

Scientific Broadhead Test

By Jon Teater

Grim Reaper may be one of the most well known broadhead companies in the industry. The company has developed a reputation of producing bone-crushing mechanical broadheads. In fact, I think most people are only aware of their mechanical heads. Actually, they have a product that is meant to run with the best fixed-blade heads in the industry, it is called the Hades.

The Hades head consists of three blades, and is marketed as having a 1- 3/16 inch cut. The head boasts a V-Notched Chisel Tip, the blades are made from 440 Stainless Steel and the body is made from aircraft grade aluminum. The design has a four-point internal blade locking system which allows the blades to remain intact and together from the initial arrow setup, through flight and ultimately impact. All-in-all, the product includes a multitude of design features that should help archers stay confident with their equipment choice.

Grim Reaper states through their instruction manual that these are the finest fixed-blade broadheads money can buy. They back up their claim with an array of world-class big game animals on the back of the product packaging. In addition to the numerous animals, are the claims of field point accuracy. This statement is backed up with additional pictures of extremely tight groups. It is hard to argue against these pictures. Certainly from a consumer's standpoint, they will be hard-pressed to find other information on the internet

that disputes these pictures and claims by Grim Reaper.

Test Overview

The test performed on the Hades 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 is measured. Thirdly, the Hades's ability to take a direct hit into wood is documented.

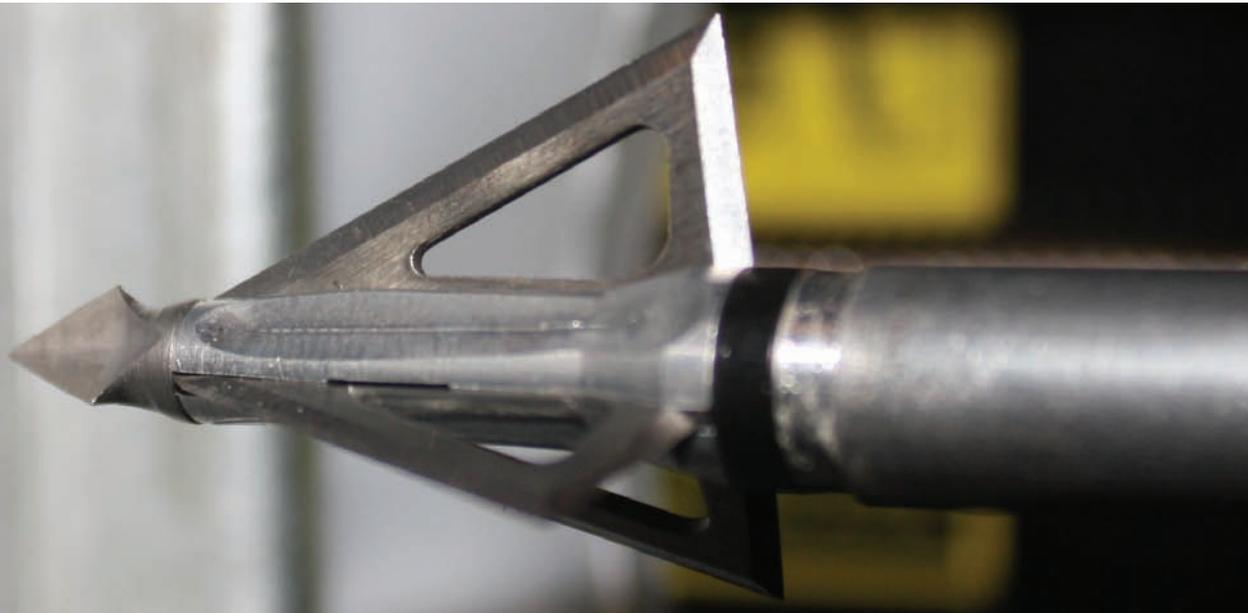
Please note that the methods used in this test provide measurable numbers that are exclusively related to the broadhead alone. In addition, I am of the opinion that testing done on animals is the most relevant method to evaluating the penetration of an entire arrow. However, it's difficult to replicate such tests, which are destructive and take years to compile. Therefore, this test has been tailored to measure characteristics that will impact penetration, and is done in a manner that offers a reliable and repeatable test.



Weight Measurements

	Broadhead 1 (Grains)	Broadhead 2 (Grains)	Broadhead 3 (Grains)	Average Weight (Grains)
Package 1	99.3	99.0	99.3	99.2
Package 2	98.0	98.4	97.4	97.9
Package 3	99.4	98.9	100.1	99.5

The unique tip shape is in line with the blades, which unlike most broadheads are sharpened on the trailing edge so they can do more cutting if the head stays in the animal. Our weight test at left shows high consistency in manu-



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Inspection

Grim Reaper provided three packages of their Hades model. 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 in weight to one another. Several heads weighed very close to the 100 grain threshold. After weighing the product, I meticulously reviewed all components for any obvious flaws/defects. The tip, blade, body collar and threaded shaft were pristine. The blades were well contained and would not come apart after pulling from various directions.

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 through an animal's 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 projectiles' "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 an odd choice to some. However, it has several properties that are more comparable to tissue than various rubbers.



