HIPERTECH™ #3

BULLETIN

HIPERFIRE® Trigger Families

Trigger Pull Weight and Creep

Introduction

We continue our examination of HIPERFIRE triggers represented by the HIPERTOUCH® and ENHANCED DUTY TRIGGER® (EDT®) product families by comparing their pull weight data to many popular and quality trigger upgrades for the AR15/10 rifle platform. The AR15 is today's Modern Sporting Rifle (MSR), or you might say, today's flintlock because it's Everyman's rifle.

In HIPERTECH Bulletin #2, we brought up the subject of trigger creep, emphasizing that we were not going to judge whether it was good or bad in a trigger for the time being. We defined its technical meaning as one metal surface sliding over another, as between trigger and hammer sears. Now is the time to begin making qualified observations about creep in general as it relates to trigger pull weight. We also stated in Bulletin #2 that we could make aspects of creep our friend, like friction. To understand this, we will dive in and take a closer look at how weight affects our perception of creep, i.e., how it feels, and whether the weight metric by itself is the best criterion for making that judgment.

Manufacturers of triggers like to eliminate creep from the conversation because of the adverse connotations associated with its mention around their products (guilt by association). HIPERFIRE takes a different approach by supplying "feel" signals that accentuate the positive aspects of creep, recognizing that elimination of creep per se is the wrong approach. Instead, we should be searching for that trigger experience that our trigger finger wants to feel, what our minds want to tell us, is intimately responsive and pleasurable.

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 Weight and Creep

Let's begin by generally describing the data collected for our analyses. Later, we will make qualified comments on the data, its limitations, and what it means.

Figure 1 below shows a trigger scan of a so-called MIL-spec semi-auto trigger for the AR15/10. It is of single-stage design, meaning it exhibits one continuously narrow pull weight range over its entire displacement up to trigger break and hammer fall. We can consider this trigger our baseline for comparing other triggers since most readers are probably all too familiar with its performance, or lack thereof. The scan was made using Dvorak Instruments' TriggerScan™ device. A picture of the device with the test rifle and trigger installed is shown further below in Figure 2. The rifle trigger test point was the same for all of the trigger data that was collected and reported here.

The trigger scan lines indicate the pull weight of the trigger as a function of trigger displacement. The chart's vertical axis scale shows the force or weight that the device must exert on the trigger bow to displace it some distance in inches, indicated by the chart's horizontal axis scale. The chart shows five separate scans of the same trigger. Those five scans were averaged and plotted as a single line offset from the five by plotting it against the other color-coded vertical scale on the right side of the chart. The maximum pull weight for the averaged scans is part of the chart's title.

Every trigger tested and reported on was first cycled 1,000 times through hammer cocking, hammer reset, and hammer fall to break-in its springs, the finish, and sears. Figure 3 shows the cycling mechanism. Each trigger was scanned five times to more fully characterize its pull weight and creep to assess its consistency better, and that of TriggerScan for the data is only as good as the instrument used to collect it.

Figure 1 also contains two scan labels that will be useful to us later when comparing one trigger's creep to another. The first portion of the scan is labeled "Take-Up," where the initial pull weight starts at zero and quickly rises in a more or less straight line to some change from that line. During this segment of pull, the clearance gaps found between the fire-controls' pivot holes and pins, or anywhere else, are closing. After that completes, the fire-control components now begin to move against one another (creep), and the springs start flexing. Now the real creep begins; the trigger sear begins sliding along the hammer's sear. Creep ends when the trigger breaks, releasing the hammer, and it begins to fall.

Most people would feel the initial take-up only as part of the total creep when the trigger moves with a build-up of force.

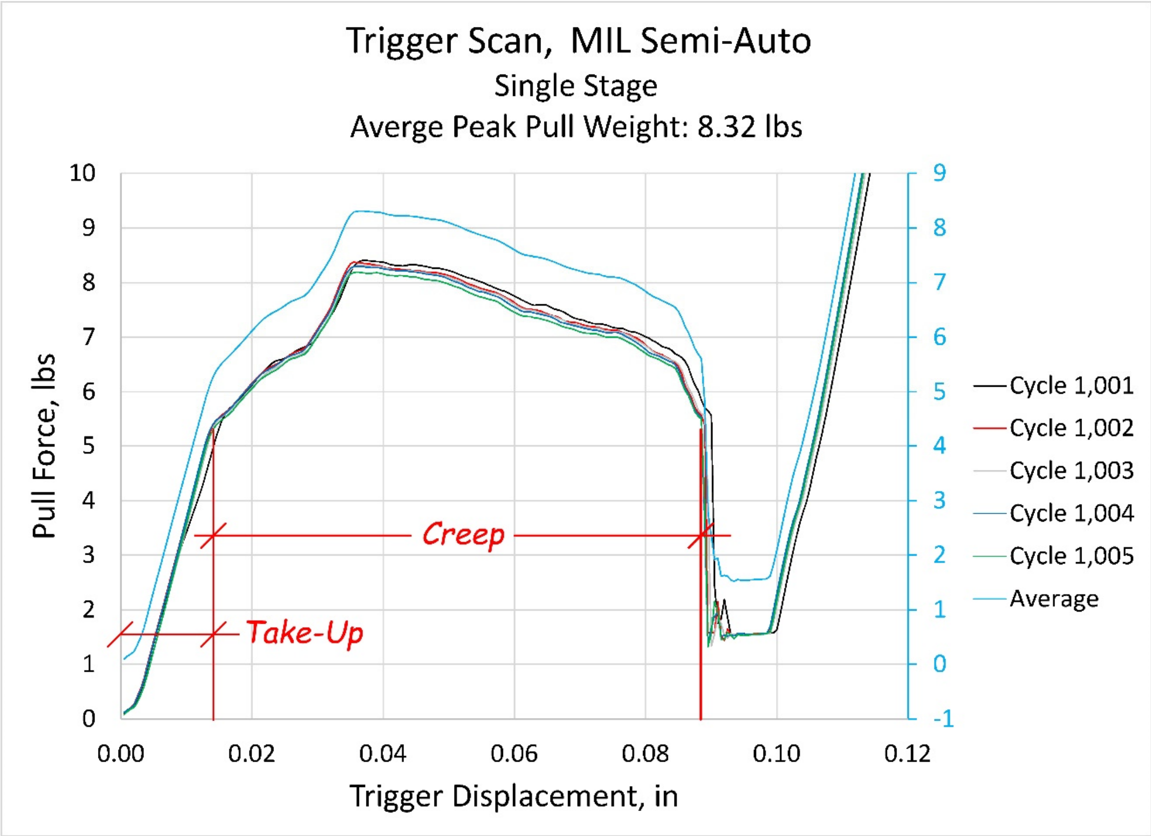

Figure 1. Chart showing a semi-auto MIL-spec trigger's pull weight dependence on trigger bow displacement at 1,001-1,005 hammer cock and release cycles — measurement data collected by TriggerScan™.

Figure 2 shows a detail of the TriggerScan device that requires an explanation. The TriggerScan is fixtured for measuring the pull weight profiles of handguns and long guns. The TriggerScan lacked rigidity after some initial test measurements on the AR15. Movement of the rifle in the fixture led to feedback into the scans themselves, producing inaccurate measurement data that could not be isolated to the displacement of the trigger bow alone. So, HIPERFIRE added some Delrin® blocks to stiffen its weak points. After this modification, the data became much cleaner and more repeatable from scan to scan of the same trigger.

Figure 2. The TriggerScan device shown in the picture has been stiffened by blocks to stabilize the rifle holding platform to eliminate extraneous movements that could be picked up by the TriggerScan force/displacement sensor.

The picture of Figure 3 shows HIPERFIRE's fire-control cycler. A motor drives a pair of timing belted shafts. The shafts drive connected links that push and pull slides mounted to rails. These slides cock the hammer during trigger pull into overtravel, to let-off of the trigger to reset the hammer off of the semi-auto disconnector, to engage the primary sears. Finally, pull the trigger to break and drop of the hammer onto a rubber bumper. The bumper replaced a real firing pin that we became terrific a breaking every so often. The machine can put on 43,000 cycles in a 24-hour day, or almost 250,000 cycles a week. Over those many cycles, the dual-sided hammer torsion spring can often break on one side or the other. If the spring breaks on both sides, the hammer will cease to fall. When that happens, the cocked and stationary hammer will interrupt a photo switch's light path, after some short time, and turn OFF the AC power to the motor. When the motor stops, so does the mechanical cycle counter also showing in the picture. That way, we can know at what number of cycles the spring broke, among other things.

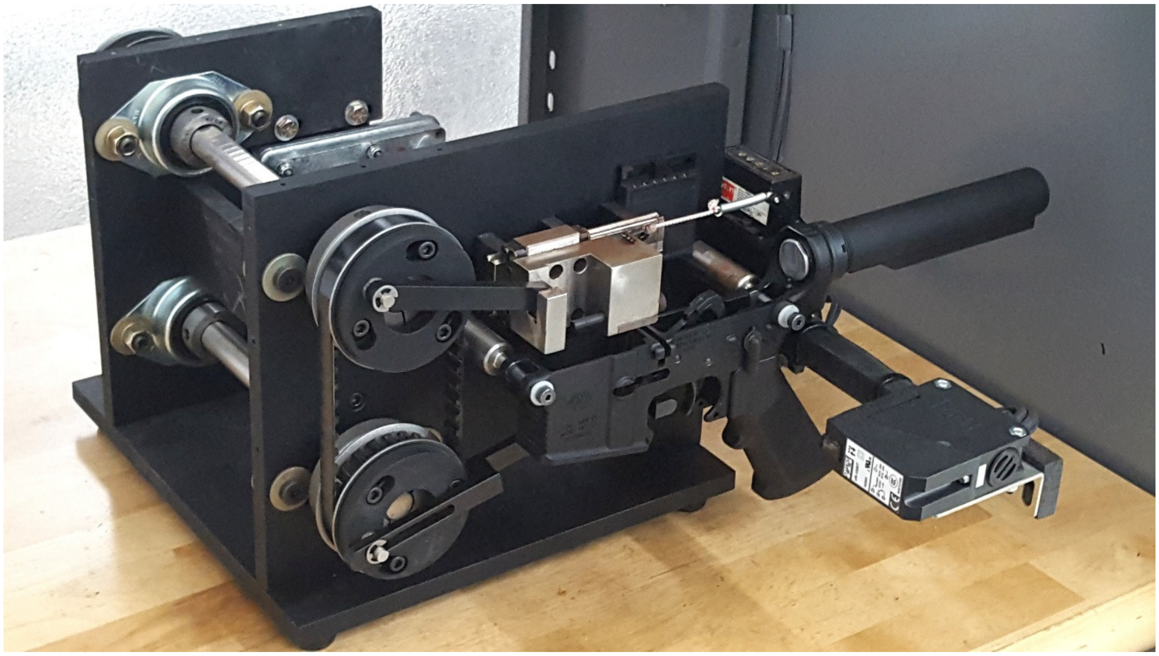

Figure 3. Here is HIPERFIRE's fire-control cycler. The motor-driven machine can cycle any AR15 trigger group through hammer cock and fall up to 43,000 cycles per day.

We've seen what a single-stage trigger scan looks like. Figure 4 shows the scan for a so-called 2-stage trigger. The 2-stage concept was developed to better manage the substantial creep of a MIL-grade trigger pull by both lowering weight overall and by allowing the shooter to prep his shot for improved accuracy. This chart also shows a short take-up portion, then a more extended so-called 1st stage take-up segment. When the shooter reaches the 2nd stage at the higher relative weight than the 1st, he has "hit the wall." His prep completes when he feels the higher weight. Pulling beyond this point through the 2nd stage, creep releases the hammer and the shot taken. Here is a case where terminology is chosen to minimize the pejorative connotation of creep. The so-called 1st stage take-up is only creep at a lower weight. Technically, creep is the entire 1st and 2nd stages, and as noted above, take-up is felt as being part of the total creep in any case. You can see that the total creep is slightly larger than the total creep of the semi-auto MIL-spec trigger of Figure 1. Again, is that bad? We're in the process of determining the best answer.

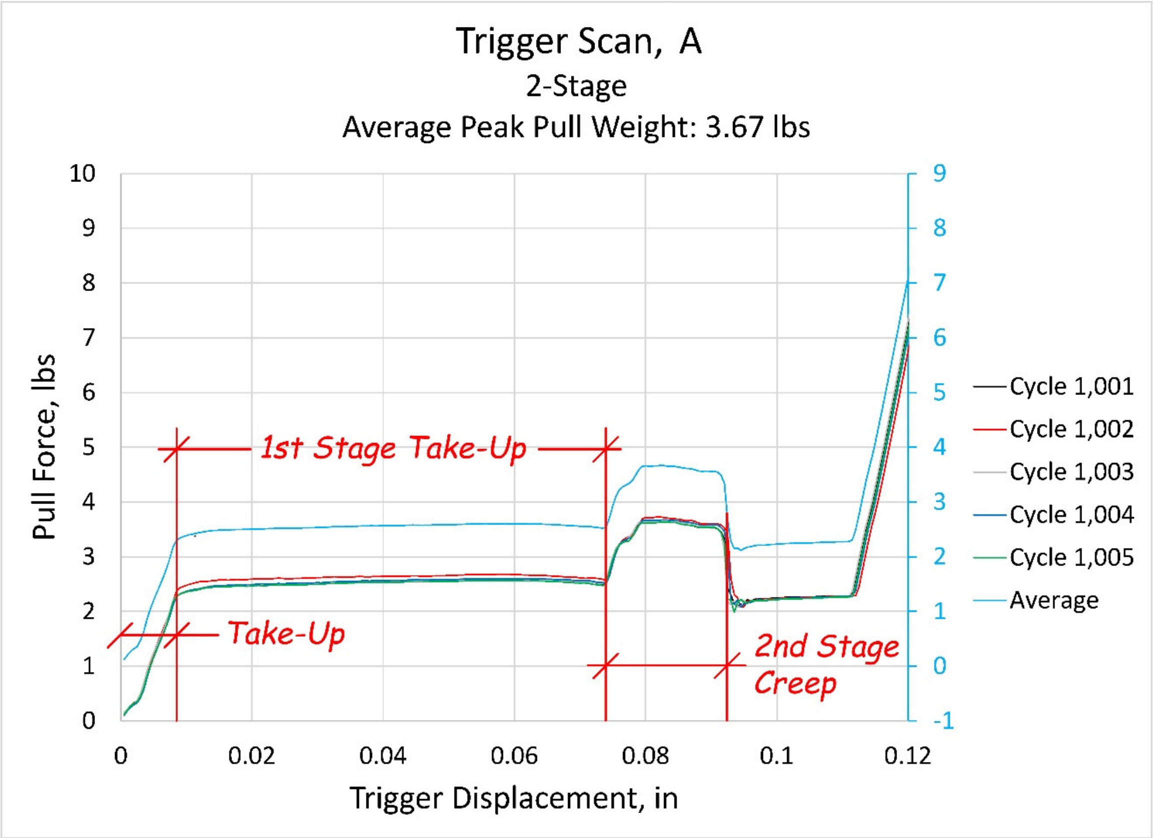

Figure 4. Trigger scan of a 2-stage trigger with trigger traverse segments labeled over the entire range of felt creep.

Let's do some more data collection. Figure 5 shows a genuinely MIL-spec fire-control, a full-auto specimen for the M4/16. Now that we have a better understanding of what creep looks like on the charts, we no longer need to apply labels. The selector was rotated to SEMI to collect measurements. In this setting, its weight should be in the neighborhood of the semi-auto MIL-spec specimen. If the selector were set to AUTO, the pull weight would be much higher, since the shooter must now also pull the trigger and against the semi-automatic disconnector spring as the full-auto disconnector is locked back by the safety-selector.

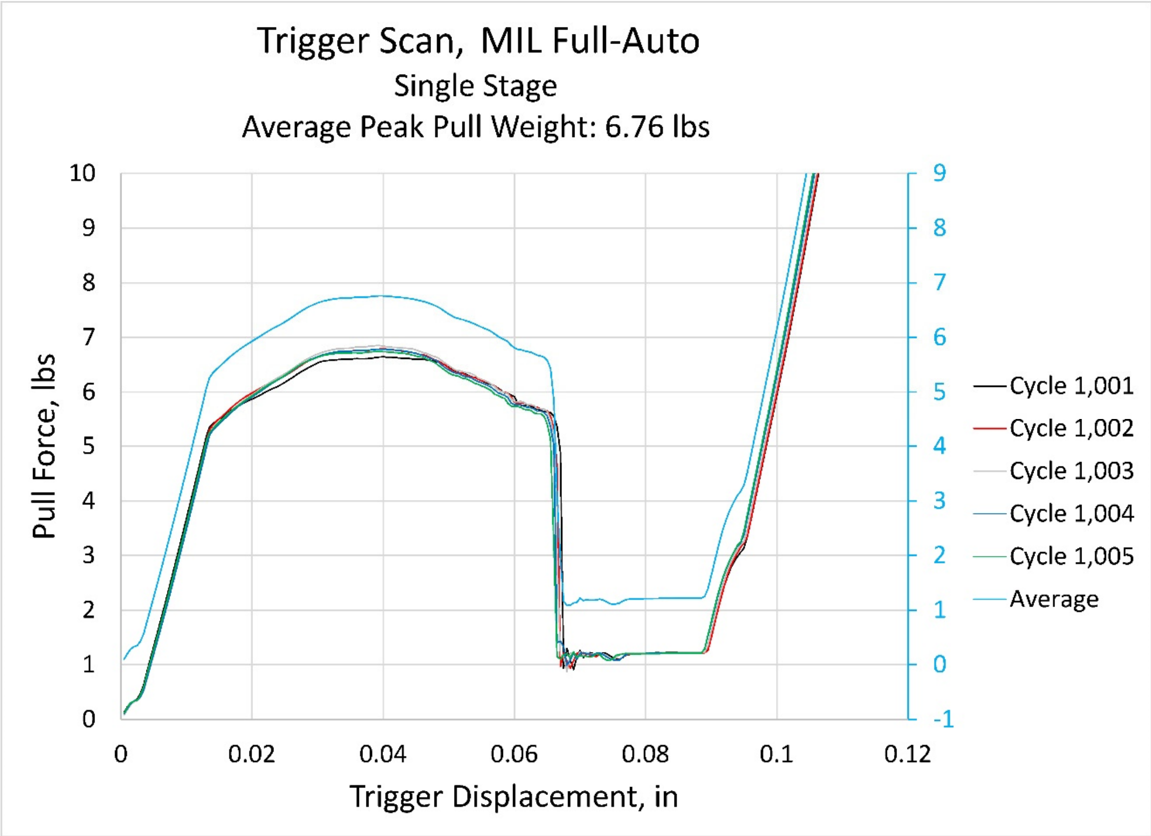

Figure 5. Chart showing a full-auto MIL-spec trigger's pull weight dependence on trigger bow displacement at 1,001-1,005 hammer cock and release cycles.

Compare the full-auto test scan lines to that of the semi-auto trigger shown in Figure 1. The full-auto trigger's peak pull weight is lower by over 1½ lbs. and the scan lines have rounded tops without the pronounced sharp peak within the creep zone of the Figure 1 chart. Figure 1 also shows that the semi-auto trigger's creep is a little over 1/16th of an inch (.0625 in.) or approximately .075 inches. Whereas, the full-auto trigger's creep is less, about .053 inches. Since the designs are "MIL-spec" designs, these differences are probably due to differences within the tolerances of the sear grinds, the installed springs, etc. Remember our discussion in Bulletin #2 regarding what affects sear friction? Even so, comparing the scans, one might say that the MIL full-auto pull is better because the weight is lower, and the creep is less than the MIL semi-auto's. Indeed, the full-auto pull "feels" better, but that is not saying much, as neither trigger is preferred in the market place over the many upgrades. But that is a very telling point. On some level, triggers rate by "feel" preference. Feel can be very subjective, whereas the data would give the impression of being a more objective measure. This subjectivity is especially active when comparing the high weight and creep numbers of the MIL-spec specimens relative to the lower weight and shorter creep numbers of the many trigger upgrades.

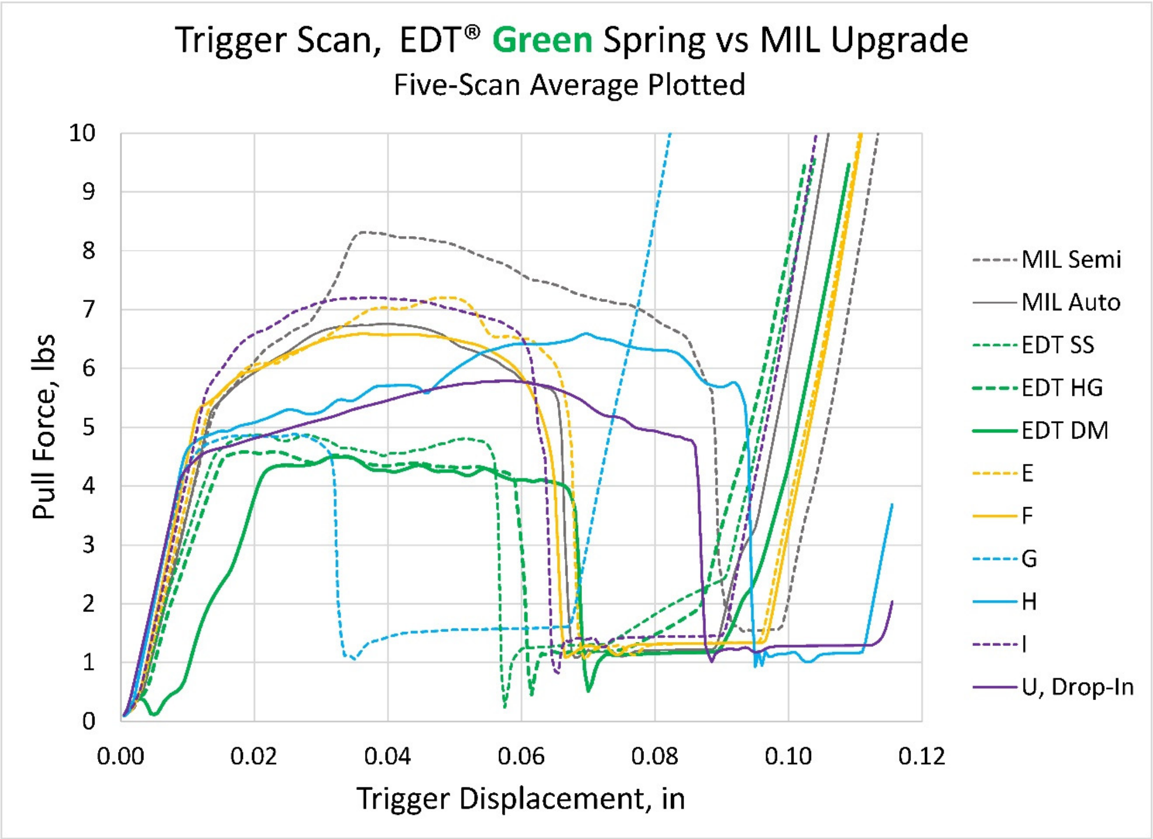

Figure 6. Chart comparing three EDT triggers loaded with the Green hammer spring (providing pull weights around 4½ lbs.) to other single-stage MIL-spec upgrades.

