HIPERFIRE® Trigger Families

Trigger Pull Energy and Creep

Introduction

We began our examination of HIPERFIRE trigger data in HIPERTECH Bulletin #3. We compare HIPERTOUCH®, and ENHANCED DUTY TRIGGER® (EDT®) product families to MIL-type and many popular after-market trigger upgrades for the AR15/AR10 rifle platform based on their trigger pull scans of force versus displacement.

In this HIPERTECH bulletin, we are going to begin massaging the data presented in Bulletin #3 to better understand why some triggers feel better than others. The perception is that triggers that feel better are better; we put that premise to the test later in our series. For now, we make a simple calculation that derives the energy exerted by the shooter when he pulls the trigger. Creep, or the amount of trigger displacement, is part of this calculation. We show that creep per se is not the enemy of good trigger design or operation. When we are done making the calculations, we compare the triggers by this new metric.

We hope that you find this as exciting and as enlightening as we did. Let's get to it.

The information provided is accurate to the best of HIPERFIRE's knowledge. Any experimental data presented has been collected and analyzed using commercially available test instruments, software, and products, subject to the application of the scientific method and engineering knowhow, so that anyone familiar with the art could reproduce and verify the results. The interpretation of that data is not necessarily definitive, but of HIPERFIRE's considered opinion.

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Trigger Pull Energy and Creep

We can look at trigger pull weight and creep in a seldom-used way that can explain why different triggers and of different type can feel so differently, or the same, when their trigger scans are so different. This way is called energy, or work, is the exertion by the shooter to cause the trigger to break and the hammer to fall. The TriggerScan™ instrument data permits us to calculate pull energy. We explain how that calculation and why it's essential to this discussion.

See Figure 1, where the location of trigger break in the MIL-spec semi-auto trigger scan occurs. At that location, the trigger pull force drops precipitously at the end of creep, where the sears are no longer in contact. We discuss the further displacement of the trigger, call over-travel, in a future HIPERTECH.

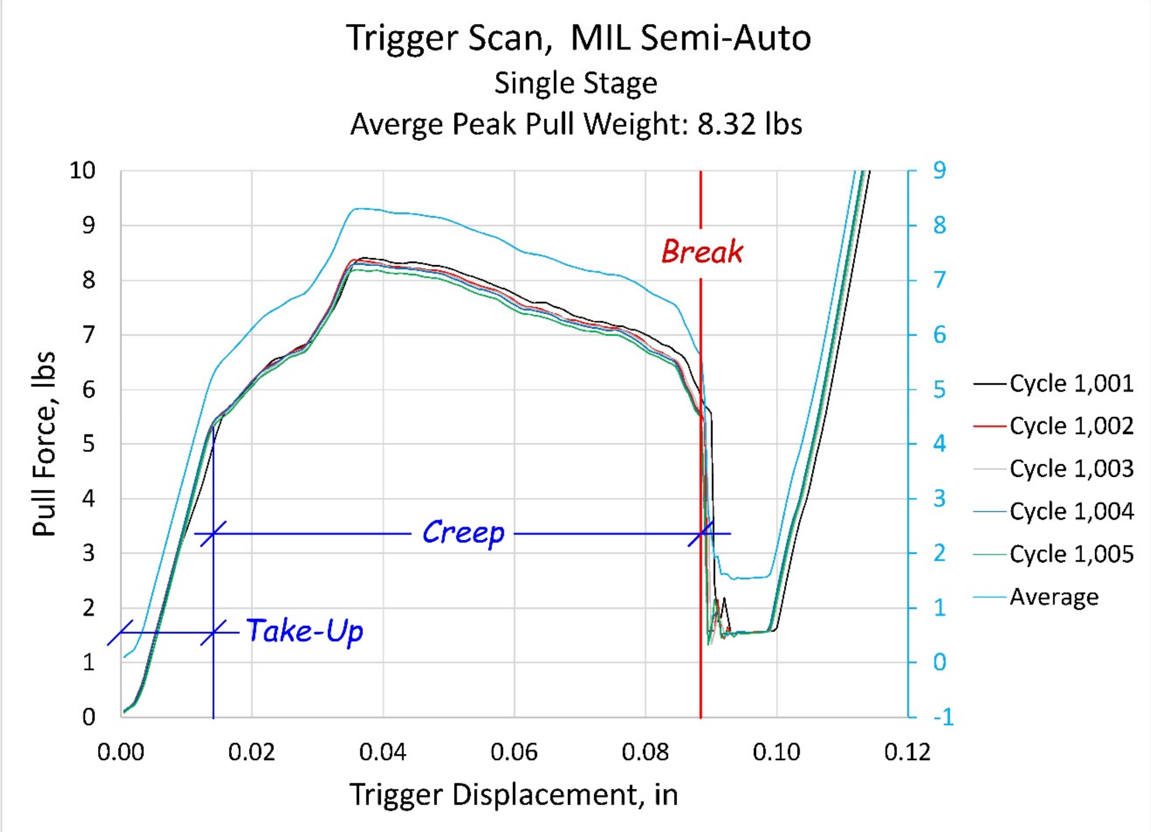

Figure 1. Chart defining wherein the trigger scan trigger break occurs — measurement data collected by TriggerScan™.

Work is what we do when we pull a trigger. It is a quantifiable engineering term for measuring the amount of energy generated or consumed in physical systems, like the shooter and trigger. The amount of force (in our case, let's choose the British Imperial System's (BIS) pound-force) used over some distance in units of inches equals the energy. We could use any measurement system as long as we are consistent, but we use BIS here for familiarity. Those units of force and distance are used to chart the trigger scan data. So, the work or energy of pulling the trigger to break is simply the area under the curve from zero displacement to break. See Figure 2, where we show the breakdown of that area into a series of data points and rectangular bars, then calculate the individual bar areas and add them all up.

