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ELIZABETHTOWN, KY 42701

# 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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R & D Technical Center Project No. 241095; TLW0395, TLW0405, TLW 0505  
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## PART A

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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 Mayfield KY plant.*

*The M/710 in .30-06 Caliber with Bushnell Scope successfully passed T & P testing during the 4<sup>th</sup> 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.*

1. – Headspace and Proof Mark Checks
2. – Accuracy (POI, Sight Adjustability)
3. – Abusive Testing (S&A, H Drop, Jar-Off, Rotation)
4. 60 Rd. Live Fire Test
5. 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. Initial inspection of sight hole depths during Iteration 1 were measured under minimum showing specification on all sight holes. The inspection method used was questionable, therefore this data is suspect. Three new iron sighted guns were received in June for other testing were inspected for sight hole depth and all hole depths measured in specification. It was noted that Mayfield is now using an endmill. This measurement is dependent on the type and dimension of the probe used. A larger probe tip will yield shallower measurements since it will not indicate at the lowest point in the hole. Since no sight bases loosened during the live fire testing (thread engagement is adequate) and a shallow hole poses no safety concern Mayfield is instructed to check this process with production gages and adjust the process if needed. No further follow up verification will be required beyond this recommended self audit.*

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 M/710 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 Adjustability	Passed (minimal adjustment remains)	Failed on Retest (Bbls. Bent)	Passed
Sight Hole Depth Measurement	Measured under Min.  (Results questioned due to inspection method)	----	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 adjustability and then subjected to dimensional checks for sight hole depth. Inspection of sight hole depths were measured under minimum drawing specification on all sight holes. The inspection method used was questionable, therefore this data is suspect. Three new iron sighted guns received in June (after Iteration 3) for other testing were inspected for sight hole depth and all hole depths measured in specification. Mayfield was notified and asked to check this operation for conformance. This will be done during the next run of sighted product which is scheduled for late June. It was learned that Mayfield now uses an end mill to generate this hole instead of a pointed drill bit. This results in a flat bottom hole which they state eliminates the possibility of dimpling the ID's of barrels during the tap operation. The design allows this change as long as hole depth and thread depth characteristics are maintained. No further follow up verification will be required beyond this recommended self audit. 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 versus POA at 100 yds. in the long range to determine if there was adequate sight adjustment in the iron sights. All 9 guns were able to have POI moved to POA at 100 yds. however the rear sights on average were only 1 mark 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. 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 adjustability at 100 yds. 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 yds. 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 could of happened during the SAAMI abuse testing or during product rework in Mayfield. Mayfield was contacted and 10 news guns were requested for another POI/sight adjustability 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 loosened during this test.

Iteration 3 was strictly a test to assess POI/sight adjustability on new guns. Guns were received in late May and tested again at 100 yds. 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.

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## **MEASUREMENTS AND INSPECTIONS:**

### **MEASUREMENTS OF SIGHT HOLES IN BARREL**

#### **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 will be measured for depth.

- The barrel will be secured in a horizontal position with the bore level.
- A Dial indicator with a sharp point will be attached to a gauge base.
- For each hole to be measured the gauge point will be zeroed on the highest point on the radius of the barrel located just in front of the sight screw hole to be measured.
- The point of the indicator will then be centered in the hole, finding the bottom of the hole where the drill point is located.
- The measurement of this depth will be recorded.
- Repeat process for each of the other 3 sight holes on each sample rifle.
- All rifles in the sample will be checked.
- Specification for the Front Sight Hole Depth is  $0.110'' \pm .005''$
- Specification for the Rear Sight Hole Depth is  $0.14'' \pm .010''$

#### **Data Required:**

- Rifle serial number
- Measured depth of each screw hole by serial number.

#### **Results:**

The following capability graphs summarize 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

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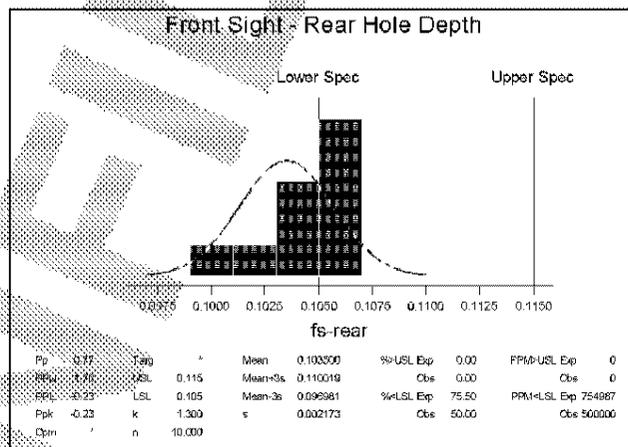
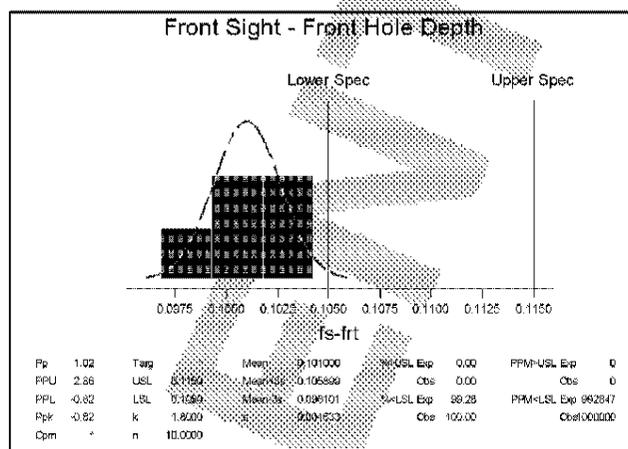
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the type of gage used, the tip size and shape of the probe, and the method. Any difference between the gage that Mayfield uses and the gage E-town used could easily account for the differences noted.



