Remington
R & D Technical Center
Elizabethtown, Kentucky

CONFIDENTIAL

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Remington Model 710 Short Action

Bolt Action Centerfire Rifle

Short Action T&P Report

(.243 Win. Caliber Only)

R & D Technical Center Project # 241429
R & D Test Lab Work Request #1929

SUBJECT TO PROTECTIVE ORDER - KINZER V. REMINGTON

RE0000116

TABLE OF CONTENTS

SUBJECT TO PROTECTIVE ORDER - KINZER V. REMINGTON

RE0000117

INTRODUCTION

Since its introduction in 2001, the model 710 bolt action rifle has gained widespread popularity for those seeking a quality, value-priced centerfire bolt action rifle. Initially offered in only .270 Winchester and .30-06 Springfield calibers, the available chamberings were expanded to include 7mm Remington and .300 Winchester magnums in 2004. In 2006, Remington will once again add to the available calibers with the introduction of the .243 Winchester in both full size (RAMAC #27416) and "youth" (27418) models.

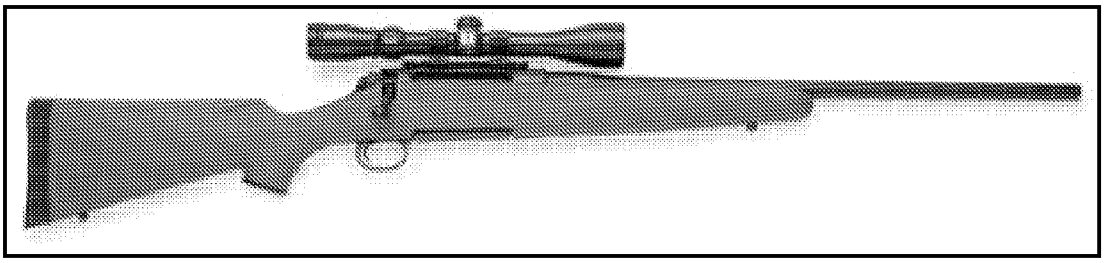

Figure 1: Model 710

The 710 "Short Action" uses all common parts with the current long action model with the exception of a special magazine box and shorter barrel length. While technically not an actual short action, this design helps maintain the current price point and simplifies manufacturing. The magazine box is simply a long action magazine with a spacer in the rear, a new follower, and modified feed lips as shown in figure 2. The barrel is 22 inches for the .243 as opposed to 24 inches for all long action calibers. The fire control design, receiver, bolt (the bolt face for .243 is common with .270, and .30-06), and stock all remain unchanged.

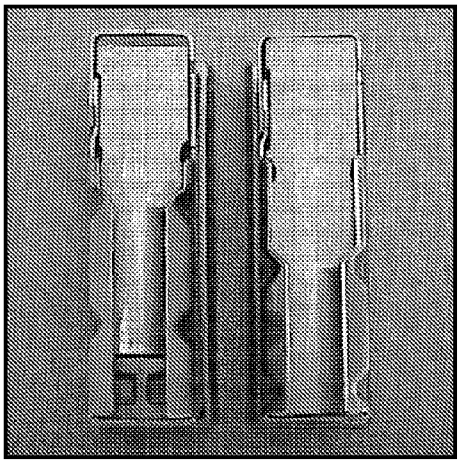

Figure 2: Short Action Magazine (l.) and Long Action Magazine (r.)

SUBJECT TO PROTECTIVE ORDER - KINZER V. REMINGTON

RE0000118

PURPOSE & SCOPE

The purpose of this test was to qualify the full-sized Model 710 Short Action in .243 Winchester for mass production. This Trial & Pilot test and report pertain only to this particular rifle configuration and the data should not be used to estimate possible results for other calibers and/or stock or barrel configurations. Due to the limited design changes that were utilized to create this model, the test plan focused on characteristics related to caliber and functional durability and performance of the action system.

SAMPLE DESCRIPTION

The sample for this test consisted of 10 firearms consecutively numbered A-1 to A-10. A list of each gun's serial number and tests to which it was subjected can be seen in the table on the following page. Where relevant, other information related to specific firearms will be documented in this report. If more detailed information is desired, the R&D test lab can be contacted to review copies of the original "Daily Test Data Sheets" as generated by the testing technicians and engineers for each firearm.

