# 597 Trigger Pull Comparison

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*OBJECTIVE* The objectives of this test were to:

- Compare the difference in trigger pull measurements made using a spring scale at two different Remington sites (Elizabethtown and Mayfield)
- Compare the trigger pull forces returned by other methods
- Evaluate the accuracy and consistency of the available methods.

*CONCLUSIONS* The following conclusions were made:

1. Difference Between Sites The trigger pulls measured at Elizabethtown using the spring scale were found to be, on average, 0.6 pounds heavier than those taken at Mayfield.

2. Spring Scale Of the trigger pull measuring devices examined in this report, the spring scale was found to have the coarsest resolution and the highest dependence on operator technique.

3. TriggerScan System The TriggerScan system does not suffer from variance caused by operator technique. If the rest supplied with the TriggerScan unit is used, however, it is sensitive to the way the rest is set up. However, a better method of fixturing could reduce the TriggerScan unit's sensitivity to setup. The pulls measured by the TriggerScan system were 0.17 pounds higher than those measured by the spring scale at Elizabethtown.

4. Chatillon Force Gauge If the Chatillon force gauge is placed in a drill press vice and used to pull the gun's trigger, the results are still affected by operator technique, but to a much smaller degree than with the spring scale. The Chatillon gauge registered the highest trigger pulls- 0.43 pounds higher than the Elizabethtown spring scale and 0.26 pounds higher than the TriggerScan unit. The Chatillon unit was more resistant than the TriggerScan unit to variances in setup, and yielded the lowest overall standard deviations.

5. Effect of Fire Control Mounting Trigger pull measurements taken with the fire control in the gun were essentially the same as those taken with the fire control out of the gun.





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*RECOMMENDATIONS* In order to measure trigger pulls consistently from site to site, a standardized measurement system is needed. The system must address three major sources for variability: force measurement error, operator variability, and variability of setup.

The Chatillon electronic force gauge and TriggerScan unit both measured force with a high degree of accuracy and resolution. Both systems had less variability due to operator technique than the spring scale. However, setup of the system is critical to both – if the point of force application on a 597 trigger is lowered by 0.040 inches, the force on the trigger needed to apply the same torque about the trigger's pivot pin will drop by 5%, or ¼ pound on a five-pound trigger pull. A set of fixtures used consistently among sites could greatly reduce the amount of setup variability.

An ideal means of measuring trigger pull would involve a set of mounts for each Remington product, standardized among all sites. These mounts would be made to interface with either a Chatillon electronic force gauge or the TriggerScan system and allow the all trigger pulls measured on a particular model to be measured using identical setups at all sites.

*PROCEDURE* Trigger pulls were measured using three main techniques.

1. Spring Scale The trigger pull was measured using the spring scale. The trigger assembly was secured, either directly in a vise (as done in Mayfield) or by mounting in the barreled action of a Model 597 and clamping the barrel in a vise (as done in Elizabethtown). The spring scale used in Elizabethtown was calibrated against a 5-pound weight. The hook on the end of the spring scale was then used to pull the trigger on the fire control. The spring scale was pulled by hand, and care was taken to ensure that the hook was pulling horizontally and in the center of the trigger bow. Figure 1 shows how the spring scale was used in Elizabethtown.

