



Standard Guide for Straightness Measurement of Arrow Shafts¹

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INTRODUCTION

Arrow shaft straightness is a desired characteristic. Unfortunately, straightness is currently measured using varying methods at varying span lengths. The archery industry, as well as consumers, have recognized that it is difficult to compare measurements at these various spans using different measurement methods.

This guide proposes the use of a fixed span distance, for all but a few very short shafts, instead of using various spans based on various manufactured shaft lengths. The span length of 28 in. was selected based on typical manufactured shaft lengths, as well as other ATA/ASTM industry standards. Using this arrow shaft straightness guide will benefit consumers as well as the archery industry.

1. Scope

1.1 This guide covers the formulation and designation of straightness measurement standards and nomenclature for arrow shafts.

1.2 This guide is designed to provide manufacturers and consumers a means for measuring the straightness of arrow shafts with tools and devices available in the archery industry and sport.

1.3 The values stated in inch-pound units are to be regarded as the standard. The SI units given in parentheses are for information only.

2. Terminology

2.1 *Definitions of Terms Specific to This Standard:*

2.1.1 *arrow straightness, n*—the conformance of the material or load axis of an arrow shaft to the true linear, longitudinal axis of the shaft.

2.1.2 *standard total indicator reading (TIR), n*—total indicator reading of arrow shaft straightness obtained through methods outlined in this guide.

3. Significance and Use

3.1 The measurement system presented in this guide is intended to ensure uniform arrow shaft straightness measure-

ment standards to avoid confusion of the consumer, which results from the use of different straightness measurement systems.

4. Measurement Guidelines for Arrow Shaft Straightness

4.1 *Straightness Measurement*—The most prevalent and commonly accepted method of measuring arrow shaft straightness involves supporting the arrow shaft along a known, fixed span, and using an indicator device while the arrow shaft is rotated about its axis on wheels or bearings. For this guide, a span type measurement is to be used. The length of the arrow shaft to be tested, the span distance to be used, and the equipment to be used are defined as follows:

4.1.1 *Shaft Length*—The shaft length to be used for straightness measurement is the actual manufactured shaft length of each arrow shaft size/type.

4.1.2 *Span Distance*—The length of the span to be used for this test is 28 in. (0.711 m) with a length tolerance of ± 0.125 in. (3.2 mm). For those shafts that are manufactured less than 29 in. in length, the span distance to be used is 25 in. (63.5 cm) and adjusted to an equivalent 28 in. reading using the approximate conversion formula:

Approximate Conversion Formula:

28-in. straightness value = 25-in. straightness value $\times 28/25$
For example:

straightness at 25 in. = 0.0030 in.

straightness at 28 in. = 0.0030 in. $\times 28/25$

where $28/25 = 1.12$,

straightness at 28 in. = 0.0030 in. $\times 1.12 = 0.0034$ in.

4.1.3 *Measurement Location*—Arrow shafts shall be measured for straightness at the center of the span. The tolerance for the measurement location shall be equal to or better than ± 0.250 in. (6.35 mm).

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4.1.4 *Measurement Equipment*—Measurements shall be taken with a noncontact laser type optical measurement device.

4.1.5 *Support Wheels*—Support wheels must feature low-friction bearings and exhibit a positive crown in order to limit the contact area with the arrow shaft.

4.1.6 *Test Description*—The arrow shafts shall be rotated about its longitudinal axis while being measured for straightness at the center of the span. This rotation cancels out the effect of gravity-induced sag. The rotation speed shall not exceed the resolution ability of the measurement device to ensure accurate measurements.

4.1.7 *Shaft Roundness*—Accuracy of this measurement method depends upon consistent roundness of the arrow shaft. In situations where shafts are not round, this attribute can be factored out of the straightness measurement by the use of additional measurement devices at the span supports. If this adjustment method is used, it shall be noted along with the measurement value.

4.2 *Measurement Accuracy*—The measurement accuracy of the laser shall be equal to or better than ± 0.001 in. (0.025 mm) under ASTM standard temperature conditions.

5. Product Marking and Specification Disclosure

5.1 Straightness measurements commonly are presented in two ways including a plus-minus (\pm) reading, as well as total indicator reading (TIR). The method of measurement shall be clearly defined with the measurement value.

5.1.1 *Plus-Minus (\pm)*—This measurement value in inches represents the range of measurements from the average value. For Example:

$$\text{straightness} = \pm 0.001 \text{ in. (0.025 mm)}$$

5.1.2 *Total Indicator Reading (TIR)*—This measurement value in inches represents the total range of measurement values.

For Example:

$$\text{straightness} = 0.002 \text{ in. TIR (0.050 mm)}$$

6. Keywords

6.1 archery; arrow shafts; measurement; straightness; total indicator reading

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