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Standard Guide for Fixed Blade Broadhead Performance and Safety Standards[1]

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1. Scope

1.1 This guide covers the formulation of preliminary guidelines in six areas of broadhead performance and safety.

1.2 The first three guidelines, flight, penetration, and sharpness, are related to performance, but they can have some bearing on safety. The last three, impact resistance, assembly and attachment methods, and packaging, determine to a great degree the safety level of the broadhead in the hands of the end user.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Terminology

2.1 *Definitions:*

2.1.1 *blades, n*—the sharp, laterally extended elements of the broadhead that perform the task of cutting after the arrow impacts the target.

2.1.2 *broadheads, n*—devices for attachment to the forward end of an arrow that are equipped with one or more sharp cutting blades. Broadheads are used when hunting with a bow and arrow to harvest game animals.

2.1.3 *ferrule, n*—the central structural section or component of the broadhead to which the forward end of the arrow shaft is attached. In some broadhead types, the ferrule is integral with the blades. In other types of broadheads, the ferrule has provisions to mount separable blades, but it may also have one or more integral blades. The ferrule may have a projecting threaded shaft that screws into a socket in the forward end of the arrow shaft, or it may have a hollow rear section into which the forward end of the arrow shaft is inserted.

2.1.4 *flight, n*—the path taken by the arrow after it is launched by the bow, but specifically including the characteristics of the motion of the arrow as it proceeds along the path of flight.

2.1.5 *penetration potential and penetration, n*—penetration potential is the combination of many factors that determine the potential of an arrow to penetrate any target that it impacts. These factors are principally the mass and velocity of the arrow, the characteristics of the assembled arrow, and the manner of flight of the arrow. Penetration is the actual depth an arrow penetrates in a given target. Considering that an arrow has given penetration potential, the actual depth of penetration will be a function of the material and consistency of the target and the manner or attitude of the arrow when it strikes the target.

3. Significance and Use

3.1 This guide is not intended to be all-inclusive. There may be additional aspects of performance and safety that need to be addressed in order to have a comprehensive study of the subject matter.

3.2 The suggested preliminary guideline summaries that follow were developed by a consensus of bowhunters with many years of field experience, industry people with knowledge in the design and manufacture of broadheads, and individuals experienced in the distribution and retail areas of the business who have close contact with end users.

4. Flight

4.1 It is quite probable that well-directed straight-line flight is the most important characteristic of an arrow equipped with a broadhead. All other factors, such as good penetration potential and high-impact resistance, cannot be used to their full extent if the broadhead-equipped arrow does not strike where it is aimed.

4.2 Straightness of flight also contributes to the performance and humaneness of the broadhead in that it increases the probability of hitting the target, and enhances penetration potential by reducing energy loss due to an angular impact. Straight flight may also contribute to safety.

4.3 Fundamental principles of aerodynamics should be applied to any broadhead design and manufacture to achieve straightness of flight. Specifically, concentricity of the ferrule, balanced placement of the blades with respect to the centerline of the ferrule, elimination of warps in the blades, and close weight control for consistency and balance are important factors in the design and manufacture of broadheads.

4.4 Mounting the broadhead on the arrow shaft can be a critical operation. For aerodynamic reasons, it is important that the blades of the broadhead be aligned accurately with the longitudinal centerline of the arrow shaft. This is a function of

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several factors: consistent alignment of the blades to the ferrule, concentricity of the ferrule, and alignment during assembly of the ferrule and the shaft. For broadheads employing threaded shaft mounting into inserts, the insert must be concentric with the centerline of the shaft, and the contacting base shoulder of the broadhead must be square with the centerline of the ferrule. For broadheads with hollow bases into which the arrow shaft is inserted, the cylindrical or tapered bore of the ferrule must be concentric with the body of the ferrule. For a cylindrical bore, the inside diametral tolerance must ensure a tight fit with the arrow shaft to maintain alignment. For a tapered bore, the matching taper on the arrow shaft must be concentric with the centerline of the shaft.

4.5 When an arrow is being launched or is in flight, the blades of a broadhead act as guidance vanes tending to assume control of the flight unless counteracted by adequately sized and oriented fletching or other control elements attached to the arrow. Normal practice is to use natural feather or synthetic vane fletching at the rear of the arrow for this purpose. In general, the best control for straight flight patterns is obtained using straight-line fletching that is offset from the centerline of the shaft, or fletching that is applied with a spiral or helical twist. This type of fletching causes the arrow to spin around its longitudinal axis in flight, producing improved directional stability. Increased drag at the rear of the arrow also aids directional stability. The requirement for the level of control to obtain straight flight will vary with the individual type of broadhead in use.

5. Accuracy

5.1 The accuracy of a broadhead-equipped arrow depends on accurate aiming, proper form and release, correct follow-through, and straightness of flight. The first three factors are under the immediate control of the shooter, while the last is a function of the equipment and a major subject of this guide. Assuming that the first three factors can be controlled adequately by the use of a mechanical shooting machine, a broadhead-equipped arrow can be judged to have acceptable accuracy if it can consistently impact within a 4-in. diameter circle at a range of 30 yd.

6. Penetration Potential

6.1 Good penetration is preferred, since it contributes directly to the humaneness and effectiveness of the broadhead in use.

