Remington Arms Company, Inc. **CONFIDENTIAL** Research and Development Technology Center
Elizabethtown, Kentucky

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To: Mike Keeney
From: Marlin Jiranek

Cc: D. Danner, S. Franz, D. Diaz, J. Snedeker, J. Zajk, J. Urbon, M. Golemboski

RE: M/710 MAGAZINE WELD SHEAR TESTING

HISTORY:

As a follow-up activity to the documentation of the weld shear strength of the previous iteration M/710 "production" magazine boxes, many of the welding parameters were changed and a new lot of magazine boxes were provided for test and evaluation. Ten of these additional magazine boxes were obtained and tested for shear strength of the two spot welds. The procedure used for the evaluation was identical to the procedure used previously for evaluation of the DAT and the first "production" magazine box samples.

SUMMARY:

The results show that the new box welds are dramatically stronger than any of the previous magazine boxes which were tested. Table 1 presents a summary of the testing to date, including the original DAT results and 1st production run results.

M/710 MAGAZINE BOX SHEAR STRENGTH TESTING Results Comparisons *Calculated Minimum Load at Failure = 2,424 lbs.*				
	Average	St. Deviation	Minimum	Maximum
2 Box DAT Test (9/12/2000)	295	-----	227	362
10 Box Test (09/13/2000):	1,022	301	417	1,550
10 Box Test (09/18/2000):	2,513	166	2,271	2,723

Table 1. Testing results of the new production magazine boxes as compared to the previous testing results of the DAT boxes and the 1st group of production magazine boxes.

As is evident in the data summary (Table 1), the newest version of the production magazine box tested on September 18, 2000 have substantially improved spot welds over the previously tested boxes. However, the strength value of the current boxes is still below the minimum calculated shear strength value for the spot welds.

It is recommended that further development of the welding process be continued to improve the shear strength of the magazine box weld to the point that the average test failure load of 10 samples, minus 2 standard deviations is greater than the minimum calculated load at failure (2,424 lb.). This recommendation is based on the premise that the current test samples pass the DAT test procedures with no failures.

PROCEDURE:

A total of 10 magazine boxes were presented for testing. All of the magazine boxes were obtained from an improved production sample which was supplied by Mike Keeney. As was previously done, the magazine boxes were fixtured into the Instron tensile testing machine using a small block and two pins.

The block was placed at the front of the magazine box to prevent the box from distorting during the tensile testing. A total force required to fail the box was reported from the Instron load cell. The shear strength per weld at the time of failure can be calculated by dividing the total force by 4 (divide by 2 to determine the force per side, then divide by 2 again to determine the force per weld (2 welds on 1 side of the box)).

RESULTS / CONCLUSIONS:

The improved magazine boxes had a differently shaped load / displacement curve than the previously tested samples. During the testing, in all weld failures, one weld would fail first, followed by the failure of the second weld. This is shown in Figure 1, a load / displacement curve of one of the tested samples. This curve is typical of the remaining load displacement curve acquired during this testing.

