TUNING A RECURVE BOW

by Ed Eliason

This module consists of tuning tips for a Recurve bow using fingers for release.

First install the arrow rest, nocking point, sight, plunger button if using, and stabilizers. Start with all of your current equipment and do not change in the middle of the tuning process. See the Recurve Equipment Setup Module for a detailed discussion of bow set up.

IMPORTANT INFORMATION ABOUT TUNING AND ADVANCED TUNING

Before you start tuning tests, please number all of your arrows and bare shafts. This will allow you to confirm inconsistencies for each arrow. For example, if the same arrow keeps shooting to the left or right, or up or down, there may be something wrong with the specific arrow. It could be also be the fletch, or nock (crooked).

The purpose of tuning is to configure the proper combination of nocking points, arrow rest, bow, and arrows. The archer’s form while tuning must be consistent. For the new archer, it is more important to work on correct and consistent form before detailed tuning. Tuning is a continuous process. As the archer’s form and consistency improves, more in-depth tuning is required. Archers should use the advanced tuning techniques only once they have reached a consistent form and technical level of shooting; an indication that they’ve achieved this is when the archer attains a score of 285 or better on a 300 Round at 18 meters.

INSTALL THE NOCKING POINTS

Always install the nocking point first. Use a c-clamp type nocking point that is moveable and easy to change; position the nocking point about 3/8” to ½” above square (height of the arrow rest) to begin. Place the arrow on the arrow rest and nock the arrow on the string. Make sure the nock and string fit are not too tight. A nice snap of the nock and string will indicate a good fit. Hold the bow horizontally, allowing the arrow to swing freely, and snap your finger on the string with a downward motion. The arrow should fall to the ground. If it does not, the nock and string fit may be too tight.

INSTALL THE ARROW REST AND CUSHION PLUNGER

We will align the arrow position relative to center shot by adjusting the plunger. Stabilize the bow's position by setting the lower limb on the floor and leaning the top limb against a wall. Ensure that the bow is nearly vertical. Position yourself so that you can view the alignment of the string relative to the limbs. The bow string should be in the center of both the top and bottom limbs. Nock an arrow and line the string and limbs; glance at the arrow. For a right handed bow you'll want the tip of the arrow point to be 1/16” to 1/8” outside (to the left) of the bowstring. Adjust the plunger depth until you've achieved
this offset. Also, the cushion plunger spring tension should be set at medium as your starting point. Typically plungers are sold with three spring tensions; use the medium spring. Set the plunger tension adjustment to medium as well. The spring tension adjustment and possibly the spring will change as the tuning progresses.

**6’ TEST**
The 6’ test was developed by Max Hamilton in the early 1960’s. Max desired to manufacture a vane that would improve flight accuracy and consistency for both target and bow hunting archers. He continued to improve his manufacturing techniques and vanes until Plastifletch became the #1 target vane in the world. At the time archers were having trouble clearing the arrow rests with the new fletch because the vanes were very stiff as compared to the feather fletch that archers were using.

The archer should shoot 3 arrows from 3 ½ meters and observe the direction of the vane/feather end of the arrow. If the fletch is low relative to where the shaft of the arrow enters the matt, it indicates the nocking point needs to be raised. If the fletch is high, it indicates the nocking point needs to be lowered.

If the fletch is to the right, it indicates that the arrow spine is stiff. This can be adjusted by any of the following methods: increasing the weight of the bow poundage, a longer arrow, increasing the weight of the arrow point, lighter vanes, or reducing tension of the cushion plunger.

If the fletch is to the left, it indicates that the arrow spine is weak. This can be adjusted by any of the following methods: reducing the weight of the bow poundage, a shorter arrow, decreasing the weight of the arrow point, heavier vanes (13-14 GR), or increasing tension of the cushion plunger.

If the fletch is low and right, correct the nocking point problem first and repeat the test. If these methods fail to correct the up/down or left/right problems, then the arrow spine isn't appropriate for the bow's weight and another arrow size is needed.