HIPERFIRE has two AR10/15 trigger product families, Enhanced Duty Trigger and HIPERTOUCH. First, we will compare trigger weight and creep of the EDT to MIL-spec and other single-stage MIL-spec upgrades because these tend to have higher pull weights. Then, we will compare HIPERTOUCH to 2-stage and drop-in triggers because they tend to have lower weights.

The following charts show only the averages of the five separate trigger scans collected for each trigger noted in the charts' legends. For the individual product's charts showing all five data scan lines, see **Appendix B**.

Figure 6 shows how the EDT triggers with the Green hammer spring installed compares to MIL-spec and the MIL-spec upgraded triggers. The EDT pull weight scans are around 4½ lbs. The peaks don't exceed 5 lbs. The other triggers show weights exceeding 6 lbs. with one exception, the "G" trigger. Its weight nears 5 lbs., but what makes it more remarkable is the much-reduced creep relative to the EDTs. The EDTs' creep is as short or much shorter than the others.

The EDTs have lower than MIL-spec weight because they include the Radical Sear Mechanics (RSM) discussed in bulletin #2. Again, this was done to reserve the MIL-grade hammer fall power by using a hammer spring as heavy or heavier than MIL-grade but still provides lower pull weight.

Figure 7 shows EDTs employing the Red hammer spring, providing trigger pulls closer to 5½ lbs. using a heavier than MIL-grade hammer spring. Similar comparisons can be drawn for the curves in Figure 7, as for Figure 6. If lower pull weight was possible and even desirable, why would manufacturers of these triggers not provide lower weights in this lower 4-6 lb. range? Speaking for HIPERFIRE, it depends on the preference of the prospective buyer, ones who desire higher weights for safety like law enforcement duty rifles, home defense, or general utility, yet lower weights the MIL-spec. These triggers are also lower cost and mimic the reliability associated with MIL-spec acceptance. Trigger "G," the one with the much-reduced creep, does not fit into this category as it would be considered unsafe. The amount of creep is adjustable by limiting the amount of trigger let-off with a set screw forward on the muzzle side of the trigger pivot that pushes against the floor of the lower receiver. This screw can come loose raising reliability concerns, if not liability ones should something go wrong at the wrong time. Another screw in the rear can be adjusted for over-travel. This topic is discussed further in a future HIPERTECH article.

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HIPERTOUCH appears to have the edge in both lower peak weight and reduced the total amount of creep. HIPERFIRE's EDT triggers will tend to have more appeal among shooters upgrading directly from MIL-spec, or possibly the other offerings shown for this reason. But there's more to feel than just peak weight. The EDTs show weights that are either flat with creep, or drop slightly with creep compared to the others except for trigger "G." So, the EDTs feel as if the weight were lower. The slight decrease in weight reduces the pull effort as if one were walking downhill. The others' weights increase with creep, making them feel heavier. It feels like the trigger finger is going uphill despite four showing the same amount of total creep.

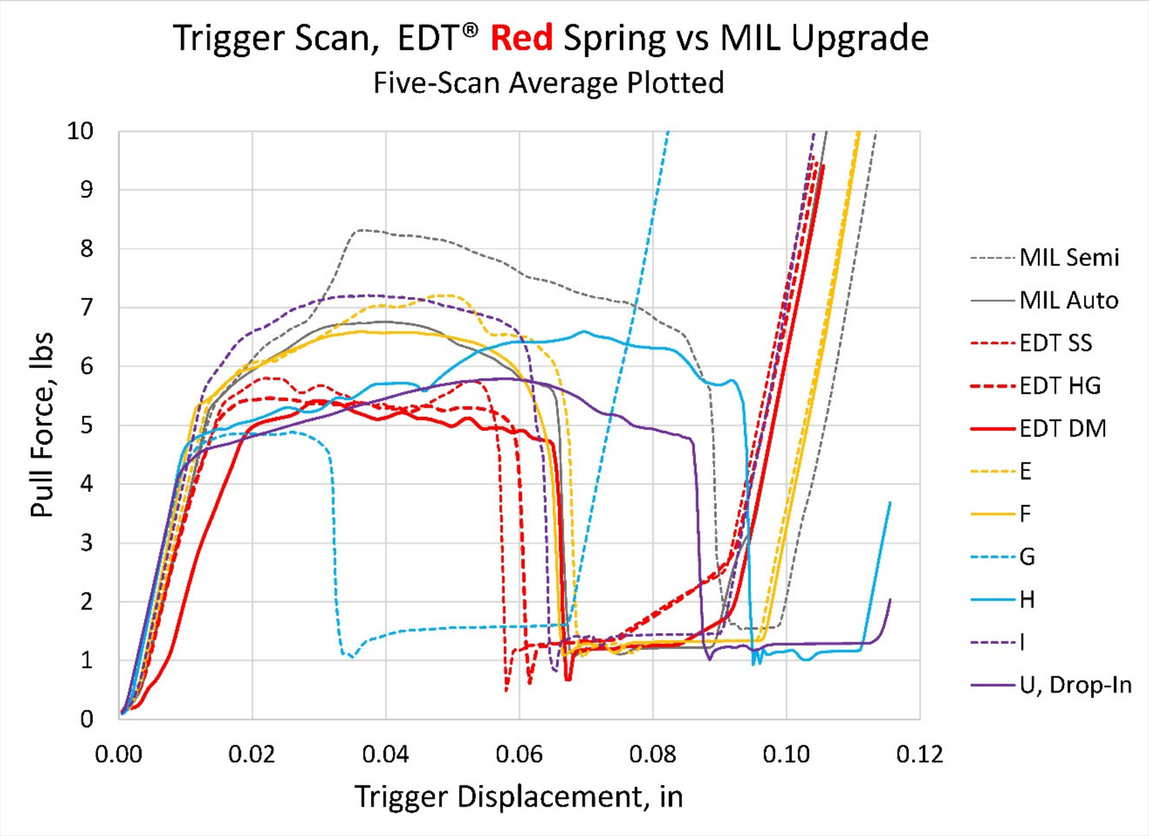

Figure 7. Chart comparing three EDT triggers loaded with the Red hammer spring (providing pull weights around 5½ lbs.) to other single-stage MIL-spec upgrades.

Another factor to consider when reviewing trigger scans like these is the shape or smoothness of the curves themselves. One might think that the waviness of some of the scans would indicate roughness or even grit. Unfortunately, the TriggerScan device does not have a small enough sampling resolution to capture this microscale surface information.

However, we all know what "grit" feels like when pulling some MIL-spec triggers; none of these triggers exhibited that kind of gritty feel. Generally speaking, the gritty feel has to do with relatively high weights with rough sear surfaces. The grit that one feels is the catch-release of the trigger on the hammer sear that some call stiction (sticky friction). The higher the weight, the more significant the force difference that the finger perceives when the trigger catches compared to when it releases. This is kind of like tiny sequential trigger breaks that one can feel as the trigger is pulled.

Also, grit is a function of how fast the trigger is pulled: slow means more grit, fast means less. We have all experienced the washboard effect driving on some gravel roads or snowmobile trails. At one speed, the trails feel like the vehicle will vibrate into pieces. But if one drives it fast enough, the vibration becomes bearable if not absent. So, if one pulls quickly enough, the grit may disappear. Of course, this can be an obstacle in the way of high accuracy shooting. In a future HIPERTECH article, we will address various ways HIPERFIRE overcomes this with the sears' geometry at manufacture. In any case, the lower the pull weight and shorter the creep, the grit is less likely to manifest. So, if you prefer moderate weight in your trigger with less creep and no grit, consider the HIPERFIRE EDT's advantage.

The next four figures compare HIPERFIRE's HIPERTOUCH family of triggers to 2-stage and drop-in triggers that may be single-stage or 2-stage. These categories tend to feature lower trigger pull weights, but total creep varies substantially. It would have been unfair to include EDT is this comparison because of their purposefully higher weights. The MIL-spec triggers are included as our baseline for what is generally considered a poor trigger.

Figure 8 shows the HPERTOUCH triggers in comparison to component install 2-stage triggers. The HIPERTOUCH triggers feature both the Radical Sear Mechanics (RSM) and Cam-Over Toggle Engine (COTE) features unique to HIPERFIRE. COTE is fitted with Green toggle springs to produce pull and break weights between 2 and 2½ lbs. The 2-stage offerings provide 1st stage weights from less than 1 to almost 3 lbs. The 2nd stage weights vary from 3½ to 5½ lbs.

HIPERTOUCH features the least total creep in three of its five cases, while in the other two, less than MIL Auto total creep in the Elite case and about the same total creep as the MIL semi-auto in the Genesis case. The other trigger upgrades provide more or less total creep than either MIL-spec trigger.

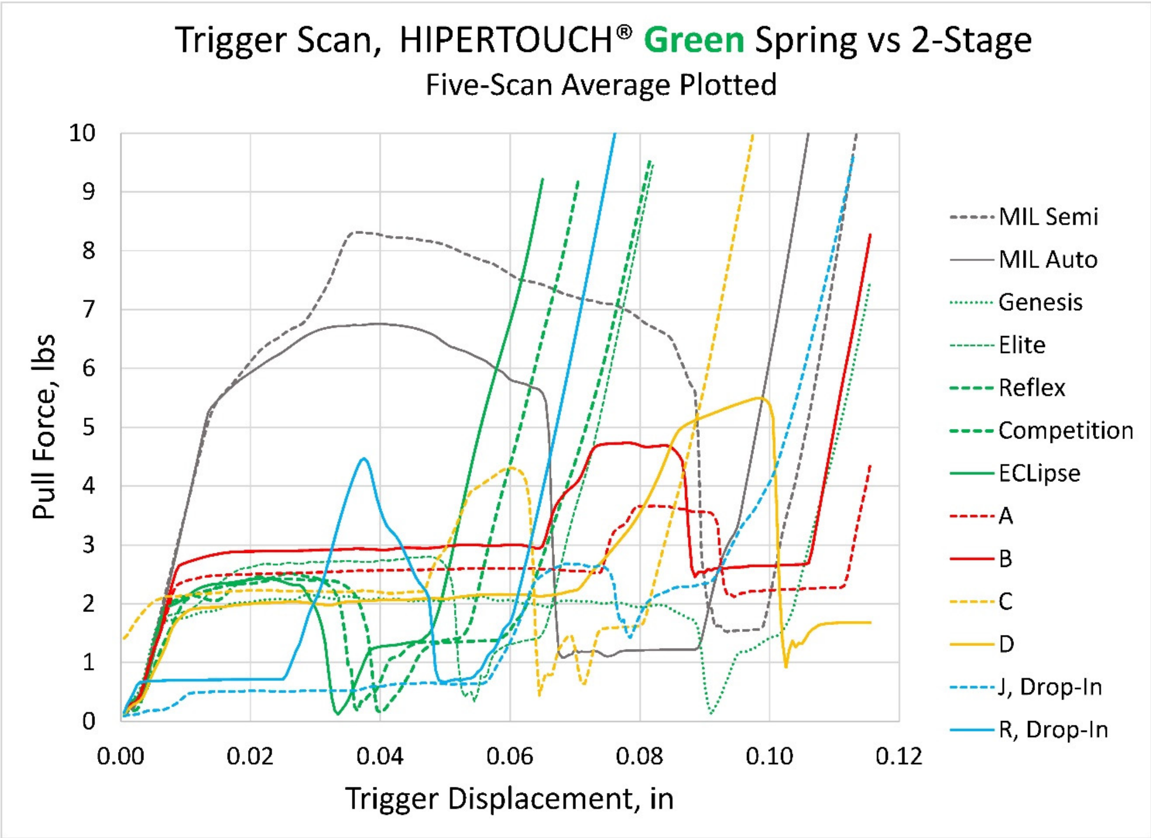

Figure 8. Chart comparing five HIPERTOUCH triggers loaded with the Green toggle springs (providing pull weights around 2½ lbs.) to 2-stage triggers.

We can't know the designer's intent for choosing the specific weights or the total creep distribution for the 2-stage triggers beyond what we have already argued, that it was to manage the set up for patient and accurate shot placement. Unlike bolt-action guns, the AR15 semi-auto platform had to include a large trigger displacement, i.e., pull creep, overtravel, and let-off for hammer reset, for safe and reliable operation of the disconnector function. Working within that paradigm, the premise for 2-stages relies on the patience part of the process for target acquisition and shot placement. When the shooter's trigger finger is "at the wall," a short, low weight pull is all that stands in the way. He can wait for the right moment without fatigue at the lower 1st stage weight. So, the time between the decision to take the shot and its execution is very short, which tends to produce higher accuracy as the rifle muzzle's aim has less time to move off target.

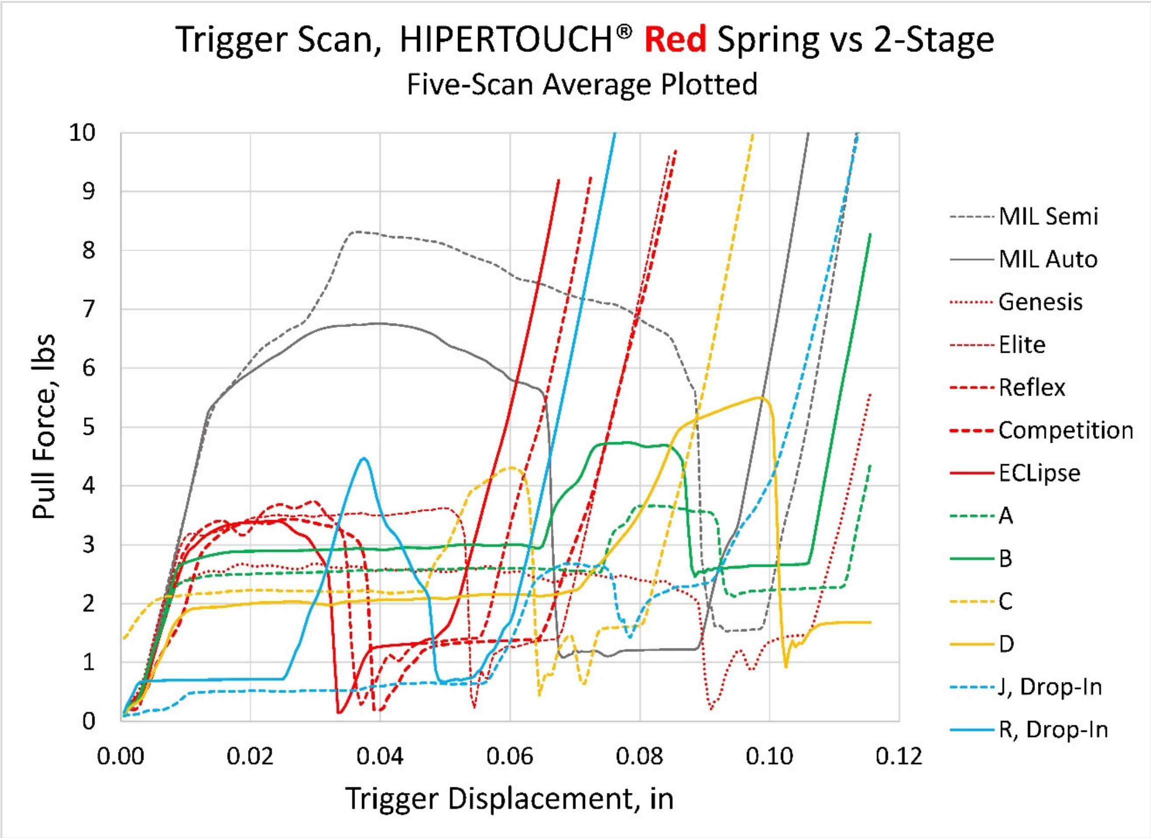

Figure 9. Chart comparing five HIPERTOUCH triggers loaded with the Red toggle springs (providing pull weights around 3½ lbs.) to 2-stage triggers.

The same comments apply regarding Figure 9. Here, HIPERTOUCH COTE features the Red toggle springs that give the HIPERTOUCH triggers 2, 2½, and 3½ lb. pull weights depending on the model and its toggle spring set up.

Let's continue our commentary on design intent. HIPERFIRE's triggers are single-stage. In the case of the three with lowest total creep, whether the pull weight is 2, 2½ or 3½ lb., the total creep is about the same as the 2nd stage creep of the 2-stage triggers. So, you may consider that the Reflex, Competition, and ECLipse triggers are 2-stage triggers with no 1st stage take-up. When the shooter's finger is on the trigger, he's already "at the wall." So, from this perspective, the prep time has been shortened, and trigger finger fatigue is impossible because there is no weight born by the trigger finger.

That does apply to the HIPERTOUCH Genesis or Elite triggers. The Genesis trigger was purposefully designed with total creep on the order of the MIL-spec triggers. That longer creep could be offset by reducing the pull weight down to 2 lbs. from the 2½ lbs. of the other four (or in the case of the Red toggle springs, to 2½ lbs. from 3 ½ lbs. of the other four). HIPERFIRE's concern was for operator safety to preclude it from selling a trigger with a pull weight less than 2 lbs. So, in the case of the Genesis trigger, one might consider it a 2-stage trigger with no second stage wall; it's all 1st stage take-up. The shooter of this trigger will find it difficult (but not impossible) to know when it will break. His surprise can be the cure the trigger flinch, especially when shooting larger caliber ammunition in AR10 scale rifles, shooting bench-rest, etc. For that shooter, high accuracy is achieved no other way. We remarked that the 2-stage trigger is amenable to the patient shooter. Because the Genesis' pull weight is low, the creep long and smooth, the shooter can slowly squeeze-off the shot.

The Elite trigger is in between the Genesis and the other three in total creep for a reason. In the case of Genesis, the creep feels exaggerated. Some say that the Reflex, Competition, and ECLipse have no creep at all or virtually no creep. That can't be true, look at the scans. But that's what they describe. And that brings up another matter that we will cover in more depth in a later HIPERTECH. For now, let's say that it's about the feel, what the mind perceives. In the Elite's case, shooters remark that it has a "hint of creep." Those that like this do because when they perceive the trigger is starting to move, it breaks. That's their prep, their signal the shot is about to be made. So, we can see that creep, what we feel or don't feel as creep, can be used to our advantage as a preference. Instead of striving to eliminate creep, we can use it to inform our shooting.

What shooters seem to want is the feel of a bolt gun's trigger in their semi-auto rifle. The so-called hair-trigger in the bolt gun is impossible in the AR15 or AR10's world because that amount of trigger deflection would prevent the safe and reliable capture of the hammer by the semi-auto disconnect function. We know this because many "trigger jobs" that were meant to reduce creep, etc., result in doubling, i.e., the hammer's skipping off the disconnector at hammer cock. Designers of 2-stage triggers set out to resolve this impasse by dividing the necessary amount of semi-auto AR15 creep in two, where the 2nd stage behaved more like a hair-trigger and made accuracy more likely. This works well for the patient shot. But what if the shooter wants to shoot fast? Now the 2nd stage feels like driving a car over a speed bump; it can become an annoyance.

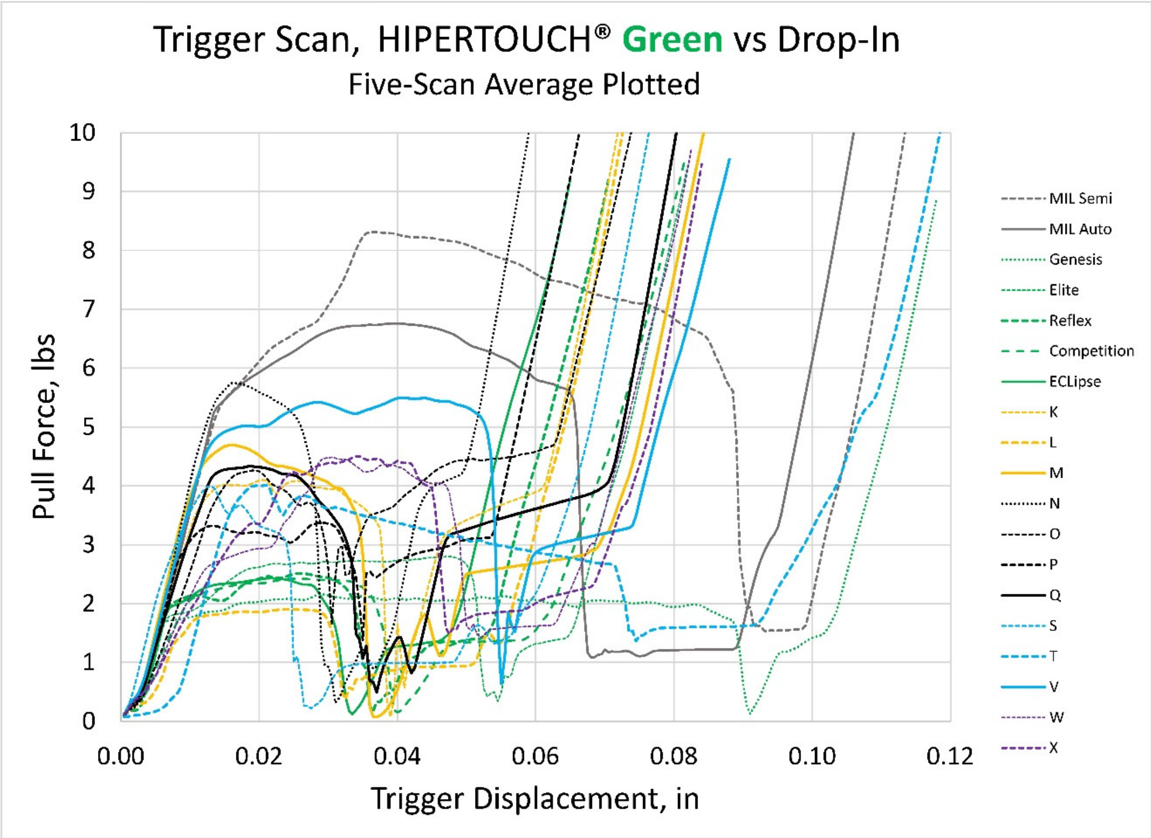

Figure 10. Chart comparing five HIPERTOUCH triggers loaded with the Green toggle springs (providing pull weights around 2½ lbs.) to various so-called drop-in triggers.