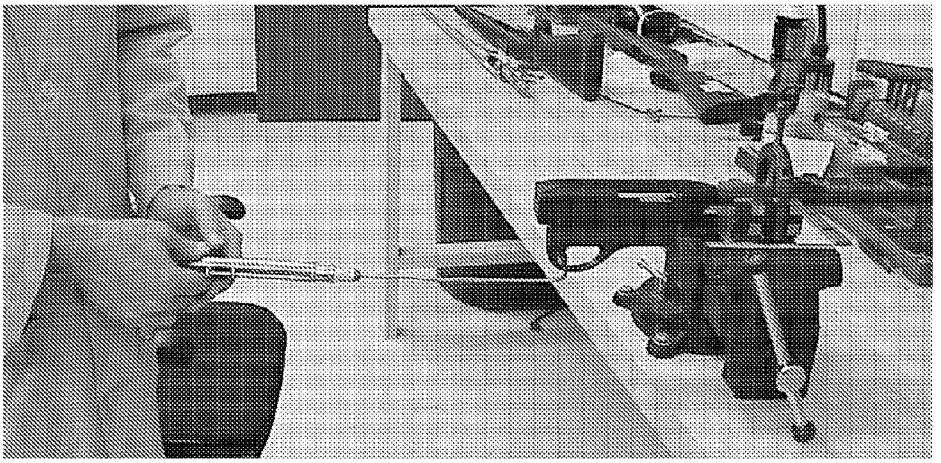

**Figure 1. Spring Scale in use.**





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2. Chatillon Electronic Force Gauge The fire controls were installed in a Model 597 barreled action and the barrel was clamped in a vise. A 10-pound Chatillon force gauge was clamped in a drill-press vise (a vise mounted on a base set up with dovetails and screws to allow translation in two axes). A metal hook was screwed into the end of the Chatillon unit. The Chatillon gauge was aligned vertically with the action to ensure that it was pulling horizontally in the center of the trigger bow. The gun was aligned laterally with the Chatillon unit, and the screw for the drill press base was turned to cause the Chatillon unit to pull the trigger. The peak tension load on the force gauge was measured to supply the trigger pull reading. Figure 2 shows how the Chatillon force gauge was used. For the comparison between trigger pulls taken in and out of the barreled action, the fire control was placed in a vise and the Chatillon unit was used to pull the trigger in the same manner described above.

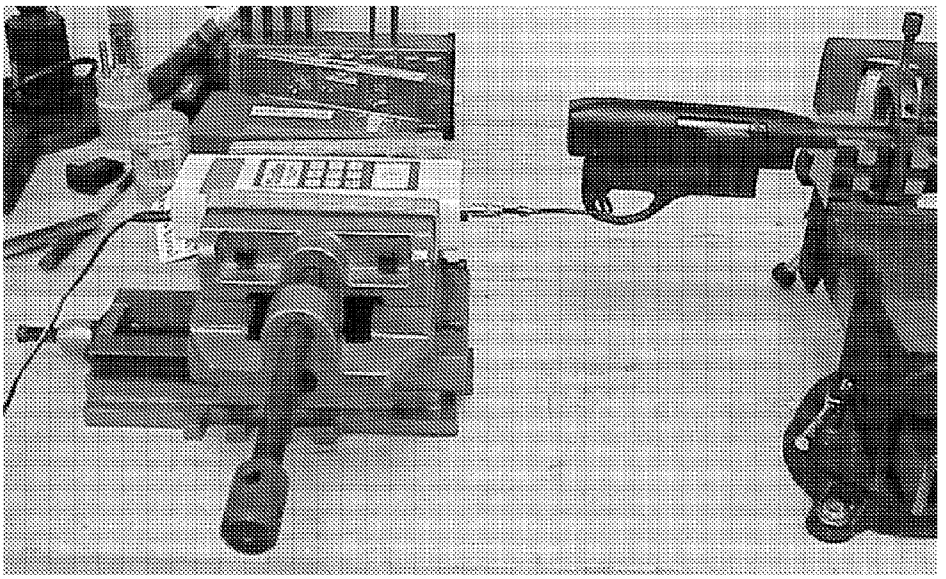

**Figure 2. Chatillon Electronic force gauge in use.**

3. TriggerScan Device The TriggerScan unit may be seen in Figure 3. The actions to be tested were placed in a Model 597. The TriggerScan unit was mounted into the deluxe rest included with the TriggerScan package. The rifle was placed on the rest, and the rest was adjusted in order to place the stationary arm of the TriggerScan unit at the front of the trigger guard and to cause the moving roller of the TriggerScan unit to be pressing upon the center of the trigger bow. The rest was also adjusted to cause the gun to be centered, with the notch in the TriggerScan roller aligning with the center of the trigger. The TriggerScan unit



**Figure 3. TriggerScan unit.**

was plugged into a laptop PC, and the peak force required to release the trigger was read for the analysis done by the TriggerScan software. Figure 4 shows how the TriggerScan unit was used to measure trigger pulls.