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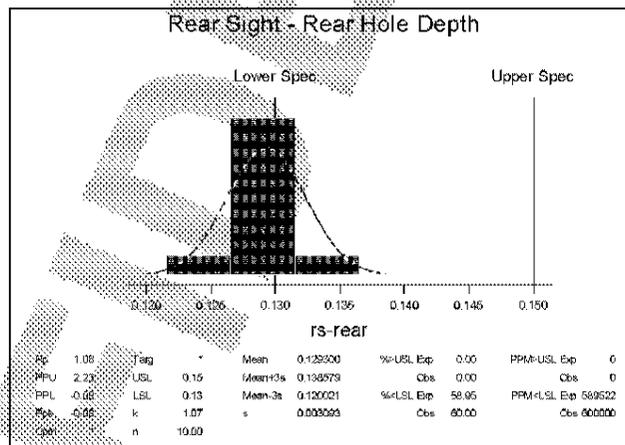
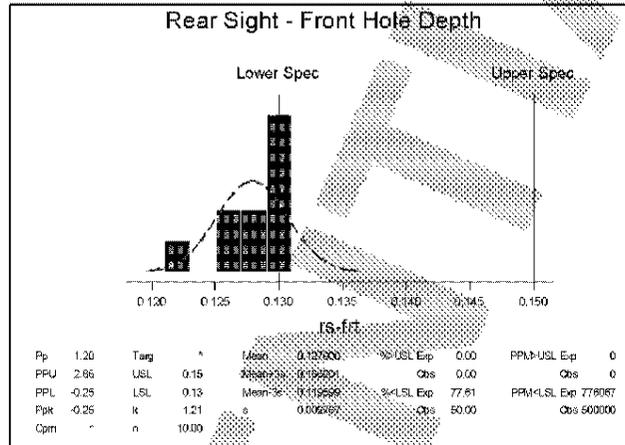
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The results from this measurement were not scrutinized until the writing of this report. Since guns for all three phases of testing had been returned to Mayfield this measurement could not be rechecked on the original guns. Three new sighted guns were received for another test in early June. All three guns were measured for sight hole depth and all measurements were within specification.

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Results from these measurements are tabulated below. Mayfield was contacted and asked to check this operation for conformance to specification. They will do this during the next run of sighted M/710 product which is scheduled for late June.

SIGHT SCREW HOLE DEPTH		sighted guns only.			
REFERENCE PRINT D-305320					
REAR			FRONT		
	HOLE A	HOLE B		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

## FUNCTION & ENDURANCE TESTING

### Testing of Sight for Looseness:

During Iteration 1 Trial & Pilot testing some sights came loose during the live fire POI 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 will be fired through each of the nine sample rifles. The front and rear sights will be checked for looseness at the start of the test, after 20 rounds, after 40 rounds and after the completion of the 60 rounds.

There is currently no listed specification in terms of force to check the "looseness" of the sight relative to the base. For this test procedure, "looseness" will be defined as whether the tester can move the sight in the base using two-finger pressure.

### Method:

- The rifle will be checked for presence of live ammunition
- Secure the rifle in a gun cradle

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- Test both the front and rear sight by using the thumb and index finger of one hand and attempt to move the sight to the left and to the right. Repeat this procedure 2 additional times for a total of three times left and 3 time right for each front and each rear sight.
- Complete this check before the start of live fire testing, after 20 rounds, after 40 rounds and finally after completing 60 rounds.
- Use caution, as barrel may be hot and use caution due to potentially sharp edges of the sight and base.

Data Required:

- Serial number of each rifle tested.
- Record results of each check at start of test and at each round level.

**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 above procedure was followed.

**ACCURACY TESTING:**

**POINT OF AIM AND POINT OF IMPACT TESTING**

To insure that each rifle can hit where it is aimed when using iron sights a test will be conducted to evaluate this property.

The shooter will shoot three (3) 5-shot groups with each sample rifle. The shooter will select a point of aim for each of the three 5-shot groups. For each of the 3, 5-shot groups the center of impact will be calculated. The 3 centers of impact will then be averaged and this location will be compared to the point of aim for each group. This group average should be within a 2.7" circle inscribed around the point of aim. If the group average is within the 2.7" circle go to the next rifle. Repeat process.

If a group average is located outside the 2.7" circle, adjust the sight for either elevation or windage or both in the direction that will bring the group average with the 2.7" circle. Repeat test until group average is within the 2.7" circle or there is no adjustment left in the sight for either elevation or windage.

- Shoot test at 100 yards.
- Use Remington .30-06 ammunition. R30065, 180 grain, Point Soft Point, Core-Lokt®
- Shoot a warmer shot.

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- Select point of aim for a given 5-shot group
- Repeat for remaining two 5-shot groups.
- Collect target(s) and calculate the center of impact for each group from the Point of Aim
- Average the center of impacts from the point of aim for the 3 groups
- Determine if the average point of impact for the 3 groups is within the 2.7" circle.
- If average point of impact is within 2.7" of point of aim go to next sample rifle.
- If average point of impact is outside of 2.7" circle of point of aim re-adjust sight for either windage, elevation or both in the direction that will bring the average point of impact toward the point of aim.
- Repeat this procedure until average point of impact is within the 2.7" circle or there is no adjustment left in the sight.

Data Required:

- Serial number of each sample rifle
- Average point of impact for each of the three 5-shot groups per rifle.
- The calculated group point of impact for each trial of a sample rifle.

**1.1.1.1**

**ABUSIVE TESTING**

**IMPACT TESTING**

**1.1.1.2**

**1.1.1.3 SAAMI Drop Test – Rifle with Iron Sights Installed:**

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