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Remington Arms Company, Inc.

Test Report – Trial & Pilot Test

M/710 Centerfire Rifle

w/Iron Sights

.30-06 Springfield

(PART A)

June 2001

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Remington Arms Company, Inc.

Test Report – Trial & Pilot Test

June 2001

M/710 Centerfire Rifle w/ Iron Sights

Caliber: .30-06 Springfield

ABSTRACT

This Report covers the results of the Trial & Pilot Testing (T&P) procedures performed on the Remington M/710 Centerfire Rifle w/ Iron Sights during January & then May 2001 at the Remington Arms Company, Inc., Research & Development Technical Center located at Elizabethtown, KY.

This Testing Program was organized around the goal of determining if this new product met design specifications specified by R&D and produced using production methods and processes at the Remington Arms Company KY plant.

The M/710 in .30-06 Caliber with Bushnell Scope successfully passed T & P testing during the 4th Quarter, 2000. This new product offering is identical in every way to the initial offering with one exception, the elimination of the Bushnell scope and the addition of iron sights. A Test Plan was developed with the primary focus of testing only those performance characteristics directly effected by this sighting system change.

The following general grouping of test procedures were used to determine product and process capability.

- Headspace and Proof Mark Checks*
- Abusive Testing (SAAMI Drop, Jar-Off, Rotation)*
- Accuracy (POI Sight Adjustment)*
- 60 Rd. Live Fire Test*
- Firearms Measurements (Sight Hole Depth)*

After reviewing each of the individual tests in this test program, the Research Test Lab and the Research Design Group have concluded that this product met the acceptance requirements as set forth by the Trial & Pilot Test Plan.

Report Prepared By

S. R. Franz

/ June 2001

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INTRODUCTION

The Model 710 Centerfire Rifle chambered in .30-06 Springfield was previously introduced to the public as a complete system with included scope and rail system. Remington is now introducing the M710 in this same caliber without scope and rails but with iron sights. This Trial & Pilot test examines the product with emphasis on the iron sight addition and the effects on the product due to this change only.

This report will review and summarize the results of various Trial & Pilot Tests (T&P) conducted during the time periods of Jan. - May of 2001 at the Remington Arms Company, Inc., Research & Development Technical Center located in Elizabethtown, KY.

This report will consist of two parts. Part A (this document) presents a brief explanation of each of the individual tests that were a part of the overall Trial & Pilot test plan, along with a brief review of the results for that particular test. Part B consists of the detailed test plan and the raw data for the T&P as well as the individual test reports associated with the test program. It is more extensive in both volume and detail and is intended to give the reader an in-depth look at each of those same tests if desired. Part B will be retained in the Test Labs central files and will not be distributed unless specifically requested.

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PURPOSE & SCOPE OF TEST PROGRAM

Purpose

The first purpose of this series of tests was to determine if the Model 710 Centerfire Rifle w/Iron Sights would perform as designed and meet the established function and safety criteria as proposed by the Research & Development Firearms Design Group. The second purpose of this series of tests was to assure that Mayfield production processes were capable of meeting the function, safety and design criteria established for this model by R&D.

Scope

This report covers Trial & Pilot testing of the Remington Model 710 Centerfire Rifle w/Iron Sights in .30-06 caliber only.

EXECUTIVE SUMMARY

The following table documents the tests that were run during this T & P, when they were run along with the final outcome of each test. Three iterations were required to satisfactorily complete all phases of testing. A more detailed explanation of each phase of testing follows this table should additional explanation be desired.

	Iteration #1 (Jan. 17,18)	Iteration #2 May	Iteration #3 May
Headspace and Proof Mark Checks	Passed	Passed	Passed
SAAMI Jar-Off, Drop & Rotation	Passed	-----	-----
POI/Sight Adjustment	Marginal (minimum adjustment remains)	Failed on Retest (Bbls. Bent)	Passed
Sight Hole Depth Measurement	Measured under Min. (Results questioned)	-----	Passed (New guns check OK) (Mayfield Process-OK)
60 Rd. Live Fire Test	N/A	Passed	-----

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An initial sample of 10 guns with iron sights were received in January for T & P testing. These guns were subjected to SAAMI Jar-Off, Drop and Rotation tests, shot for POI/Sight Adjustment and then subjected to dimensional checks for sight hole depth.