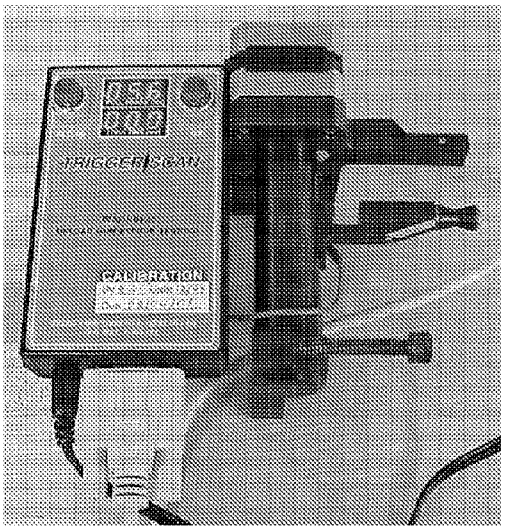

**Figure 3. TriggerScan unit.**

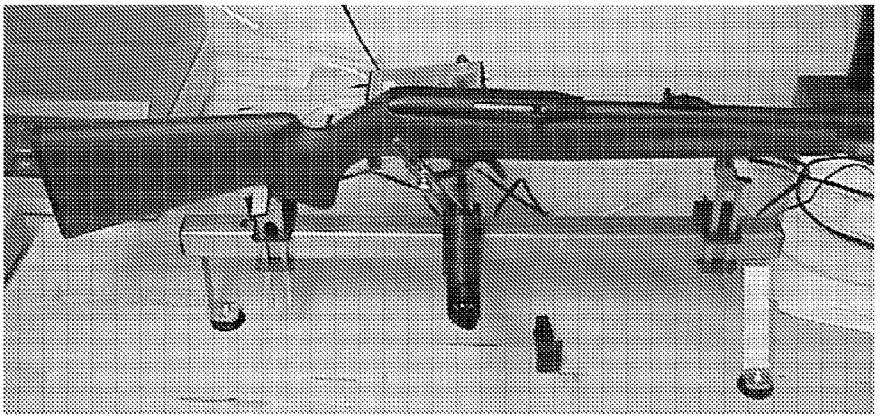

**Figure 4. TriggerScan unit in operation.**

Each of the five fire controls was tested in Mayfield using their spring scale. In these tests, each of the units was measured five times.

In Elizabethtown, each of the same units were tested, this time using a different spring scale. Each of the fire controls was tested five times, in a random order, by each of three testers. The fire controls were then remounted and tested five more times by each of the three testers, in a different random order. Thus, a total of thirty pulls were performed for each fire control, in two sets of five pulls by each of three testers.

The same arrangement was used for the testing performed with the Chatillon force gauge: each fire control was tested five times, in a random order, by each of three testers. The equipment was then set up again and the fire controls were tested five more times, in a random order, by each of three different testers.

The testing in the TriggerScan unit was performed by only one tester. The five controls were mounted and tested in a random order, with five readings taken from each one. The rest that the gun was used in was then disassembled and set up again. Then, five more readings were taken from each of the fire controls, and they were again tested in a random order.

A second set of testing using the Chatillon gauge was performed in order to test whether clamping the action in a vise had any effect on the trigger pull. In this test, ten pulls were taken for each fire control, in order, by only one tester.

| *Test Method* | *Number of Testers* | *Total Number of Tests per Fire Control* |
|---|---|---|
| *Mayfield Spring Gauge* | 1 | 5 |
| *Elizabethtown Spring Gauge* | 3 | 30 |
| *Chatillon Gauge* | 3 | 30 |
| *TriggerScan unit* | 1 | 10 |
| *Chatillon Gauge, out of gun* | 1 | 10 |

**Table 1. Summary of tests performed.**





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*RESULTS*

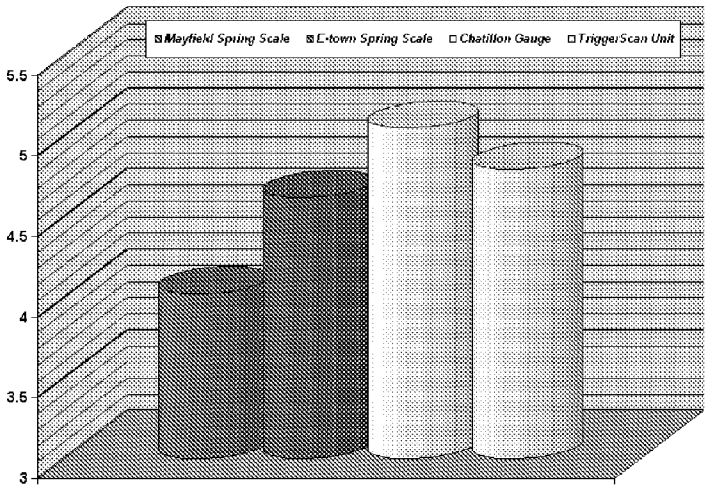


**Figure 5. Average trigger pull by method.**

Figure 5 contains the average trigger pull measured by each of the three methods, with separate columns for trigger pulls measured using the spring scale at Mayfield and Elizabethtown. Table 2 contains the values measured for trigger pulls.