![Paper Tuning Setup](image1.png)

**Figure 1. Paper Tuning Setup**

**PAPER TEST**
The paper test is an improvement to the Max Hamilton test. It is more accurate because it eliminates the inconsistencies of the target matt as a factor. Build a frame to hold butcher paper 3-6 feet in front of the target matt. Stand 4 ½ meters from the frame and shoot 3 arrows at shoulder height, see Figure 1.
As above, observe the direction of the paper tear, using the fletched end of the arrow shaft relative to the arrow point's entry in the paper. To control a vertical tear, change the nocking point as described in the 6' test, see Figure 3 examples. To control horizontal tear, change bow poundage, change the weight of the vanes, or change the tension on the cushion plunger or the length of the arrow, again as described in the 6' test, see Figure 4 examples. If all of these methods fail to correct the tuning, another arrow size is needed. The paper tear test is a very good method of tuning for either a Recurve or Compound. Figure 2, below, indicates good arrow flight.

Figure 2. Paper tear indicating good arrow flight.

Figure 3. Paper tear on left indicates a high nocking point; tear on right indicates a low nocking point.

Figure 4. Paper tear on left indicates a stiff arrow for right-handed archers (weak for lefties); tear on right indicates a weak arrow for right-handed archers (stiff for lefties).

Figure 5. Tear indicates that there are a couple of problems. Remember fix the nock issue first. When the tear is flat, fix the weakness or stiffness of the arrow.
**Bare Shaft Test**

The Bare Shaft Test is the preferred method of tuning a Recurve bow because of its accuracy and ease. Stand about 4-5 meters from the target matt and shoot a group of 3-4 arrows aiming at some point on the target face. Now shoot a bare shaft (a shaft without any fletch) aiming at the same spot. The bare shaft is referred to as a planing shaft. Once it starts to travel, high, low, left or right from your fletched arrows group, it will not change direction. This test is designed to determine if the nocking point is high or low and if the arrows are weak or stiff for your bow/arrow combination. Your bow and arrows will be properly tuned when the bare shaft shoots in your fletched group.

The up/down separation of the bareshafts from the fletched arrows is the result of a vertical misalignment of the bow configuration which will cause the arrow to porpoise when shot, see Figure 6. This is corrected by adjusting the nocking point and should always be corrected first. Pay attention to the impact area only. (The point end of the arrow not the fletched end.) If the bare shaft shoots higher than the fletched group: lower the nocking point. If the bare shaft shoots lower than the fletched group: raise the nocking point.

![Figure 6. Porpoising Flight and Bareshaft - Fletched Arrow Relationships](image)
The left / right separation of the bareshafts from the fletched arrows is primarily the result of a mismatch between the arrow’s stiffness and the weight of the limbs which will result in the fishtailing of the arrow when shot, see Figure 7.

Figure 7. Fishtailing Flight and Bareshaft - Fletched Arrow Relationships

For a right handed shooter:
If the bare shaft shoots to the right of the fletched group – it means the arrow is too weak. Try decreasing bow poundage, increasing plunger pressure, shooting a shorter arrow. If still too weak try an arrow with a stiffer spine.

If the bare shaft shoots to the left of the fletched group – it means the arrow is too stiff. Try increasing bow poundage, decreasing plunger pressure, or a longer arrow. If the arrow is still too stiff try a different arrow. Be careful when increasing bow weight to be sure the archer is physically strong enough for the extra weight. Proper form is most important for the developing archer.

For a left handed shooter:
If the bare shaft shoots to the left of the fletched group – it means the arrow is too weak. Try decreasing bow poundage, increasing plunger pressure, shooting a shorter arrow. If still too weak try an arrow with a stiffer spine.

If the bare shaft shoots to the right of the fletched group – it means the arrow is too stiff. Try increasing bow poundage, decreasing plunger pressure, or a longer arrow. If the arrow is still too stiff try a different arrow. Be careful when increasing bow weight to be sure the archer is physically strong enough for the extra weight. Proper form is most important for the developing archer.
**Tiller Tuning**

If your bare shaft is at 11:00 o’clock relative to the fletched group, both the knocking point is off (low) and your arrow is stiff. It is possible that all you need to do is to turn the top limb adjustment screw one turn down. This will do two things: raise the nocking point and add more weight to your bow. Thus the arrow is weakened and the nocking point is correcting by changing the bow’s tiller. The opposite is true if the bare shaft is at 4:00 o’clock. The archer can change the tiller instead of changing the nocking point on the string. When the archer is happy with the tiller change, mark the nocking point and reset the tiller back to the manufacture's recommendations. This test is intentionally done from a short distance to start the tuning process. If it were done from a longer distance, the bare shaft could shoot too far in any direction and miss the target matt.