Figures 10 and 11 compare HIPERTOUCH trigger scans to those of various popular cassette drop-in triggers and the two MIL-spec triggers again as the

AR15/10 baseline. The HIPERTOUCH COTE employed the green and red toggle springs with their associated pull weights already discussed.

One can readily see that the drop-in after-market triggers' pull weights and total creep run the gamut. This is somewhat surprising because our perception is that the drop-ins' attractive fit and finish imply fine craftsmanship and precision operation as a class. What isn't surprising is that's the appeal of the drop-in after all. And, its relative ease of installation compared to the component installed triggers discussed above. However accurate the adage, "perception is reality," one must also say that reality being what it is will come out on top in the end.

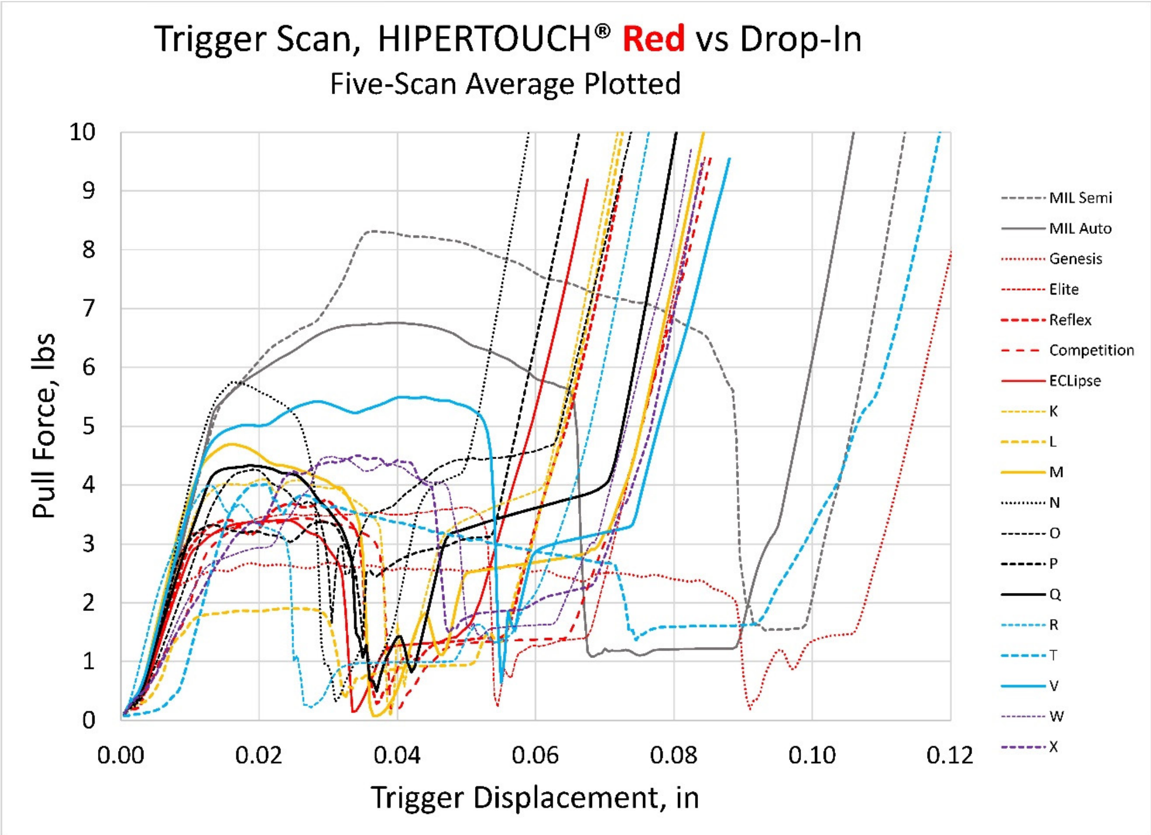

Figure 11. Chart comparing five HIPERTOUCH triggers loaded with the Red toggle springs (providing pull weights around 3½ lbs.) to various so-called drop-in triggers.

We discussed the components of total creep that included the initial take-up segment of each trigger scanned. You'll notice in the above charts that the take-up line segments are of nearly the same slope (rise over run) and magnitude, i.e., trigger displacement in inches, from one trigger to the next. Yes, we can quibble over the objective measurements of pull force and displacement, but the question is, can we feel it? We would say no. In the big picture analysis, component installs or cassette drop-in installs don't affect that part of total creep at all, that's not where the precision lies. This is another take-a-way that drop-ins are not the panacea we've been told they were. So, aside from the apparent ease of installation, as a class, they don't offer anything that a component installed trigger couldn't provide in actual performance. On the downside, some drop-ins require set screws for stabilization, weight, or creep calibration. These screws can come loose. And, most drop-ins can not be disassembled for cleaning. These are some of the takeaways from the ease argument. We will present more on the advisability of buying any drop-in apart from a specific product's positive attributes in later HIPERTECH bulletins.

If the above scans showing trigger weight and creep are the criteria by which triggers should be judged, then drop-ins as a class would seem to fail the test. Specific drop-ins do deliver low weight and much reduced total creep compared to the MIL-spec standard. Some of the others do not, despite their advertising content, which was a surprising discovery during this inquiry. So, the "drop-in" moniker should not be taken as a guarantee of low weight, reduced creep, high precision, etc., but rather each trigger should be evaluated based on its own merits. Unfortunately, none of the trigger manufacturers will publish in detail read here how their triggers perform. What can be said is that the HIPERTOUCH triggers deliver low weights, even user-adjustable low weights, and the amount of creep any shooter can select as fitting his preference.

Conclusion

We have shown how HIPERFIRE's trigger offerings stack up against a rather formidable group of popular triggers of different types. We have seen and accepted the fact that what most shooters want are lower weights and less creep. Where the trigger manufacturers have departed from this assertion, they have a good reason, or no reason in the case of some "drop-ins" sadly. Because shooters have identified their preference, this is what HIPERFIRE has offered. In the next two HIPERTECH bulletins, we will continue our analysis of the trigger scans. Presenting this data was just a warm-up. See **Appendix A** for coverage so far.

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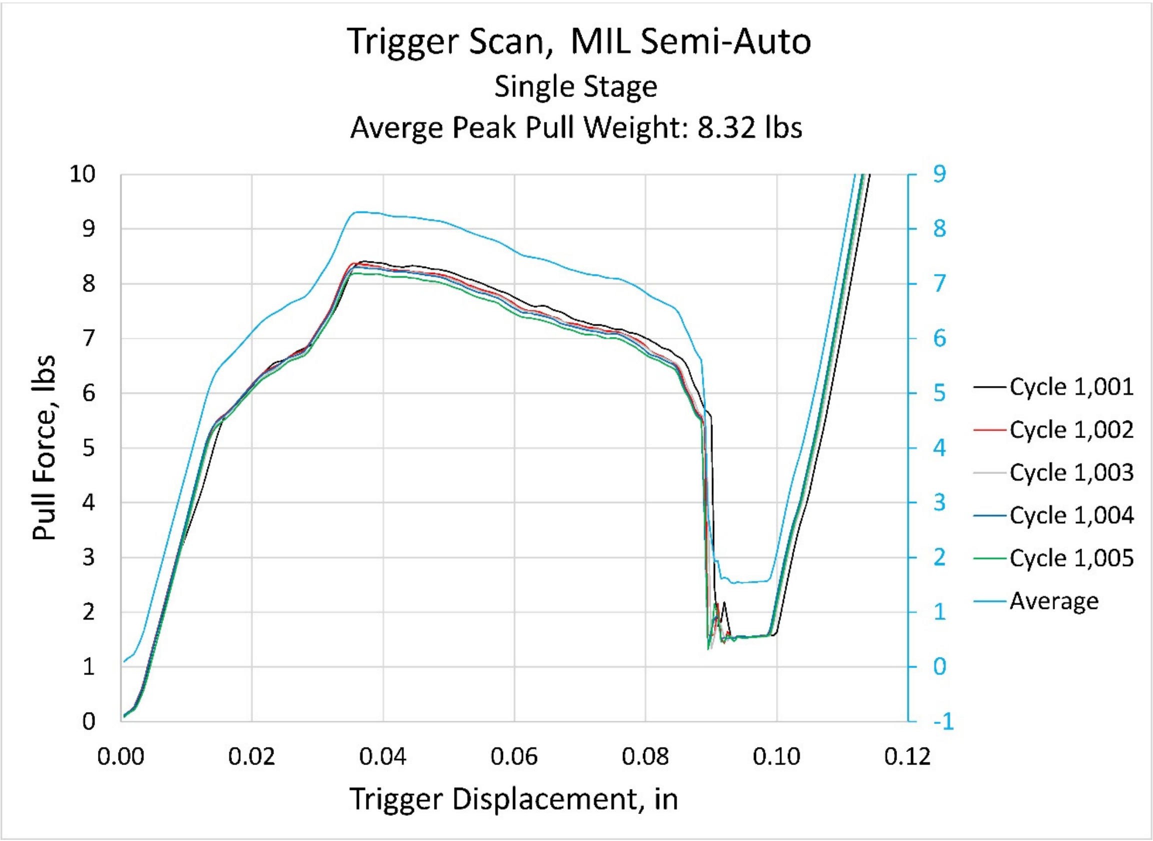
Appendix A Green Means Column Feature Criteria Satisfied

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"
HIPERTECH Bulletin				1	2	3	
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							
F							
G							
H							
I							
J, Drop-In							
K							
L							
M							
N							
O							
P							
Q							
R, Drop-In							
S							
T							
U, Drop-In							
V							
W							
X							

Appendix B



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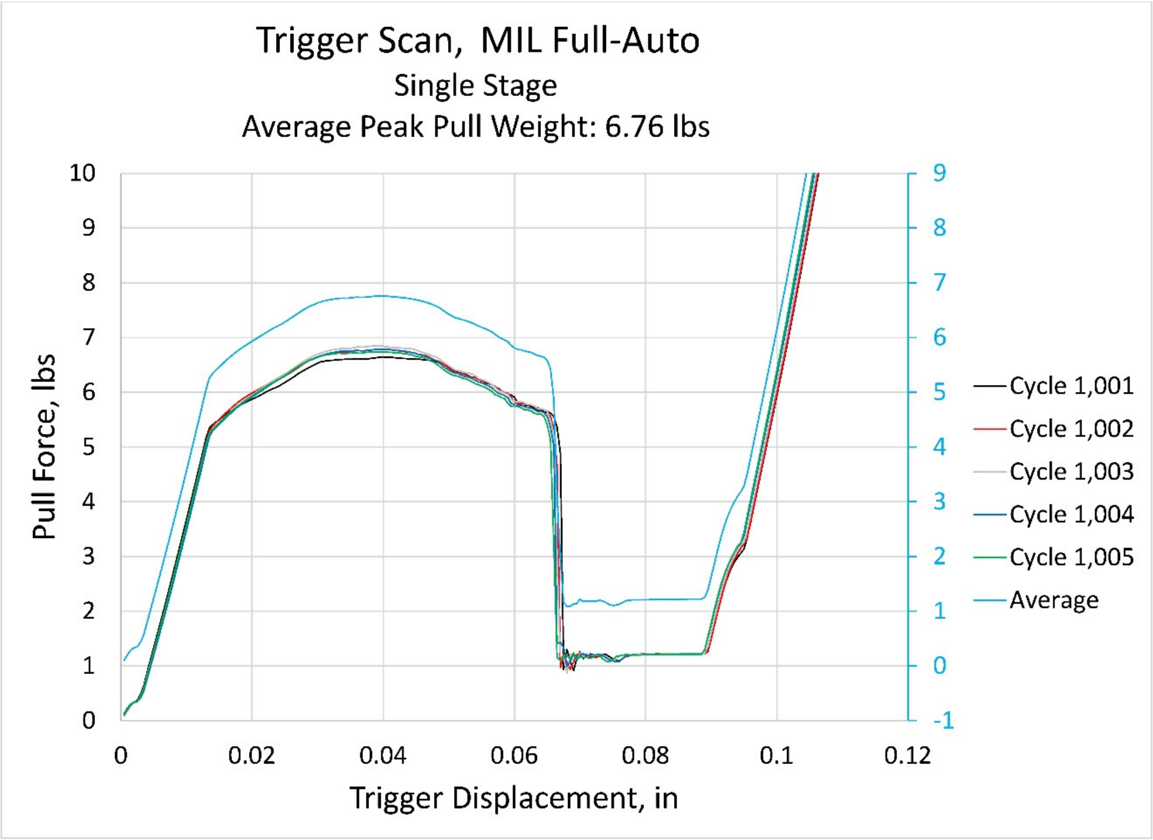

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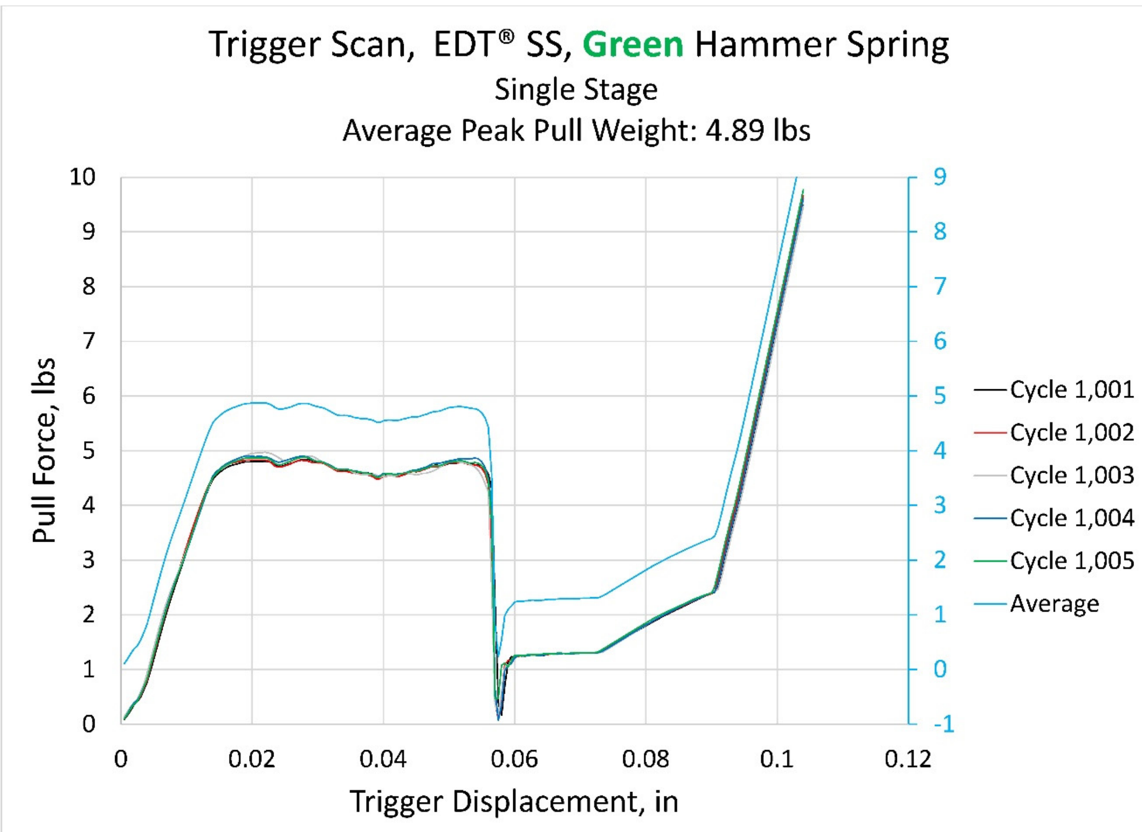
Trigger Scan, EDT® SS, Green Hammer Spring
Single Stage
Average Peak Pull Weight: 4.89 lbs
Pull Force, lbs
Trigger Displacement, in
10
9
8
7
6
5
4
3
2
1
0
-1
0
0.02
0.04
0.06
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0.1
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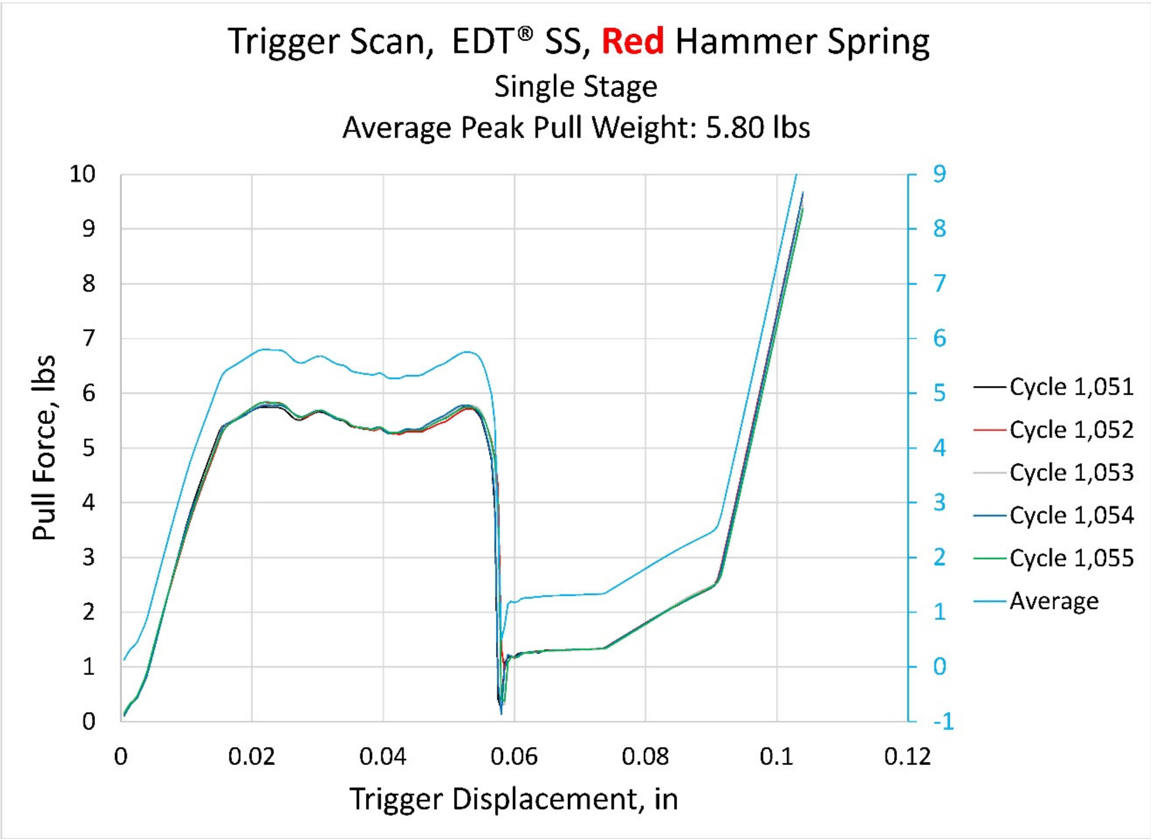
Cycle 1,003
Cycle 1,004
Cycle 1,005
Average



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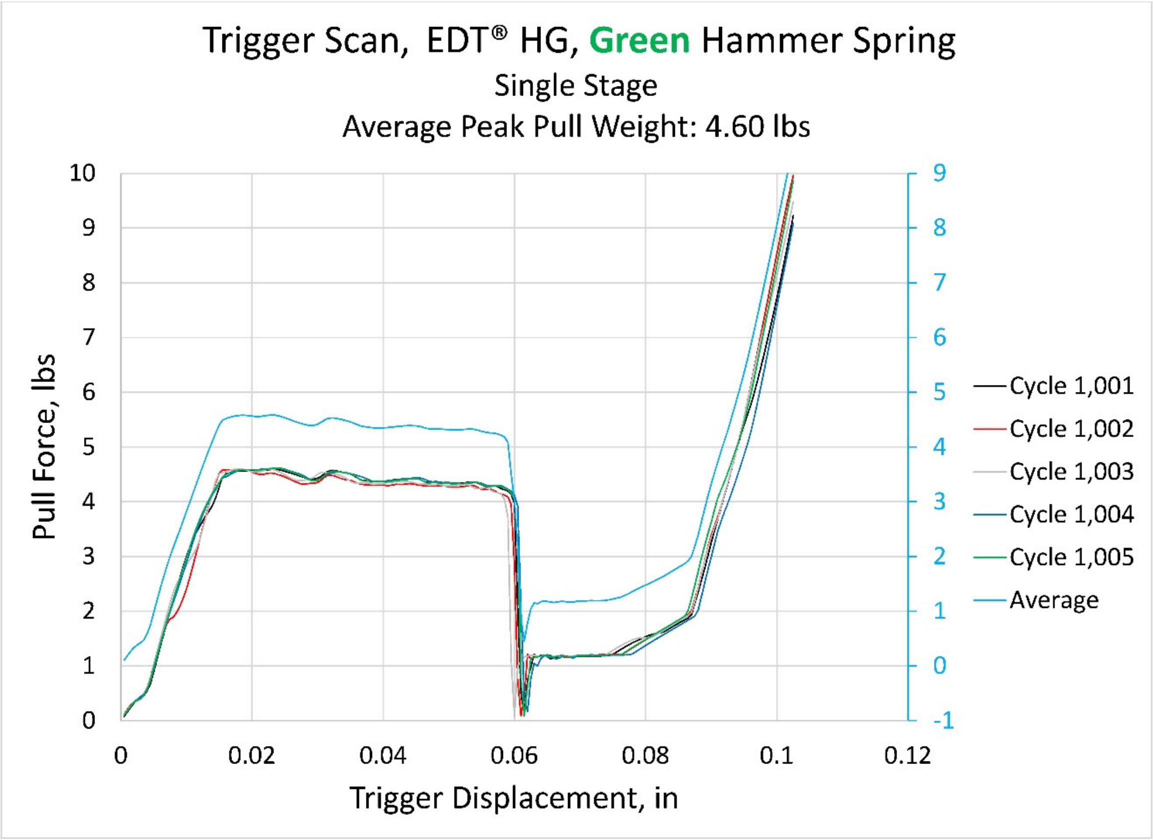