| | Fire Control Number | | | | | |
|---|---|---|---|---|---|---|
| | *1* | *2* | *3* | *4* | *5* | *Average* |
| **Mayfield Spring Scale** | 4.050 | 3.900 | 4.000 | 3.900 | 4.250 | 4.020 |
| **Elizabethtown Spring Scale** | 4.425 | 4.633 | 4.692 | 4.308 | 5.025 | 4.617 |
| **Chatillon** | 5.104 | 5.089 | 4.969 | 4.682 | 5.395 | 5.048 |
| **TriggerScan** | 4.887 | 4.561 | 4.883 | 4.407 | 5.207 | 4.789 |
| **Chatillon out of gun** | 4.950 | 5.080 | 4.942 | 4.555 | 5.356 | 4.976 |

**Table 2. Average trigger pulls (in pounds) for each fire control listed by measuring technique.**

**Spring Scale.** Figures 6 and 7 show the average spring scale pull forces per group. The black whiskers on each graph show the 95% confidence interval for the location of the





 

mean. The spring scale was found to be heavily dependant on operator technique. This is fairly clear from Figure 6, where the pulls performed by Tester 2 may be seen to average 0.22 pounds higher than the trigger pulls measured by the other two testers.

The trigger pulls measurements performed at Mayfield averaged 0.60 pounds lighter than the average of the Elizabethtown spring scale measurements. Some portion of this discrepancy was most likely due to differences in operator technique. Another possible factor is the calibration of the spring scales used, since different spring scales were used in Elizabethtown and Mayfield.

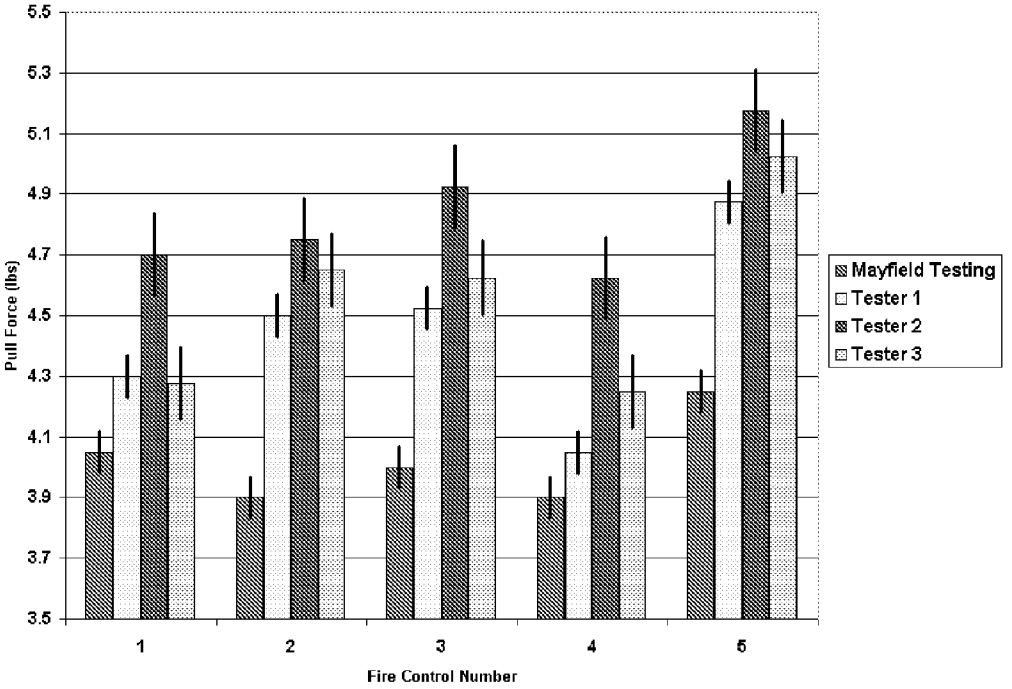


**Figure 6. Average spring scale trigger pull force.**

Figure 7 graphs the trigger pull measurements from the first set and second set of measurements by each tester, in order to show differences between the sets that might be attributable to setup. At the 95% confidence level, no statistically significant difference could be seen between the first five and the second five measurements taken from the Elizabethtown spring scale, indicating that either the spring scale is resistant to differences in setup or that the resolution of the spring scale (0.25 pound) is not fine enough to detect any difference.