Table 1: Test Matrix by Gun

		Serial #:	71270437	71271744	71271746	71271759	71271764	71271381	71271389	71271686	71271692	71271844
		Gun #:	A-1	A-2	A-3	A-4	A-5	A-6	A-7	A-8	A-9	A-10
		Caliber:	.243 Win.	.243 Win.	.243 Win.	.243 Win.	.243 Win.	.243 Win.	.243 Win.	.243 Win.	.243 Win.	.243 Win.
Initial Inspection & Proof	Out of Box Inspection		●	●	●	●	●	●	●	●	●	●
	Inspect Chamber & Bore		●	●	●	●	●	●	●	●	●	●
	Headspace		●	●	●	●	●	●	●	●	●	●
	Proof		●	●	●	●	●	●	●	●	●	●
	Headspace		●	●	●	●	●	●	●	●	●	●
Measurements	Firing Pin Indent		●	●	●	●	●	●	●	●	●	●
	Sear / Trigger Engagement		●	●	●	●	●	●	●	●	●	●
	Sear Lift		●	●	●	●	●	●	●	●	●	●
	Twist Rate		●	●	●	●	●	●	●	●	●	●
	Measure Bore & Groove		●	●	●	●	●	●	●	●	●	●
	Chamber Cast		●	●	●							
	Trigger Pull		●	●	●	●	●	●	●	●	●	●
	Accuracy		●	●	●	●	●	●	●	●	●	●
Function & Endurance	Jack Function		●	●	●	●	●	●	●	●	●	●
	Endurance		●	●	●	●	●	●	●	●	●	●
	Shoulder Function		●	●	●	●	●	●	●	●	●	●
	Clean & Inspect		●	●	●	●	●	●	●	●	●	●
	Headspace		●	●	●	●	●	●	●	●	●	●
	Endurance		●	●	●	●	●					
	Clean & Inspect		●	●	●	●	●					
	Headspace		●	●	●	●	●					

SUBJECT TO PROTECTIVE ORDER - KINZER V. REMINGTON

RE0000119

RESULTS SUMMARY

The following is a summary of results by testing segment. Detailed results can be found in Appendix B.

Initial Inspection & Proof

Initial out-of-box inspection of each gun found no items worthy of note. All packages were properly labeled. All components, accessories, and literature were found to be present and undamaged.

Average headspace of the samples was found to be minimum specification +0.003 inches with the minimum measured being +0.001" and the maximum +0.004". Maximum headspace growth after proof was found to be 0.002" which occurred in a gun that was subjected to 2 proof rounds due to a pierced primer on the initial proof round. Headspace was also measured at 500 round intervals during the endurance testing and at the end of each gun's live fire testing. Max overall growth throughout the entire test was no greater than 0.002" for any one gun.

Measurements

Firing pin indents were found to be at or above the SAAMI recommended minimum of 0.017". The range of the 10 samples tested was from 0.017" to 0.021" with an average of 0.020". No light indents or fail-to-fires were seen during this test.

Sear to trigger engagement was found to be slightly higher that that specified for non-magnum calibers (0.020" to 0.025") but within the limits of that specified for magnum calibers (0.025" to 0.030"). The range for the initial 10 sample measurements was 0.027" to 0.030" with the average being 0.029". The engagement was also measured at 500 rounds and 1000 rounds where applicable and remained relatively unchanged. Sear lift was also measured and found to be at the high end of the 0.008" to 0.018" specification with 2 guns being slightly higher. The R&D measurements of this characteristic are typically higher than those of manufacturing due to different methods and fixtures, therefore these numbers were judged acceptable.

Chamber and bore dimensions were all found to be acceptable with SAAMI and Remington drawing specifications. Some dimensions were up to 0.002" above or below the specified range, however this was deemed acceptable given the possible errors in casting and measurement technique and the fact that no malfunctions accountable to these variances were witnessed. Fired cases also showed no signs of chamber problems. The small percentage of extraction issues noted in the Function & Endurance portion of this section and the Conclusion were determined to be related to extractor manufacture and/or assembly. Rifling twist rate was found to be within the specified range of 1 turn per 8.875" to 9.375" given some small range of error resulting from measurement method.

Initial trigger pull forces were measured with the Dvorak system and all found to be within an acceptable range. The 710 fire control assembly drawing specifies a range of 4.0 to 5.5 pounds for the non-magnum calibers. All samples were within this range except 2 which were found to be slightly higher. These however were below the 6.0 pound upper limit specified for magnum calibers. The data for these guns ranged between 4.665 and 5.763 pounds. The average was 5.185

SUBJECT TO PROTECTIVE ORDER - KINZER V. REMINGTON

RE0000120

pounds. Trigger pull was also measured at 500 and 1000 round intervals where applicable and negligible change was witnessed.

All samples were tested for accuracy at 100 yards and exhibited good results. The extreme spread for three averaged 5-shot groups for each gun was 0.85" to 2.20" with the average being 1.50". The best single group was 0.525" and the largest single group was 2.550". The gallery specification for this caliber is 1.5" for 3-shot groups and 2.2" for 5-shot groups.