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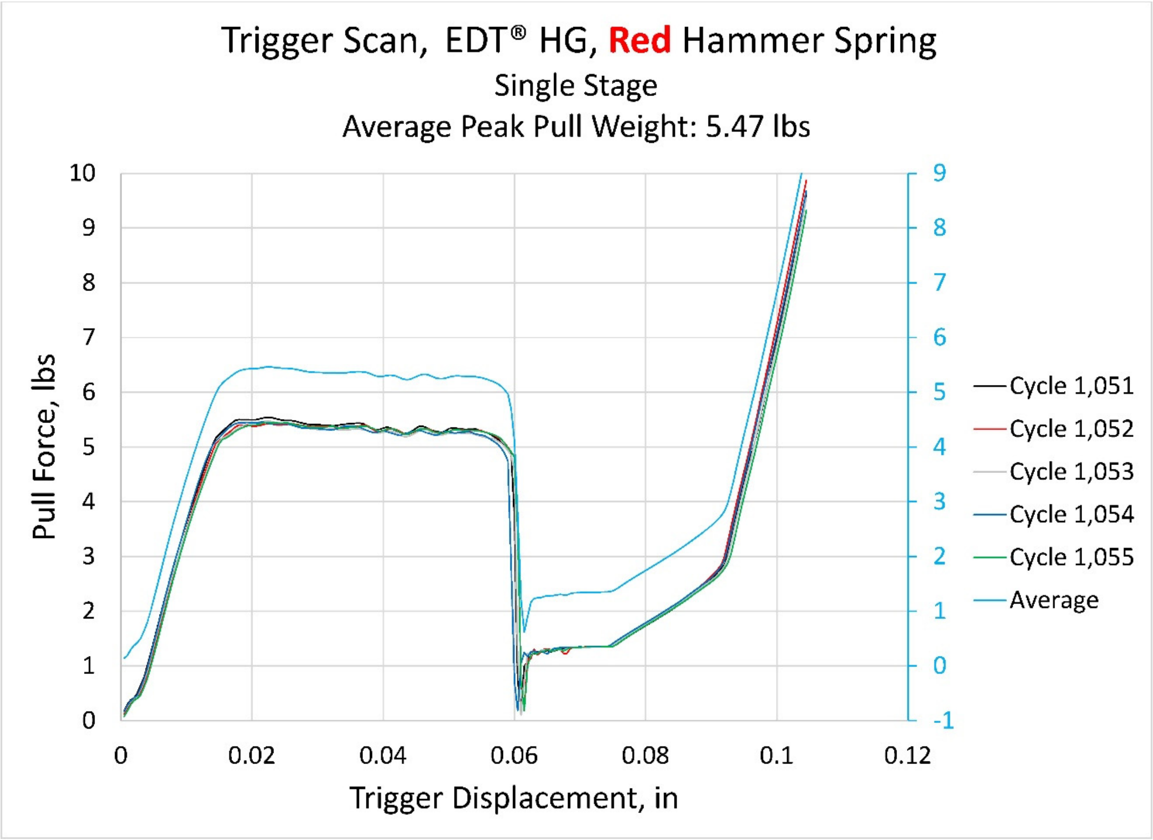

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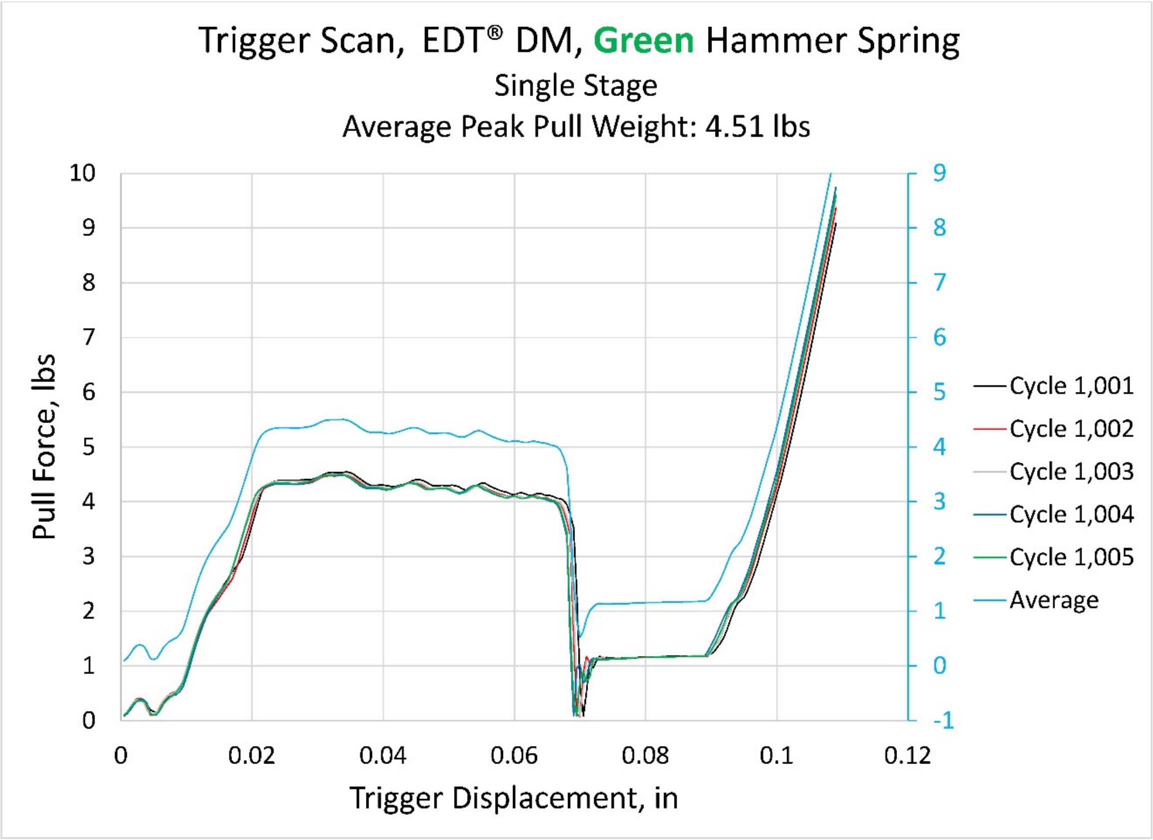
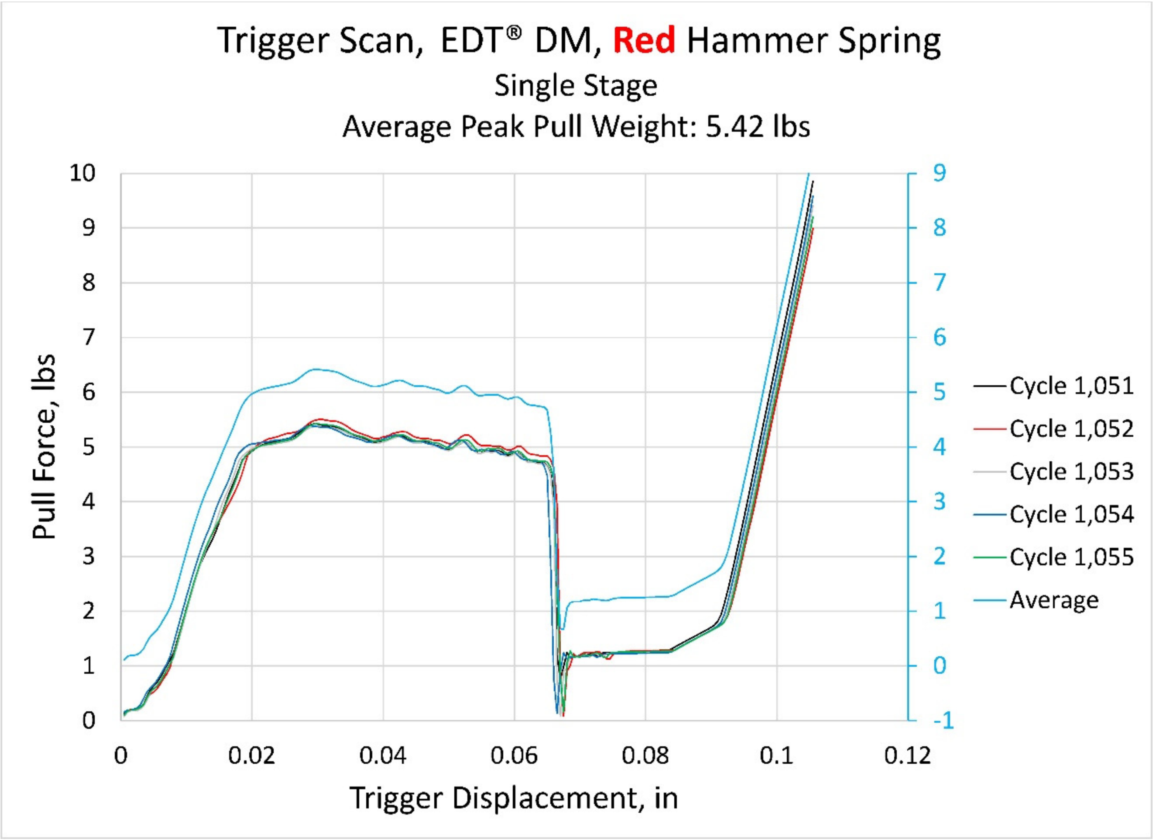
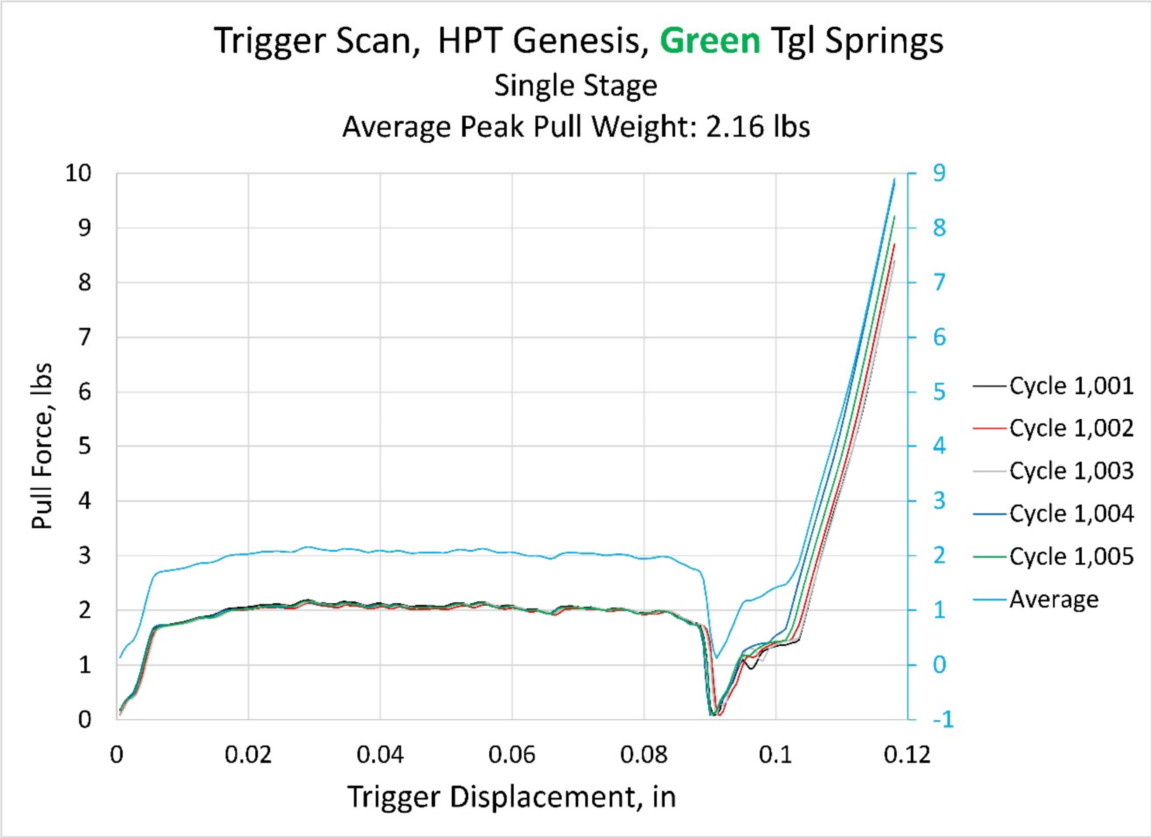

Trigger Scan, EDT® DM, Green Hammer Spring
Single Stage
Average Peak Pull Weight: 4.51 lbs
Pull Force, lbs
Trigger Displacement, in
10
9
8
7
6
5
4
3
2
1
0
-1
0
0.02
0.04
0.06
0.08
0.1
0.12
Cycle 1,001
Cycle 1,002
Cycle 1,003
Cycle 1,004
Cycle 1,005
Average


Trigger Scan, EDT® DM, Red Hammer Spring
Single Stage
Average Peak Pull Weight: 5.42 lbs
Pull Force, lbs
Trigger Displacement, in
10
9
8
7
6
5
4
3
2
1
0
-1
0
0.02
0.04
0.06
0.08
0.1
0.12
Cycle 1,051
Cycle 1,052
Cycle 1,053
Cycle 1,054
Cycle 1,055
Average



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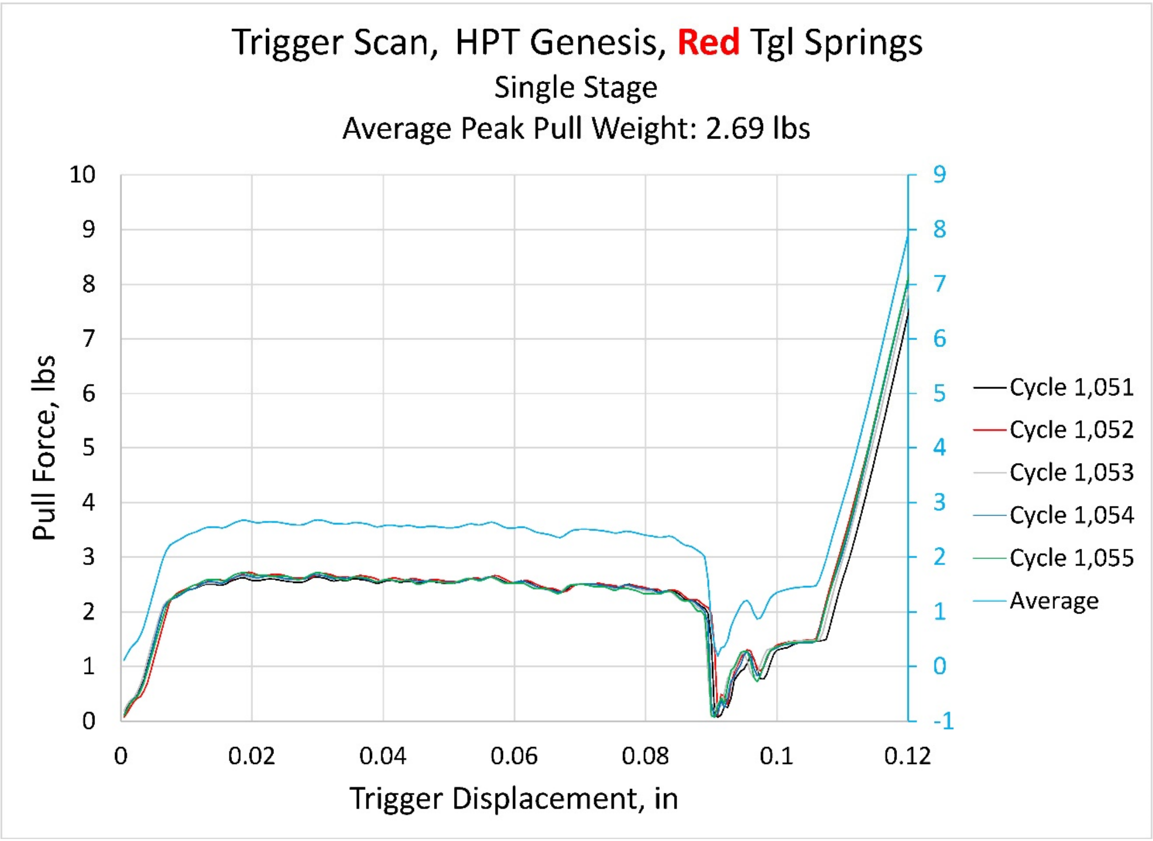
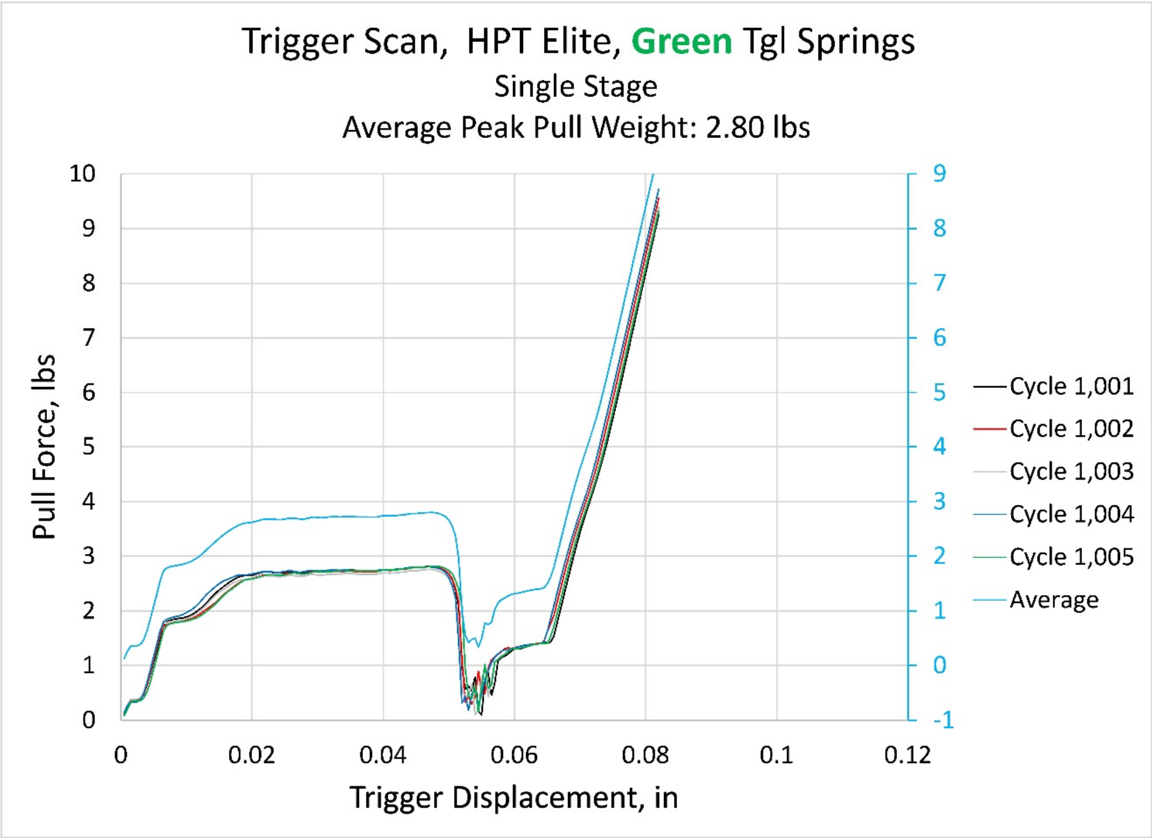
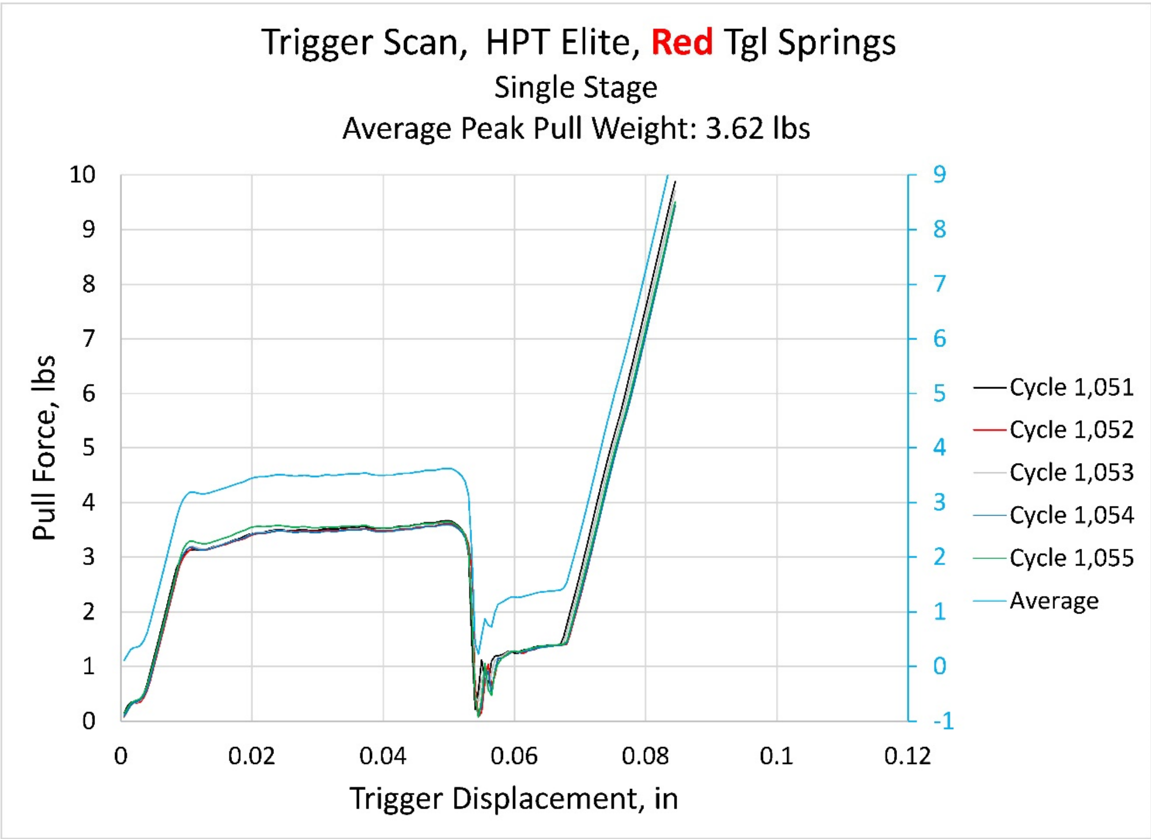
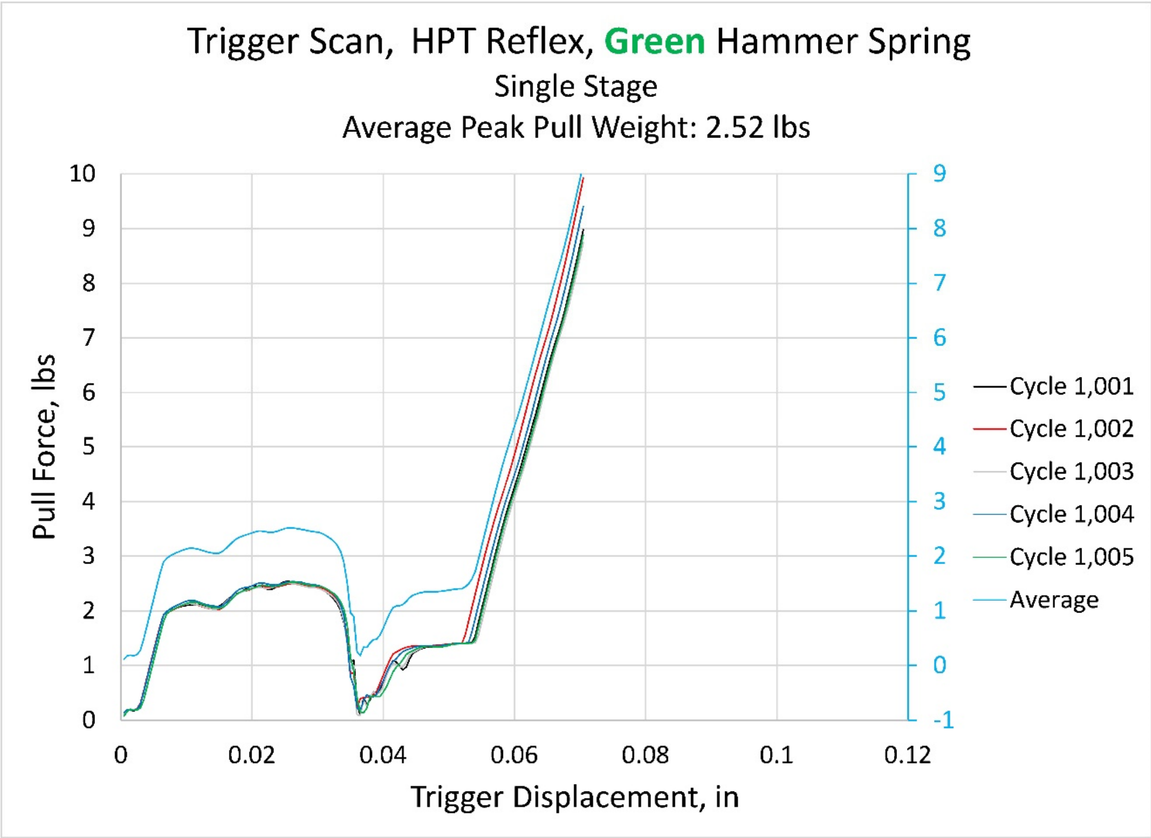
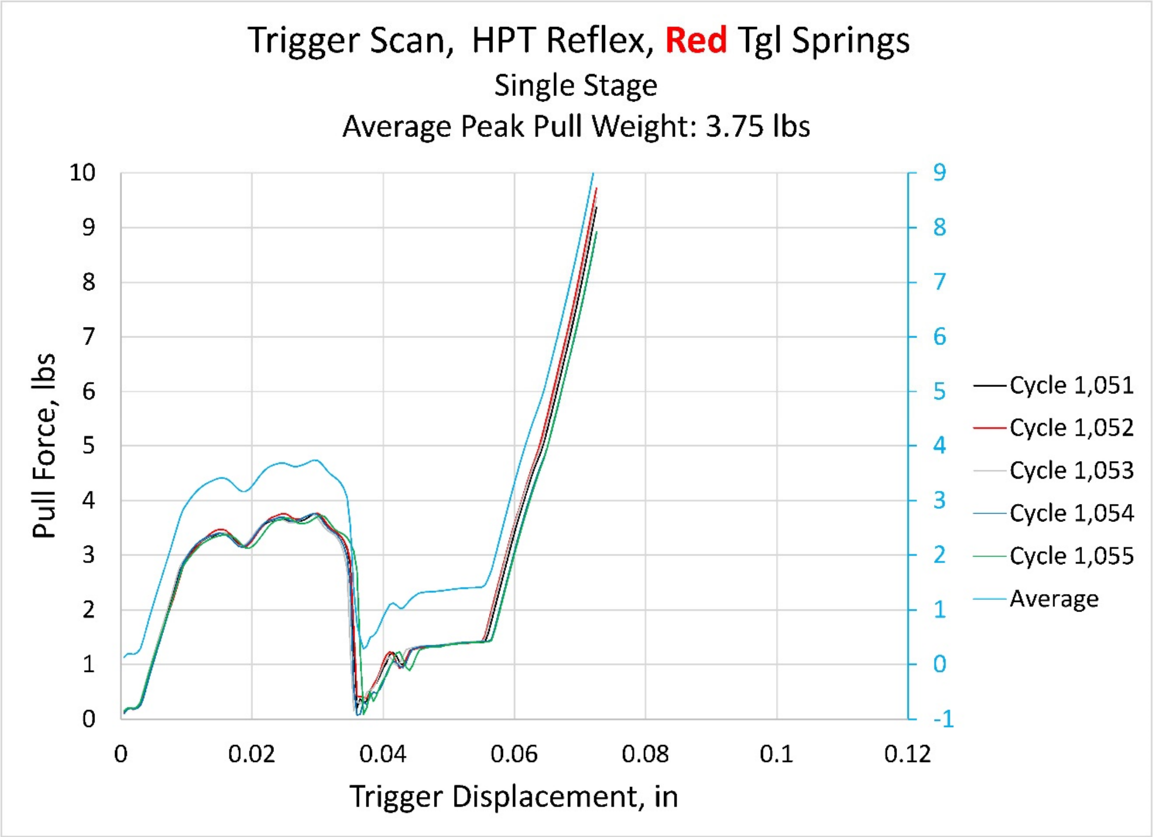