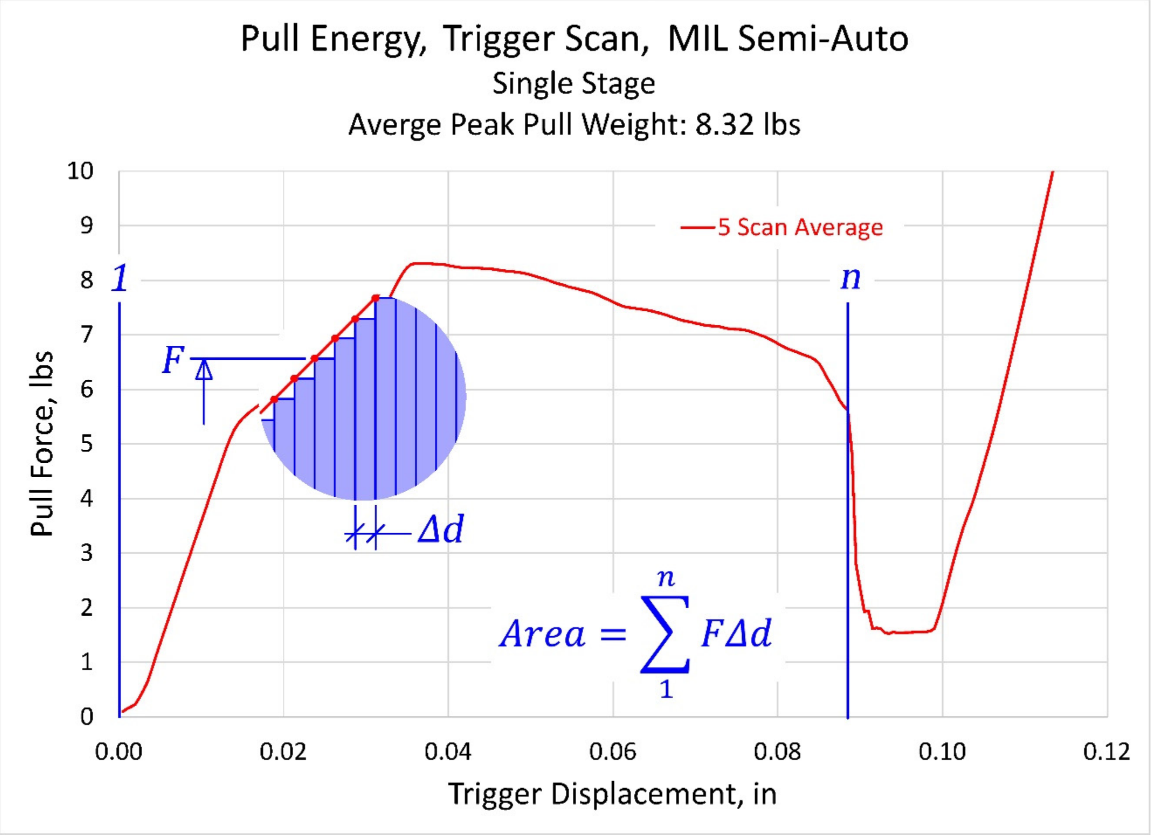

Figure 2. Summing the areas associated with each sequential pair of data points up to trigger break equals the "area under the curve."

Figures 3-8 follow and show examples of what the area under the curve looks like for various triggers and the calculated values for work.