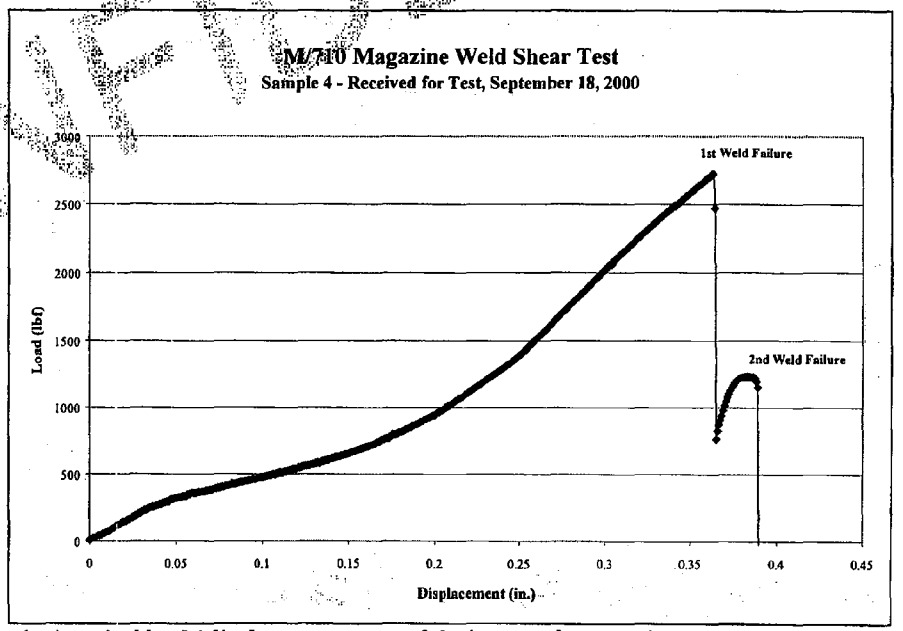

Figure 1. A typical load / displacement curve of the improved production magazine boxes. Note that the two welds fail at separate times.

Figure 2 presents an image of the weld regions after the testing. Figure 3 presents a higher magnification image of the lower weld. It can be seen from the figure that there are small amounts of "torn" material at each of the weld locations. This is indicative of a moderate metallurgical bond between the two faces of the magazine box.

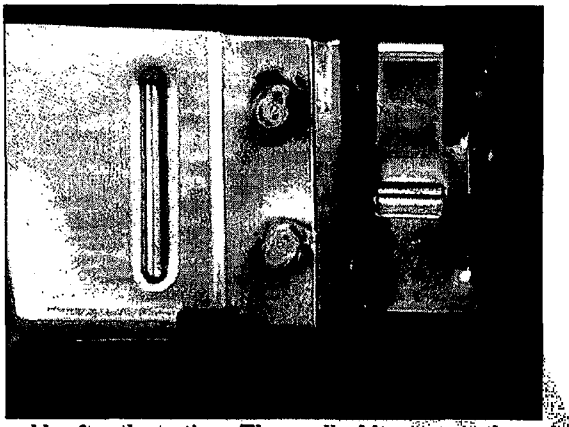

Figure 2. Image of the welds after the testing. The small white spots at the center of each of the weld are regions of "torn" material, indicating a good weld in that particular location.

Figure 3. Image of the lower magazine box weld after the test. Note the "tearing" of material in a circular pattern around the centrally located crater (shiny spot).

Ideally, the failure surface would be composed of a large portion of severely deformed and fractured material. This weld failure is indicative of a joint which has not been maximized in terms of weld strength or metallurgical bond.

Table 2 presents the results of all 10 samples of the improved magazine boxes which were tested, as well as the average and standard deviation. The results are consistent with the observations, indicating that the newest production magazine boxes tested have a greater strength level than the previously tested magazine boxes.

M/710 MAGAZINE BOX WELD SHEAR STRENGTH TESTING										
Boxes Tested on September 18, 2000										
Sample:	1	2	3	4	5	6	7	8	9	10
Load at Failure:	2723	2562	2271	2714	2299	2418	2694	2399	2499	2551

Average Load at Failure:	**2513**
Standard Deviation:	**166**

Table 2. The individual results of the weld shear strength testing of the improved production magazine boxes for the M/710 bolt action rifle.

While the strength of the improved box welds has increased dramatically over the previously tested magazine boxes, these welds still require improvement to bring the strength up to the minimum calculated strength. As calculated in the previous report, assuming minimum material properties, the shear load at failure for an individual spot weld is 606 lb. Multiplied by 4 to account for 2 welds and 2 sides of the magazine box equals a minimum failure load of 2,424 lb. for the magazine box.

It is suggested that these boxes be used for the current DAT testing procedure and that further development of the welding process continue to strengthen the current weld set-up. For future endeavors, it is suggested that the minimum calculated load be used as a minimum sample allowance. In the future, for qualification of the welds, it is suggested that a sample of 10 magazine boxes be tested and the passing criteria is that the average load at failure value minus 2 standard deviations is equal to or greater than the minimum calculated value of 2,424 lb. This recommendation is based on the premise that the current test samples pass the DAT test procedures with no failures.