Scientific Broadhead Test

Muzzy has reached its 27th year, a great accomplishment to say the least. The company has fine-tuned their products over the years. The company's main goal today remains the same as it did in the early days under its founder, John Musacchia, Sr. - producing a broadhead that flies true, stays sharp and penetrates through bone. The company remains committed to providing the finest products.

After discussing this test with one of the executives at Muzzy, I was pleasantly surprised to hear about the company's extensive testing methods and focus on manufacturing in-house. Testing concepts vary widely when it comes to broadheads. The folks at Muzzy try to perform tests that are both relevant and extreme. The extreme tests push the limits of the MX-3. These tests consist of shooting into thick plates of steel. I do like the fact that they are testing the outer boundaries to validate the strength of the ferrule and shaft. The testing that is done in this article is less intense than the destructive testing done by Muzzy. Yet this work for publication is something Muzzy and the staff at *ArrowTrade* believe provides real insight into broadheads.

Please note that the test methods used provide measurable numbers that are exclusively related to broadheads alone, not to the entire hunting arrow. In addition, I am of the opinion that testing done on animals is the most relevant method to evaluating the penetration of an arrow. However, it's difficult to replicate such tests, which are destructive and take years to compile. Therefore, this test has been tailored to measuring characteristics that will affect penetration, and it is done in a manner that offers a reliable and repeatable test.

Test Overview

The test performed on the Muzzy MX-3 is separated into three parts. First, the product is evaluated for quality purposes. Next, the broadhead is pushed through polyethylene (poly) sheeting and the amount of work required and peak force are measured. Thirdly, the Muzzy's ability to take a direct hit into wood is documented.

Inspection

Muzzy provided three packages of MX-3s. Much can be said about products that weigh close to their advertised weight. As shown in the table each head is weighed. All heads were fairly close or identical to one another, but were less than the advertised weight of 100 grains (refer to weight measurement table). After weighing the product, I took digital images of several of the broadheads under a high-power microscope. As shown in the picture, the Trocar Tip and blades have little to no imperfections and were extremely sharp out of the package.

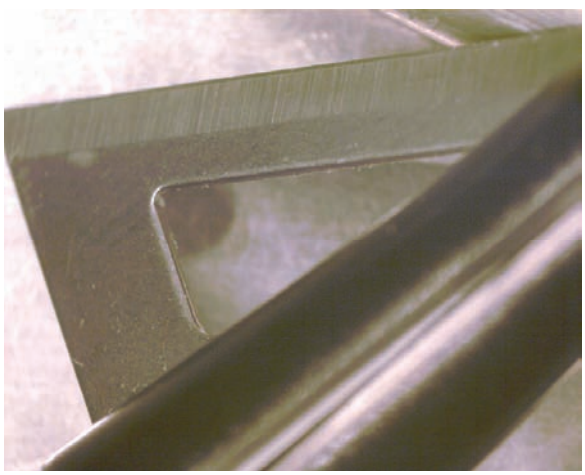
Penetration Force

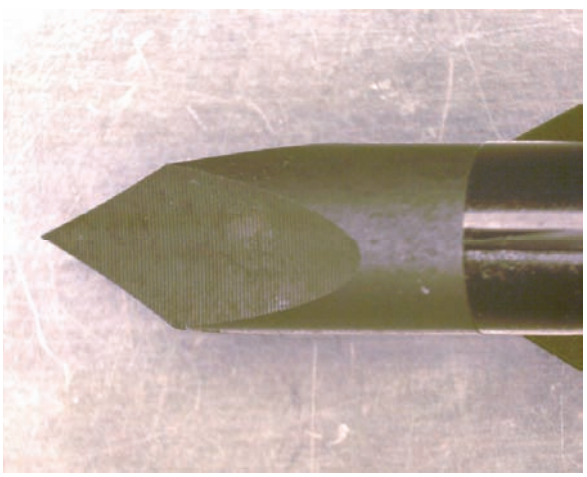
A broadhead is a critical piece of the puzzle when it comes to penetration. The mechanical advantage that a broadhead creates is essential for cutting and slicing a path through game. In a hunting scenario, the broadhead will make contact with soft tissue and bone as it travels

Weight Measurements

	Broadhead 1 (Grains)	Broadhead 2 (Grains)	Broadhead 3 (Grains)	Average Weight (Grains)
Package 1	98.7	98.8	98.2	**98.6**
Package 2	98.3	98.5	98.8	**98.5**
Package 3	98.2	98.6	98.6	**98.5**