Only 9 guns were subjected to the SAAMI abuse and POI tests since one gun was damaged while adjusting fire control settings to minimum process specification. All 9 guns passed all three SAAMI abuse tests. These same 9 guns were tested for POI/Sight Adjustment at 100 yards in the long range to determine if there was adequate sight adjustment with the iron sights. All 9 guns were able to have POI moved to POA at 100 yards, however the rear sights on average were one graduation from the rear extreme position (almost all the way down). This gives ample adjustment range to raise the POI for longer range shots but limits the amount of adjustment should the POI need to be moved further downward for shorter range shots or varying bullet/load configurations. Inspection of sight hole depths were measured just under minimum drawing specification on all sight holes. This is a difficult measurement to make since it is dependent on probe tip shape, size and measurement location and orientation. A shallow hole poses no safety concern as long as adequate thread engagement remains for good positive sight retention. Mayfield was notified of E-town's measurements. E-town would recheck new guns for sight hole depth after refining their inspection technique. Mayfield was asked to verify their process controls and then monitor product during the next run of sighted product which is scheduled for late June or early July. It was noted that front sights came loose relative to the base during both the abuse and POI tests. Mayfield was notified of the sight retention situation and all 10 guns were returned. Mayfield priorities were focused on production of the scoped product until a steady state production process was established. They then refined the dovetail process that attaches the front sight to the base and reworked the returned test guns.

These same samples were received back in E-town for additional testing in May. Iteration 2 testing was to consist of a recheck of sight adjustment at 100 yards due to the marginal results from the first test and the fact that sights were being reworked. In addition a 60 rd. per gun live fire test was added to check for adequate sight retention. This time around seven of the nine guns tested for POI could not be adjusted in at 100 yards. With the rear sights moved all the way to the rear on the base point of impacts were from 6" to 12" high. The two remaining guns could be adjusted in but rear sights were moved to the extreme rear position. Investigation by Design determined that the barrels on these guns were bent. This either occurred during the SAAMI abuse testing or during product rework in Mayfield. Mayfield was contacted and 10 new guns were requested for another POI/Sight Adjustment test (Iteration 3). While E-town was waiting for the 10 new guns the 60 round live fire test was run on Iteration 2 guns. No sights came loose during this live fire test.

Iteration 3 was a test to re-qualify POI/Sight Adjustment on 10 new guns. These guns were received in late May and tested at 100 yards in the long range. All 10 guns POI could be adjusted to the POA with adequate adjustment remaining in the rear sight. Sight position varied from 2 to 6 notches from the rear or lowest position. These guns were returned to Mayfield before sight hole depth could be checked, however three new iron sighted guns were received in early June for other testing. Sight hole depths were checked on these samples and all hole depths measured in specification.

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ABUSIVE TESTING

IMPACT TESTING

Elimination of the Bushnell scope and addition of the iron sights results in a significant gun weight change. To verify that this weight change did not alter the shock sensitivity of the firearm 9 rifles were subjected to standard SAAMI Jar-Off, Drop and Rotation tests. All guns had fire controls adjusted to minimum process specification for trigger pull and engagement before the start of each major drop phase (Jar-Off, Drop and Rotation). Measurements were rechecked at the conclusion of each major test phase. The procedures as outlined by SAAMI and documented in the Test Plan was followed completely.

Results:

No inadvertent discharges occurred on any of the 9 rifles tested during any phase of testing.

	<u>Number Guns Tested</u>	<u>Number Guns Passed</u>
SAAMI Jar-Off Test	9	9
SAAMI Rotation Test	9	9
SAAMI Drop Test	9	9

ACCURACY TESTING:

POINT OF IMPACT/SIGHT ADJUSTMENT TEST

An accuracy test at 100 yards was conducted in E-town's long range to insure that each rifles Point of Impact (POI) can be adjusted to coincide with the Point of Aim (POA) using the supplied iron sights. A major emphasis is placed on the ability to adjust the POI to the POA with enough sight adjustment remaining to compensate for varying distances and load configurations. As stated earlier a total of three iterations were required to confirm that sight adjustment was adequate. Remington ammo R30065 (180 grain PSP Core Lock) was used for all three iterations.

Procedure:

A special target is used (1 ft. dia. black bull) to aid visibility due to the range involved. The 6 o'clock position on the bull is used for the point of aim. See the Test Plan (Part B) for a description of the procedures and sight pictured used.

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Results:

Iteration 1

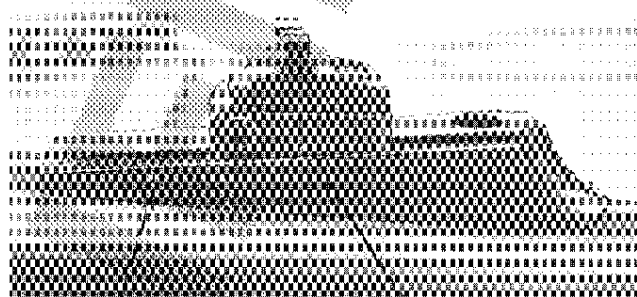
This test was shot in January of this year. 9 rifles were shot and all were able to be adjusted such that the POI was within 2.7" of the POA at 100 yards. The location of the rear sight on average was 1 graduation from the extreme rear position. This leaves limited sight adjustment to lower the POI. Since a retest was needed for sight retention it was decided to redo this test as well when guns were returned for confirmation of results.

