

## Producing Perfect Plunger Position & Pressure

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Your plunger button is capable of two adjustments: center-shot and tension. This seems relatively simple, but for many archers determining how these two adjustments should be set may as well be magic. After trying several different tuning methods and taking their best parts, I have found this process to be the most consistent. I am convinced that the strength of this method is that each step in the process has both a relatively concrete starting point, and the ability to go back and check the validity and repeatability of the results any adjustments achieve.

It's important to note that this process requires that you have arrows that are close to appropriately spined. This method is designed to then help you determine the most forgiving setup with a given set of arrows.

### Setting initial center-shot

There are broadly two schools of thought with setting your center-shot. One states that you should set it with the string exactly down the center of the arrow. Another states that you should offset the arrow half the width of your shaft, so that the string lines up with the corner of the shaft's carbon closest to the riser. Both of these setups have been used successfully at the highest levels of competition, so how do you know which you should use?

The short answer is that you don't until you experiment. But that is not helpful when initially setting up your bow. When setting up a new set of arrows, I recommend new archers split the difference and align the point of the arrow with the edge of the string opposite the riser window. This will almost never be your final center-shot setting, but it allows you to bare shaft group tune before moving on to plunger tuning.

Experienced archers can begin with the position that has worked with previous setups, as the most forgiving center-shot setting is highly influenced by your anchor position, hook, release, and other elements of your form.

I have been able to successfully tune setups that worked at both center-shot positions (centered and offset). But those setups required very different combinations of dynamic spine, brace height, tension settings, and often required that I used different string alignment when shooting.

### Setting initial tension

Figuring out how much tension you should set your plunger to can seem very circular. There are a number of tests that you can use to find out if it is right, but you still need a place to start.

For standard plungers, such as the Shibuya DX and Beiter, the following chart will get most people close enough to conduct further tuning tests.

Bow Poundage	Spring Tension
Under 32#	Soft spring
32-48#	Medium spring
Over 48#	Hard spring

Another method is a relatively simple formula. Most archers' plunger tension, if measured in grams, is between eight and twelve times their draw weight. So you can gently and slowly

press your plunger button down on a kitchen scale or arrow scale. Take the reading from when the plunger stem just starts to move. So an archer shooting 30# on the fingers will want to start with their plunger between 240g and 360g of pressure. Remember, it's not important to be terribly exact with your setting here, as you will adjust it to find the best setting for you later in the tuning process. This method can be particularly helpful for archers with magnetic plungers that have massive adjustment ranges.

### **Determining the effective range of tension adjustment**

Every setup will have a limited range of button tension that will be able to affect the flight of the arrow. Too weak and the arrow will depress the piston to the point that it makes contact with the plunger's barrel. Too stiff and the arrow will not depress the piston at all. In reality the button's tension typically has a highly diminished effect on the arrow before these two extremes.

You can determine this adjustment range with a relatively simple test. Hang a target or piece of paper with a square cross (+) taped on it. I prefer the latter because it removes the psychological pressures to "shoot tens." Aim at the center and shoot a group. Mark the center of the group and then adjust your plunger tension one half turn stiffer. Shoot another group. The center of this group should move (right for right-handed archers, left for left-handed archers). At some point, you will likely notice that your group gets considerably larger while no longer moving laterally. The setting before that is the maximum effective tension for your setup. Reset to your initial position and repeat this, but weaken the tension instead. This will show you your minimum effective tension for your setup. Note both of these positions.

Ideally both your minimum and maximum tension can be achieved with a single spring. If not, you may find that one spring gives you a larger adjustment range than another. Regardless of the guidelines for starting position above, use the spring that gives you the largest adjustment range.

If the range of adjustment strongly favors one side of the target, you can adjust your center-shot to move the center of this adjustment range towards the middle of the target. I would advise against using an inside offset<sup>1</sup> (where the arrow is aligned between the string and the riser), as this can cause major clearance issues. This is still a temporary center-shot position, but may result in fewer adjustments being necessary in the following test.

Set your tension in the middle of your determined adjustment range for the following test.<sup>2</sup>

### **Plunger tuning**

This process more accurately determines your most effective center-shot position and plunger tension.

Hang a vertical line at a short distance (~10m). A plumb-bob or the edge of a level target works well. Aim at the bottom of this line and shoot an arrow with your 10m crawl. Reduce your crawl and shoot again. Repeat until you've hit the top of the line or are against the nock. Adjust your center-shot and plunger tension until the arrow impacts form a vertical line.

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<sup>1</sup> If your testing determines that an inside offset would be beneficial, consider changing the position of your string blur, going to a weaker arrow spine (or making the arrow dynamically weaker), or examining other elements of your form.

<sup>2</sup> I prefer to bare-shaft tune in the middle of this range when changing arrow configuration, as it gives me the greatest degree of control when fine tuning.

If the arrows rise to the left, move the center-shot to the right.  
If the arrows rise to the right, move the center-shot to the left.

If the majority of impacts are on the draw hand side, increase tension.  
If the majority of impacts are on the bow hand side, reduce tension.

This is a process of continual adjustment until the line is both vertical and centered on your point of aim. Adjust center-shot (1/2-1/4th of a turn at a time) to adjust the slope of the line, then adjust tension (1/3-1/2 turn or 4-5 clicks) to adjust the position of the line. This frequently results in a curve rather than a line. Correct this with very small (1/8 to 1/16 of a turn) center-shot adjustments.

### **Fine Tuning**

For single distance events, you can use the following process to reduce the horizontal size of your groups.

Hang a vertical line out of tape on the target bale set about 25% less distance than you are tuning for (15m indoors, 35m outdoors). The width of the tape should be approximately the same width as the ten ring. Shoot as many arrows at the tape as you can using your crawl for your competition distance and not worrying about the vertical impact, only the horizontal. Measure the width of your horizontal group. Adjust plunger tension in one direction by 1/4 turn or 2 clicks. Repeat until the size of the group increases. Reset and repeat, adjusting in the other direction.

Choose the setting that resulted in the smallest group size. If this group is not centered on the vertical line, make a very small center-shot adjustment towards the line to center it.

Move the target back to your target distance, but mark the center of the vertical line (or make a square cross with a horizontal line at the center). Aim at that spot and shoot a group. Then increase your crawl by 1-2 marks and shoot another group of arrows. Then reduce your crawl by the same amount and shoot a third group of arrows. The center of each group should be on the vertical line. Ideally, all arrows impact within the width of the line. If not, make a small tension adjustment until they do. This should ensure that you can be confident that any crawl adjustments that must be made in a competition have minimal impact on your tune.

### **Adjustments**

You can make adjustments to your plunger in the moment in order to move your group from left to right. The "tension adjustment" portion of this process shows you your range of adjustment and helps you understand how much impact each degree of adjustment has on your horizontal group placement.

While adjusting tension is more expedient with most plunger designs, for single distance events (such as 18 and 50m), making small changes to your centershot is often more forgiving as well as more effective. This tends to have a smaller effect on the dynamics of the arrow flight. On some models, changing the plunger stem for something slightly longer or shorter may be a good option, although this may be too extreme. I recommend plotting how far 1/8th of a turn or the next size stem moves your group in practice, so that this option is available to you in competition.

### **Conclusion**

This process allows you to be confident that your plunger is properly tuned, not based around recommendations or charts, but based around real world results and experimentation. This is

very repetitive, but it's important to remember that tuning is practice: you must execute high quality shots in order to generate good data.

### **Acknowledgements**

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