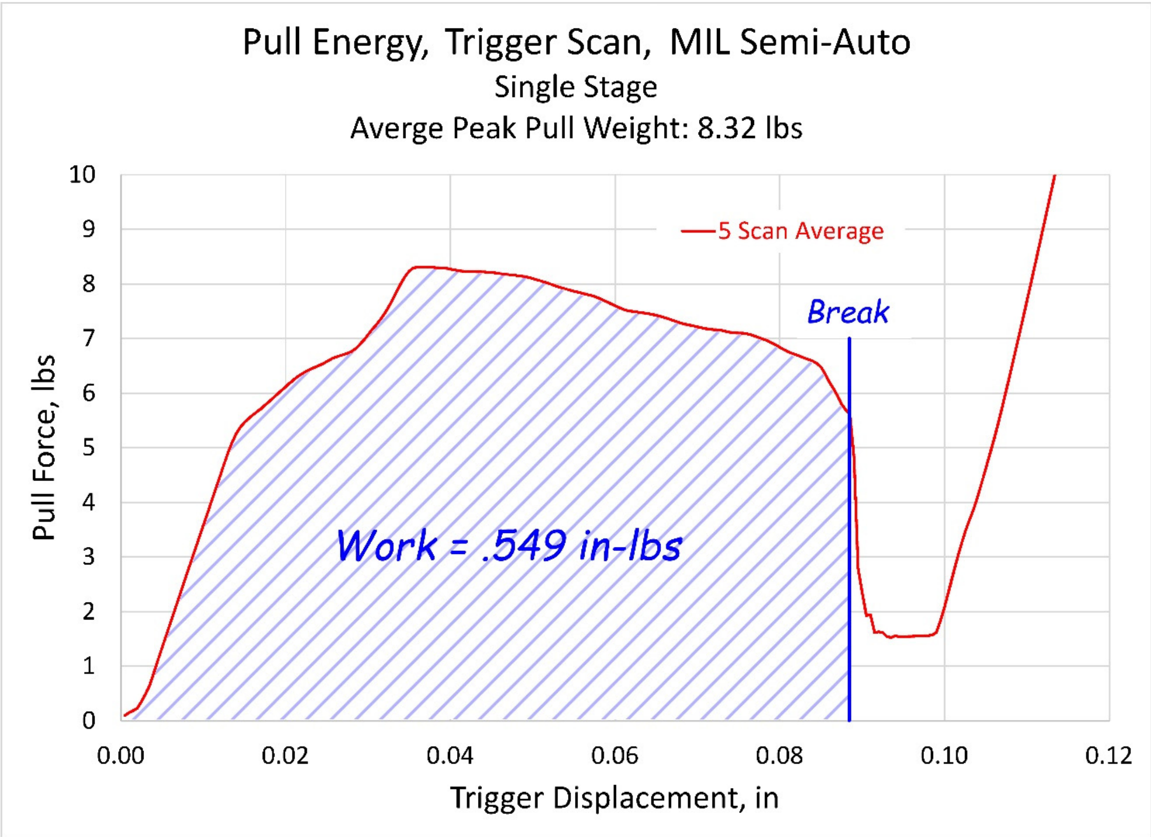

Figure 3. Chart showing the area under the curve up to trigger break, or the work that must be done (energy expended) to cause trigger break and hammer release of the MIL-spec semi-auto trigger.

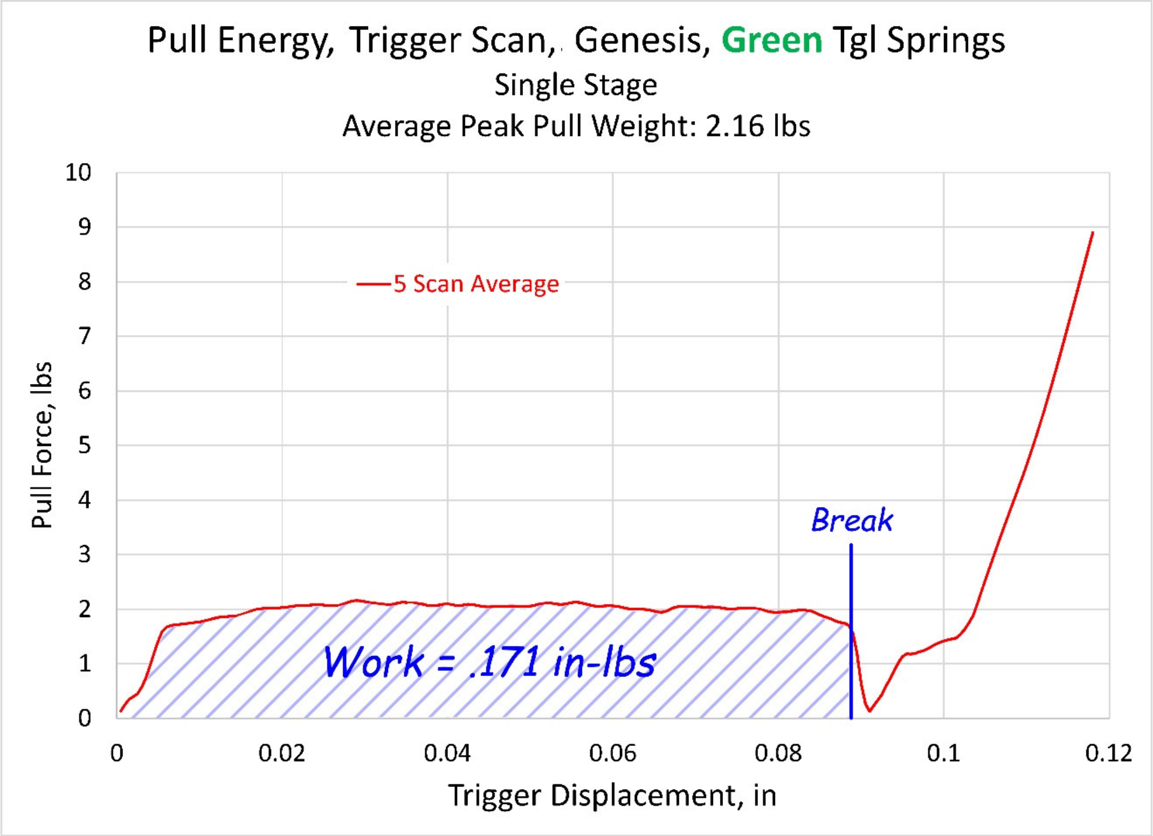

Figure 4. Chart showing the area under the curve up to trigger break, or the work or energy expended to cause trigger break and hammer release of the HIPERTOUCH Genesis trigger with the COTE Green toggle springs installed.

