DRAFT

Remington Arms Company Inc.
RESEARCH & DEVELOPMENT TECHNICAL CENTER
315 WEST RING ROAD
ELIZABETHTOWN, KY 42701

# Remington Model 710

## .30-06 Caliber
## Bolt Action Rifle

## Engineering Evaluation Report
## High Load Firing Pin Test



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*Report Prepared By:*

*S. R. Franz/J.E. Urbon*

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**Introduction**

The Remington Model 710 is a low cost bolt action centerfire rifle currently in development at the R & D Technology Center. Although similar to the Model 700 in its' basic function, it does utilize new and innovative design concepts to take full advantage of synthetic materials to aid in reducing cost. One of these is a synthetic insert that slides into the circular receiver. This serves as a guide for the bolt, eliminating costly internal receiver cuts. In addition this same insert houses the fire control components with additional support from a single steel side plate attached to the right side of the fire control. This means that the pins that support the fire control components (trigger, sear safety cam) are supported in plastic on the left side and steel on the right side. Since load is transmitted to these pins from the firing pin main spring a series of tests were devised to evaluate the strength of this design. This report documents work done on one of these tests where a high load is applied to the rear of the firing head to determine the force required to render the system inoperable. Since no absolute pass/fail criteria has been established for any of these tests the results will be evaluated using standard engineering Factor of Safety guidelines.

**Procedure**

A standard Model 710 barreled action was assembled to an aluminum test stock which contained the as designed internal inletting cuts. The exterior of the stock was not contoured and was squared off. The stock was cut off in the back just behind the stock mounting nut. The front end of the stock and the barrel were also shortened to allow the entire assembly to be mounted in the Instron Model 8502 Tension/Compression Fatigue machine. The action was clamped vertically in a vise which in turn was secured to the Instron's table. The 1,000 lb. load cell was mounted in the Instron and a large diameter pin was secured in the upper jaws and aligned with the back of the firing pin head. The synthetic bolt shroud was removed from the bolt assembly to allow access to the firing pin head. The Instron machine was set-up for 0-.150 inch travel with a maximum load limit of 950 lbs.. All tested actions were checked for correct engagement before being mounted in the test setup. The action was operated to cock the firing pin and then closed. The safety was put in the ready to fire position and the load was applied at a rate of .1 inch/min. Force versus displacement data was captured for each action tested at a sampling rate of 10 pts/sec. Two 710 fire control assemblies were tested this way. In addition one 710 assembly was soaked overnight (24 hrs.) in Birchwood Casey solvent before testing. One 700 control sample was also tested.

General setup for the Model 710 is shown in Fig. 1 and 2 below.

**Fig. 1 - Model 710 Setup (Overall)**

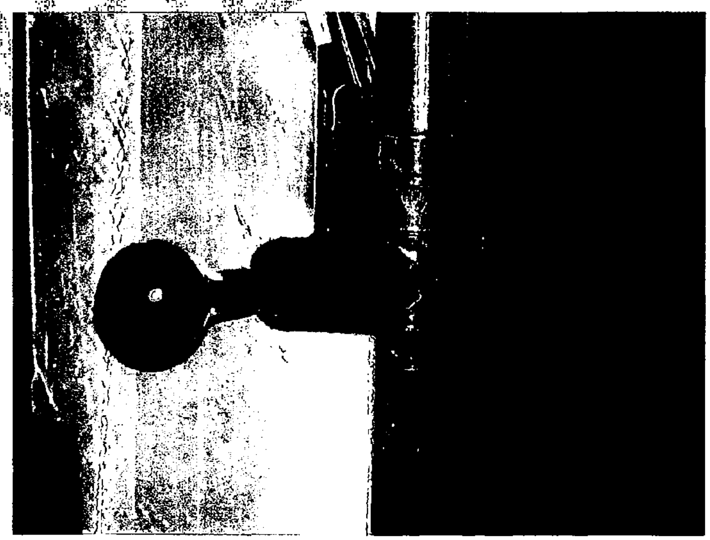

**Fig. 2 - Model 710 Setup (Close-up)**

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**Results Summary**

The Model 710 and Model 700 behaved similarly during this test. The mode of failure and the force level at which it occurred were approximately the same. In all four test runs a high enough load was reached that caused the firing pin head to over-ride the sear safety cam. When this occurred the firing pin assembly was bound or trapped in this condition. In the authors opinion in no case would this mode of failure result in an unsafe condition that would result in an unintentional discharge of the firearm. The following table summarizes the peak load recorded at the instant the over-ride occurred.



| | Model 710 | Model 700 Control |
|---|---|---|
| Test #1 | 337 | 394 |
| Test #2 | 428 | ---- |
| Test #3 (24 hr. Solvent Soak) | 377 | ---- |

**Table 1. – Maximum Load (lbs.)**

In order to cause an over-ride like this some part movement and deformation must occur. In the 710's case it appears that deformation of the synthetic insert resulted in the over-ride. In the 700's case the fire control mounting pins were bent. The loads required to cause this situation are far in excess of normal service loads. In the 710's case the firing pin spring load is in the 23 lb. – 26 lb. range. The lowest load recorded above (337 lbs.) is about 13 times that of the high end service load (26 lbs.). This Factor of Safety (FS) is far in excess of accepted engineering safety levels. This coupled with comparison to the 700 validates the robustness of the 710 design in this area.

