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An American National Standard

Standard Specification for Classification and Marking of Single-Lens Scopes for Use with Archery Bows[1]

This standard is issued under the fixed designation F 1753; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers lenses and scopes used in conjunction with archery bows. It establishes a standardized system for the classification of these lenses in terms of their optical magnification, the marking of the scopes in which the lenses are mounted, and charts depicting the empirical relationship of the apparent magnification the consumer can expect to obtain when a correctly marked lens is used under specific conditions.

1.2 *Acuity*—The visual acuity of these lenses is related to the magnification of the lens in general. For the average subject there can be an improvement in acuity with lenses having apparent magnifications of 2 to 4× and a decrement in acuity with lenses of 6× and greater.

1.2.1 Acuity also is dependent on other factors, such as the specific individual, lens quality, and the size and quality of the rear aperture (peep) used in conjunction with the lens. Beyond this statement, acuity is not the subject of this specification.

2. Terminology

2.1 *Definitions:*

2.1.1 *apparent magnification*, *n*—the apparent increase in size of an object as viewed through the subject lens held at a specific distance from the user's eye.

2.1.2 *diopter*, *n*—the reciprocal of the focal length of the lens as measured in metres. One diopter is the rating obtained when the constant 1 is divided by the focal length value of a lens having a 1-m focal length.

2.1.3 *eye-to-scope distance (ETS)*, *n*—the distance the (scope) lens is placed from the individual's eye when in use. If the eye-to-scope distance is measured in metres, it is specified as (ESM) and no conversion factor is required in the apparent magnification formula. When the eye-to-scope distance is measured in inches, it is designated as (ESI). To calculate apparent magnification, the metres-to-inches conversion factor of 39.37 appears in the equation.

2.1.4 *focal length*, *n*—the distance, measured in metres, from the center of the subject lens to the point where incident plane light waves passing through the lens are brought to the sharpest possible focus.

2.1.5 *optical magnification*, *n*—the characteristic of a particular lens defined as the reciprocal of the lens focal length as measured in metres and stated in diopters.

2.1.6 *peep sight*, *n*—a rear sighting device placed in or onto the bow string, having a small opening in it that the archer peers through to view the lens or scope being used as a sighting device. The combination of the lens and rear peep sight used in this manner mimics a primitive telescope.

3. Classification

3.1 *Optical Magnification*—This is the magnifying power of a lens as measured by the reciprocal of the focal length of the lens in metres. It is expressed as a practical unit in terms of a focal length equal to one metre (the unit diopter). The larger the diopter number, the greater the magnifying power of the lens.

3.2 *Apparent Magnification*—This is the apparent increase in object size one experiences when viewing the object through one of these magnifying lenses. It is dependent on the following two factors:

3.2.1 The optical magnification of the scope lens as measured in diopters, and

3.2.2 The distance the scope is placed from the user's eye.

3.3 Apparent magnification is defined empirically by the following relationship:

$$\text{Apparent magnification} = 1/(1 - D \times ESM) \quad (1)$$

where:

D = lens optical magnification, diopters, and
ESM = eye-to-scope distance, m.

3.3.1 If the eye-to-scope distance is measured in inches (ESI), the relationship becomes:

$$\text{Apparent magnification} = 1/(1 - D \times ESI/39.37) \quad (2)$$

where:

ESI = eye-to-scope distance, in., and
39.37 = metres-to-inches conversion factor.

3.4 Fig. 1 and Fig. 2 are graphic representations of the magnification relationship. Individually, one might prefer one chart over the other. Both charts contain the same information but display that information in a different format.

[1] This specification is under the jurisdiction of ASTM Committee F08 on Sports Equipment and Facilitiesand is the direct responsibility of Subcommittee F08.16on Archery Products.

