



ARCHERY MANUFACTURERS ORGANIZATION

200 Castlewood Drive • North Palm Beach, Florida 33408 • 407/842-4100

August 17, 1989

Messrs. M. & R. Ostidich
Outlab

Gentlemen,

Your letter to the Archery Manufacturers Organization was directed to me for reply.

You have requested a copy of the AMO Standard for testing bows. The best that I can provide to you is a copy of the proposal that I prepared at the time we reached agreement on the standard test method and specifications. The standard has never been formally documented, but it is being followed, and is universally recognized as official and appropriate.

You will note that the method of test calls for an average value of arrow velocity derived from a sequence of five shots using the 540 grain arrow. This is the accepted technique but it is not the one that I personally use. If you have had opportunity to read my Bow Reports in Bowhunting World (formerly Archery World) magazine, you will not that I use a series of arrows covering a range from approximately 400 to 650 grains to establish a performance profile for the bow being tested. Then, by calculation, I obtain the Rating Velocity from the arrow velocity curve at the 540 grain arrow weight. I feel that this method yields a more representative value and is less subject to experimental error. The AMO Standards committee preferred the more direct approach of testing just the one 540 grain arrow to obtain the Rating Velocity since it required less time and effort. The proposal was prepared using the latter method.

In addition to the copy of the proposal, I have also included a copy of an article I wrote in 1975. It describes in detail the procedure that I follow for testing a bow and defines the applicable formulae. There are some hand written changes noted to effect a more precise use (32.16 feet per second per second) of the acceleration of gravity.

I trust that you will find the information that you require in this material.

Sincerely,

Norb Mullaney
Chairman
ASTM Subcommittee F08.16
Archery Products

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"THE ASSOCIATION SERVING THE TOTAL NEEDS OF THE ARCHERY INDUSTRY"



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P-R-O-P-O-S-A-L

- 1.0 Background: The Archery Manufacturers Organization has established a standard for determining an "AMO Rating Velocity" for bows. This rating velocity is to be evaluated under the following conditions:
 - 1.1 60 lbs. peak or maximum draw force
 - 1.2 30 inches (AMO) draw length (28 1/4 inches DLPP)
 - 1.3 540 grains arrow weight (9 times the peak or maximum draw weight of the bow)
- 2.0 Purpose: This proposal details a precise testing technique that will satisfy the requirements and intent of the AMO Rating Velocity standard and constitutes an offer to perform such tests for the Archery Manufacturers Organization and/or its members. The test procedure and velocity rating will provide only a certification of performance – that is, the velocity at which a given bow will launch an arrow of the specified weight under standard conditions. It is not intended to provide any engineering or structural evaluation of the bow that would determine its "fitness for the use intended" or safe function, or any other attribute except as stated.
- 3.0 Test Procedure and Equipment:
 - 3.1 Preparation:
 - 3.1.1 Depending upon provisions on the test bow as received, mount arrow rest and pressure point. Use cushion plunger and wire flipper type rest where possible. If no provision for plunger, use a pro-flex type pressure sensitive rest and pressure plate combination.
 - 3.1.2 Install nocking point on the bow string.
 - 3.1.3 Lubricate compound bows as required.
 - 3.2 Shoot-in and Tune: Rough tune for hand shooting and hand shoot the test bow at least 30 times.

3.3 Force-Draw Data:

- 3.3.1 For bows with adjustable draw weight, adjust peak or maximum draw force to precisely 60 pounds. For conventional bows and bows without let-off, the 60 pound maximum draw force shall be attained or held at 50 inches draw length AMO (28 1/4 inches DLPP).
- 3.3.2 For bows with non-adjustable draw weight, the draw weight shall fall between 60 and 65 pounds. The Rating Velocity shall be adjusted mathematically to the 60 pound level of draw force. (Refer to item 3.9.2)
- 3.3.3 Measure and record the draw force at one inch increments of draw length from brace height to at least 30 inches draw length.
- 3.3.4 From the force-draw plot accurately determine the peak or maximum draw force and the holding force at the standard test draw length of 30 inches AMO (28 1/4 inches DLPP).