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**Discussion of Results**

As stated earlier a total of three Model 710 fire controls were tested. In all three cases the same barreled action and cut-off test stock was used. Engagement on all three samples were checked before testing to ensure they were in specification.

Sample number one was fixtured and tested. Since this was the first sample it was not known what the outcome would be. The force increased to a peak value of about 320 lbs, decreased slightly and then increased to a maximum of 337 lbs at which point the over-ride occurred. The force dropped off sharply after this. The test was stopped at this time. The resulting over-ride condition can be seen in Fig. 3.



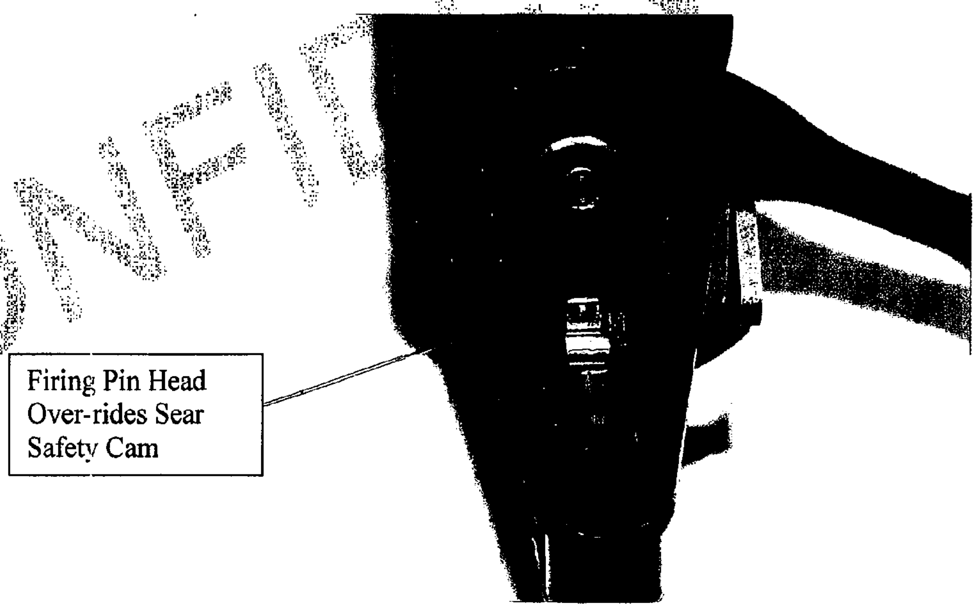


**Fig. 3 – Model 710 Over-ride**

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The second sample was checked for engagement, fixtured and run. This time a primed case was loaded into the chamber to determine if the primer would fire if an over-ride occurred. The result was similar accept the load profile differed slightly at the high end of the scale. The system appeared to get stiffer just before the over-ride. The peak value on run #2 was almost 100 lbs. higher than run #1. The primer was not contacted during this test.

Test run number three was with the Model 700 control. It was set-up the same way except this time the action was not bedded in a stock. The Model 710's stock actually supports the rear of the synthetic insert and as a result needed to be tested with the stock in place. It was felt that the Model 700 stock would not influence the test results and therefore was tested as shown in Fig. 4 below.

**Fig. 4 – Model 700 Set-up**

Test results were similar in that an over-ride of the sear safety cam occurred. The maximum force reached just before over-ride was 394 lbs. The slope of the force/time curve was steeper than the M/710 from the very beginning, however the end result was the same.

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The over-ride can be seen in Fig. 5.