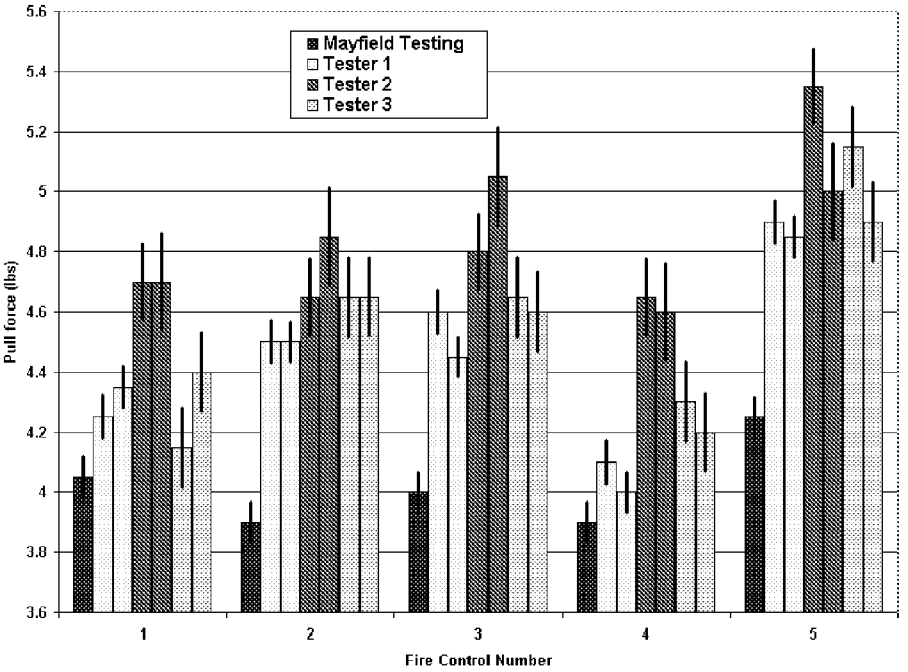


**Figure 7. Spring scale pull forces, by 5-pull group.**

### Chatillon Gauge and TriggerScan unit

Figures 8, 9, and 10 contain the results from the measurements taken with the Chatillon force gauge. Figure 8 contains the average pull force for each fire control and each tester. The dark line indicates the 95% confidence intervals for the mean of each column.

The Chatillon force gauge was sensitive to technique of the tester, but not as sensitive as the spring scale. Pulls measured by Tester 2 averaged 0.11 pounds lighter than those taken by Tester 1 or 3. This difference was found to be statistically significant at the 95% confidence level.

The trigger pulls measured using TriggerScan unit averaged 0.259 pounds less than the average of the trigger pulls measured with the Chatillon electronic force gauge.





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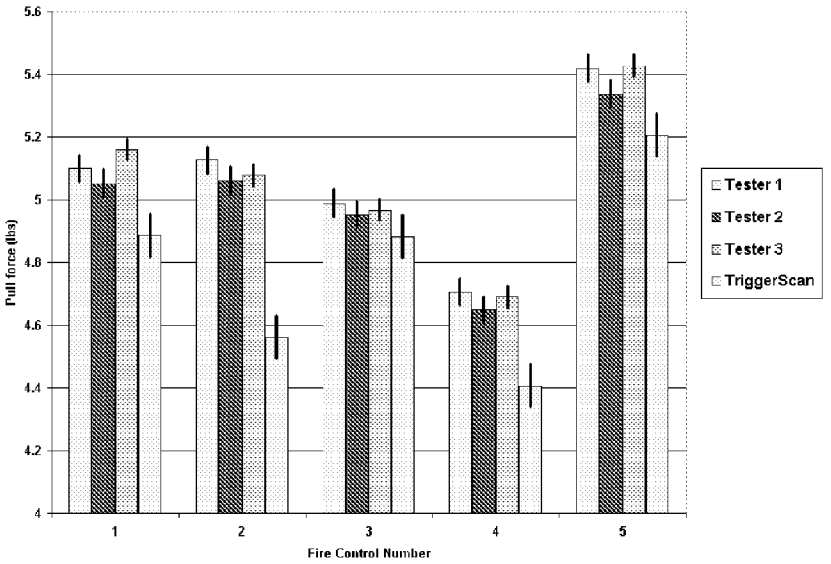