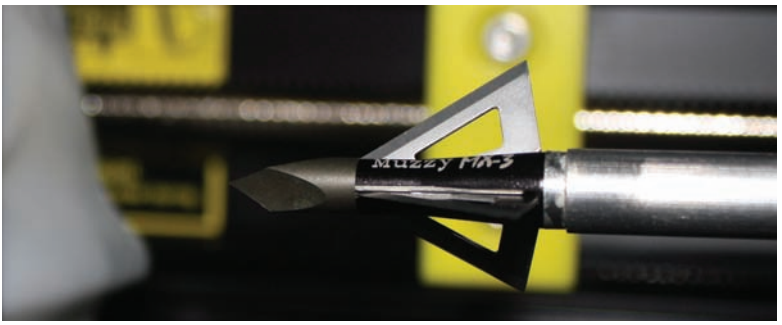
PHOTOS BELOW: ***Microscopic photos show extremely sharp edges.***





Muzzy MX-3

By Jon Teater



Here the broadhead mounted to the drive unit, ready to penetrate the layers of test media.

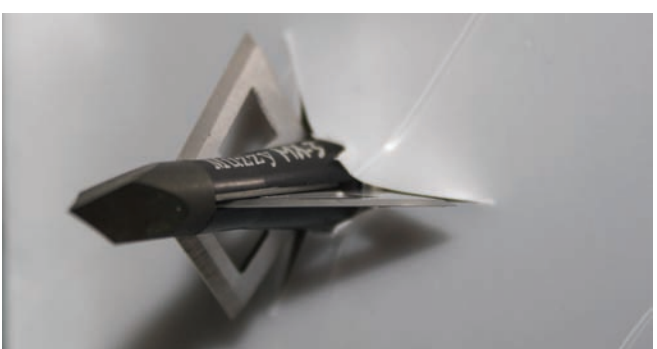
through an animal's body cavity. As the broadhead travels through the cavity it will meet resistance. A broadhead's ability to pass through a material with ease (or minimal force) due to cutting features/characteristics (i.e. sharpness, profile, number of blades, etc.) may result in an increase in the projectile's "penetration potential."

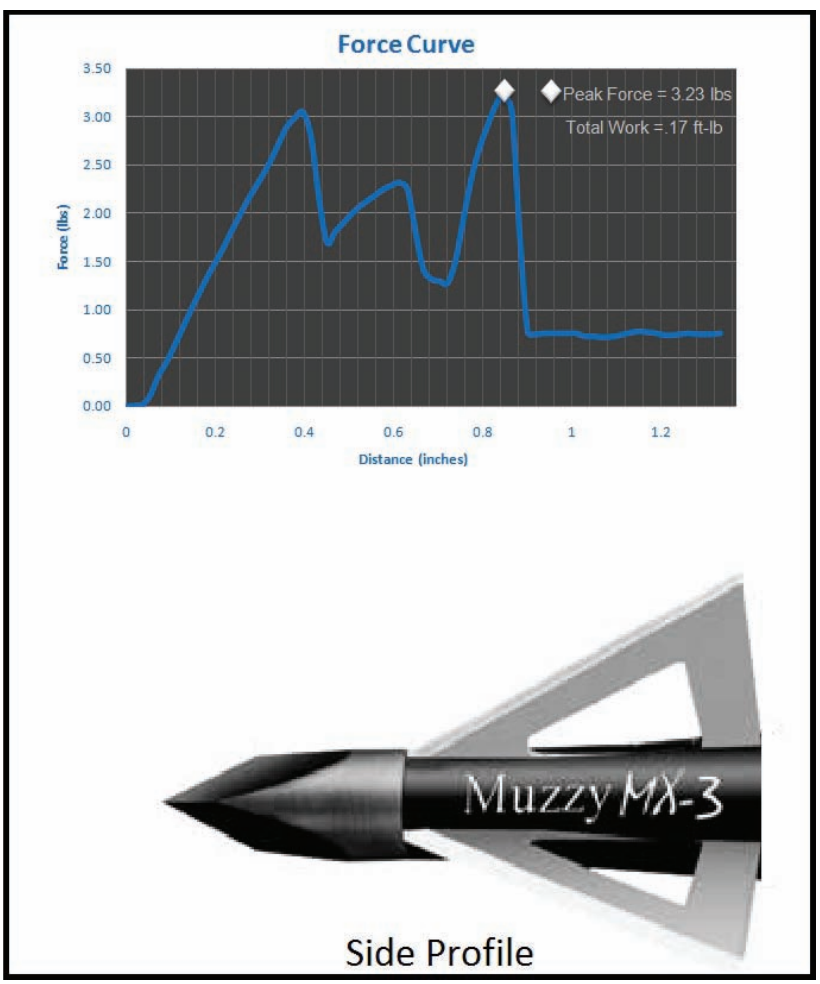
This portion of the test is static; therefore, the dynamics of shooting an arrow from a compound bow into a medium is not present. A broadhead will ideally make most of its contact against skin and soft tissue as it enters and moves through an animal. It is rather difficult to find a material that is readily available and comparable to tissue. With that said, I evaluated several materials and did research comparing various materials based on factors such as elongation, impact resistance, tensile strength and tear strength. The decision was made to use poly sheeting, which may seem odd to some. However, it has several properties that are more comparable to tissue than various rubbers.

