Easton Weight Codes- Sorting out the Mystery

By George Tekmitchov

When it comes to finger shooting recurve bows, there is no more important arrow specification than arrow spine. Consistent, correct arrow spine for each and every arrow being shot from a particular setup is paramount to grouping performance. The reason is simple and obvious if you have ever seen the behavior of an arrow shaft leaving the recurve bow. All of a shooter's arrows must bend in the precise same manner on every shot, shot to shot, in order to group.

While most accomplished archers know this intuitively, I once undertook a project to determine exactly how spine tolerances affect score. After all, when it comes to target archery, score is all that really matters. In the 1990's, I arranged a test in which American archer and Olympic medalist Denise Parker shot a specific dozen arrows every day for a six week period, carefully documenting every single shot and its impact point on the target at 70 meters. Half of the arrows Denise was shooting were properly matched in spine, while the other half were at a tolerance used by a non-Easton shaft. The shafts were blind coded and mixed and visually identical, so Denise had no idea which ones were which.

At the end of the six week study, all of the data were examined, and we found that there was a two point difference in raw score for every 12 arrows shot- the same two point margin that decided 80% of the World and Olympic matches of that era, and still decides most sets in the current competition match format.

It might seem obvious how important spine is, but there is nothing quite like real-world proof to see how important. If you have ever looked at a set of premium Easton A/C target shafts- X10, Pro Tour, ACE, ACC, ACG, or Pro Field, you may have noticed a somewhat mysterious code on the labels- "C2" or "C3" or "DP" or some other combination. This is what Easton calls a Weight Code. The purpose of this article is to explain what these weight codes are, why they're important, and what you need to know about them.

"But wait- you started talking about the importance of spine, how does that relate to weight?" Patience, dear reader, we will get to that shortly.

In order to understand weight codes, first you must know a bit about the materials used to build arrow shafts. Specifically, you need to know a little bit about how the stiffness-to-weight of a given material is expressed. Engineers use a dimension known as Young's Modulus of Elasticity, usually simply referred to as "elastic modulus", to express this property.

All experienced shooters know that when it comes to pure consistency, there's nothing better than aluminum as a shaft material. Within a given alloy, the stiffness to weight ratio of an aluminum arrow is amazingly consistent. As long as the dimensions of wall thickness, diameter (inside and outside) and concentricity are spot on, the stiffness (spine) of the arrow will also be spot on. The reason is simple. Aluminum alloys have extremely exact elastic modulus values from one arrow production batch to another. For example, XX75 alloy is always very close to 10,400,000 million modulus- whether it was made in 1964 or last week, the stiffness to weight, and the spine of a given size XX75 arrow will always be exact because all 7075 aluminum alloy has this exact stiffness to weight property.

Not so with carbon fiber. Commercial carbon fiber can vary by more than plus or minus two million modulus, which is a relatively huge amount. For instance, one typical fiber used in premium carbon shafts has a modulus of 46,000,000. But, unless an arrow manufacturer takes the extra steps needed to improve upon the normal material variation, this could range from 44,000,000 to 48,000,000 or more. This is a huge variation.

An additional variable is found in the epoxy or other polymer resins used to hold the actual carbon fibers together in the arrow shaft. The percentages of resin to carbon must be held to a very tight tolerance to keep this under control and produce a structure that has a consistent “bulk modulus”- that is, the stiffness of the combination of materials, in this example, epoxy and carbon fiber, which is something all carbon fiber composites have in common. But, the ratio is subject to variation from several process and material related issues. Even the age of the starting material can have a tremendous effect on the stiffness properties, because this factor affects several process related variables that affect the outcome.

Any single one of these variables can substantially affect the stiffness of the arrow. Combine the variables that are possible, and you can see that some carbon shafts can have a tremendous spine variation.

This is so important for accuracy, that Easton takes several important steps to mitigate the effects of these variations. First, as the largest carbon buyers in the archery industry, Easton works directly with the companies who make the carbon fiber, to obtain only select material lots, which are as close as possible to the exact stiffness needed for a given design. Using only select materials from the world’s premiere carbon fiber manufacturers, and continually testing the materials as they are prepared for use, minimizes most of the carbon fiber variation.

Another important factor is that Easton does all of the arrow fabrication. From the construction of the super-precise aluminum core and accompanying preparation to the carbon wrapping, curing, machining, straightening, and other finishing operations, Easton carries out each step entirely in their facilities in Salt Lake City, USA. This ensures total control over all of the many processes and steps required to create each arrow shaft.

Still, even using the finest carbon fiber available, and precisely controlling the other variables is not enough to completely eliminate the variation. There are two approaches to dealing with this issue.

First, one could simply finish the arrows to a given weight, and allow the spine value to float. This would result in the performance problems mentioned at the beginning of this discussion.

The second way is that one could construct arrows to the exact spine needed, as that is the most important consideration for arrow shaft accuracy and consistency- especially for finger release. This is where the importance of weight codes comes into play. Easton produces every arrow to the precise spine specification required, and then, takes the additional step of individually weighing each shaft and assigning that shaft to a group- the weight code group.

Weight Codes explained

If you look at the label of an Easton X10 shaft, you might be a little bewildered by the various numbers and codes indicated. Let's decipher these.

First off there are two separate lines:

906 A/C/X10 410 Series A
Aluminum/Carbon X10 C.2

Looking at the numbers in order:
First line:
906 is the core tube size expressed as diameter and wall- 9/64ths diameter and 0.006" wall thickness. All X10 sizes are based on this size core tube, so all use the same basic components.

A/C/X10 is obviously the model designation.

410 is the spine value, 0.410" deflection per ATA standard.

Series A is the design revision for that particular size shaft. In case of any changes to materials or other specifications over the years, a separate series is issued. This is done very infrequently- once a decade or so- and does not affect arrow performance- any of these can be mixed by a shooter with no effects on grouping.

On the second line is the weight code, which is the subject of this article.

In the case of the specific arrows in the photo, you can see the designation C.2. When a production run (of many thousands of arrows) is created, each arrow shaft is individually weighed after final spine-tuning, and the entire population of arrow shafts can be charted (as with a bell curve) for weight. Typically, there is about a 5 to 6 grain total spread from lightest to heaviest among the thousands of arrows in a given run of a given size, and this is subdivided into less than one grain increments for assignment to a specific code- and even finer graduations for each individual dozen.

Here are the key points to understand the significance of this.

- All ACE and X10 weight codes cover a total spread of 1.5 grains (.097 gram)
- All packaged shafts are +/- 0.5 grains in that package
- It is easily possible to mix shafts from two adjacent weight codes with no ill effect ("heavy" C.2 and "light" C.3 for example)

Spine is so important to arrow accuracy, Easton goes far beyond the rest of the industry to ensure that you receive both the specified spine and matched weight for every premium target shaft produced in a given model. Weight codes are one of several methods used to ensure that every premium shaft you purchase of a given size and code will correctly match those you already have, or will obtain in the future.

This is one of the more significant reasons why weight-coded Easton shafts have been used to win more than 99% of all individual and team medals since 1996!