Function & Endurance

Function and endurance was found to be acceptable with an overall malfunction rate of 0.40%. Four of the guns exhibited 0 malfunctions, while the remaining 6 samples ranged from 0.2% to 1.35% malfunction rate. "Fail To Eject" malfunctions contributed 88% of the total faults, while the remaining 12% was attributed of "Fail To eXtract", "Stem High", and "Stem Magazine" malfunctions. The FTE malfunctions were found to be isolated to certain bolt assembly and/or extractors and therefore determined not to be a result of chamber or magazine characteristics. While this malfunction rate does fall below the SAAMI recommended rate of 2% for this action type, it is recommended that Mayfield review the assembly processes and inspection steps related to the bolt head and extractor.

CONCLUSION

Overall results were favorable and the R&D Test Lab formally supports exit from T&P testing subject to the following conditions as stated in the exit letter (see Appendix C for additional details) issued by Scott Franz.

1. A Design Transmittal must occur to formally establish component dimensional parameters reflective of T&P product.

2. Mayfield should review the processes related to manufacturing, assembly, inspection, and testing of the extractor to ensure proper function and operation.

Furthermore, the following recommendations are made based on observations during the testing. While these issues were not specifically evaluated as part of the T&P test protocol, they are issues that could lead to customer dissatisfaction and therefore it is recommended that Marketing approve before shipment of product.

1. The ability still exists for the user to incorrectly load the magazine box as with previous models of the 710. Specifically the user can load cartridges in such a way that the stack is incorrectly staggered which can lead to malfunctions when opening the bolt on the first shot.

2. There is excessive free-play between the magazine box and the magazine well. While no functional concern was uncovered, the "rattle" noise generated during gun movement probably exceeds the customer expectation / needs for hunting situations and quality perception.

SUBJECT TO PROTECTIVE ORDER - KINZER V. REMINGTON

RE0000121

3. There is slight interference between the firing pin head and the comb of the stock when the bolt is in the open position. Function is not impaired; however the firing pin leaves a small "gouge" on the stock comb.

4. There is very slight interference between the safety and the stock inletting when the safety is in the off / fire position. Once again function is not impaired, but a aesthetic issue is created as the safety button leaves an indent on the stock surface.

