



## Standard Test Method for Grading Spun Yarns for Appearance<sup>1</sup>

This standard is issued under the fixed designation D 2255; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### INTRODUCTION

Cotton yarn appearance standards were first adopted in 1938 and revised in 1964, with Series III being revised again in 1975. The 1964 boards had different yarn sizes for the four-grade exhibits on each board. The 1975 Series III board used the same yarn number for each grade.

The appearance grade of yarn is based on the composite evaluation of several factors, such as unevenness, fuzziness, and neppiness. The differences in the yarn numbers in the 1964 standards along with the differences in other factors distort the comparison between grades and makes grading more difficult.

To overcome this shortcoming, in 1975 the Series III board was revised using the same size yarn for all four grades. After evaluating the improvements, it was decided to revise all of the series using a mid-range yarn number for each grade in the series, and narrow the range in the most active series. This was accomplished by adding a new board, Series VI. A near mid-range yarn number was selected to represent equal steps between adjacent grades for all the factors considered in yarn appearance grading. These yarns were produced with current commercial manufacturing equipment and practices.

Finally, to obtain better yarn definition and better reproducibility from set to set, it was decided to use offset photo printing.

Shortly after these new boards were published in 1979, it became apparent that in the Series II-79 Board the A and B grades were not clearly defined and appeared to be switched. This was corrected in the 1987 Series II Board.

In 1987 a world wide survey was conducted on how the Yarn Appearance Boards were being used. From responses it became apparent that the boards are being used for grading yarns other than 100 % cotton combed or carded yarns. Respondents were using the boards to grade yarn blends, ring spun yarns, open-end spun yarns and other spinning systems. The boards are used both for process quality control and customer acceptance.

In view of the above findings, it was decided to revise the method to include grading of all single spun yarns.

### 1. Scope

1.1 This test method covers the grading of singles spun yarns for appearance.

1.2 This test method does not apply to plied yarns.

1.3 *This standard does not purport to address the safety problems 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.*<sup>2</sup>

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee D-13 on Textiles and is the direct responsibility of Subcommittee D13.58 on Yarn Test Methods, General.

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<sup>2</sup> The requirements for the appearance of cotton yarns are covered in Tolerances D2645, Roller-Drafted Yarns.

### 2. Referenced Documents

2.1 *ASTM Standards:*

D 123 Terminology Relating to Textiles<sup>3</sup>

D 2258 Practice for Sampling Yarn for Testing<sup>3</sup>

### 3. Terminology

3.1 *Definitions:*

3.1.1 *bunch, n*—a defect in a yarn characterized by a segment not over 6 mm ( $\frac{1}{4}$  in.) in length that shows an abrupt increase in diameter caused by more fibers matted in this particular place.

3.1.2 *cover, n*—*in yarns*, the outside layer of fibers that form the surface of a yarn.

3.1.3 *fuzz, n*—untangled fiber ends that protrude from the surface of a yarn or fabric.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 07.01.

3.1.3.1 *Discussion*—Fuzz should not be confused with “cover.”

3.1.4 *nep, n*—a tightly tangled knot-like mass of unorganized fibers. (Compare nap, pill.)

3.1.5 *slub, n*—an abruptly thickened place in a yarn. (*Syn.* lump, piecing, slough-off, slug. Compare cockles.)

3.1.6 *thick place, n*—a yarn defect characterized by a diameter greater than that of the adjoining segments and extending for 6 mm (¼ in.).

3.1.6.1 *Discussion*—The thick place is normally caused by a greater number of fibers per yarn cross section than usual.

3.1.7 *thin place, n*—a yarn defect characterized by a segment that is at least 25 % smaller in diameter than the average diameter of the yarn.

3.1.7.1 *Discussion*—A thin place may be of any length.

3.1.8 *yarn appearance, n*—the visual effect obtained by viewing a sample of yarn wound with a designated traverse on a black board of designated size.

3.1.9 For definitions of other textile terms used in this method, refer to Terminology D 123.

#### 4. Description of Yarn Grades

4.1 *Grade A Yarn*—Grade A yarn may have no large neps which are over three times the normal diameter of the yarn and very few small ones. Grade A yarn must have good uniformity from inch to inch, and good cover without excessive fuzziness. No foreign matter may be present in Grade A yarn.

4.2 *Grade B Yarn*—Grade B Yarn may have no large neps, but may have a few small ones. Grade B yarn may have no more than three small pieces of foreign matter per board or specimen providing they do not form slubs. Grade B yarn may be slightly more irregular and may have slightly more fuzz than a Grade A yarn.

4.3 *Grade C Yarn*—Grade C yarn may have more neps, and larger ones as well as more fuzziness and a greater amount of foreign matter than Grade B yarn. The contrast between the thick and thin places and the normal diameter of the yarn may be greater than in Grade B yarn resulting in an over-all rougher appearance.

4.4 *Grade D Yarn*—Grade D yarn may have some slubs that are more than three times the average diameter of the yarn. Grade D yarn may have more neps, neps of a larger size, more thick and thin places, more fuzz and more foreign matter than Grade C yarn. When slubs or large neps are present, Grade D yarn may have fewer neps than Grade C yarn. Grade D yarn may have an over-all rougher appearance than Grade C yarn.