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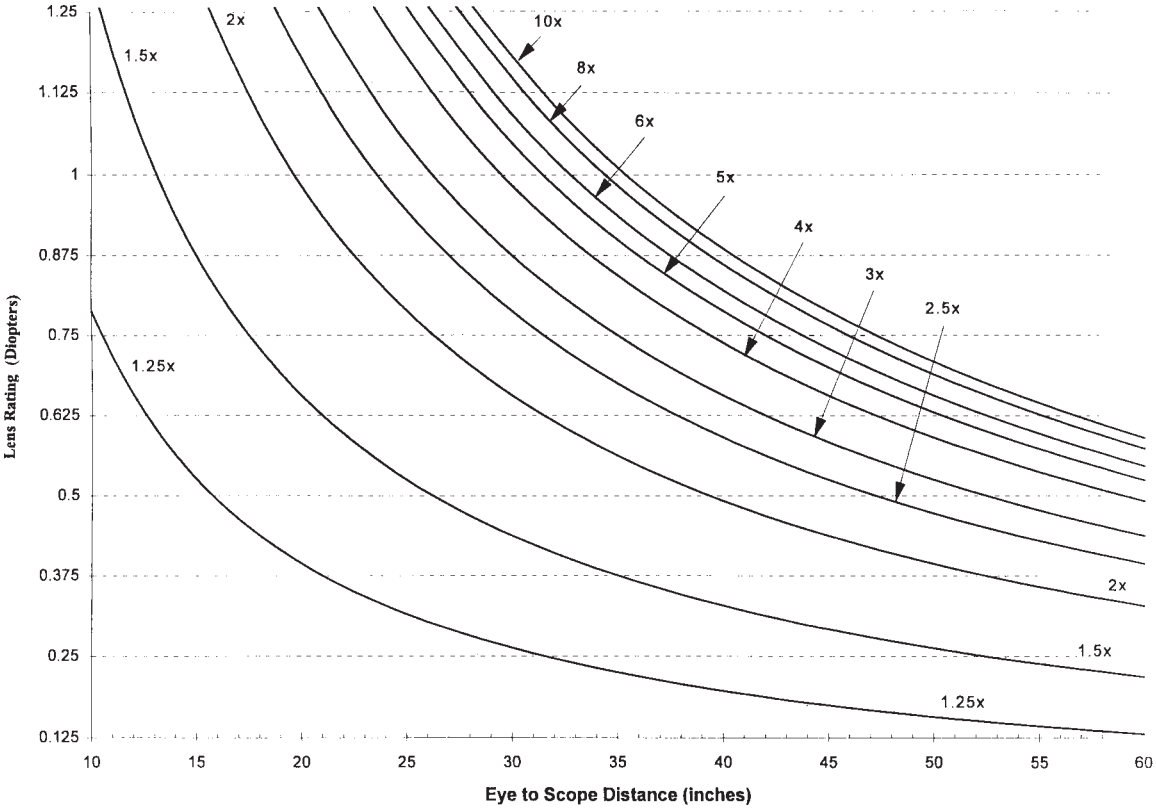