SUBJECT TO PROTECTIVE ORDER - KINZER V. REMINGTON

RE0000122

APPENDIX A: Test Flow Chart

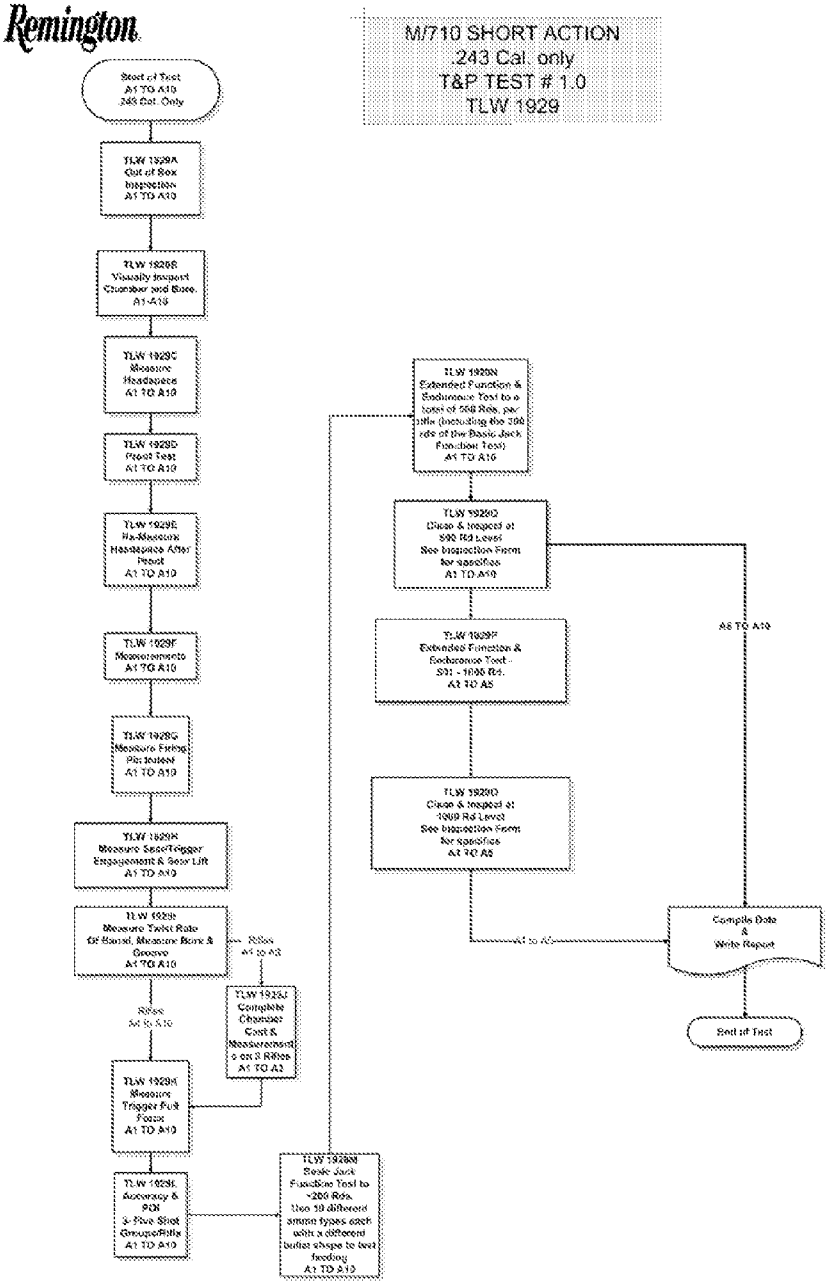

Figure A-1:Test Plan Flow Chart

SUBJECT TO PROTECTIVE ORDER - KINZER V. REMINGTON

RE0000123

APPENDIX B: Detailed Results

Table B-1: Headspace & Proof

Headspace & Proof (min. + x.xxx")							
Gun	0 Rds.	Proof	After Proof	500 Rds.	1000 Rds.	Delta	Comments
A-1	0.001	OK*	0.003	0.003	0.003	**0.002**	1st pierced 2nd OK
A-2	0.004	OK	0.004	0.005	0.005	**0.001**	
A-3	0.003	OK	0.004	0.004	0.004	**0.001**	
A-4	0.003	OK	0.003	0.003	0.003	**0.000**	
A-5	0.003	OK	0.003	0.004	0.004	**0.001**	
A-6	0.004	OK	0.004	0.004	--	**0**	
A-7	0.002	OK	0.002	0.002	--	**0**	
A-8	0.003	OK	0.003	0.004	--	**0.001**	
A-9	0.003	OK	0.004	0.004	--	**0.001**	
A-10	0.001	OK	0.002	0.003	--	**0.002**	
Min.	**0.001**	--	**0.002**	**0.002**	**0.003**	**0.0000**	
Max.	**0.004**	--	**0.004**	**0.005**	**0.005**	**0.0020**	
Avg.	**0.003**	--	**0.003**	**0.004**	**0.004**	**0.0009**	
S.D.	**0.001**	--	**0.001**	**0.001**	**0.001**	**0.0007**	

Table B-2: Firing Pin Indent

Firing Pin Indent (inches)				
Gun	1	2	3	Avg.
A-1	0.019	0.020	0.020	**0.020**
A-2	0.018	0.020	0.019	**0.019**
A-3	0.020	0.020	0.020	**0.020**
A-4	0.020	0.021	0.020	**0.020**
A-5	0.020	0.021	0.021	**0.021**
A-6	0.020	0.020	0.018	**0.019**
A-7	0.020	0.020	0.020	**0.020**
A-8	0.017	0.017	0.017	**0.017**
A-9	0.020	0.019	0.020	**0.020**
A-10	0.020	0.020	0.020	**0.020**
			Min.	**0.017**
			Max.	**0.021**
			Avg.	**0.020**
			S.D.	**0.001**

SUBJECT TO PROTECTIVE ORDER - KINZER V. REMINGTON

RE0000124

Table B-3: Sear/Trigger Engagement & Sear Lift @ 0 Rounds

Sear/Trigger Engagement & Sear Lift @ 0 Rounds (inches)					
Gun	1	2	3	Avg.	Sear Lift
A-1	0.0296	0.0305	0.0306	**0.0302**	0.0161
A-2	0.0275	0.0273	0.0277	**0.0275**	0.0175
A-3	0.0300	0.0299	0.0293	**0.0297**	0.0181
A-4	0.0286	0.0289	0.0286	**0.0287**	0.0201
A-5	0.0292	0.0290	0.0291	**0.0291**	0.0152
A-6	0.0279	0.0278	0.0278	**0.0278**	0.0181
A-7	0.0290	0.0295	0.0292	**0.0292**	0.0166
A-8	0.0270	0.0271	0.0267	**0.0269**	0.0170
A-9	0.0300	0.0304	0.0299	**0.0301**	0.0195
A-10	0.0300	0.0302	0.0304	**0.0302**	0.0179
			Min.	**0.027**	**0.0152**
			Max.	**0.030**	**0.0201**
			Avg.	**0.029**	**0.0176**
			S.D.	**0.001**	**0.0015**