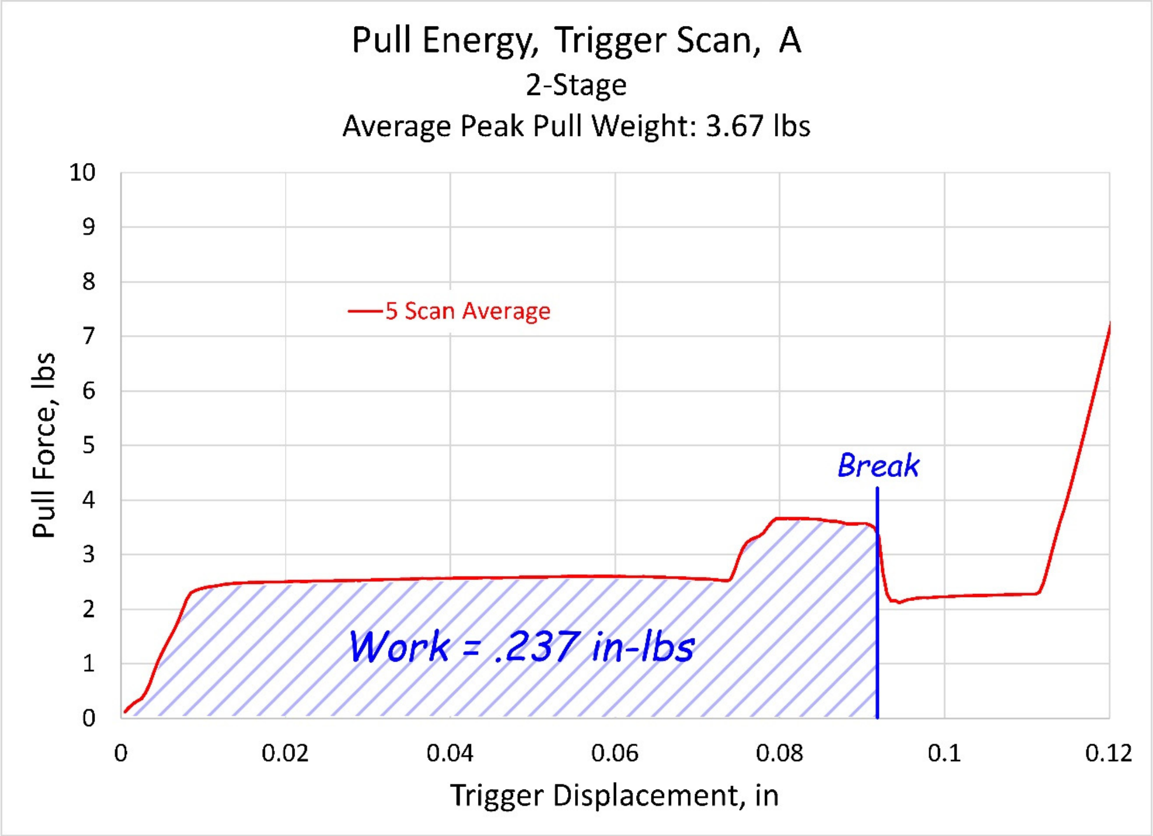

Figure 5. Chart showing the area under the curve up to trigger break for the "A" 2-stage trigger, or the work done (energy expended) to cause trigger break and hammer release.

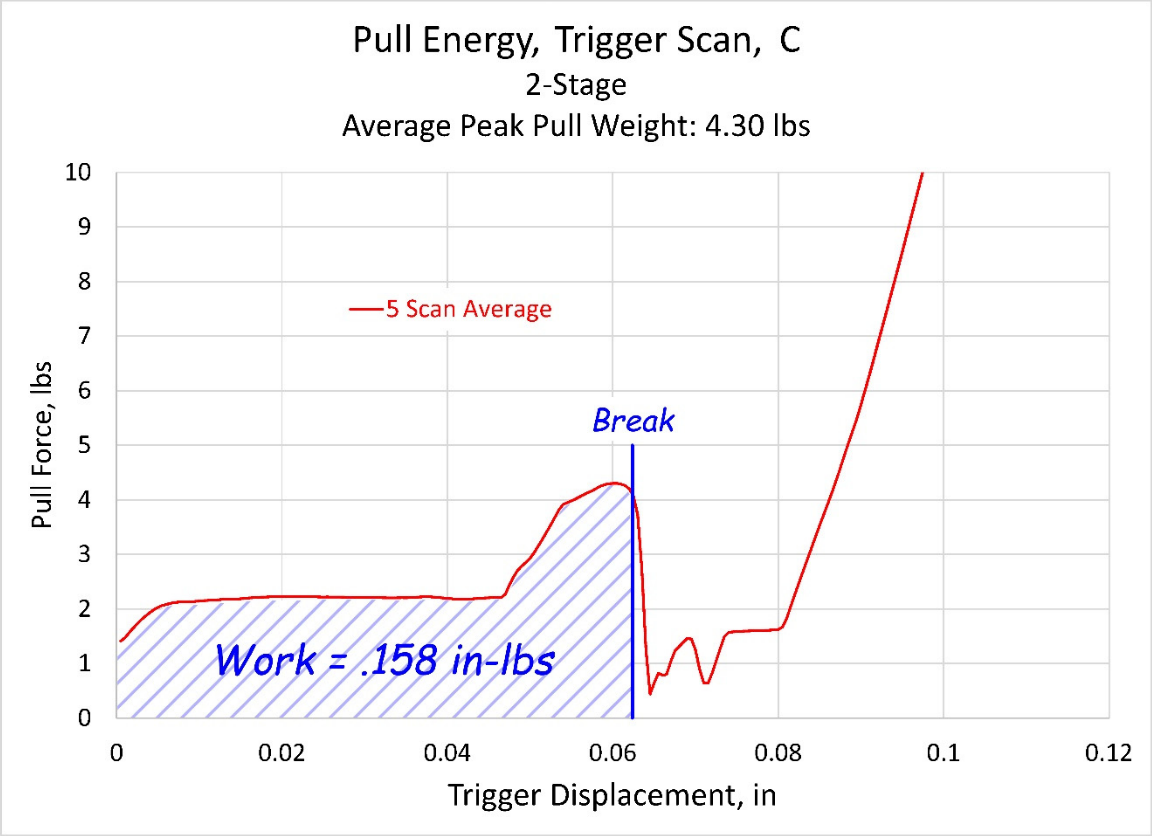

Figure 6. Chart showing the area under the curve up to trigger break for the "C" 2-stage trigger, or the work done (energy expended) to cause trigger break and hammer release.