**French Method – Walk Back Test (outdoor test)**

This is a great test that checks the center shot of the bow/rest and the cushion plunger tension. Set up a target matt on a stand and then lean another matt below the matt you are shooting. The archer should start at 10 meters from the matt with the sight set at a mark near the top of the target matt. Do not adjust your sight setting, it should remain at 10 meters for the duration of the test. Shoot one or two arrows from 10 meters, then shoot one or two at 20 meters, and repeat at 30, 40, and 50 meters. This test is best done on a nice day with very little wind. Mark the groups shot at each distance. In an ideal test the group of arrows at each distance would lie in a vertical line.

**For right handed archers:**

If the path of the arrow groups curve to the right (top to bottom), the pressure plunger is protruding through the bow too much. To correct, back the cushion plunger out ½ turn at a time. If the path curves to the left (top to bottom), the pressure plunger is not protruding through the bow enough. To correct, screw the cushion plunger into the bow ½ turn at a time.

If the path of the arrow groups runs diagonally to the left (top to bottom), the spring tension of the cushion plunger is too stiff. To correct, soften the tension by backing the setscrew of the pressure plunger out ½ turn at a time. If the path of the arrow groups run diagonally to the right (top to bottom), the spring tension of the cushion plunger is too weak. To correct, soften the tension by backing the setscrew of the pressure plunger ½ turn at a time clockwise.
**SHORT DISTANCE FINE-TUNING**

1. Make a broad horizontal line through the center of a piece of cardboard, or a target face. Be sure that you can see the line from the shooting position. Remember, all arrows must be numbered so that you can find any issues with arrow, nocks, or fletch.

2. Shoot six arrows at different locations on the line. Concentrate on keeping your pin on the line. Don’t worry about left and right hits; just try to keep your shots on the line.

3. Shoot two good groups, discarding any rough or bad shots, and note the vertical impact of the arrows and their relationship to the line. All adjustments are made with the nock point during these steps. If your arrows are not consistently grouping on the line, make small 1/32" adjustments up or down with the nock point and shoot two more groups. Continue making nock adjustments in small increments. If all of your arrows begin to hit on the line you are successfully correcting the nock position. In the event that your groups widen, move your nock back to its original location and make small adjustments in the opposite direction.

4. After achieving a nice, straight, horizontal pattern, rotate your target so your line is vertical.

5. Just as before, shoot two good groups, discarding any rough or bad shots, and note the horizontal impact of the arrows and their relationship to the line. All adjustments are made with the arrow rest during these steps. If your arrows are not consistently grouping on the line, make small 1/32" adjustments left or right with the arrow rest and shoot two more groups. Continue making rest adjustments in small increments. If all of your arrows begin to hit on the line you are correcting the rest position. In the event that your groups widen move your rest back to its original location and make small adjustments in the opposite direction.

**MORE ADVANCED TUNING (FOR VERY ADVANCED SHOOTERS)**

This test is for those archers who shoot 1150 or better in an outdoor FITA (30 arrows at each FITA distance: 30m, 50m, 70m, and 90m for men and 30m, 50m, 60m, and 70m for women. Walk back to 30 or 40 meters and repeat the short distance fine-tuning test. However, if your groups are significantly
better at 30 and 50 meters as compared to 70 and 90 meters, it could be that the fletch is too big and is causing the arrow to float or parachute and slowing the arrow speed to the target. This would be especially difficult in wind conditions. Also, a heavier point may alleviate this problem.

**Fine Tuning at Longer Distances**

This testing can be done during practice sessions. At the beginning, write down the details of your set up so that if desired, changes could be made to the original set up. Shoot 12 arrow ends at an 8” paper plate. Write the details of the testing on the paper plate. Possible examples include:

1. Change the tiller on both limbs to 1/8” to ¼”, first the top limb and then the bottom limb.
2. Change the brace height to ½” to ¾”.
3. Move the arrow rest or cushion plunger to ¼ to ½ turns in and out.
4. Change the point weight on your arrows. Evaluate what shoots best and change your base bow setup to match.

**Conclusion**

Once the archer is satisfied with the set up and shooting groups, it is time to shoot a group and a bare shaft at 18 to 30 meters. Make note of where the bare shaft hits in comparison to the group. This is the bare shaft “tuning mark.” If you change bows or arrows, knowing where the “tuning mark” is will help you save time on the next round.

Please do not copy another’s “tuning mark.” This is very personal. The tuning mark of highly competitive archers may be at 6 o’clock, 4 o’clock or 11 o’clock. Find your own “tuning mark”. It is your tuning form that works for you.