Table B-4: Sear/Trigger Engagement @ 500 Rounds

Sear/Trigger Engagement @ 500 Rounds (in.)				
Gun	1	2	3	Avg.
A-1	0.0278	0.0280	0.0281	**0.0279**
A-2	0.0274	0.0270	0.0261	**0.0268**
A-3	0.0285	0.0290	0.0292	**0.0289**
A-4	0.0281	0.0278	0.0278	**0.0279**
A-5	0.0286	0.0290	0.0288	**0.0288**
A-6	0.0280	0.0278	0.0280	**0.0279**
A-7	0.0285	0.0285	0.0286	**0.0285**
A-8	0.0275	0.0276	0.0279	**0.0276**
A-9	0.0312	0.0312	0.0314	**0.0312**
A-10	0.0308	0.0306	0.0310	**0.0308**
			Min.	**0.027**
			Max.	**0.031**
			Avg.	**0.029**
			S.D.	**0.001**

Table B-5: Sear/Trigger Engagement @ 1000 Rounds

Sear/Trigger Engagement @ 1000 Rounds (in.)				
Gun	1	2	3	Avg.
A-1	0.0275	0.0275	0.0280	0.0276
A-2	0.0272	0.0267	0.0269	0.0269
A-3	0.0304	0.0303	0.0301	0.0302
A-4	0.0282	0.0285	0.0282	0.0283
A-5	0.0280	0.0285	0.0285	0.0283
			Min.	**0.027**
			Max.	**0.030**
			Avg.	**0.028**
			S.D.	**0.001**

SUBJECT TO PROTECTIVE ORDER - KINZER V. REMINGTON

RE0000125

Table B-6: Bore Measurements

Bore Measurements			
Gun	Bore Dia. (in.)	Groove Dia. (in.)	Twist Rate (1 turn: x")
A-1	0.237	0.2430	9.0
A-2	0.237	0.2430	9.3
A-3	0.237	0.2425	9.2
A-4	0.237	0.2425	9.0
A-5	0.237	0.2430	9.5
A-6	0.237	0.2430	9.0
A-7	0.237	0.2425	9.0
A-8	0.237	0.2430	9.2
A-9	0.237	0.2430	8.8
A-10	0.237	0.2425	9.2
Min.	**0.237**	**0.2425**	**8.8**
Max.	**0.237**	**0.243**	**9.5**
Avg.	**0.237**	**0.2428**	**9.12**
S.D.	**0.0000**	**0.0003**	**0.1989**

Table B-7: Chamber Cast Data

Chamber Dimensions (inches)										
Letter	Description	Dim.	+ Tol.	- Tol.	A-1	A-2	A-3	Min.	Max.	Avg.
A	I.D.	0.4714	0.002	0.000	0.4703	0.4712	0.4711	**0.4703**	**0.4712**	**0.4709**
B	I.D.	0.4564	0.002	0.000	0.4567	0.4565	0.4569	**0.4565**	**0.4569**	**0.4567**
C	I.D.	0.4551	0.002	0.000	0.4602	0.4578	0.4581	**0.4578**	**0.4602**	**0.4587**
D	I.D.	0.4000	0.002	0.000	0.3990	0.3980	0.3970	**0.3970**	**0.3990**	**0.3980**
E	I.D.	0.2783	0.002	0.000	0.2814	0.2811	0.2815	**0.2811**	**0.2815**	**0.2813**
F	I.D.	0.2770	0.002	0.000	0.2793	0.2787	0.2787	**0.2787**	**0.2793**	**0.2789**
G	I.D.	0.2463	0.002	0.000	0.2441	0.2451	0.2446	**0.2441**	**0.2451**	**0.2446**
H	RADIUS	0.145	0.030	0.000	0.151	0.162	0.148	**0.148**	**0.162**	**0.154**
I	DEGREE	20'	--	--	19.5	19.7	19.9	**19.5**	**19.9**	**19.7**
J	DEGREE	30'	--	--	30.2	29.7	29.8	**29.7**	**30.2**	**29.9**