Trigger Scan, HPT Genesis, Red Tgl Springs
Single Stage
Average Peak Pull Weight: 2.69 lbs
Pull Force, lbs
Trigger Displacement, in
0
0.02
0.04
0.06
0.08
0.1
0.12
0
1
2
3
4
5
6
7
8
9
10
-1
Cycle 1,051
Cycle 1,052
Cycle 1,053
Cycle 1,054
Cycle 1,055
Average


Trigger Scan, HPT Elite, Green Tgl Springs
Single Stage
Average Peak Pull Weight: 2.80 lbs
Pull Force, lbs
Trigger Displacement, in
0
0.02
0.04
0.06
0.08
0.1
0.12
0
1
2
3
4
5
6
7
8
9
10
-1
Cycle 1,001
Cycle 1,002
Cycle 1,003
Cycle 1,004
Cycle 1,005
Average


Trigger Scan, HPT Elite, Red Tgl Springs
Single Stage
Average Peak Pull Weight: 3.62 lbs
Pull Force, lbs
Trigger Displacement, in
0
0.02
0.04
0.06
0.08
0.1
0.12
0
1
2
3
4
5
6
7
8
9
10
-1
Cycle 1,051
Cycle 1,052
Cycle 1,053
Cycle 1,054
Cycle 1,055
Average


Trigger Scan, HPT Reflex, Green Hammer Spring
Single Stage
Average Peak Pull Weight: 2.52 lbs
Pull Force, lbs
Trigger Displacement, in
0
1
2
3
4
5
6
7
8
9
10
0
0.02
0.04
0.06
0.08
0.1
0.12
-1
Cycle 1,001
Cycle 1,002
Cycle 1,003
Cycle 1,004
Cycle 1,005
Average



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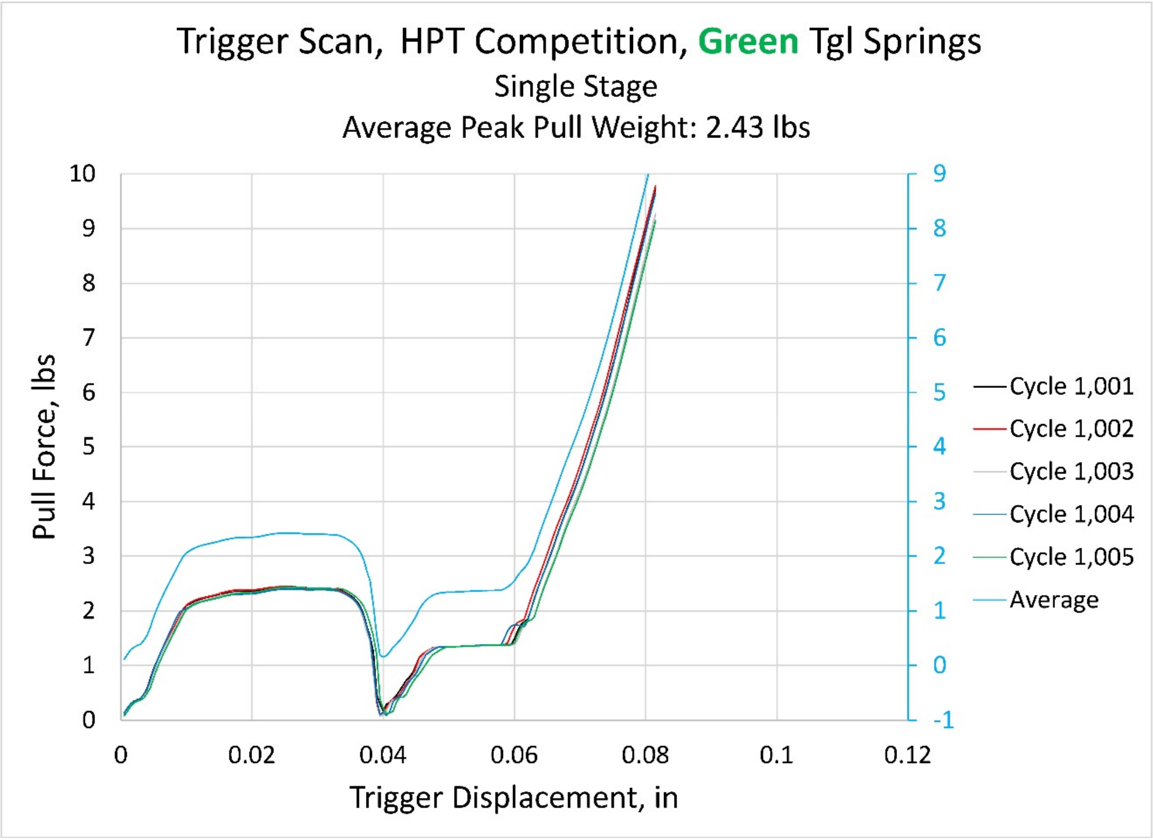

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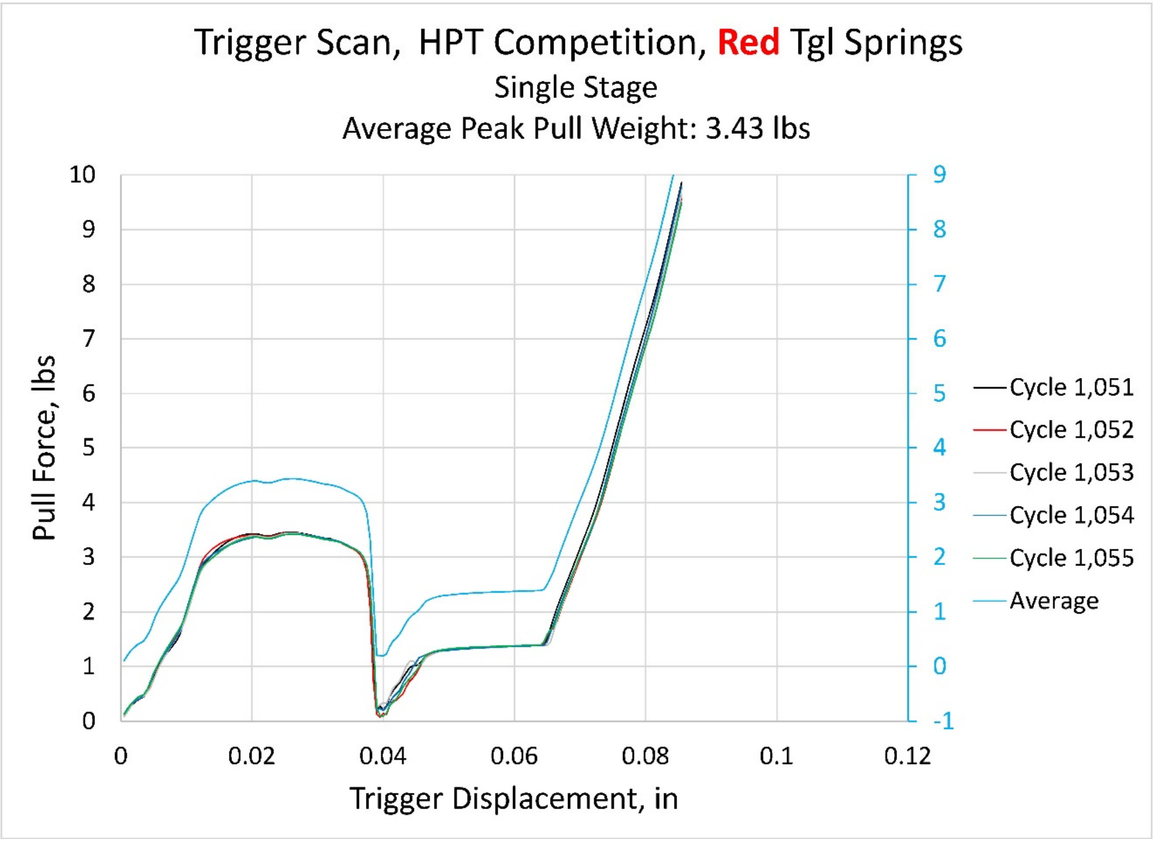

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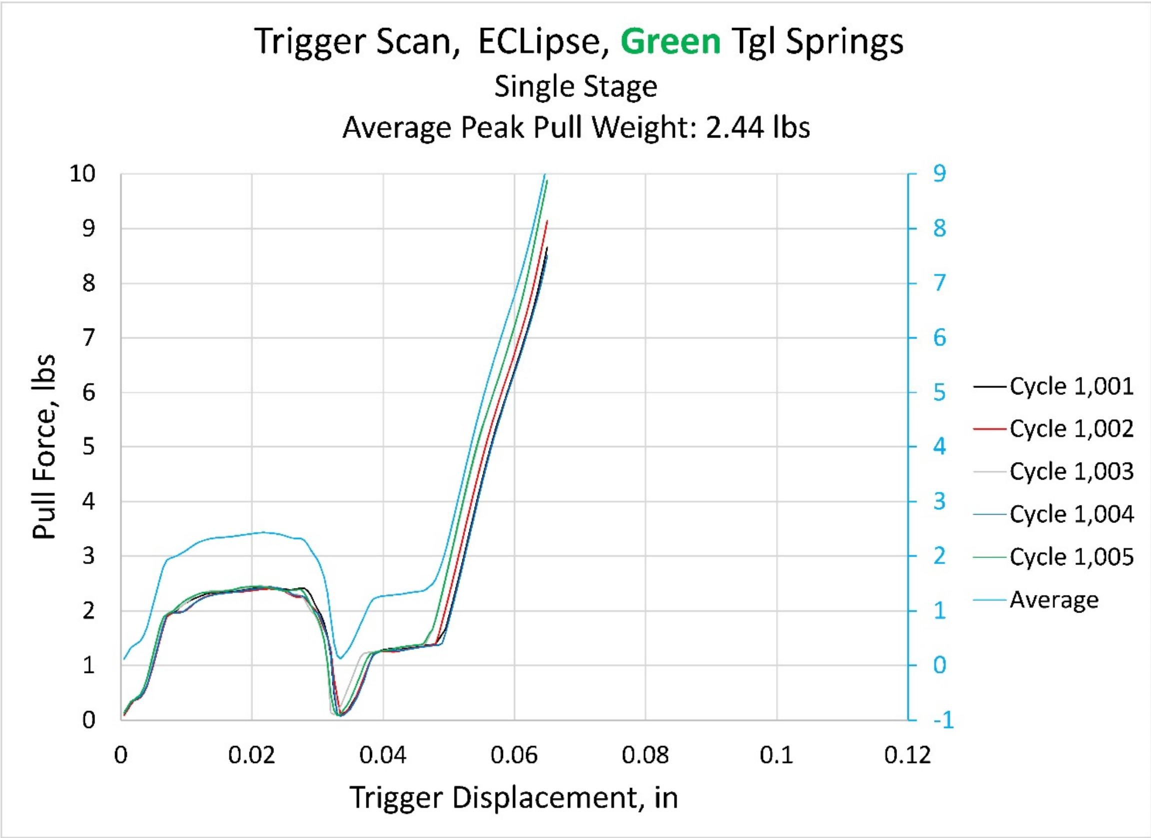

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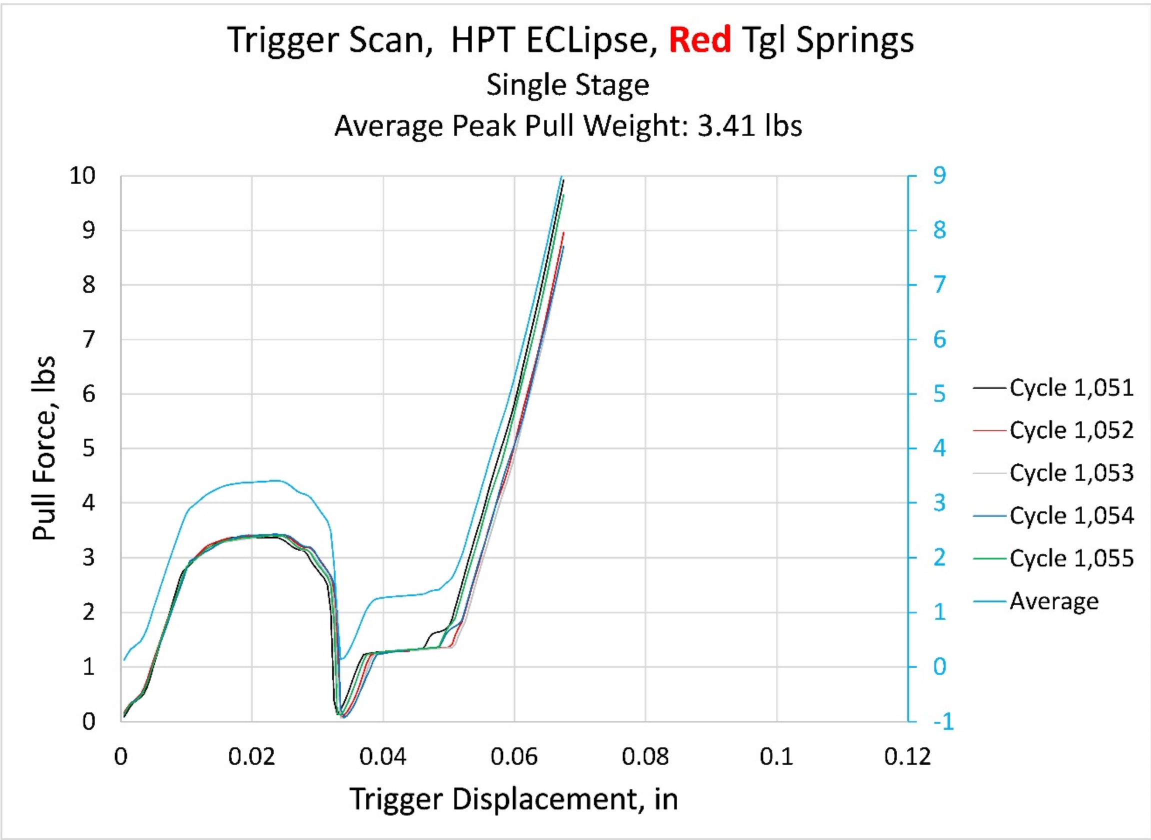
Trigger Scan, HPT ECLipse, Red Tgl Springs
Single Stage
Average Peak Pull Weight: 3.41 lbs
Pull Force, lbs
Trigger Displacement, in
0
0.02
0.04
0.06
0.08
0.1
0.12
0
1
2
3
4
5
6
7
8
9
10
-1
Cycle 1,051
Cycle 1,052
Cycle 1,053
Cycle 1,054
Cycle 1,055
Average