Iteration 2

This test was shot in May when guns were received back from Mayfield. At this time 7 of 9 rifles could not be zero in. POI was anywhere from 6" to 12" high. The rear sight was moved all the way to the rear on the 2 guns that could be adjusted in. Design determined that the barrels on these guns were bent. A new series of 10 guns were requested from Mayfield for POI/Sight Adjustment verification. These were received and tested in late May.

Iteration 3

All 10 guns were able to be zeroed in at 100 yards with adequate sight adjustment remaining. 7 of the 10 guns rear sights were 2 full graduations from the rear position. One gun was at 4 graduations and 2 were at 6 graduations from the rear. Results from this test were more in-line with that recorded during the first test, with slightly more adjustment remaining. Each graduation results in approximately a three inch movement in the POI, which gives plenty of adjustment in both directions. The following picture shows the design and scale used for the rear sight.



Rear Position

Rear Sight at 8 1/2 graduations

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60 Rd. LIVE FIRE TEST

Testing of Sight for Looseness:

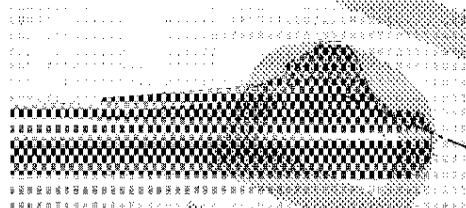
During Iteration 1 Trial & Pilot testing some front sights came loose during both the live fire POI test and the Abuse test. To determine if production has eliminated this problem with the current run of product a 60 rd./gun live fire test was added for Iteration 2 testing.

Procedure

Sixty (60) rounds were fired through each of the nine sample rifles. The front and rear sights were checked for looseness at the start of the test, after 20 rounds, after 40 rounds and after the completion of the 60 rounds.

Results

None of the 9 guns tested during this test had any part of either the front or rear sight come loose. All testing was shot from the shooting jacks in the short range and the procedure documented in the Test Plan was followed.



Location where Front
Sights came loose in Base

MEASUREMENTS AND INSPECTIONS:

MEASUREMENTS OF SIGHT SCREW HOLE DEPTH

Procedure:

To assure that the screw holes in the barrels used for attaching the front and rear sight bases are drilled to the correct model drawing depth, both of the two front sight screw holes and both of the rear sight screw holes were measured for depth.

A full copy of the procedure used to measure this characteristic can be found in the T & P Test Plan (see Part B).

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- Specification for the Front Sight Hole Depth is 0.110" +/- .005"
- Specification for the Rear Sight Hole Depth is 0.14" +/- .010"

Results:

The following table summarizes the initial measurements for each of the four sight screw holes. As measured by E-town all four holes were measured on the shallow side. The worst case being the front hole for the front sight which had a mean value .004" below the lower specification of .105". This measurement is extremely sensitive to both the type of gage used, the probe tip size and shape, and the method. Any difference between the gage that Mayfield uses and the gage E-town used could easily account for the differences noted.

Sight Screw Hole Depths

	Front Sight (Specification: .110" +/- .005)		Rear Sight (Specification: .14" +/- .01)	
	Front Hole	Rear Hole	Front Hole	Rear Hole
Avg. (10)	0.101	0.1035	0.128	0.129
Std. Dev.	0.0016	0.0021	0.0028	0.0031
+3 Sigma	0.106	0.110	0.136	0.139
- 3 Sigma	0.096	0.097	0.120	0.120

The results from this measurement were not known until the writing of this report. Since guns for all three phases of testing had been returned to Mayfield this measurement could not be rechecked on the original guns. Three new sighted guns were received for another test in early June. All three guns were measured for sight hole depth, this time ensuring that a sharp probe tip was used and that the measurement was taken in the center of the hole. All measurements were within drawing specification.

Results from these measurements are tabulated below. Mayfield was contacted and asked to check this operation for conformance to specification. They were to verify during the next run of sighted M/710 product. It was learned that Mayfield now uses an end mill to generate the sight holes as opposed to a standard pointed drill. This results in a flat bottom hole which eliminates the potential to dimple barrel id's during the thread tapping operation. This change is allowed by the drawing as long as hole depth and thread depth specifications are met.

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SIGHT SCREW HOLE DEPTH					
REFERENCE PRINT D-306320					
sighted guns only					
REAR	HOLE A	HOLE B	FRONT	HOLE C	HOLE D
A1	0.140	0.140	A1	0.113	0.110
A2	0.140	0.139	A2	0.111	0.112
A3	0.141	0.140	A3	0.111	0.110
Avg.	0.140	0.140		0.112	0.111
S. D.	0.0003	0.0006		0.0013	0.0009

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