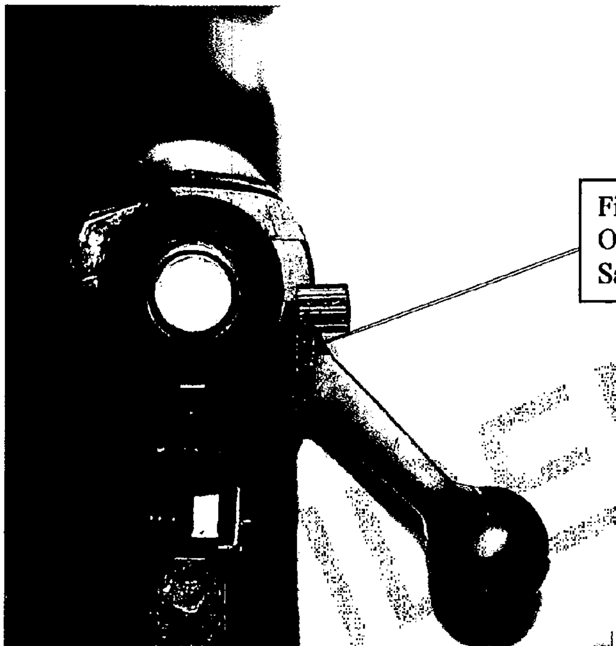


**Fig. 5 – Model 700 Over-ride**

The fourth and final run was made on a M/710. The synthetic insert with fire control components assembled was soaked for 24 hrs. in Birchwood Casey cleaning solvent. Previous solvent testing with various synthetic materials has shown this solvent to be the most aggressive in terms of degrading material properties. This run also resulted in an over-ride of the sear safety cam. The peak load recorded was 377 lbs., right between the other two M/710's tested.

All four force/displacement curves have been plotted on the same scale for comparison purposes. This graph is shown in Fig. 6 on the next page. Although the M/700 is a stiffer system as evidenced by the steeper slope the maximum force required to cause the over-ride is not significantly different.

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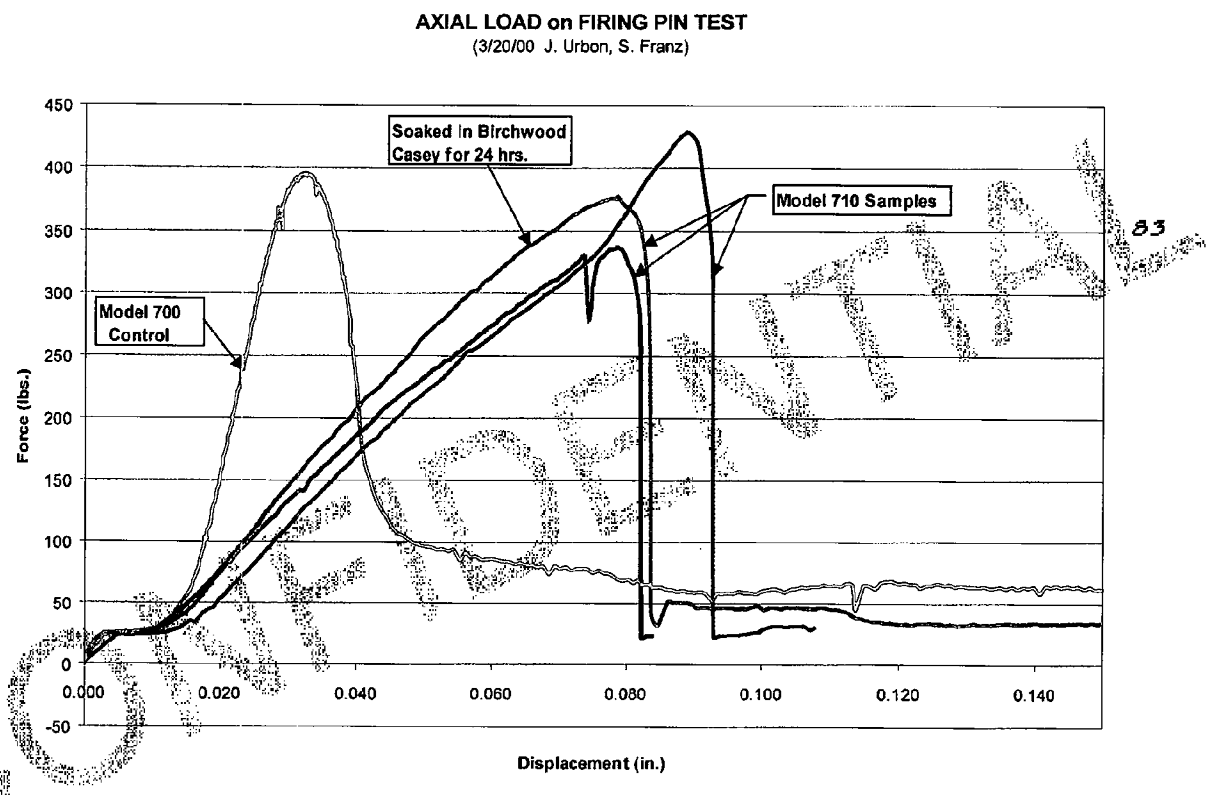


**Fig. 6 – Graph of Force Vs Displacement**
**Model 710 Vs Model 700**