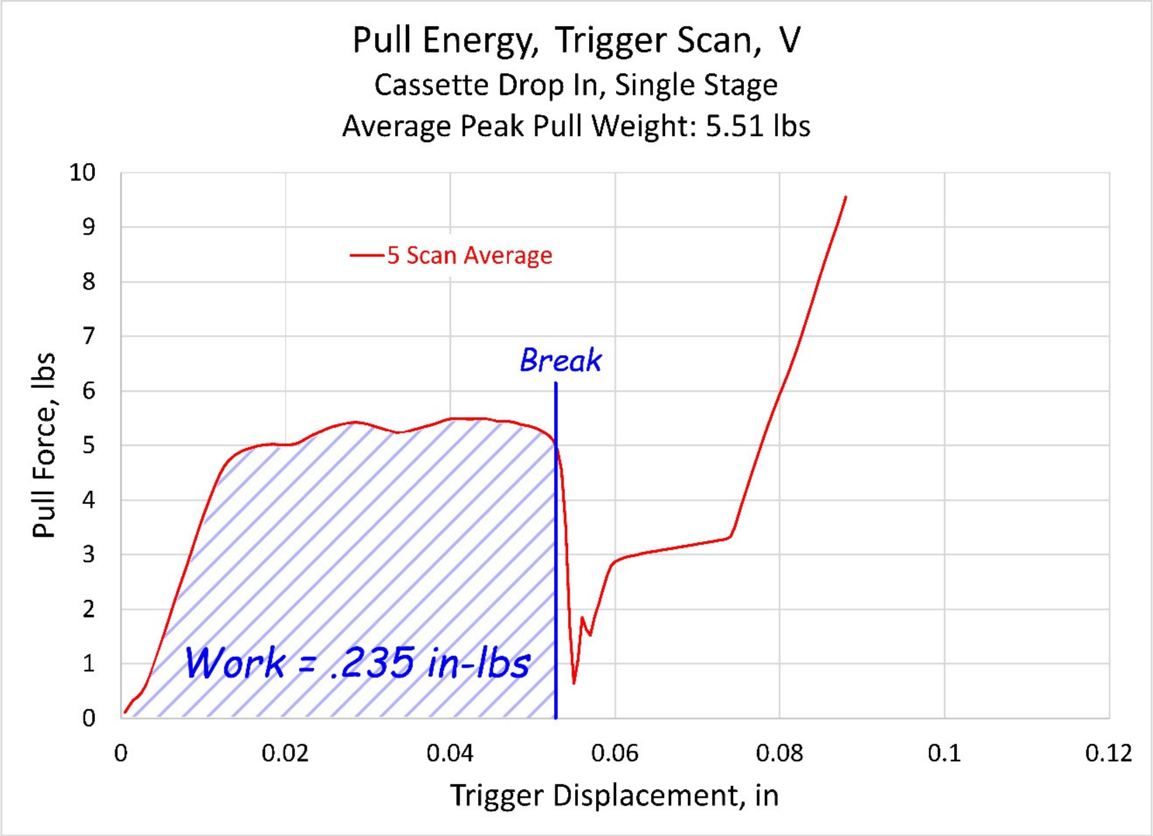

Figure 7. Chart showing the area under the curve up to trigger break for the "V" single-stage cassette drop-in trigger, or the work done (energy expended) to cause trigger break and hammer release.