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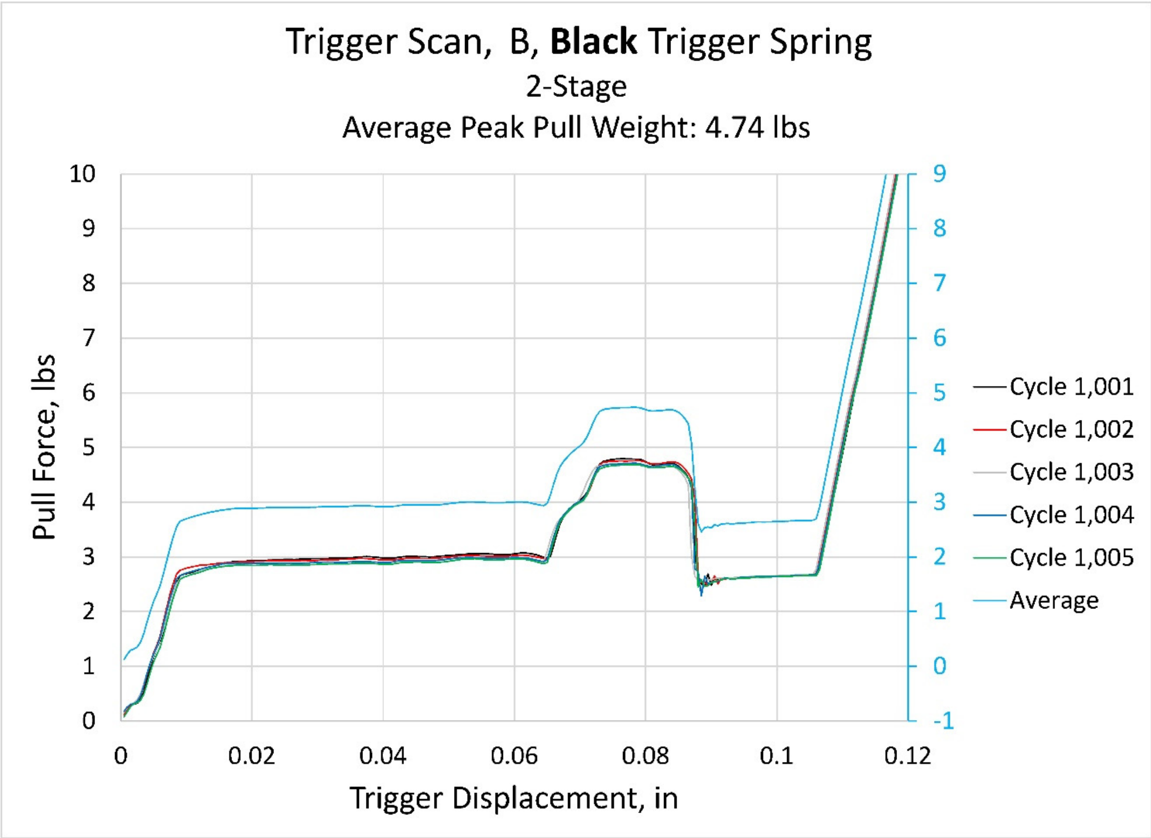

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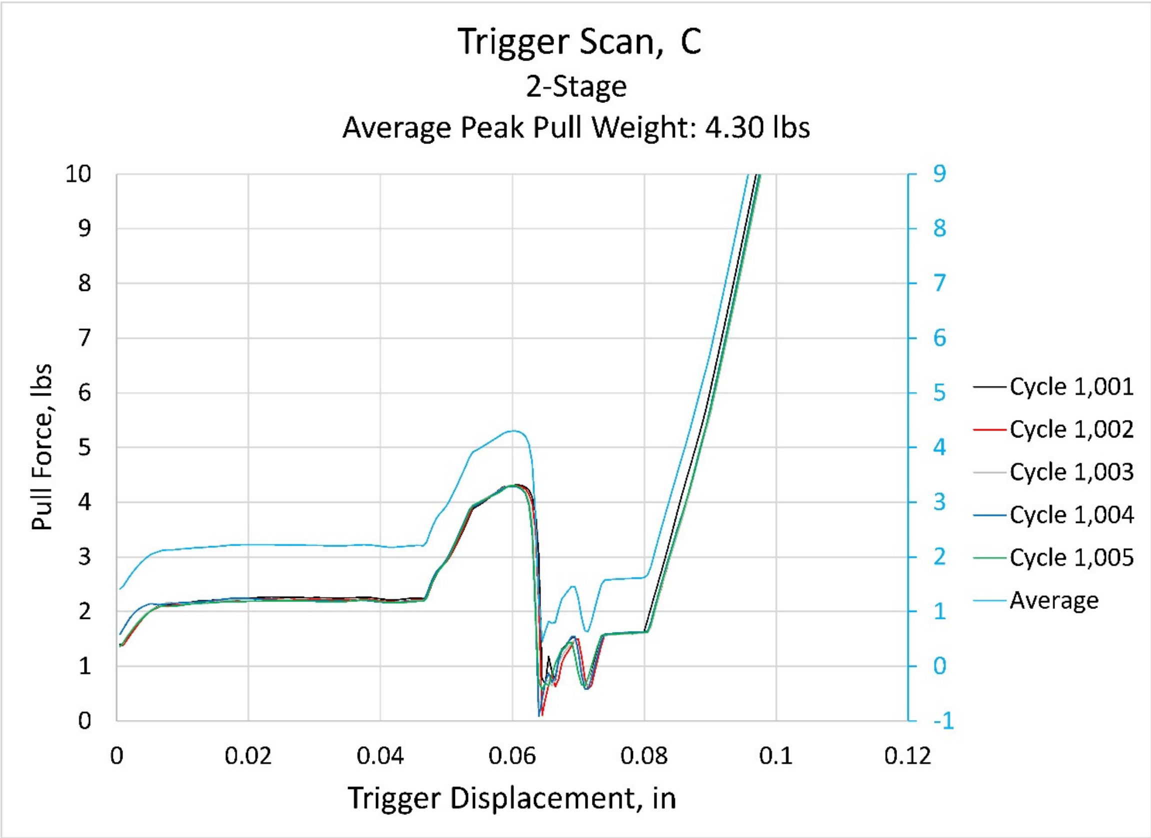

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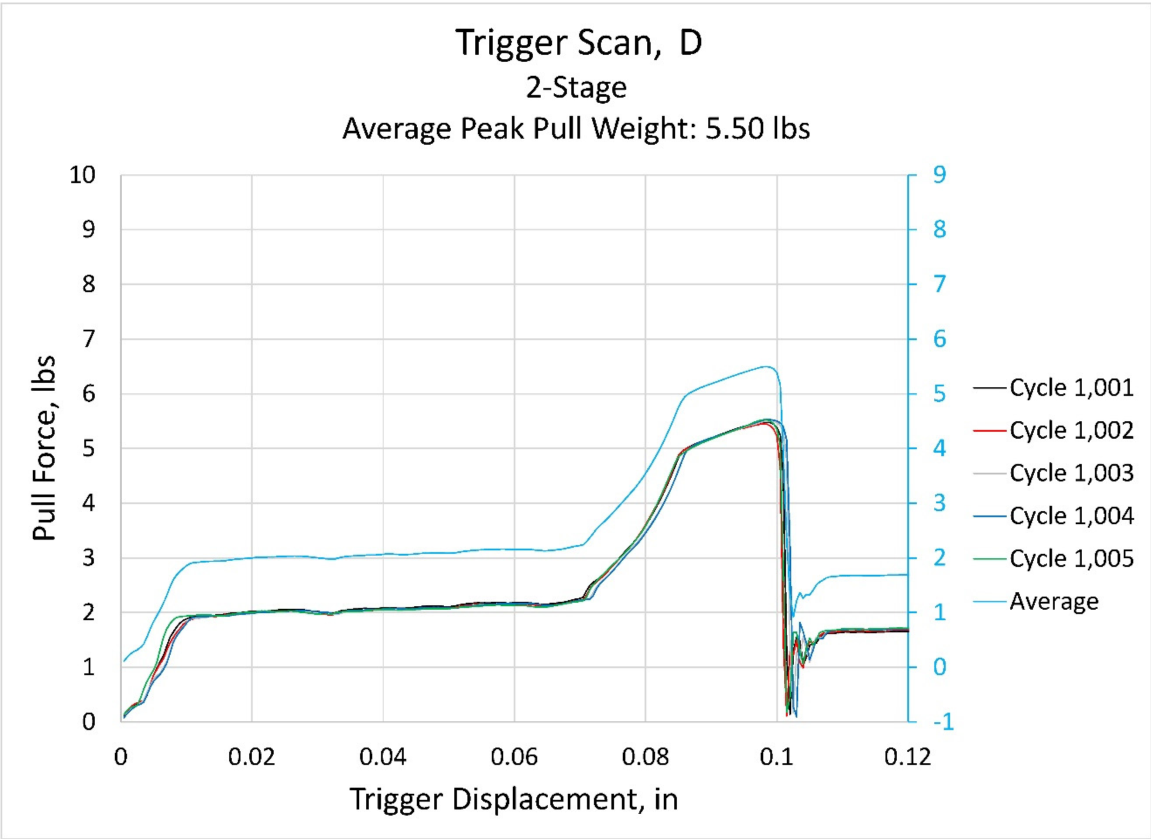
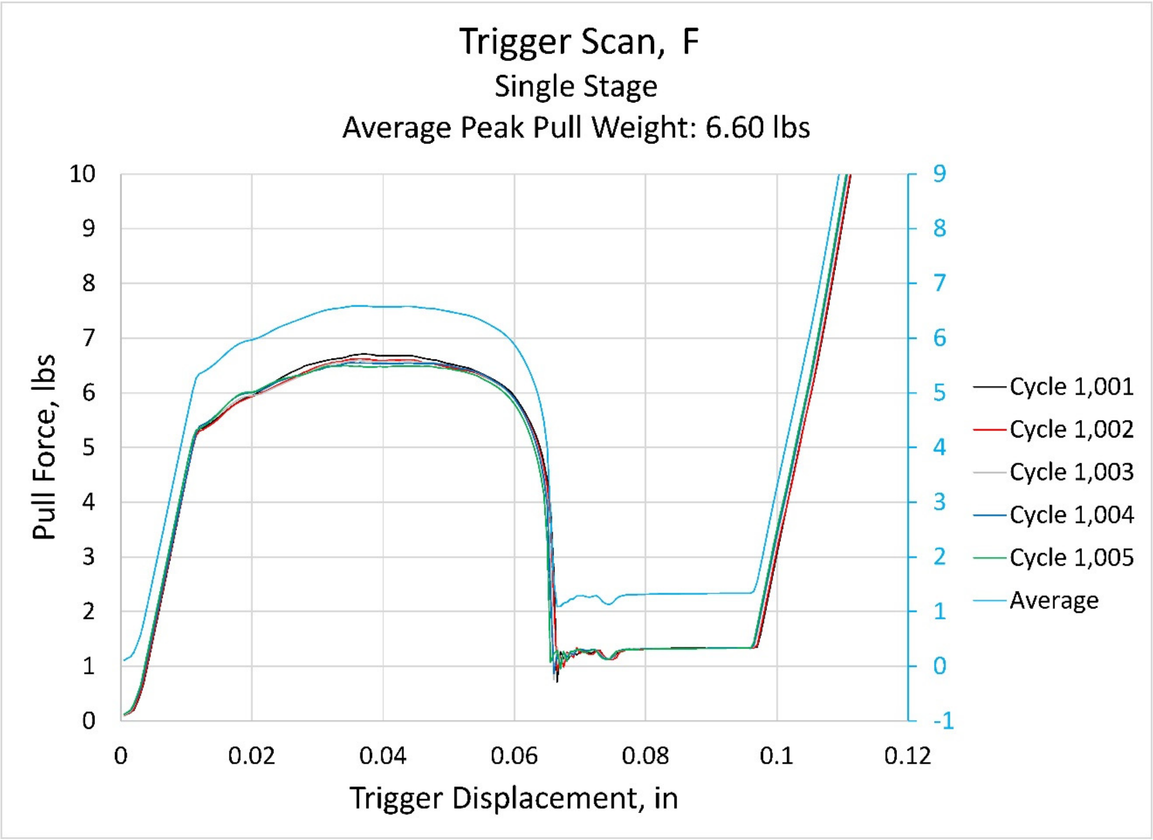
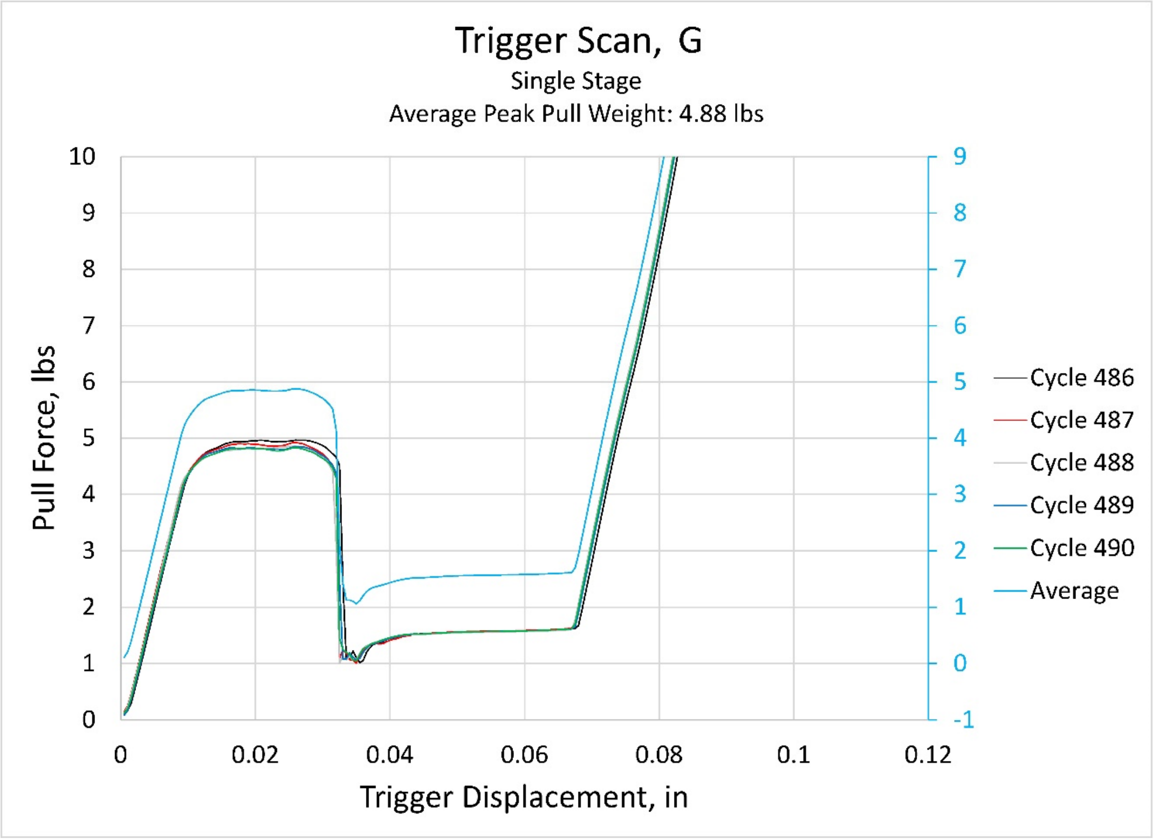

Trigger Scan, D
2-Stage
Average Peak Pull Weight: 5.50 lbs
Pull Force, lbs
Trigger Displacement, in
10
9
8
7
6
5
4
3
2
1
0
-1
0
0.02
0.04
0.06
0.08
0.1
0.12
Cycle 1,001
Cycle 1,002
Cycle 1,003
Cycle 1,004
Cycle 1,005
Average


Trigger Scan, E
Single Stage
Average Peak Pull Weight: 7.21 lbs
Pull Force, lbs
Trigger Displacement, in
0
1
2
3
4
5
6
7
8
9
10
-1
0.02
0.04
0.06
0.08
0.1
0.12
Cycle 1,001
Cycle 1,002
Cycle 1,003
Cycle 1,004
Cycle 1,005
Average


Trigger Scan, F
Single Stage
Average Peak Pull Weight: 6.60 lbs
Pull Force, lbs
Trigger Displacement, in
0
0.02
0.04
0.06
0.08
0.1
0.12
10
9
8
7
6
5
4
3
2
1
0
-1
Cycle 1,001
Cycle 1,002
Cycle 1,003
Cycle 1,004
Cycle 1,005
Average



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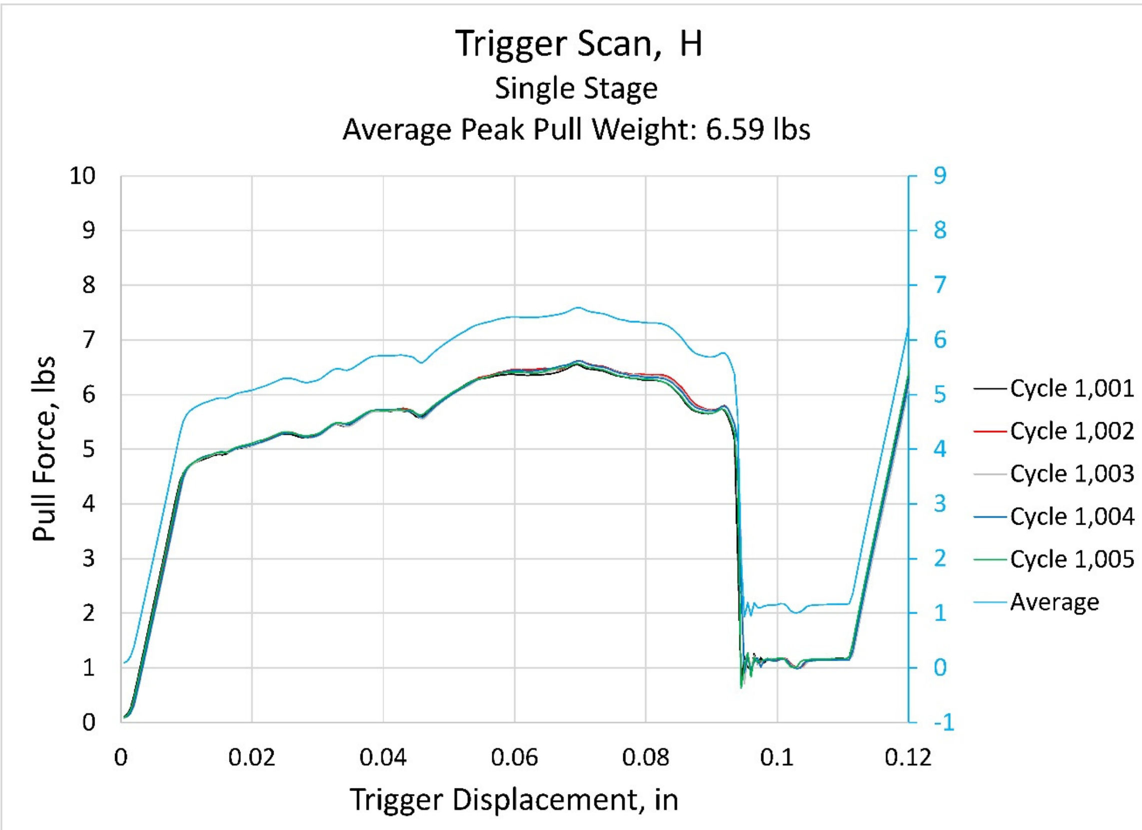

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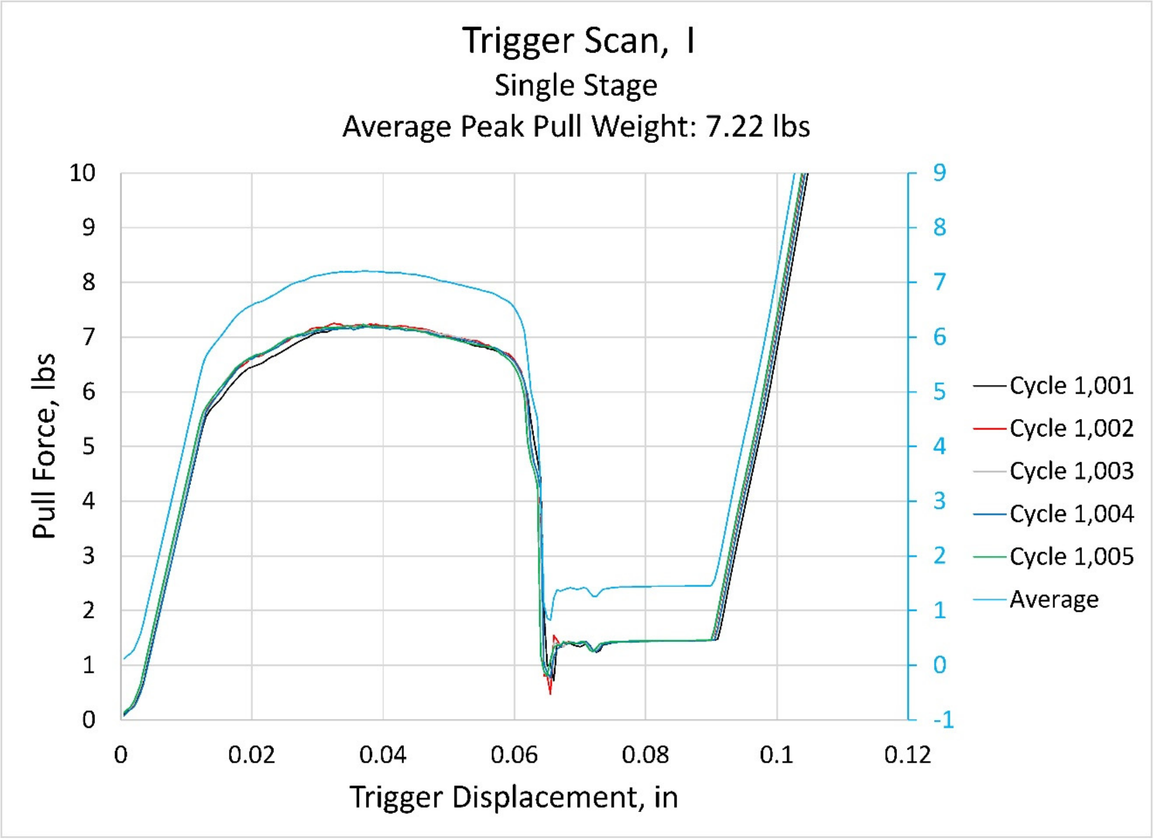