**Figure 8. Average pull force for Chatillon gauge and TriggerScan unit.**

Figure 9 contains the results of the first and second groups of trigger pull measurement taken by each tester. The second set of five pulls was found to average 0.037 pounds less than the first set. This difference was found to be statistically significant at the 95% confidence level, showing a tendency for the Chatillon unit to be affected by setup.

The TriggerScan unit was found to be affected more greatly by setup. Trigger pulls taken in the second set averaged 0.17 pounds lighter than those taken in the first set.

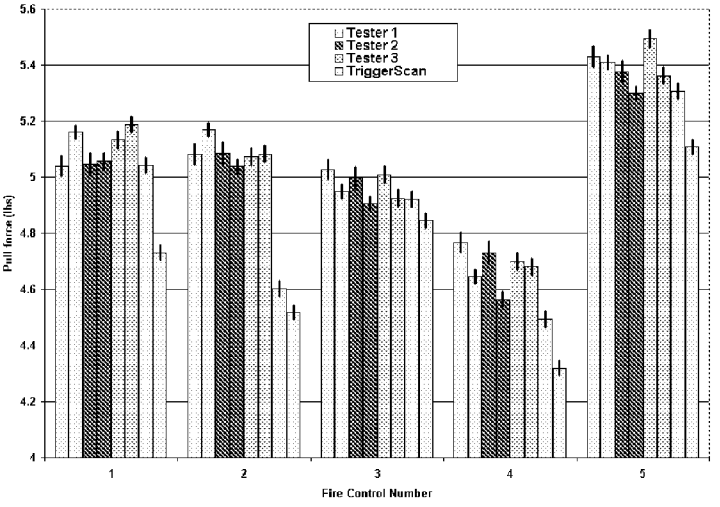


**Figure 9. Trigger Pull forces for Chatillon and TriggerScan, broken into 5-pull groups.**





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Figure 10 is a histogram showing the distribution of trigger pulls measured using the Chatillon force gauge. A normal distribution of trigger pulls may be seen.

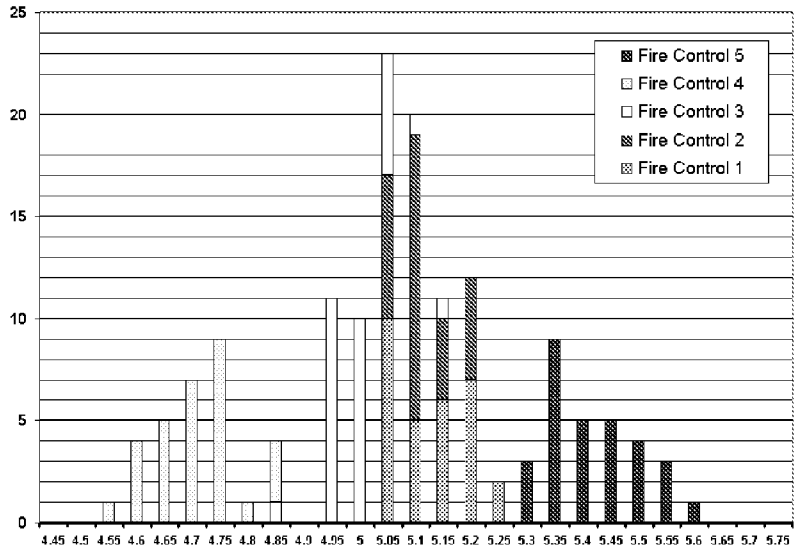


**Figure 6. Histogram of Chatillon force gauge readings.**

The Chatillon gauge was used to take a set of trigger pull measurements with the fire control not mounted in a barrel action. This was done to see if measuring the trigger pulls with the fire controls mounted in barreled actions affected the trigger pull measurements. The second set averaged 0.034 pounds lighter, a difference that was (at the 95% confidence level) statistically significant. However, this difference is slight, and may be attributed to variances in setup, since the Chatillon force gauge shown in Figure 9 revealed an average 0.037 difference in trigger pull after setup.





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