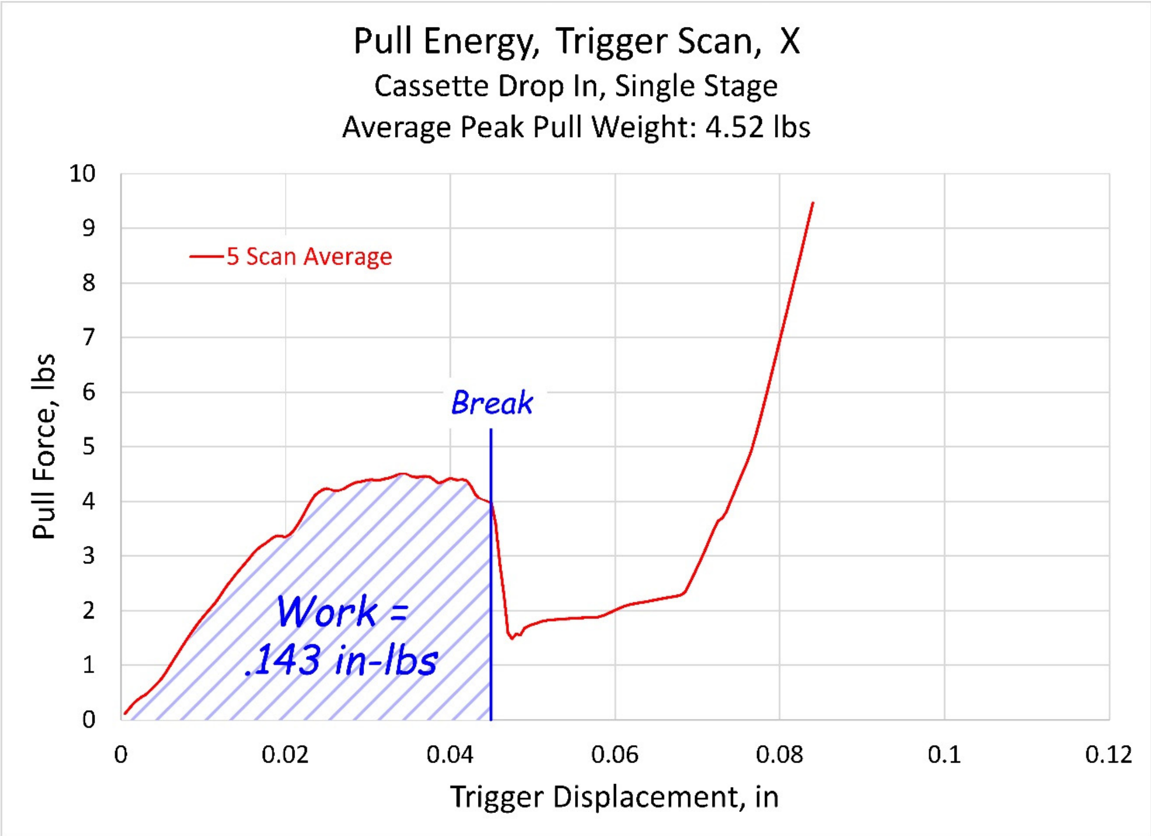

Figure 8. Chart showing the area under the curve up to trigger break for the "X" single-stage cassette drop-in trigger, or the work done (energy expended) to cause trigger break and hammer release.

You can see that the energies among the examples shown in Figures 4-8 are more similar than what either pull weight or creep alone might indicate. The prevailing bias among the market place's more discriminating buyer is that trigger weight alone tells us all we need to know, or that creep, any creep is bad, or that low weight and reduced creep is always best. How much of that bias depends on personal preference? Or, do we as human beings tend to have one over-riding perception of what feels right? In other words, how does ergonomics, i.e., human engineering, play into what makes a trigger feel good, or be good. We're still working on the answers to those questions by these continuing analyses.

We stated in HIPERTECH #2 that we were not going to judge the creep good or bad in that writing. Here, we begin to qualify creep by including it in the

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energy calculation. We make its influence implicit rather than explicit because we think that creep taken alone by too many shooters, plays a disproportionately greater and distorting role in trigger assessment than it ought.

In Figures 9-11, we compare HIPERFIRE's trigger pull energies to other triggers within the same groups like MIL-type single-stage, 2-stage, and cassette drop-ins as done in HIPERTECH #3, because this analysis also depends on TriggerScan scans of these triggers.

The values shown plotted are not the explicit pull energy values of each trigger, as exampled in Figures 3-8. Instead, what's plotted are those values relative to the MIL-spec sample's values. So, we calculate the average energy for the two MIL-spec triggers, one being semi-auto, the other being full-auto. This average became the baseline for comparing all the triggers. Compared to this baseline average, we calculate a percent difference from the MIL-spec average for each trigger. This "normalized" the others' results to the baseline. The plots displayed in Figures 9-11 describe this difference as a percent. So, triggers with negative, or minus values, plotted below the baseline of 0% are triggers with less than MIL-spec energy by that percent amount, higher values contra wise. Negative values indicate better or easier to pull triggers. In other words, "less is more."

Figure 9 below shows that the EDTs pull with less effort than any of the triggers except "G" with about half as much energy as MI-spec using either the Green or Red hammer springs. We discuss what makes "G" unique and perhaps "better" in future HIPERTECH articles. Again, the energy comparison approach discounts the solo importance of weight or creep in the trigger, because the energy term includes them both.