6.2 A broadhead is intended to penetrate the body of a game animal and produce massive hemorrhage. Depth of penetration and severance of blood vessels are important factors in measuring the effectiveness of the broadhead. The number of blades and width of those blades multiplied by the depth of penetration determines the area of flesh that is cut by the broadhead. However, increasing the number of blades generally increases resistance to penetration. If the broadhead passes completely through the body of the game animal, the area of cut is maximum for that specific path. Complete penetration is not necessary for adequate effectiveness; nevertheless, optimum penetration is highly desirable.

6.2.1 Comparative testing in the bodies of game animals is impractical for several reasons. However, tests can be devised to test the relative penetration depths of various broadheads by shooting them into materials of uniform density and consistency. The effects of design features, such as length/width (L/W) ratio (Fig. 1), number of blades, number of cutouts, sharpness, etc., can be evaluated to optimize the design configuration. Comparison with existing broadheads of proven field performance is suggested as a criterion of acceptability.

6.3 *Guidelines*:

6.3.1 Establish the minimum L/W ratio to ensure good slicing action.

6.3.2 Establish the minimum and maximum number of blades and the minimum acceptable sharpness.

6.3.3 Establish other parameters affecting penetration potential, such as surface roughness, cutout design, sudden changes in cross section, tip design, etc.

7. Sharpness

7.1 Standards for blade sharpness may be difficult to determine with a high degree of accuracy; however, most experienced users of broadheads agree that such standards are desirable. Several *performance*-type tests have been in general use in the field for years which are crude but reasonably effective. Blades that will shave hair, slice poorly supported thin paper, or sever a lightly tensioned rubber band are usually considered sufficiently sharp for humane and effective hunting. These tests may be satisfactory for smoothly honed edges, but they are questionable when attempting to evaluate the sharpness of a serrated edge. Historically, broadheads can be categorized into two general classes: (*1*) those furnished adequately sharp by the manufacturer, and (*2*) those designed to be sharpened by the ultimate user. Simple sharpness tests are mandatory for this reason, and those described will continue to be used for field evaluation. A sharp broadhead is unquestionably necessary for a quick and humane kill, and it is not an overstatement to say that all broadheads, regardless of their design, should have, or be capable of, a very high level of sharpness.

7.2 *Guidelines*—For the manufacturer of presharpened broadheads, it may be practical to establish an acceptable maximum cutting edge width by microscopic examination, and use this procedure to control process and quality.

8. Impact Resistance

8.1 In use, the broadhead may be subject to substantial direct or angular front-end impact when encountering solid bone. This requires that the broadhead have a high level of structural integrity, not only in all of its components, but also in the blade retention system. It is probable that front-end

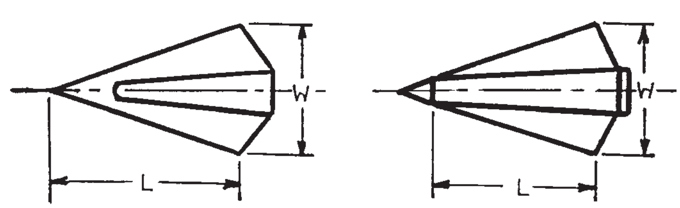

FIG. 1 Schematic Configuration

angular impact generates more severe stresses than direct in-line impact in most broadhead designs, although both conditions can be tested readily. Shooting the broadhead into a solid surface such as concrete block or brick, a metal plate, or dense hardwood will simulate such impact. A bent broadhead resulting from this type of impact may not necessarily be a condemning fault unless the blades break off or become disengaged from the ferrule. A loose blade inside the body cavity of a harvested animal may pose some danger to the hunter. For this reason, blade retention and integrity should be maintained under impact conditions that may be experienced in the field in normal use.

8.2 *Guidelines*—Shoot a broadhead into a solid plate or structure head-on and at an angle to determine structural integrity and blade retention. Determine arrow weight, velocity, and range to duplicate the internal stresses experienced under the most severe field conditions.

9. Assembly and Attachment Methods

9.1 The insertion of blades into ferrule slots and the attachment of assembled or partially assembled broadheads to arrows may require a carefully written or plainly illustrated instruction sheet, or both, so that these tasks may be performed in relative safety. Another set of instructions may be needed for sharpening of broadheads with fixed or new replaceable blades. To enhance the ease and safety of handling while performing these tasks, it may be helpful to include special shields covering the sharp edges and special wrenches for mounting the heads on arrows, or both.

9.2 *Guidelines*:

9.2.1 Include instructions and illustrations for attaching broadheads to arrows,

9.2.2 Include instructions and illustrations for inserting blades in slotted ferrules,

9.2.3 Provide shield or wrench for enhancing safety during assembly and disassembly of broadheads, and

9.2.4 Include instructions and illustrations for sharpening fixed blade broadheads.

10. Packaging

10.1 Packaging should be constructed to provide adequate safety to the purchaser and other individuals who handle the products before final purchase. Assembled broadheads packaged in thin plastic or cellophane containers with no conspicuous warning statements may provide less than adequate protection. While it may not be possible to eliminate all hazards due to careless handling, packaging practices may need to be examined to make certain that adequate safety precautions and warning labels have been implemented.

10.2 *Guidelines*:

10.2.1 Evaluate packaging methods and determine the adequacy of their safety level.

10.2.2 Incorporate conspicuous warning labels alerting users to blade sharpness and the potential for injury when instructions are not followed carefully.

11. Keywords

11.1 broadheads; blades; ferrule; flight; penetration