

FOC

Arrow **FOC** (front of center) is an important concept that all archers should understand. Whether bowhunting, target or 3d shooting, the FOC of an arrow will affect the flight of the arrow. FOC becomes especially important the farther downrange the target is, and also if a broadhead (most notably a fixed blade broadhead) is used.

The basic definition of FOC is the percent difference between the physical midpoint of the arrow and the center of gravity (balance point) of the arrow as compared to the total length.

When an arrow is shot, the fletchings immediately begin working to correct the flight of the arrow. Any little imperfection in the initial launch of the arrow, either from shooting with fingers, imperfect release, improperly tuned bow, torquing the handle of the bow, etc. will cause the arrow to flex as it leaves the bow and/or come out crooked. The job of the fletchings is to correct this imperfect flight by straightening the arrow as air flows over the fletchings during flight.

In order for the fletchings to correct the flight of the arrow, they must move the arrow into a straighter flight path by rotating the shaft about the center of pressure. The center of pressure is the point along the shaft where the aerodynamic forces are balanced. Just like with a weather vane, the fletchings on the back of the arrow provide more surface area on which the air can act upon the arrow.

Fletchings are best able to steer the arrow when the center of pressure is farther behind the center of gravity. This is more easily done the longer the distance from the fletchings to the center of gravity. Therefore the farther the center of gravity is from the back of the arrow, the easier it is for the fletchings to correct the arrow flight.

If the center of gravity and center of pressure are too close together, or worse if the center of gravity is behind the center of pressure, the arrow will become unstable. To witness this, take an arrow or a dart and try to throw it backwards! What happens?

For penetration purposes, the opposite phenomenon occurs. A larger FOC will prevent an arrow from flexing as much when coming into contact with the intended target. Hunters will want a higher FOC so that as the broadhead enters the game, the distance from the front of the arrow to the center of gravity is lower, making it more difficult for the arrow to flex or deflect. Any flex or deflection of the shaft upon entry means that energy is being lost somewhere other than directly along the center of the shaft, lessening the overall penetration.

A larger FOC is necessary for shooting long distances where crosswinds tend to have a large effect on arrow flight. The same applies to shooting broadheads because the larger surface area of a broadhead is more greatly affected by

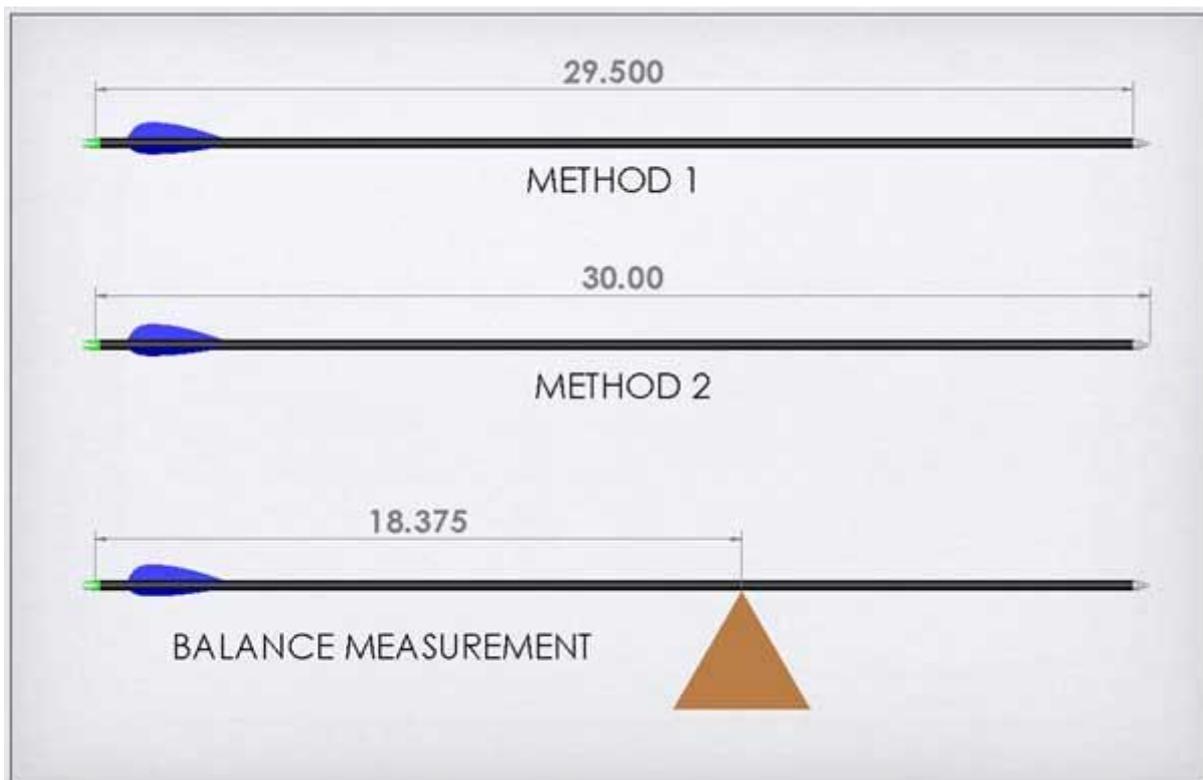
launch imperfections as well as crosswinds. Broadheads effectively move the center of pressure closer to the point and tend to steer an arrow which can often have a negative affect that the fletchings must overcome.

There are two main ways of calculating FOC. Both use similar formulas; the difference being that one takes into account the length of the point and insert while the other does not.

Calculating arrow FOC

AMO Method:

- 1) Measure the length of the shaft from the throat of the nock to the end of the shaft, excluding the insert; this is length "**L**"
- 2) Using a sharp edge, balance the arrow (including the point) and mark the balance point
- 3) Measure the distance from the throat of the nock to the balance point; this is length "**B**"



- 4) Input **B** and **L** into the following formula:

$$FOC\% = \left(\frac{B}{L} - 0.5 \right) * 100$$

The second method replaces the total length of the arrow, including the point, for the "L" value.

Arrow FOC calculator

This site has a calculator that will do the calculations for you once the measurements have been taken: ArcheryCalculator.com

Comparing arrow FOC values

When comparing FOC values, it is important that both values be calculated with the same formula. The second method will generally result in a lower FOC value.

Recommended values for FOC (using the AMO method) vary depending on the application, target arrows (field points) should generally be in the 8-11% range and broadhead tipped arrows in the 10-15% range. FITA and longer distance shooters will often go for a 12%+ FOC, even though they are using field points, because of the long distances involved. Some traditional hunters have used FOCs of over 30% because with the right setup it can enhance penetration on animals.

Calculating arrow FOC example

Here is an example of how to calculate FOC and how a field point and broadhead with identical weights can have different FOC values on the same arrow. This first image shows a Carbon Express Mayhem arrow with a 100 grain field point. The finished arrow is balanced on a triangular piece of wood and the balance point marked with a silver Sharpie:



Here the field point is changed out for a 100 grain NAP HellRazor and the balance point is marked with a thin piece of green painter's tape:



Now a close up of the different marks:



As can be seen, the broadhead has a slightly higher FOC if using the AMO method, though just barely, with 10.45% vs. 10.35% of the field point. If using the second method stated above, the FOC difference is significantly more, and in the opposite direction, broadhead 7.48% and field point 8.68%. I have found that using the AMO method is a better overall method of comparing values and is the method that I consistently use.