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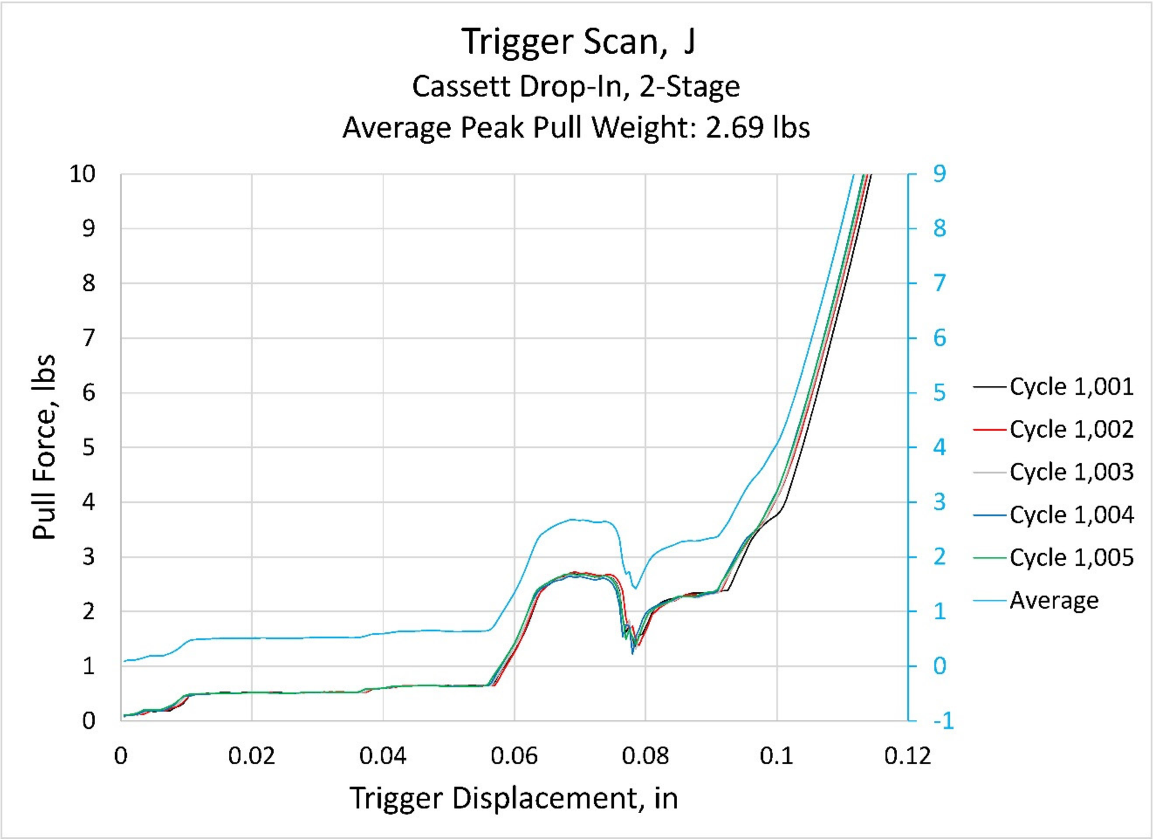
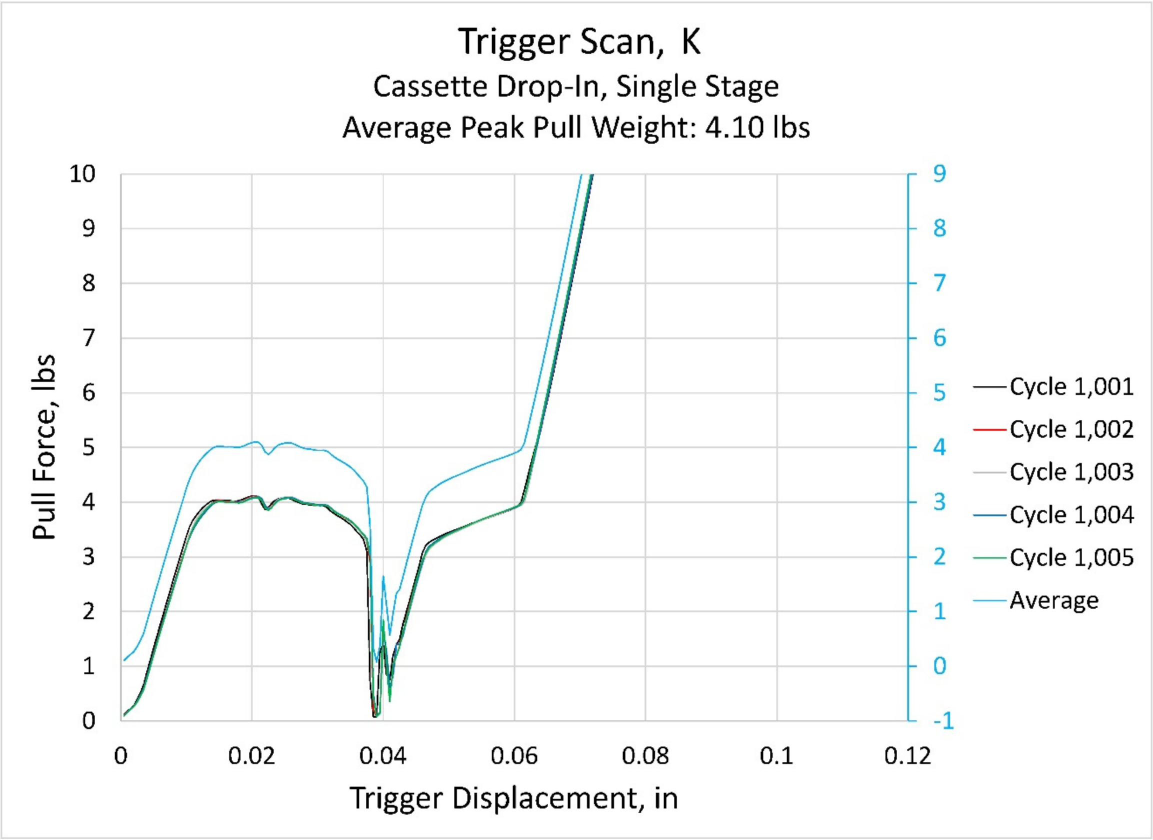
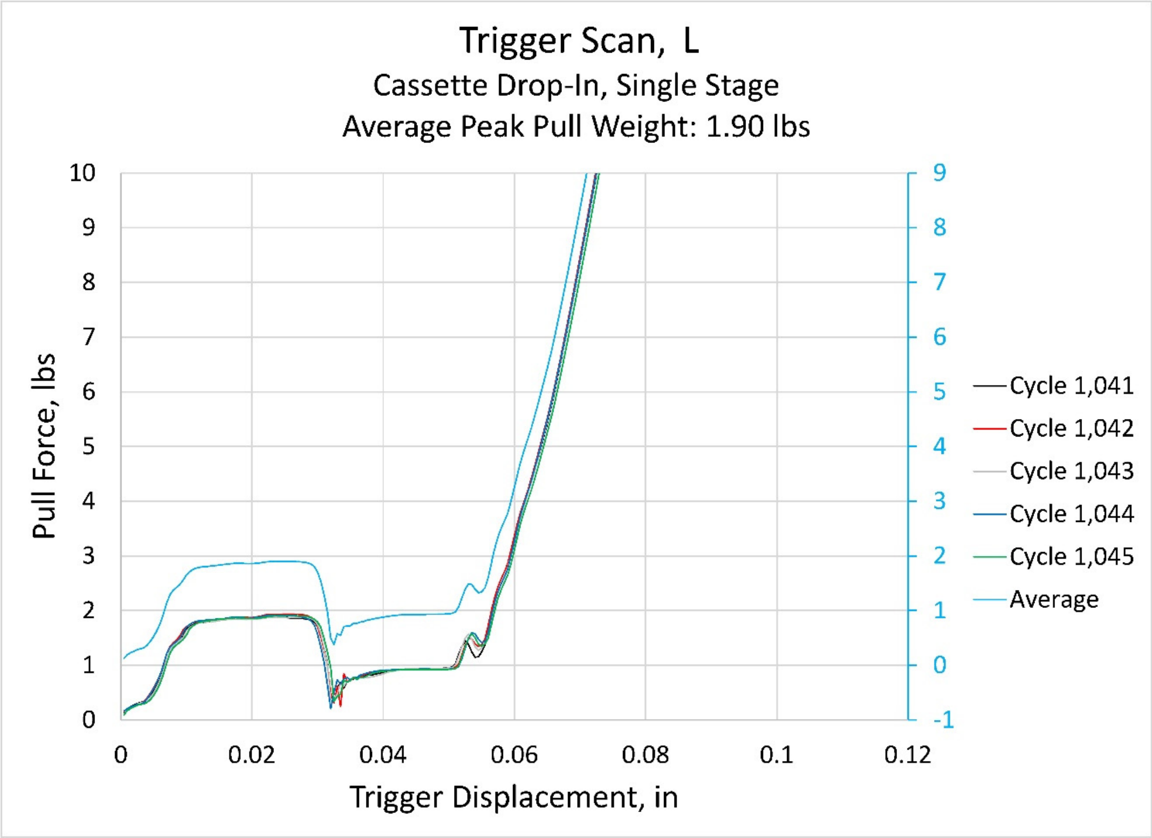
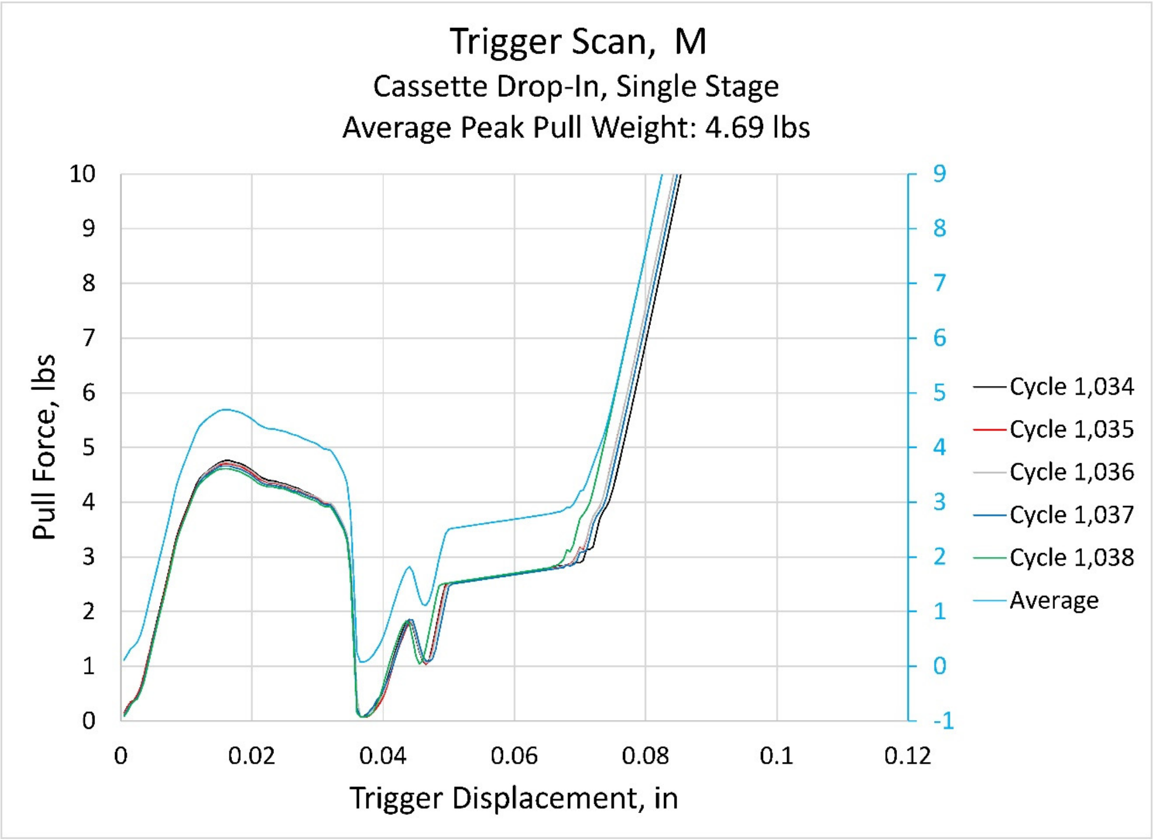
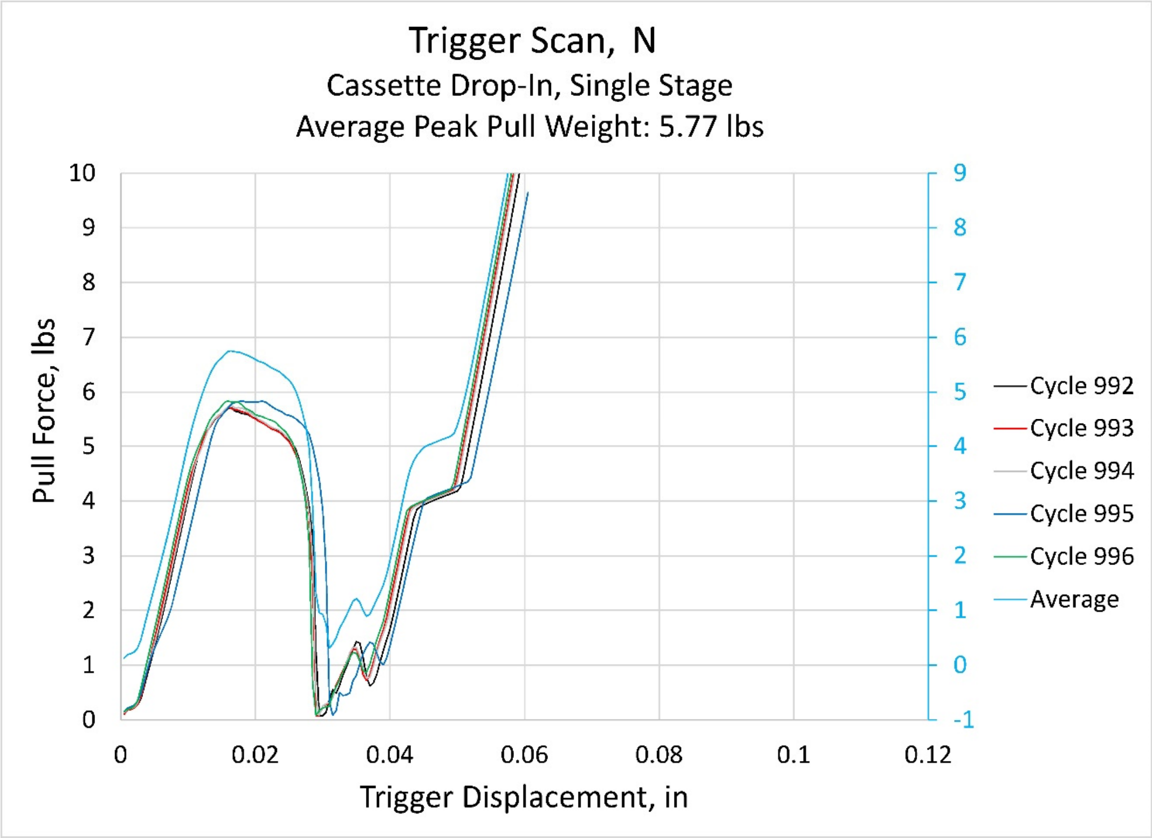

Trigger Scan, J
Cassett Drop-In, 2-Stage
Average Peak Pull Weight: 2.69 lbs
Pull Force, lbs
Trigger Displacement, in
0
0.02
0.04
0.06
0.08
0.1
0.12
0
1
2
3
4
5
6
7
8
9
10
-1
0
1
2
3
4
5
6
7
8
9
Cycle 1,001
Cycle 1,002
Cycle 1,003
Cycle 1,004
Cycle 1,005
Average


Trigger Scan, K
Cassette Drop-In, Single Stage
Average Peak Pull Weight: 4.10 lbs
Pull Force, lbs
10
9
8
7
6
5
4
3
2
1
0
9
8
7
6
5
4
3
2
1
0
-1
0
0.02
0.04
0.06
0.08
0.1
0.12
Trigger Displacement, in
Cycle 1,001
Cycle 1,002
Cycle 1,003
Cycle 1,004
Cycle 1,005
Average


Trigger Scan, L
Cassette Drop-In, Single Stage
Average Peak Pull Weight: 1.90 lbs
Pull Force, lbs
Trigger Displacement, in
Cycle 1,041
Cycle 1,042
Cycle 1,043
Cycle 1,044
Cycle 1,045
Average


Trigger Scan, M
Cassette Drop-In, Single Stage
Average Peak Pull Weight: 4.69 lbs
Pull Force, lbs
Trigger Displacement, in
10
9
8
7
6
5
4
3
2
1
0
-1
0
0.02
0.04
0.06
0.08
0.1
0.12
Cycle 1,034
Cycle 1,035
Cycle 1,036
Cycle 1,037
Cycle 1,038
Average



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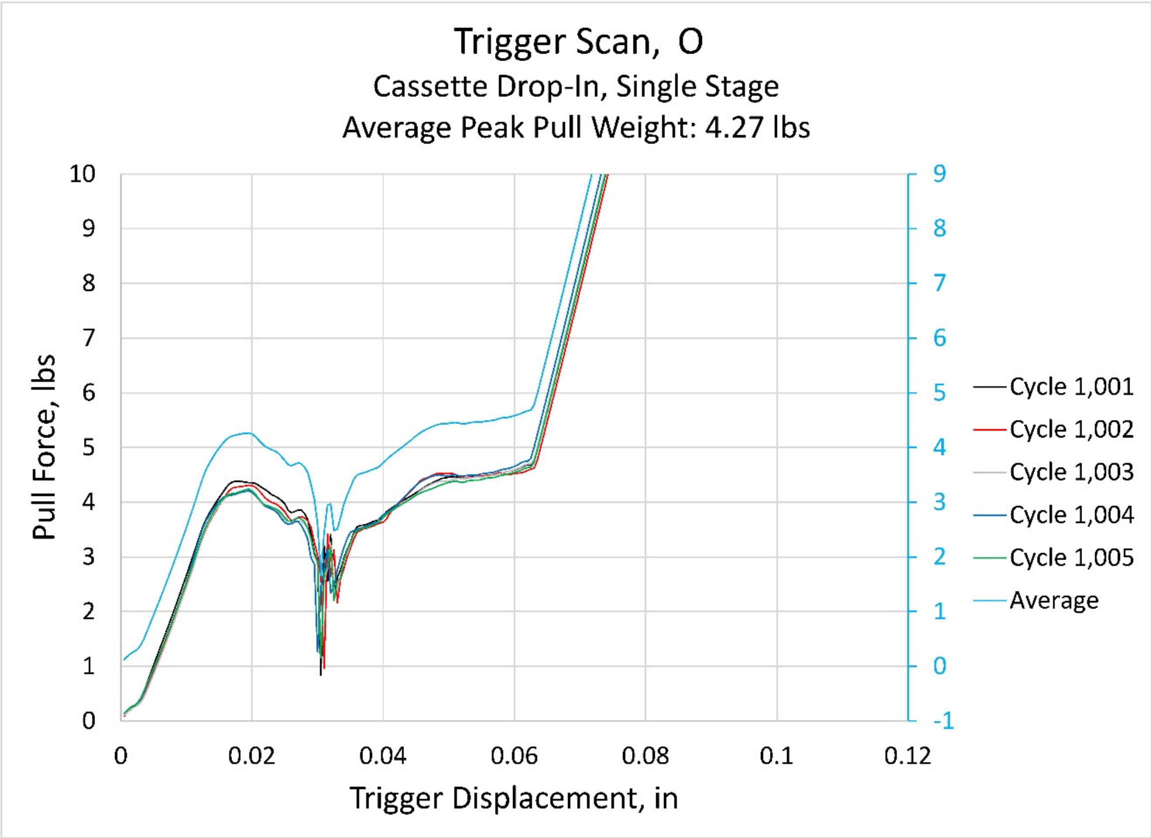

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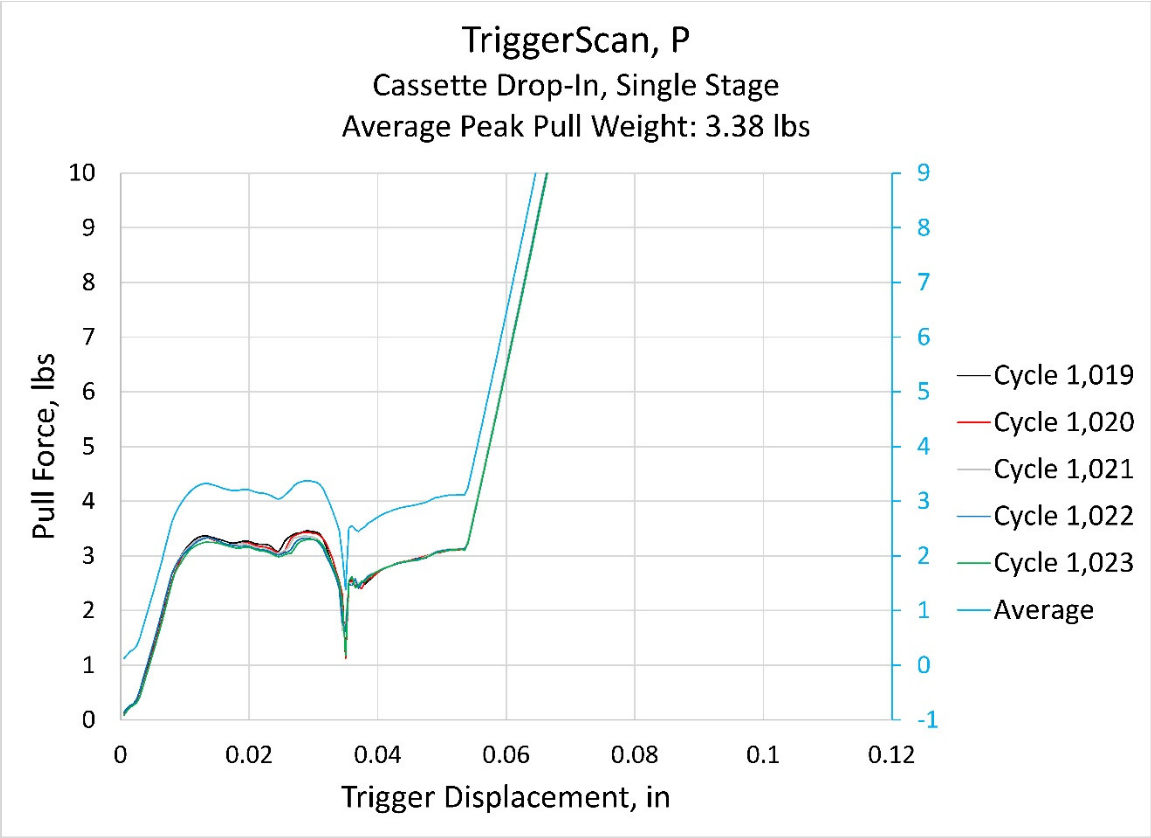

