure</u>
<u>Cartridge, Caliber .224 "Code A"</u>		
<u>E2, Lot No. 49NB72.</u>		
1	2973	50,000
2	3003	50,500
3	2960	48,200
4	2955	47,700
5	2919	43,900
6	3003	52,400
7	2962	48,800
8	2880	44,700
9	3016	53,600
10	2980	49,800
11	2999	51,200
12	2994	51,200
13	2931	48,500
14	2985	49,900
15	2907	46,300
16	2957	48,700
17	2905	47,700
18	2969	50,700
19	2952	49,400
20	2941	46,600
Avg	2960	49,000
Max	3016	53,600
Min	2880	43,900
Ex Var	136	9700
Mean Var	28.9	1915

<u>Velocity</u>	<u>Pressure</u>
<u>Cartridge, Caliber .222, Special,</u>	
<u>"Code B", Lot No. N270</u>	
2851	39,400
2817	38,100
2856	40,300
2838	41,200
2851	37,600
2862	38,500
2846	38,800
2792	35,800
2847	40,000
2814	38,400
2875	39,700
2823	39,100
2856	38,300
2867	39,600
2822	35,500
2862	41,100
2836	38,400
2921	46,000
2889	40,200
2897	40,900
2851	39,300
2921	46,000
2792	35,500
129	10,500
22.5	1495

PENETRATION TESTS

Complete penetration (CP) is the condition which exists when any portion of the bullet protrudes through the target, or opens a hole in the target which permits the passage of light.

Complete perforation (C Perf) is the occurrence wherein a hole has been made in the target the diameter of which clearly indicates passage of the bullet, or a major part of the bullet, entirely through and free of the target.

Failure to penetrate (FP) is the condition which exists when the bullet fails to penetrate the target.

Date: 26 May 1958

Rifle: Caliber .22, AR15, Number 10.

Cartridge: Caliber .224 "Code A" E2, Lot 49NB72.

Ammunition Temperature: 61 to 70°F Range Temperature: 61 to 70°F.

Density: 1.013 to 0.997

Target: Body Armor, M12

<u>Time</u>	<u>Range, yds</u>	<u>Number of Hits</u>	<u>Results</u>
1010 to 1045	300	5	All hits gave a complete perforation. Four bullets hit one plate in the vest and the other hit the edge of a second plate after passing through the first.
1245 to 1345	400	5	All hits gave a complete perforation. Four bullets hit one plate in the vest and the other hit the edge of a second plate after passing through the first.
1430 to 1515	500	5	All bullets gave a complete penetration in one plate in the vest but failed to exit from the vest.

Date: 26 May 1958

Rifle: Caliber .22, AR15, Number 10.

Cartridge: Caliber .222 Special, "Code B", Lot N270.

Ammunition Temperature: 61 to 70°F Range Temperature: 61 to 70°F.

Density: 1.013 to 0.997

Target: Body Armor, M12

<u>Time</u>	<u>Range, yds</u>	<u>No. of Hits</u>	<u>Results</u>
0930 to 1005	300	6	All hits gave a complete perforation. Five bullets hit one plate in the vest and the other hit the edge of two plates.
1100 to 1145	400	5	All hits gave a complete perforation. All bullets hit one plate in the vest and one bullet also passed through a web belt.
1345 to 1415	500	6	Four bullets which hit a single plate in the vest (one also hit a web belt) gave a complete perforation. One other bullet passed through one plate and hit the edge of a second but failed to exit from the vest. Another bullet hit the edge of two plates but failed to exit from the vest.
1530 to 1555	600	5	All bullets gave a complete penetration in one plate in the vest but failed to exit from the vest.

Date: 12 August 1958

Rifle: Caliber .22, AR15, Number 18.

Range: 500 yards.

Ammunition Temperature: 75°F Range Temperature: 75°F.

Density: 0.982

Target: One-inch white pine boards spaced one inch apart.

<u>Time</u>	<u>No. of Hits</u>	<u>Results</u>
		Cartridge, Caliber .222 Special, "Code B", Lot N270.
0900 to 0906	5	Of 5 bullets which hit the target 3 gave a complete perforation in 12 boards, one gave a complete perforation in 13 boards, and one gave a complete perforation in 14 boards.
		Cartridge, Caliber .224 "Code A", Lot 49NB72.
0908 to 0920	5	Of 5 bullets which hit the target one gave a complete perforation in 8 boards and 4 gave a complete perforation in 9 boards.

Date: 12 August 1958

Rifle: Caliber .22, AR15, Number 18.

Cartridge: Caliber .222 Special, "Code B", Lot N270.

Ammunition Temperature: 77 to 83°F Range Temperature: 77 to 83°F.

Density: 0.978 to 0.966

Target: Helmet, Soldier, Steel, OD, M1, MIL-H-10990 with Liner,
Soldier, Steel Helmet, M1 Type XIII, MIL-L-1910.

Time	Hit No.	Obliq, deg	Character of Penetration			
			Front Side of Helmet	Front Side of Liner	Rear Side of Liner	Rear Side of Helmet
Range: 500 yards						
1023	1	47	C Perf	C Perf	FP	-
	2	32	C Perf	C Perf	FP	-
1042	3	62	C Perf	C Perf	FP	-
	4	47	C Perf	C Perf	FP	-
	5	69	C Perf	C Perf	FP	-
Range: 600 yards						
1312	1	2	CP	CP	-	-
	2	35	C Perf	C Perf	FP	-
1335	3	29	FP (Dented helmet)		-	-
	4	26	FP (Dented helmet)		-	-

Date: 12 August 1958

Rifle: Caliber .22, AR15, Number 18.

Cartridge: Caliber .224 "Code A" E2, Lot 49NB72.

Ammunition Temperature: 77 to 83°F Range Temperature: 77 to 83°F.

Density: 0.978 to 0.966

Target: Helmet, Soldier, Steel, OD, M1, MIL-H-10990 with Liner, Soldier,
Steel Helmet, M1 Type XIII, MIL-L-1910.

Time	Hit No.	Obliq, deg	Character of Penetration			
			Front Side of Helmet	Front Side of Liner	Rear Side of Liner	Rear Side of Helmet
Range: 500 yards						
1005	1	34	C Perf	C Perf	FP	-
1015	2	19	C Perf	C Perf	FP	-
	3	28	C Perf	C Perf	FP	-
	4	13	FP (Dented helmet)		-	-
	5	24	FP (Dented helmet)		-	-
Range: 600 yards						
1108	1	9	FP (Dented helmet)		-	-
1247	2	8	CP (Bullet stopped in helmet)		-	-
	3	6	FP (Dented helmet)		-	-
	4	7	FP (Dented helmet)		-	-
1300	5	12	FP (Dented helmet)		-	-

APPENDIX D

Distribution

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