SUBJECT TO PROTECTIVE ORDER - KINZER V. REMINGTON

RE0000126

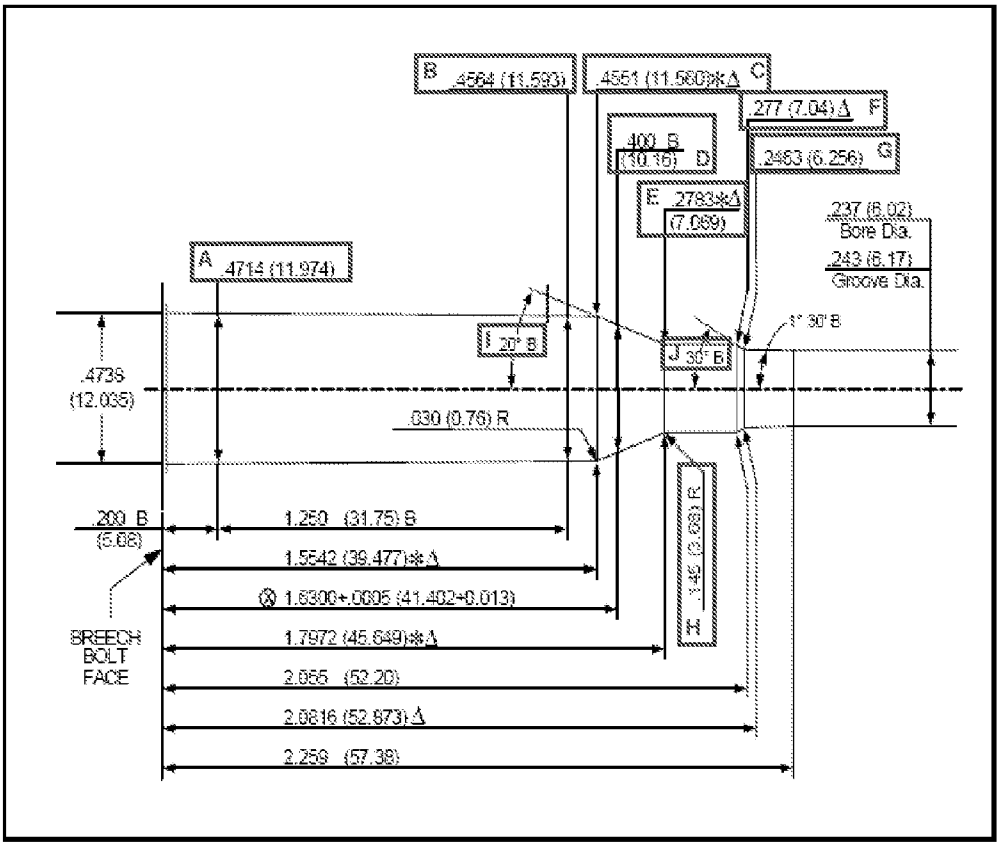

Figure B-1: Chamber Drawing

Table B-8: Trigger Pull Force @ 0 Rounds

Trigger Pull Force @ 0 Round Level (lbs.)						
Gun	**1**	**2**	**3**	**4**	**5**	**Avg.**
A-1	5.492	4.779	4.745	4.574	4.751	**4.868**
A-2	4.347	4.643	4.531	4.882	4.923	**4.665**
A-3	5.271	4.697	5.048	4.915	4.709	**4.928**
A-4	5.347	5.788	5.270	5.331	5.125	**5.372**
A-5	5.846	5.298	5.574	6.145	5.953	**5.763**
A-6	4.895	4.830	4.905	4.802	4.885	**4.863**
A-7	5.411	5.477	5.499	5.890	5.709	**5.597**
A-8	5.475	5.841	4.663	4.940	5.385	**5.261**
A-9	5.055	5.159	4.970	5.105	4.890	**5.036**
A-10	5.993	5.128	5.186	5.449	5.742	**5.500**
					Min.	**4.665**
					Max.	**5.763**
					Avg.	**5.185**
					S.D.	**0.366**

SUBJECT TO PROTECTIVE ORDER - KINZER V. REMINGTON

RE0000127

Table B-9: Trigger Pull Force @ 500 Rounds

Trigger Pull Force @ 500 Round Level (lbs.)				
Gun	1	2	3	Avg.
A-1	5.265	5.550	5.328	**5.381**
A-2	4.400	4.361	4.239	**4.333**
A-3	5.400	5.015	5.255	**5.223**
A-4	5.535	5.802	5.964	**5.767**
A-5	5.927	5.784	5.629	**5.78**
A-6	5.604	5.527	5.455	**5.529**
A-7	5.460	5.685	5.639	**5.595**
A-8	5.082	5.187	5.247	**5.172**
A-9	5.522	5.380	5.819	**5.574**
A-10	6.613	6.669	6.664	**6.642**
			Min.	**4.333**
			Max.	**6.642**
			Avg.	**5.500**
			S.D.	**0.580**