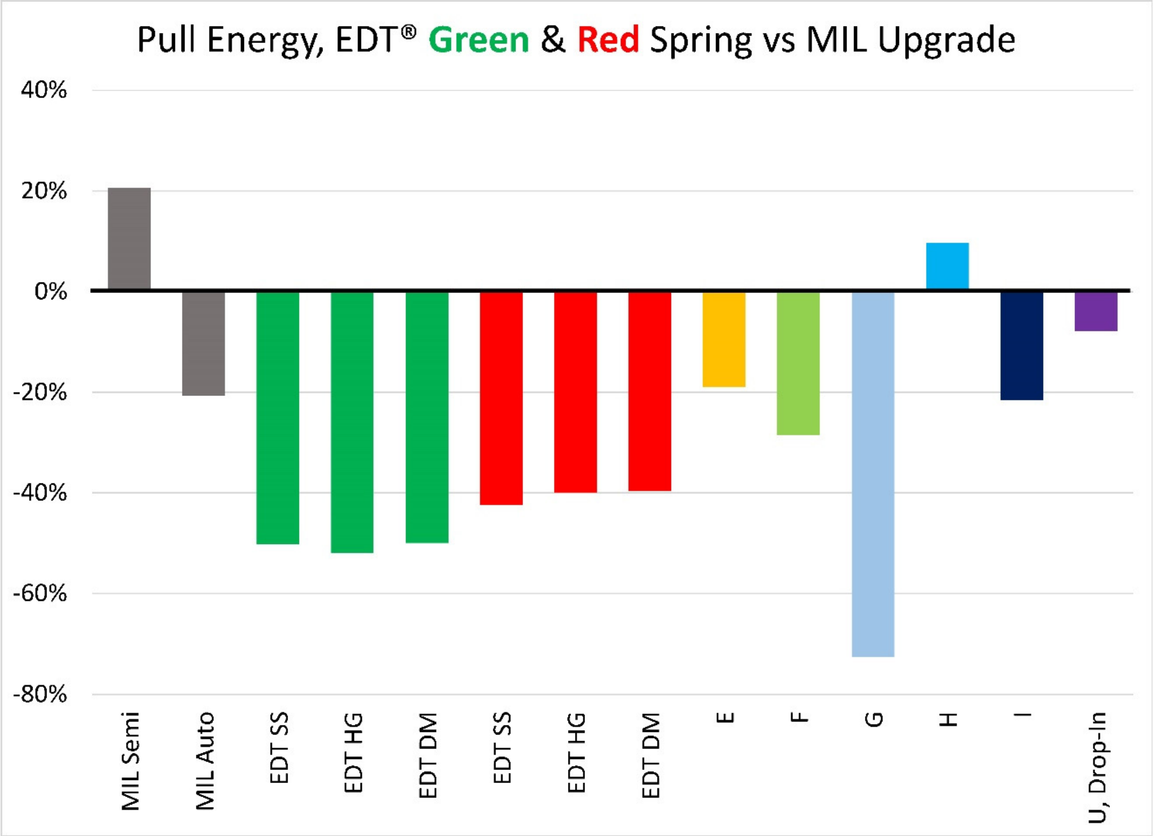

Figure 9. Chart comparing EDTs with green (green bars) and red (red bars) hammer springs to single-stage MIL type triggers based on pull energy to trigger break.

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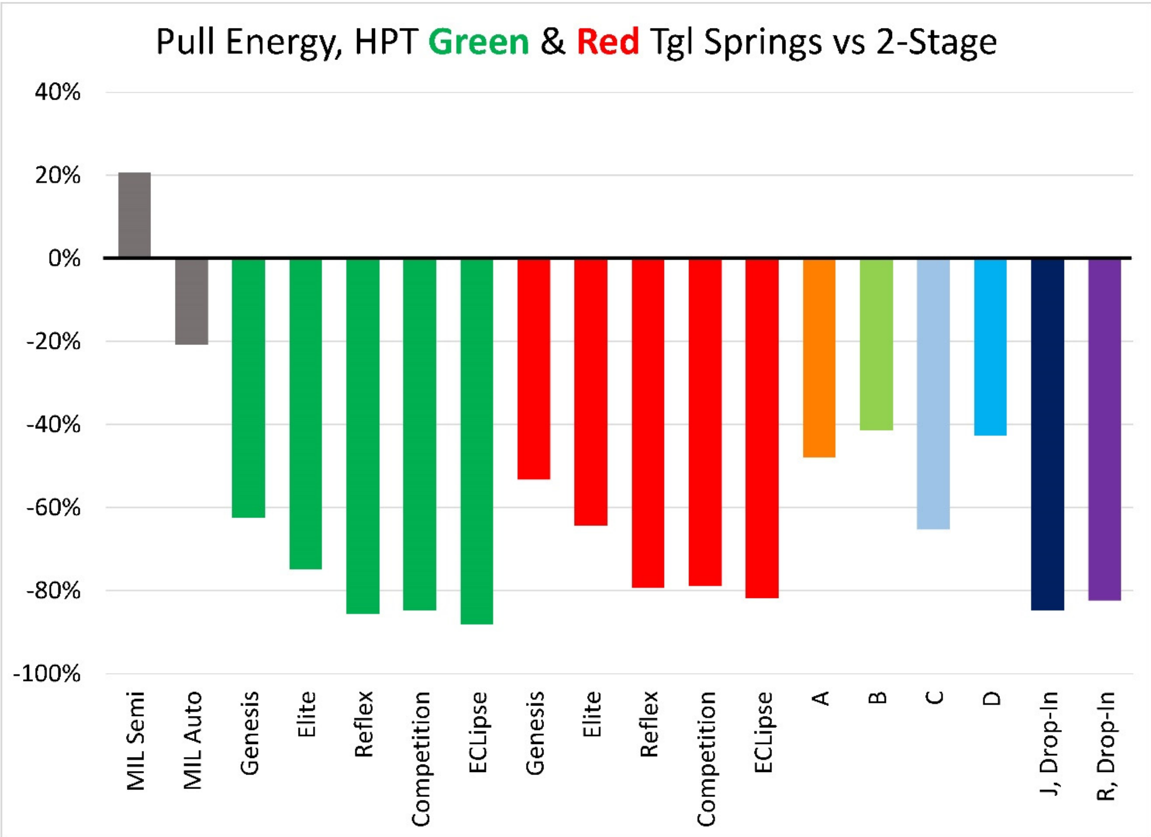

Figure 10. Chart comparing HIPERTOUCH triggers with green (green bars) and red (red bars) toggle springs to 2-stage type triggers based on pull energy to trigger break.

Figure 10 compares the HIPERTOUCH triggers to 2-stage triggers. It should be no surprise that HIPERTOUCH has significantly reduced energies compared to the EDTs and, most notably, the MIL-type triggers due to their lower pull weights.

It should also not surprise us that the 2-stage component-install triggers' pull energies are less than the MIL-spec baseline due to their very low 1st stage pull weights even though their shorter 2nd stage is of slightly higher weight. These triggers consume more energy during pull to trigger break because over-all, they exhibit more total creep. We see that the two drop-in type 2-stage trig-gers exhibit energies on par with the HIPERTOUCH because they exhibit much less total creep compared to the component-install versions. As with the “G” trigger above, we devote more attention to what makes them different in later HIPERTECHs.