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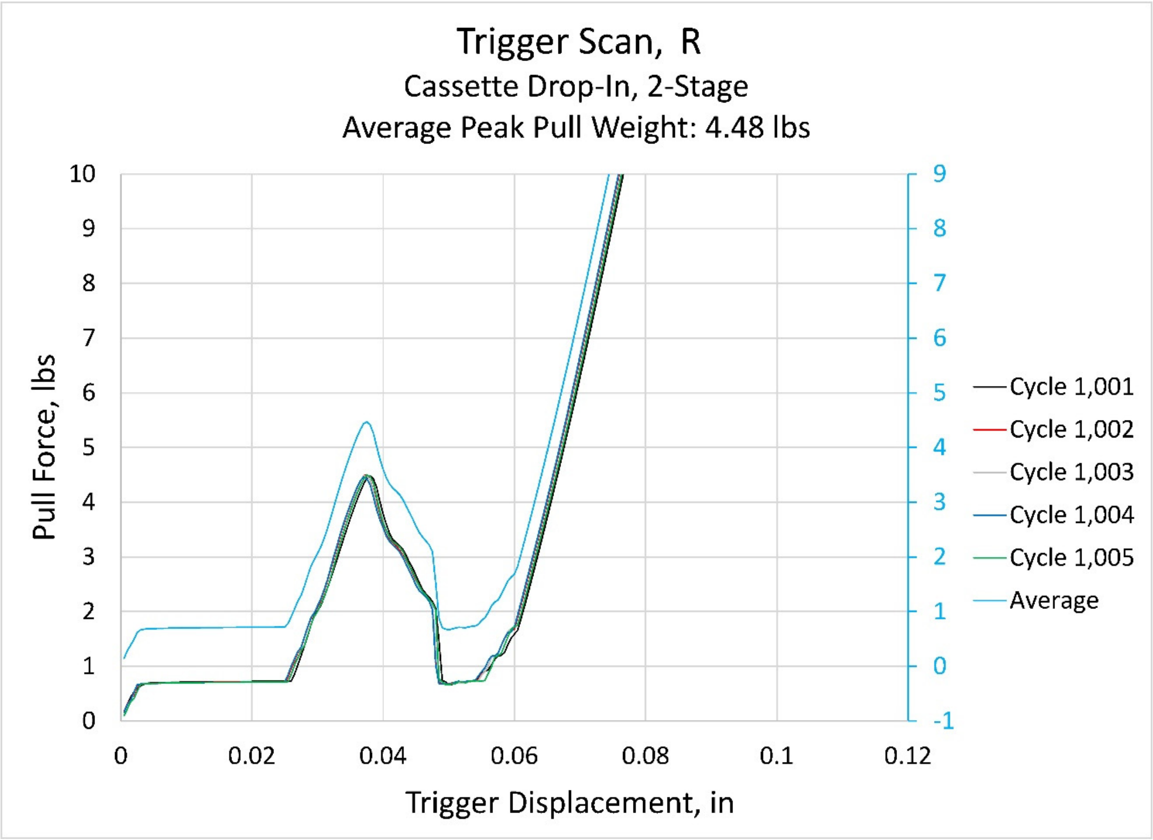
Trigger Scan, Q
Cassette Drop-In, Single Stage
Average Peak Pull Weight: 4.35 lbs
Pull Force, lbs
Trigger Displacement, in
0
1
2
3
4
5
6
7
8
9
10
-1
0
0.02
0.04
0.06
0.08
0.1
0.12
Cycle 1,018
Cycle 1,019
Cycle 1,020
Cycle 1,021
Cycle 1,022
Average



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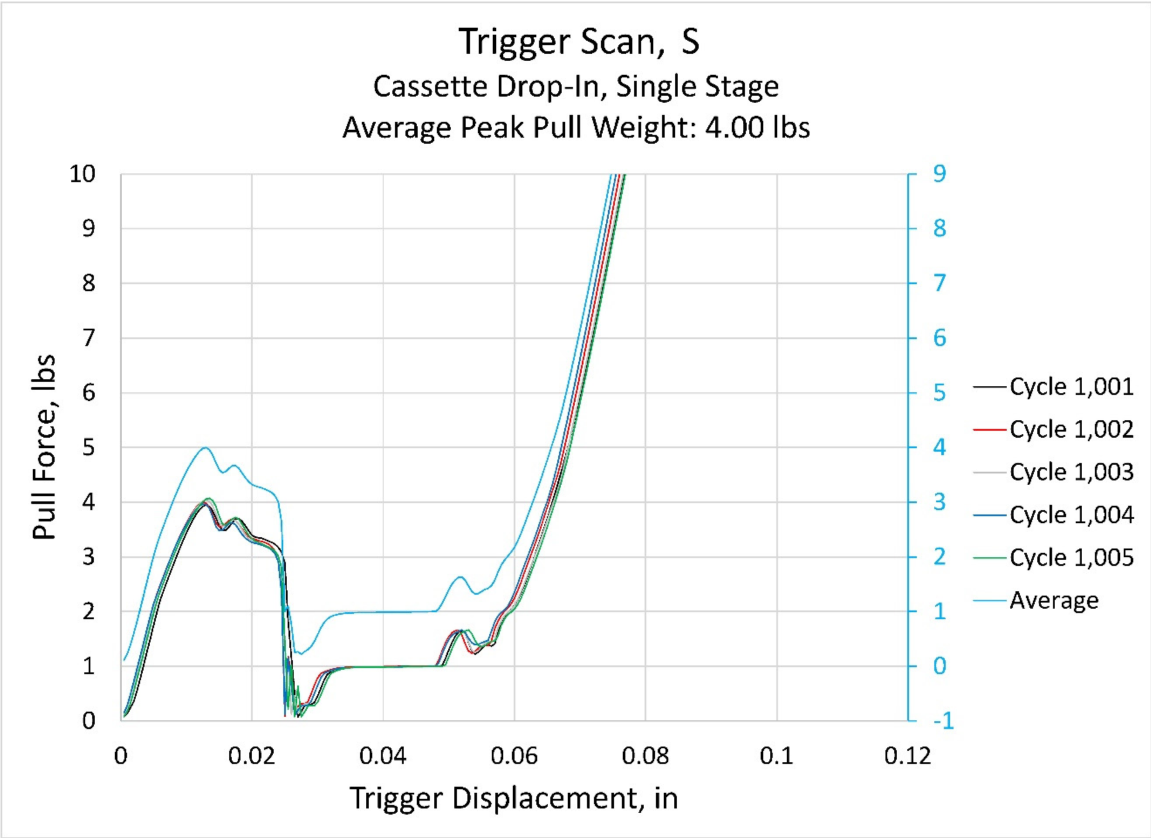

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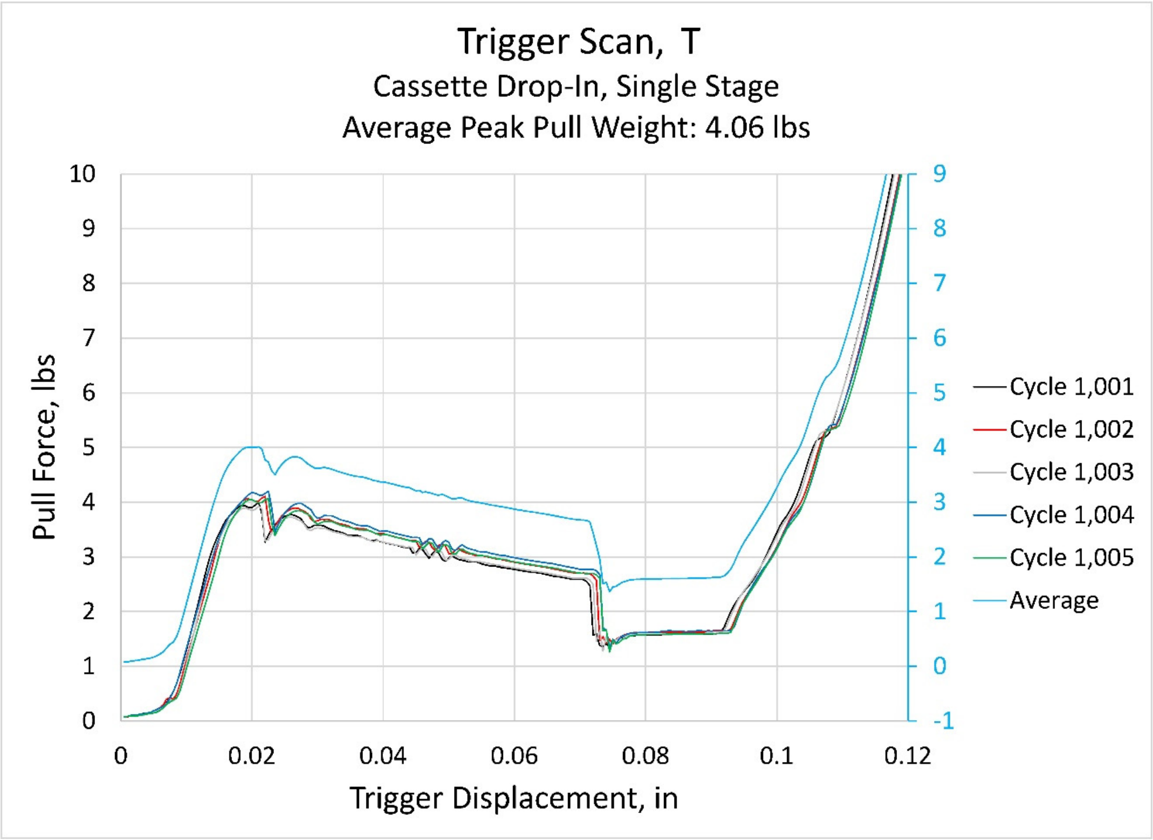

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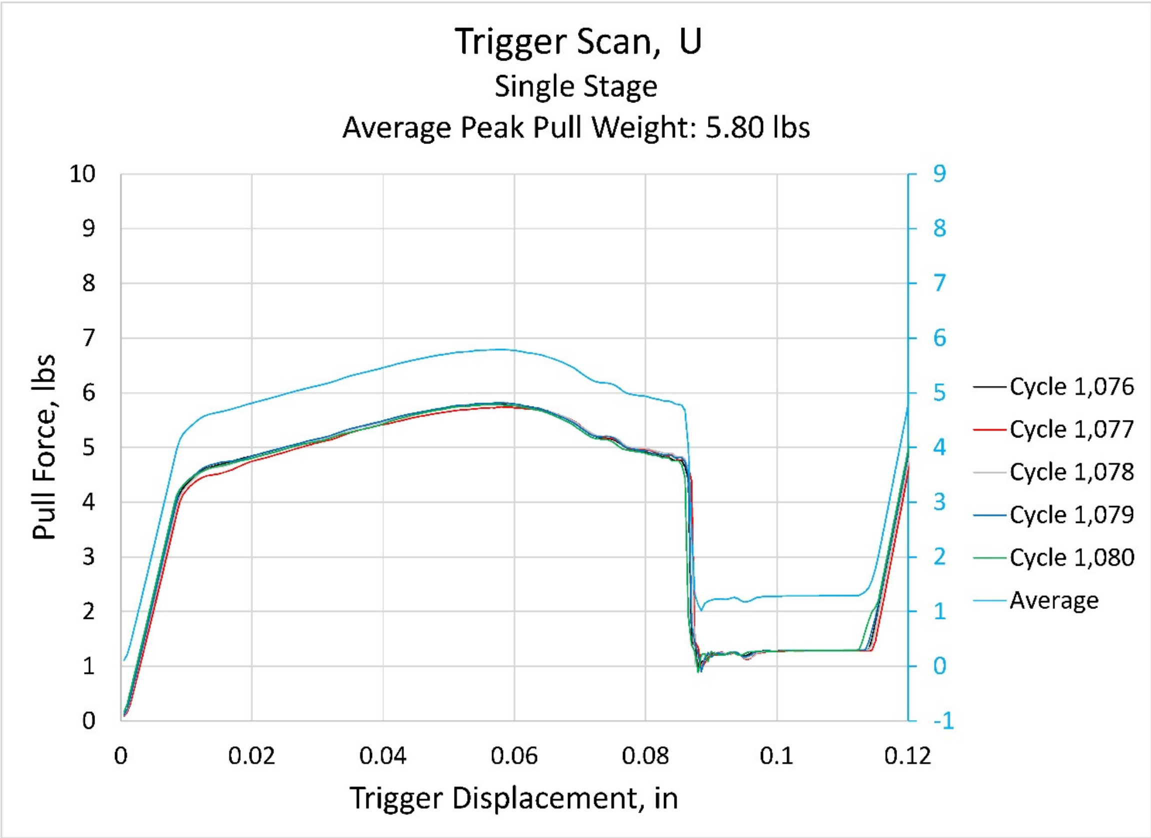

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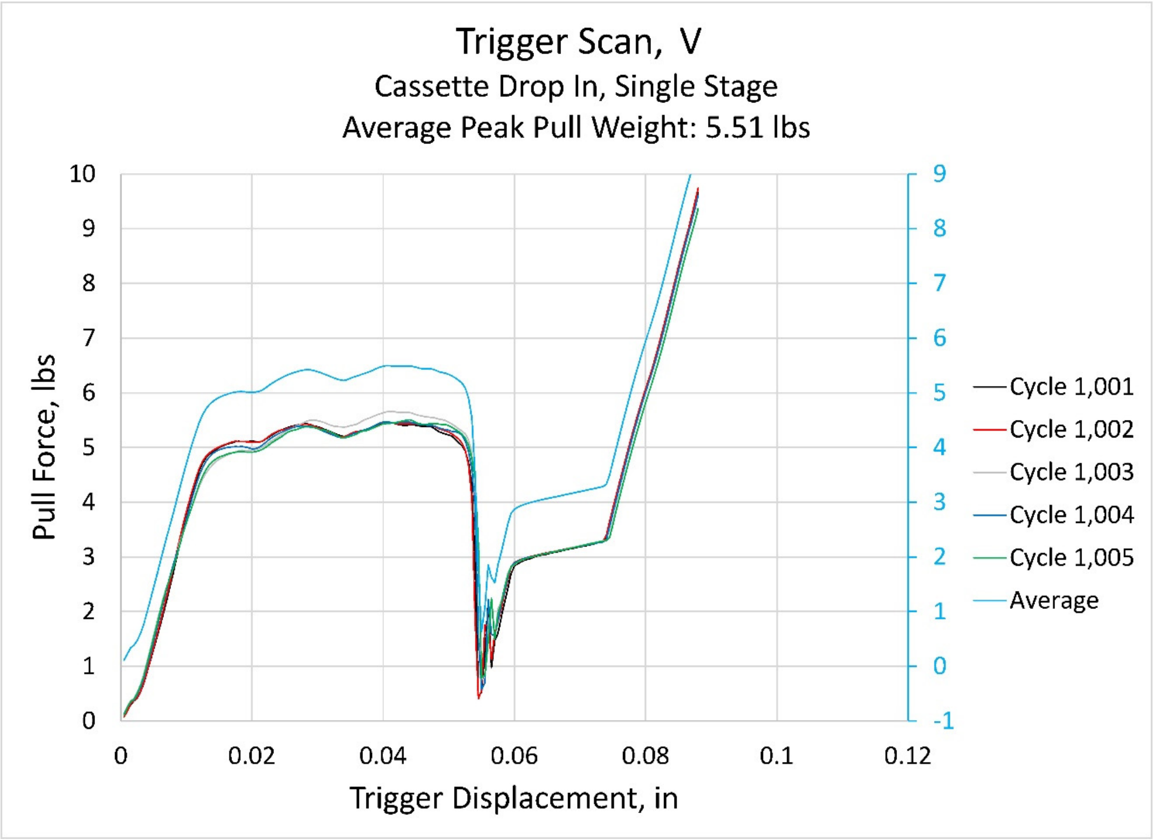

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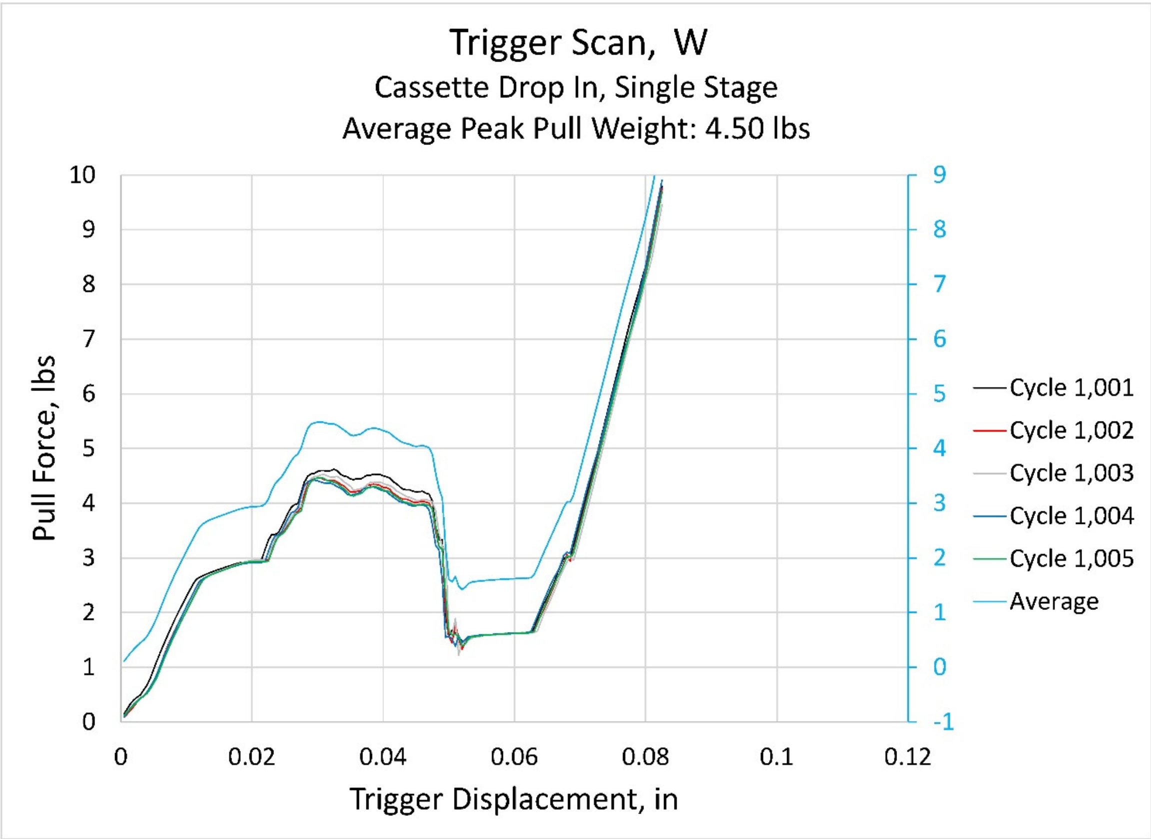

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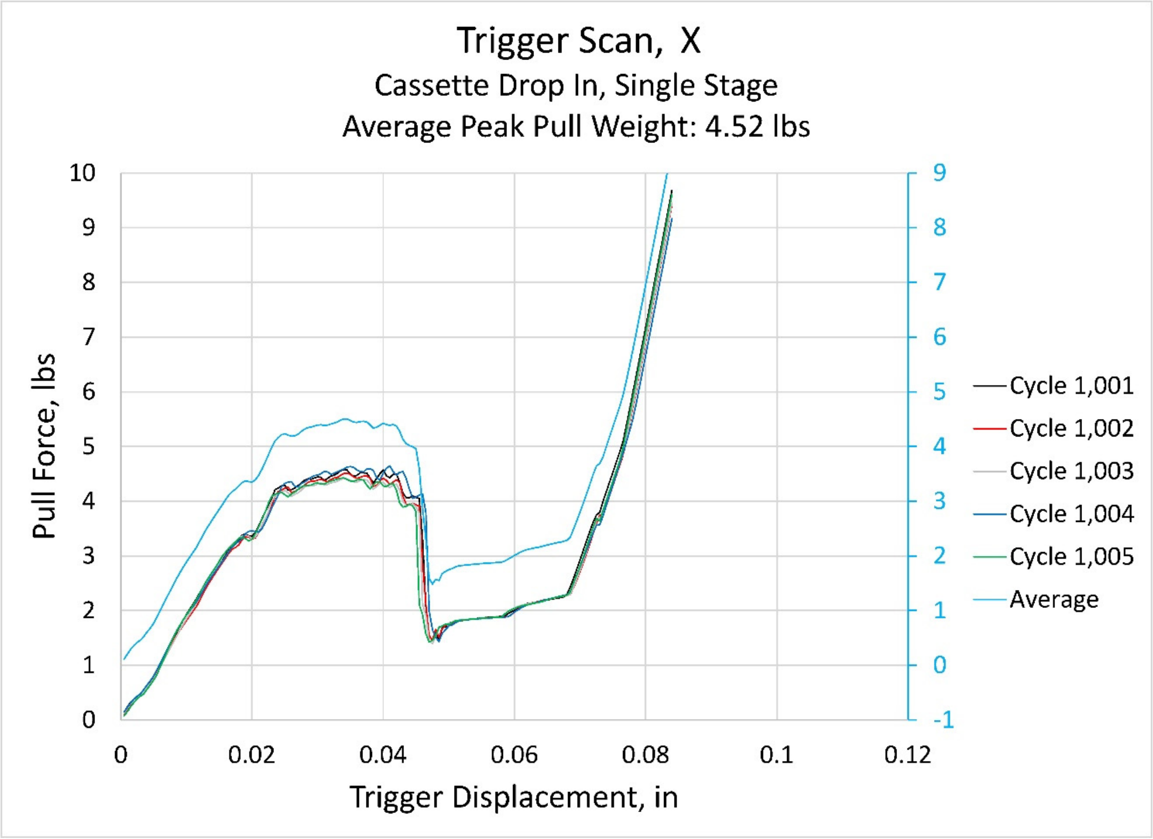
Trigger Scan, X
Cassette Drop In, Single Stage
Average Peak Pull Weight: 4.52 lbs
Pull Force, lbs
Trigger Displacement, in
Cycle 1,001
Cycle 1,002
Cycle 1,003
Cycle 1,004
Cycle 1,005
Average