Table B-10: Trigger Pull Force @ 1000 Rounds

Trigger Pull Force @ 1000 Round Level (lbs.)				
Gun	1	2	3	Avg.
A-1	5.693	5.756	5.630	**5.692**
A-2	4.867	4.680	5.001	**4.849**
A-3	4.459	4.686	4.320	**4.488**
A-4	5.960	5.816	6.201	**5.992**
A-5	5.874	5.596	5.600	**5.690**
			Min.	**4.488**
			Max.	**5.992**
			Avg.	**5.342**
			S.D.	**0.640**

Table B-11: Accuracy @ 100 Yards

Accuracy (Group Sizes in Inches)					
Gun	Grp. 1	Grp.2	Grp.3	Avg.	Shooter
A-1	2.000	1.550	1.475	**1.675**	J.S.
A-2	1.675	2.150	2.550	**2.125**	J.S.
A-3	0.750	0.600	1.200	**0.850**	S.W.
A-4	1.950	2.100	2.150	**2.067**	S.W.
A-5	1.950	0.650	1.300	**1.300**	J.S.
A-6	0.700	1.350	1.100	**1.050**	J.S.
A-7	1.425	1.850	1.650	**1.642**	S.W.
A-8	2.450	1.600	2.550	**2.200**	S.W.
A-9	1.725	1.875	1.700	**1.767**	J.S.
A-10	1.300	1.300	0.525	**1.042**	J.S.
Ammo Type		R243W3	Min.	**0.850**	
Ammo Lot		Z23NAL	Max.	**2.200**	
Sights		Scope	Avg.	**1.497**	
Distance		100 yard	S.D.	**0.488**	

SUBJECT TO PROTECTIVE ORDER - KINZER V. REMINGTON

RE0000128

Table B-12: Function & Endurance Data

	Jack Function (200 rnds)				Endurance (300 rnds)				Shoulder Function (20 rnds)				Endurance (500 rnds)				Total Rnds	Total Malf.	Malf. Rate (%)
Gun	FTE	FTX	SH	SM	FTE	FTX	SH	SM	FTE	FTX	SH	SM	FTE	FTX	SH	SM			
A-1																	1020	0	0
A-2																	1020	0	0
A-3	1				1								2				1020	4	0.39
A-4									1				9				1020	10	0.98
A-5					1								1				1020	2	0.20
A-6	1				6												520	7	1.35
A-7	3	2			1												520	6	1.15
A-8							1					1					520	2	0.38
A-9																	520	0	0
A-10																	520	0	0
Tot.	5	2	0	0	9	0	1	0	1	0	0	1	12	0	0	0	7700	31	0.403
																	Min.	0	0.00
																	Max.	10	1.35
																	Avg.	3	

Malfunction Codes				
	FTE	= Fail To Eject	SH	= Stem High
	FTX	= Fail To eXtract	SM	= Stem Magazine

Table B-13: Total Malfunctions by Type

Total Malfunctions by Type				
Gun	FTE	FTX	SH	SM
A-1	0	0	0	0
A-2	0	0	0	0
A-3	4	0	0	0
A-4	10	0	0	0
A-5	2	0	0	0
A-6	7	0	0	0
A-7	4	2	0	0
A-8	0	0	1	1
A-9	0	0	0	0
A-10	0	0	0	0
Tot.	27	2	1	1

Table B-14: Function & Endurance Comments

Gun	Comments
A-1	none
A-2	none
A-3	none
A-4	Extractor lubricated @ 571 after serveral consecutive FTE; only 1 FTE afterwards.
A-5	none
A-6	none
A-7	2 FTX & 1 FTE during 40 rnds. Extractor changed @ 41; no improvement. Bolt changed @ 44; only 1 FTE afterwards.
A-8	none
A-9	none
A-10	none