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

Force Test Broadhead 1 (Package 3)

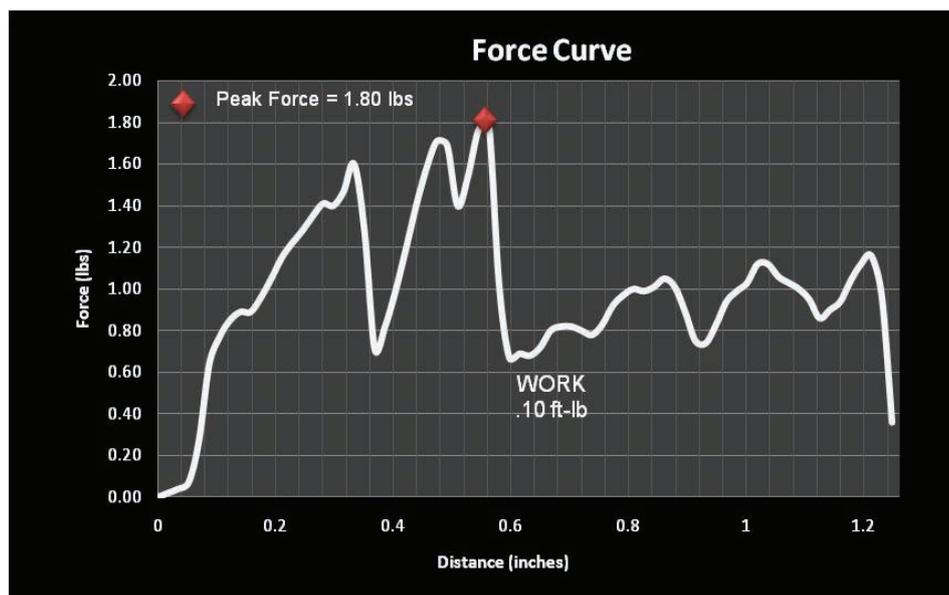
Parameter	Peak Force (lbs)	Work (ft-lb)
1	1.67	0.10
2	1.61	0.10
3	1.61	0.10
4	1.55	0.10
5	1.53	0.10
Average	1.59	0.10

Force Test Broadhead 3 (Package 3)

Parameter	Peak Force (lbs)	Work (ft-lb)
1	1.85	0.10
2	1.89	0.11
3	1.80	0.10
4	1.84	0.11
5	1.78	0.10
Average	1.83	0.10

As with most tests it is difficult to remove all the variables. In this test I have minimized the variables by testing the broadhead independently 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 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.

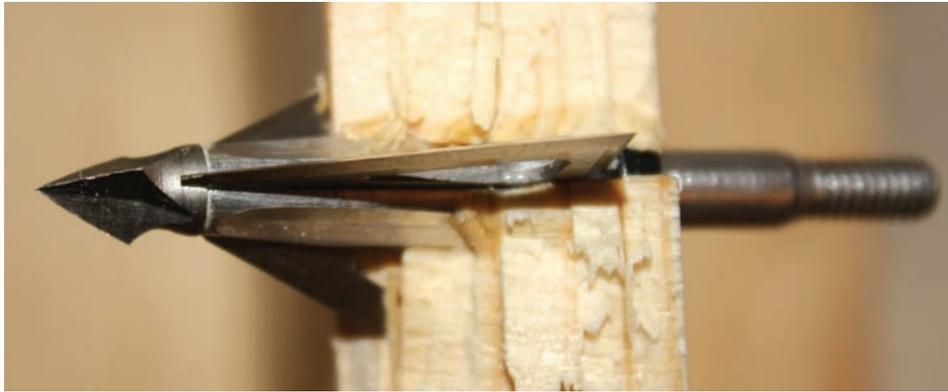
A force curve is recorded as the Hades broadhead penetrates the medium. The graphical representation details the resistance at each stage of penetration through sheeting. The graph comparison indicates



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

* The rating velocity is measured per ATA/BOW-104-2008

After firing the broadhead into the premium pine board from a distance of 10 feet, the wood is carefully split apart at the impact point so we can photograph the results.



peaks and valleys at different stages during penetration. There are two primary resistance points as the Hades broadhead traveled through the medium. The first is located at the point the broadhead transitions from the V-Notched Chisel Tip to the blades. The second location is approximately the first 1/4 of the blade. The other tables detail the total amount of work and peak force (lbs) the Hades broadhead 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 1-3/16 inches, many times the size of a field point.

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 Hades broadheads 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 much the same.

As shown in the picture, the side profile of the broadhead indicates deep penetration into the wood. The penetration of both heads was similar. Both broadheads remained intact and neither suffered any real damage. The broadheads remained extremely sharp after removal from the wood.

Overall

The Hades broadhead performed very well in this test and in comparison to other high caliber products it did better than average. The product was preassembled and contained a collar that can be interchanged with

greater/lesser weighing bands for simple weight adjustment. Further, the collar acts similar to a broadhead ring adapter that many archers use nowadays. However, it is still recommended by the manufacturer to use the universal broadhead adaptor rings. In addition, the package includes all necessary hardware for installation, such as a broadhead wrench and washer. In total, the package is well put together and everything is ready to go right out of the box.

I was not overly surprised that the empirical data detailed a very sharp, well-designed head. The more important test as it relates to design, the design integrity test, proved the product is well suited for field use. Additionally, the material used for this head should be unaffected by the effects of weather, which is essential to longevity and use. There are a few other talking points related to this head. The blades have an extra feature. The back edge of all three blades is sharpened. This particular feature can provide additional cutting opportunities, assuming that the head remains inside an animal's cavity after the shot. Also the product is 100 percent made in the USA-enough said at a time when our American jobs are in short supply.

As my overall rating, I would say the product is above average in design integrity and sharpness.



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