FIG. 1 Apparent Magnification of Single-Lens Scopes

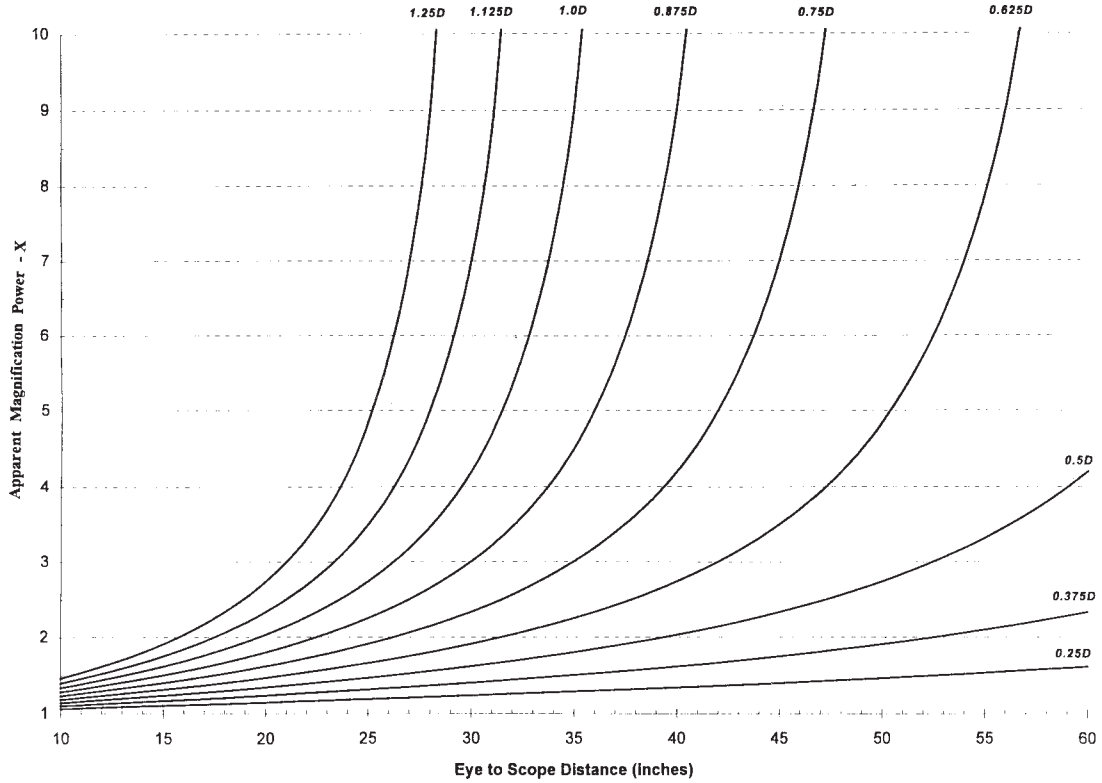

FIG. 2 Apparent Magnification of Single-Lens Scopes

3.4.1 Given the optical magnification of a lens in diopters and the distance it is to be placed from the user's eye, one can determine the apparent magnification, that is, 2×, 3×, 4×, etc.

NOTE 1—Fig. 3 and Fig. 4 are simply the metric versions of the charts in Fig. 1 and Fig. 2.

3.5 *Classification Tolerance*—The classification of lenses used in archery scopes shall be determined by measurement of their focal length in metres. These lenses shall be specified as a given diopter and will conform to that classification by having a focal length that corresponds to that diopter value within ±3 %.

4. Significance and Use

4.1 This specification is intended to ensure uniform classification of the lenses and the marking of scopes to avoid confusion of the consumer, which results form the use of different classification and identification systems.

4.2 This specification is based on the use of the diopter that is the reciprocal of the focal length of the lens as measured in metres.

5. Product Marking

5.1 Scopes for use on archery bows shall be marked clearly and permanently with the diopter number of the lens used in that scope.

6. Keywords

6.1 archery lenses; diopter; focal length; magnifying sights; scopes

RATIONALE

A number of manufacturers of lenses and scopes used in archery recognized the need for uniformity in specifying the magnifying power of single-lens bow scopes and contacted Subcommittee F08.16 for assistance. Various lenses were obtained, tests were done to determine the actual and apparent magnification, and mathematical relationships were developed leading to the establishment of this specification.