As with most tests it is difficult to remove all the variables. In this test I have minimized the variables by testing the broadhead independent of the arrow and other forces (i.e. momentum). The test starts with the use of a rigid fixture. The fixture includes sophisticated equipment (a load cell) that records the amount of force (in pounds) it takes to penetrate a medium. Three layers of the mentioned poly sheeting are compressed in a holding fixture. The broadhead travels through the sheeting within the holding fixture through the use of a linear slide and stepper motor. The motor is designed to control the speed and limit the distance that the broadhead will travel.

A force curve is recorded as the MX-3 penetrates the medium. The graphical representation details the resistance at each stage of penetration through sheeting. The broadhead's profile is provided as part of the graph. The profile/graph comparison indicates peaks and valleys at different stages during penetration. The major resistance points are at the central point of the Trocar Tip and the first 1/3 of the blade. The other tables detail the total amount of work and peak force (lbs) the MX-3 takes to penetrate the medium. To put the information into perspective, a field point takes approximately 10 or 11 pounds of peak force to penetrate the three layers of poly sheeting. Keep in mind that the cutting diameter of this broadhead is approximately 1-1/4 inches, yet it required only about 1/3 the force needed by a field tip.

PHOTO BELOW: The force is recorded from tip to shaft as the broadhead penetrates the multiple layers of poly sheeting.





Design Integrity

The thought behind this portion of the test is to evaluate the broadhead's ability to withstand damage upon impacting a dense material. A broadhead that ends up becoming damaged while impacting bone will suffer in penetrating because of an increase in resistance that ultimately occurs.

For this test, two arrows are tipped with MX-3 heads and are shot by a compound bow into wood, at a distance of approximately 10 feet. The density of wood has some similarities to hard tissue (bone). Many tests consider plywood to be a good choice. I found there to be inconsistencies in plywood and decided on a premium pine that is nominally one inch thick (actual measurement .7665 inches). A product that can "survive" and is unharmed after penetrating wood should be considered well designed by most archers. One can assume that if the product is able to remain unscathed or only slightly blemished from this portion of the test, then the results in the field should be alike.

As shown in the picture, the side profile of the broadhead indicates deep penetration into the wood. The penetration of both heads is similar. Both broadheads remained intact and neither suffered any damage. The broadheads remained extremely sharp after removal from the wood. In fact, I could barely tell if either of the broadheads were any less sharp than after the initial assembly.

Overall

The MX-3 lived up to its reputation as being "Bad to the Bone." I found assembly was quite easy, after following the directions, and the product had all the necessary hardware for tightening and practice shooting. The advertised .025 inch stainless steel blades were very sharp and the product did its job under some tough test conditions.

Most pro-shops will find the Muzzy reputation alone to be the primary selling point for this product. The company offers the MX-3 line in multiple weights for 2011, which proves to be essential for those that are after different types of game. The company's offerings and results of this article should be enough to gain interest from most pro-shop owners and archers alike. Furthermore, this article proves that Muzzy has designed this product to be field ready. The shorter profile and quality components are what will help pull in potential consumers interested in heads that fly well at high speeds. Overall, I would rate the product to be exceptional in design integrity and above average in sharpness.

About the Author: Jon Teater began archery product testing in 2005. His technical experience, hunting skills, and test equipment allow Jon to perform some of the most in-depth technical reviews of products in the industry. Jon has designed and built sophisticated test equipment, which enables compound bows and crossbows to be shot automatically, providing a top-notch test environment on which to base his conclusions. Jon provides readers with accurate product assessments that have been published in *Bow and Arrow,* on *ArcheryTalk.com* and in *ArrowTrade* Magazine. Jon and his wife Lisa live in Upstate New York with their baby son, Tristan. This *ArrowTrade* contributor can be reached at jon@archeryconsumer.com.

Force Test Broadhead 2 (Package 1)

Parameter	Peak Force (lbs)	Work (ft-lb)
1	3.23	0.17
2	3.40	0.18
3	3.34	0.18
4	3.42	0.17
5	3.34	0.17
Average	3.35	0.17

Force Test Broadhead 3 (Package 2)

Parameter	Peak Force (lbs)	Work (ft-lb)
1	3.30	0.16
2	3.41	0.16
3	3.50	0.17
4	3.44	0.17
5	3.45	0.16
Average	3.42	0.16

Bow Setup and Distance from Wood		Weight (lbs)	Draw Length (inches)	Arrow Weight (grains)	Velocity (fps) *	Kinetic Energy (lb-ft)	Momentum	Distance to Wood (ft)
	Compound Bow	60	29	481	253	68.38	17.35	10