SUBJECT TO PROTECTIVE ORDER - KINZER V. REMINGTON

RE0000129

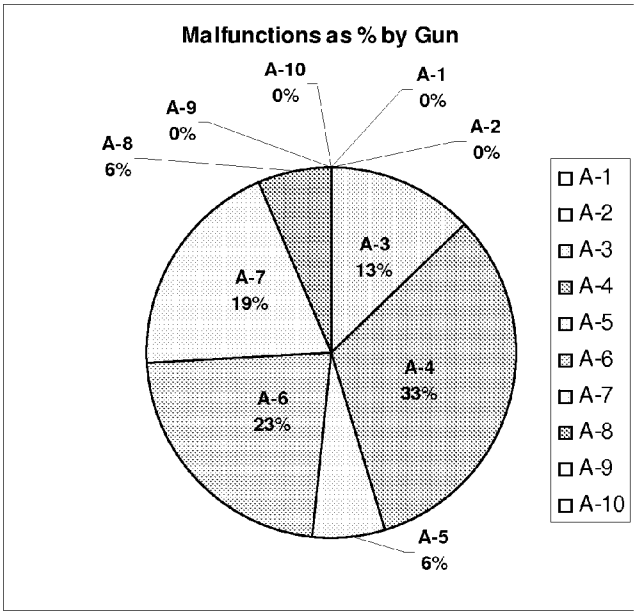

Figure B-2: Malfunctions as % by Gun

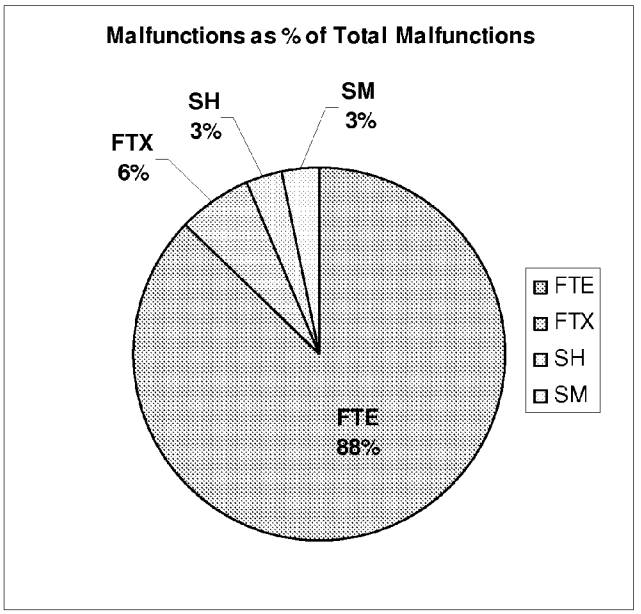

Figure B-3: Malfunctions as % of Total Malfunctions

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RE0000130

APPENDIX C: R&D Exit Letter from S. Franz

Remington Arms Company, Inc. January 31, 2006
John C. Trull – John R. Fink
Post Office Box 700
Madison, NC 27025

VIA EMAIL: JOHN.TRULL@REMINGTON.COM; JOHN.FINK@REMINGTON.COM

The Test and Measurement organization within the Elizabethtown Research and Development facility formally supports exit from Trial and Pilot testing of the M/710 Short Action Bolt Action Rifle (in .243 Win. only caliber) subject to the following issues and conditions:

1. A Design Transmittal must occur to formally establish component dimensional parameters reflective of T&P product. All shipped product must conform to these parameters or a written deviation from design must be obtained from the Design team.

2. Mayfield should review the processes related to manufacturing, assembly, inspection, and testing of the extractor to ensure proper function and operation. Fail to eject (FTEj) malfunctions were the single largest malfunction encountered over the duration of testing. 27 of 31 total malfunctions (87%) encountered in over 7,700 rounds of testing were FTEj's. An overall malfunction rate of .4% is admittedly low. Fail to eject malfunctions were isolated to specific guns and the cause was determined to be extractor related. Test believes that the FTEj's were not related specifically to the short action design.

The following observations were made during trial & pilot and are communicated here for information purposes. Test reasonably believes some of these may result in customer dissatisfaction. These issues have no absolute test objective criteria associated with them at this time so Test has no basis to withhold ship approval. Consequently, Test supports ship contingent on Marketing approval of these conditions:

- All previously identified M/710 characteristics that have been accepted by Marketing continue to be present in this short action variant. Issues such as the ability to load the magazine box incorrectly, which results in an improper cartridge stack are also present in the short action. One exception is the lack of box deformation from the tips of rounds impacting the front surface of the box during recoil. Magazine boxes in the short action after 1,000 rounds exhibited no deformation.

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- Magazine box fit in the stock is on the loose side. Although no malfunctions associated with this loose fit occurred over the duration of testing the box actually rattles in the stock. This is not specific to the short action and is a result of recent tooling changes made to the stock mold to address other fit issues. Mayfield and E-town personnel are working with the molder to address this loose box fit issue.

- The bottom surface of the firing pin head can hit the top surface of the stock when the bolt is fully retracted. This has resulted in minor stock damage on some guns. The damage is strictly cosmetic.

- When the safety is pushed fully forward into the "Fire" position it leaves a small mark on the stock forward of the safety arm. Movement of the safety in no way is impaired. This is solely a cosmetic issue.

Test recommends that these issues be resolved through design/process changes if Marketing finds any of these conditions unacceptable.

Elizabethtown stands ready to assist should you determine that additional audits of the product are required.

With Kind Regard,

Scott R. Franz
Manager of Research and Technology
Remington Arms Company, Inc.

cc: T.L. Millner R.H. Bristol II P. L. Cahan D.H. Campbell
K.D. Lance D.D. Diaz

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RE0000132