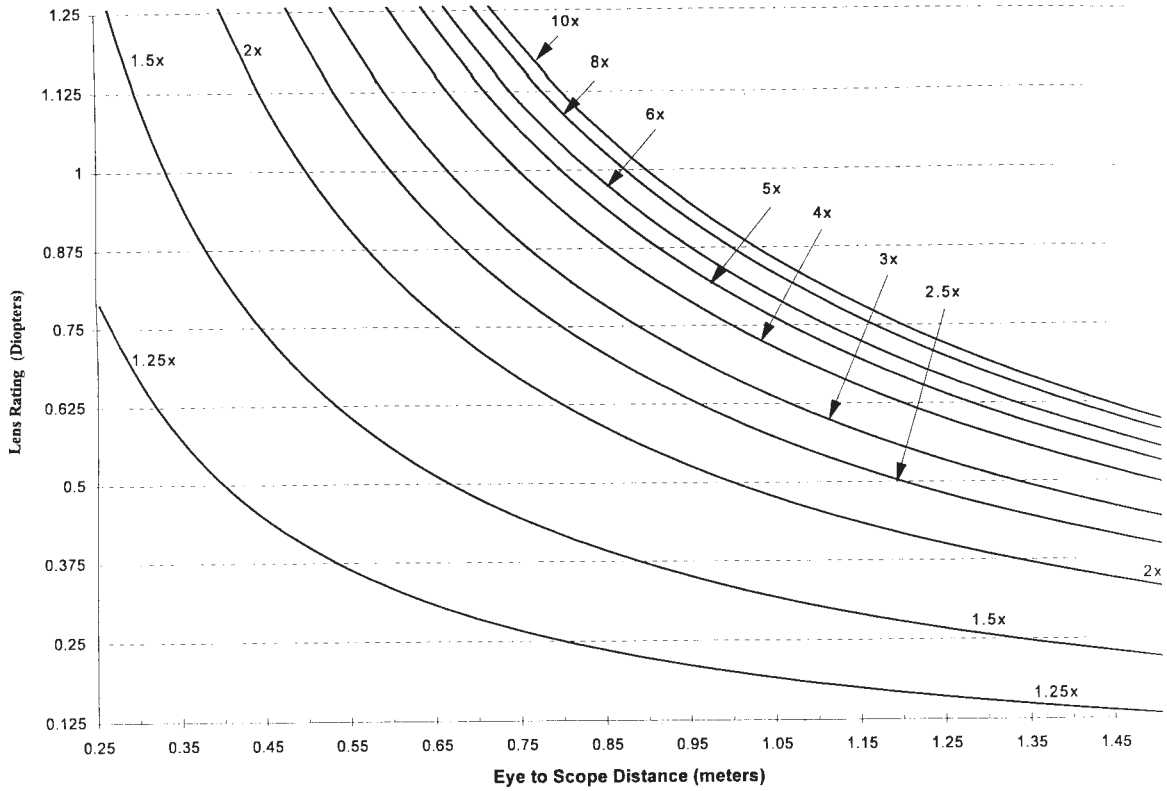

FIG. 3 Apparent Magnification of Single-Lens Scopes

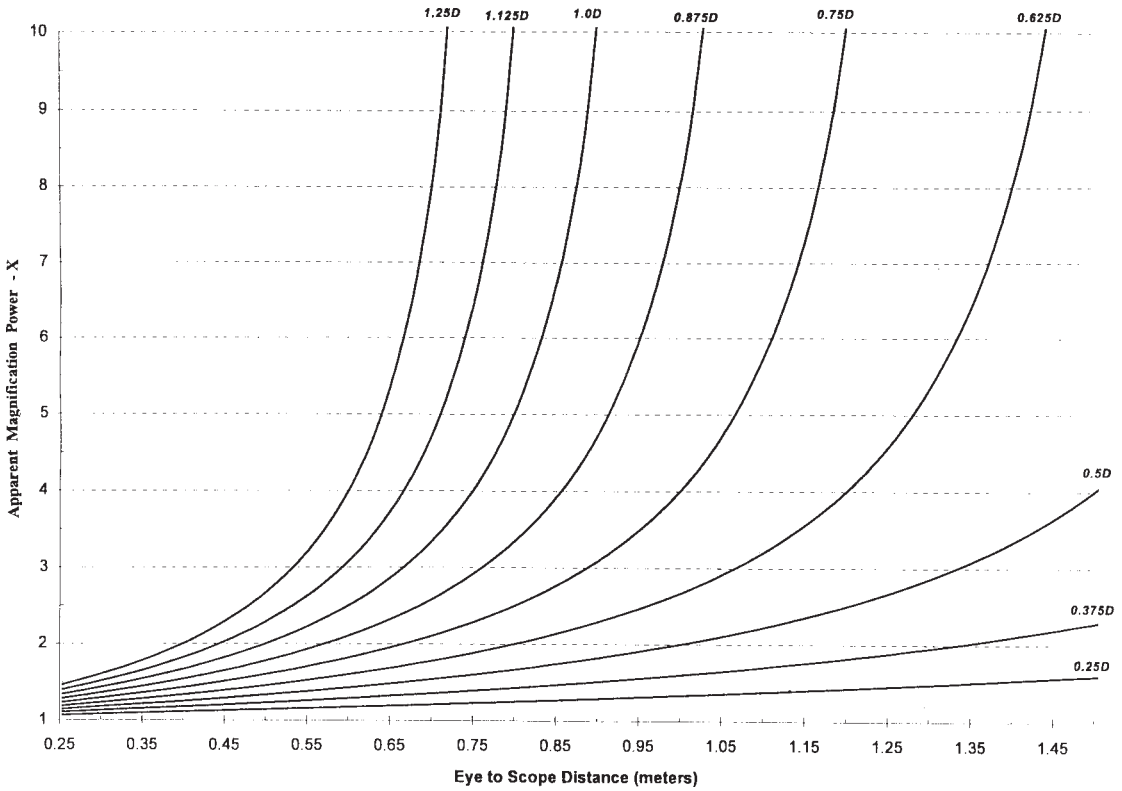

FIG. 4 Apparent Magnification of Single-Lens Scopes