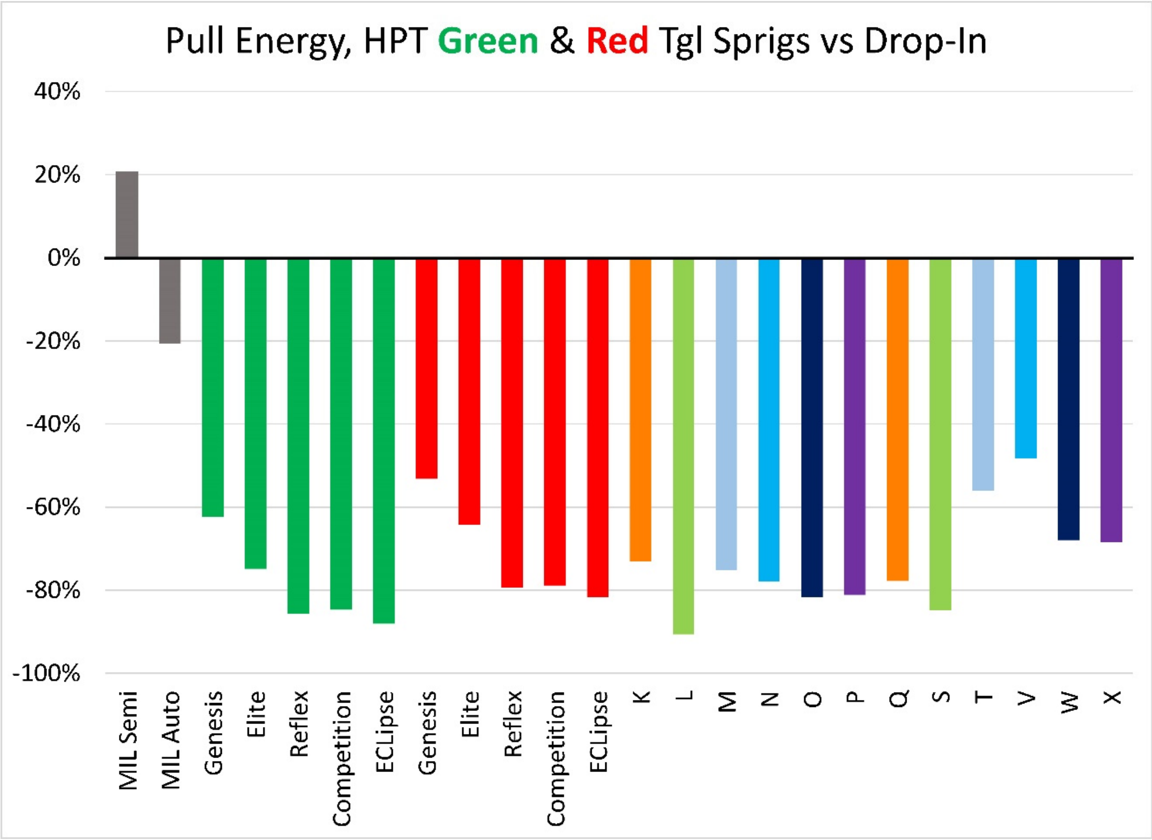

Figure 11. Chart comparing HIPERTOUCH triggers with green (green bars) and red (red bars) toggle springs to 2-stage type triggers based on pull energy to trigger break.

Figure 11 would indicate that based on pull energy alone, the single-stage cassette drop-in triggers are as "good" as the HIPERTOUCH, i.e., they consume low amounts of energy to pull compared to Mil-spec and "better" than their 2-stage counterparts. They accomplish this by reducing weight and creep compared to MIL-spec, not by having a "perceived" grater precision, as pointed out in HIPERTECH #3. Employment of a single-stage pull is a significant factor in reducing creep overall, and their reduced energy values.

Conclusion

HIPERFIRE triggers demonstrated substantial improvement in pull energy compared to MIL-spec, which was the goal we set for ourselves when designing our triggers first for the semi-auto 50-cal. rifle, then the AR15/10 platform. What we wanted was low pull weight with reduced creep; we got it. The other triggers in the groups we measured also fared well compared to MIL-spec with more or less comparable energies to HIPERFIRE's. Overall, based on the trigger pull energy metric, the marketplace's desires have been satisfied with the offerings.

So, we are not surprised by the energy numbers. Their "good" perception in the marketplace is a positive reflection of this data. However, it seems to have blurred the perceived distinctions between them by putting a cloud over what reviewers have said, or advertising has claimed regarding weight or creep independently. Whether one or more triggers are "better" than the others are yet to be determined. That's what we want to know; "On what basis should we choose any trigger over another?"

We evaluated and laid the significant groundwork in our investigative journey into the science of trigger pull; we are getting closer. We have a new combination of these factors to consider in HIPERTECH Bulletin #5. With it, we reward your patience and attention; stay tuned.

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Appendix A Green Means Column Feature Criteria Satisfied

AR15/AR10 Trigger	Single-Stage	2-Stage	Drop-In Single-Stage	Cam-Over Toggle Engine	Radical Sear Mechanics	Pull Weight Less Than 4lb	Creep Less Than .05"	Pull Energy Less Than -50%
HIPERTECH Bulletin				1	2	3		4
MIL-SPEC Semi-Auto								
MIL-SPEC Full-Suto								
EDT Sharp Shooter								
EDT Heavy Gunner								
EDT Designated Marksman								
HIPERTOUCH Genesis								
HIPERTOUCH Elite								
HIPERTOUCH Reflex								
HIPERTOUCH Competition								
HIPERTOUCH Eclipse								
A								
B								
C								
D								
E								
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