3.4 Measure and Record the Following Data:

- 3.4.1 Brace height
- 3.4.2 Bow length at braced condition - axle to axle (center line to center line) or tip to tip (string nock)
- 3.4.3 Bow mass weight
- 3.4.4 String data - strands and length
- 3.4.5 Cable clearance from arrow shaft in shooting position but not drawn (where applicable)
- 3.4.6 Description of arrow rest and pressure point used
- 3.4.7 Other significant characteristics as required

3.5 Stored Energy Data:

- 3.5.1 Calculate the stored energy.
- 3.5.2 Determine percent of let-off.
- 3.5.3 Calculate the energy storage ratio (stored energy divided by the peak or maximum draw force (S.E./P.D.F.))

5.6 Test Arrow:

- 3.6.1 The test arrow shall be selected of a shaft material, size, and spine to match the specified standard test draw weight and draw length and meet the 540 grain weight requirement.
- 3.6.2 The arrow shall be fletched with three full contoured 5 inch die cut feathers set parallel with the shaft (straight fletch).
- 3.6.3 The test arrow shall be equipped with an interchangeable point system so that precise weight control can be achieved by varying the weight of the point.
- 3.6.4 The weight of the test arrow shall be maintained at 540 grains within the limits of plus or minus 0.5 grains. This will control the consistency of theoretical velocity readings to plus or minus 0.07 feet per second.
- 5.6.5 The test arrow shall be weighed for each certification test. This will permit correction of the test results for the difference in the weight of the test arrow from a precise 540 grains. (See Item 3.9.1)

3.7 Set up Test Bow in Shooting Machine:

- 3.7.1 The bow shall be mounted in a shooting machine with a mechanical release and the draw length shall be set. The draw length should be 28 1/4 inches plus or minus 1/32 inch, measured from the pivot point of the handle grip to the inside of the bow string at the nocking point (50 inches AMO draw).
- 3.7.2 The initial chronograph gate shall be set at a distance of 36 inches from the pivot point of the bow handle.
- 3.7.3 Tune the bow for machine shooting.

3.8 Dynamic Test: Chronograph a minimum of five shots or as required using the standard test arrow to obtain a satisfactory arrow velocity average. Photo-electric type gate or trigger circuits are satisfactory for use in conjunction with the chronograph.

3.9 Correction of Test Data: The average arrow velocity reading obtained (Item 3.8) from the dynamic test may require correction for one or both of two possible variations from standard test conditions.

3.9.1 Weight of Test Arrow: The weight of the test arrow may vary from precisely 540 grains, considering the difficulty of holding the initial weight (no matter how precise) because of fletching wear. If a variation exists, a correction can be made using the following procedure:

$$V_R \text{ (AMO) corrected} = 671 \sqrt{\frac{(S.E.)}{540 + \frac{450240 (S.E.)}{V^2} - W_A}}$$

where

- (S.E.) = stored energy in foot pounds from the force-draw data (Item 3.5.1)
- V = actual average chronographed arrow velocity in feet per second (Item 3.8)
- W_A = actual weight of the test arrow in grains (Item 3.6.5)

3.9.2 Draw Weight of Bow: On bows with non-adjustable draw weight the actual measured draw weight may differ from the standard 60 pounds specified. (See Item 3.3.2) If this situation exists, then the following correction should be made:

$$V_R \text{ (AMO) corrected} = V \sqrt{\frac{60}{(P.D.F.)}}$$

where

- V = actual average chronographed velocity in feet per second (Item 3.8)
- P.D.F. = peak draw force measured for test bow (Item 3.3.4)

3.9.5 In general, for bows with non-adjustable draw weight, it will usually be necessary to make both corrections. (Items 3.9.1 and 3.9.2) For bows with adjustable draw weight only, the correction for arrow weight (Item 3.9.1) is likely to be required.

3.9.4 The 60 to 65 pounds draw weight range for bows with non-adjustable draw weight is proposed because the basic performance characteristics of a specific bow usually diminish slightly with increase in draw weight. By setting the desired standard draw weight as the minimum and allowing a readily attainable tolerance only on the plus side, an incentive is established for a manufacturer to submit a bow as close as possible to the 60 pound standard draw weight level. The closer the test bow is to the 60 pound minimum draw weight level, the better the basic performance characteristics are likely to be. The correction technique presented in Item 3.9.2 will provide the appropriate Rating Velocity for the precise 60 pound equivalent bow.