4.5 *Yarn Below Grade D*—Yarn below Grade D may have more defects and an overall rougher appearance than Grade D yarn.

NOTE 1—The permitted number of defects for any grade should always be determined by comparison with the official “ASTM Spun Yarn Appearance Standards” photographs.

#### 5. Summary of Test Method

5.1 Yarn specimens, wound on black boards, are compared with photographs of specimens representing the appearance grades. The grade is based on fuzziness, neppiness, unevenness, and visible foreign matter.

**TABLE 1 Requirements for Preparations of Specimens**

Series	Range of Yarn Numbers		Count <sup>A</sup>	Wraps <sup>B</sup>	
	Single Cotton Count	Tex		per in.	per cm
1	1 to 12	590 to 50 +	8	20	8
2	12 + to 24	50 to 25 +	18	22	9
3	24 + to 36	25 to 16 +	30	26	10
4	36 + to 50	16 to 12 +	42	32	13
5	50 + to 75	12 to 8 +	60	38	15
6	75 + to 135	8 to 4 +	100	48	19

<sup>A</sup> Actual single yarn count used on boards.

<sup>B</sup> The specified number of wraps is subject to a tolerance of ± 10 %.

#### 6. Significance and Use

6.1 This method is considered satisfactory for acceptance grading of commercial shipments because it has been used extensively in the trade for this purpose.

6.1.1 In case of dispute, the statistical bias, if any, between the laboratory of the purchaser and the laboratory of the supplier should be determined with each comparison being based on testing randomized specimens from one sample of material.

6.2 The appearance of a woven or knitted fabric depends to a large extent on the smoothness, cleanliness, and general appearance of the yarns from which the fabric is manufactured. Instruments are available for the measurement of unevenness and for counting neps and other imperfections in yarn, but the values obtained from such tests are not easily integrated into an over-all expression for actual fabric appearance. Yarn appearance grading affords additional information which the manufacturer of woven or knitted goods may, through experience, correlate with the appearance to be expected in fabrics made from the yarns.

#### 7. Apparatus

7.1 *Spun Yarn Appearance Standards*<sup>4</sup>—A series of photographic standards representing Grades A, B, C, and D in six ranges of yarn numbers. Grade A is the highest and the others are progressively lower. The range of yarn numbers to be graded by each series is listed in Table 1. The standards are illustrated in Fig. 1.

7.2 *Yarn Grading Cabinet*<sup>5</sup>—A cabinet with storage space for the appearance standards, a shelf or rack on which one panel of standards and the specimen to be graded can be displayed, and lights mounted on brackets to illuminate the specimen and standards at the proper angle. A picture of the yarn appearance grading cabinet being used by a grader is shown in Fig. 2.

7.2.1 The lights on the cabinet shall consist of two units focused on the standard when in the grading position from a location about 300 mm (12 in.) in front with one unit slightly above and one unit slightly below the standards. Each unit shall be equipped with two 150-W daylight incandescent bulbs

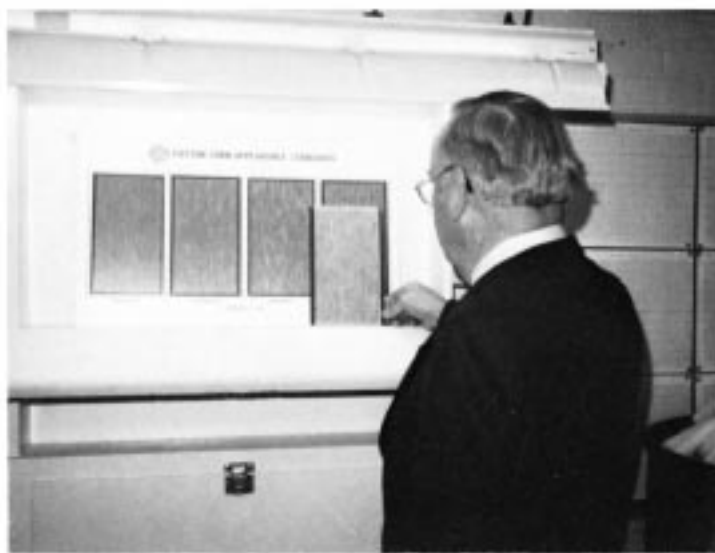
<sup>4</sup> Available from the ASTM Headquarters. Request adjunct No. as follows:

ADJD225501 (Series 1-79) ADJD225504 (Series 4-79)  
ADJD225502 (Series 2-79) ADJD225505 (Series 5-79)  
ADJD225503 (Series 3-79) ADJD225506 (Series 6-79)

<sup>5</sup> Prints of detailed drawings of a suitable cabinet are available from ASTM Headquarters. Request Adjunct No. ADJD2255.



**FIG. 1 ASTM Spun Yarn Appearance Standards**



**FIG. 2 Yarn Appearance Grading Cabinet Being Used by Grader**

mounted in a reflector which extends across the cabinet to provide uniform light intensity over the standard.

7.3 *Yarn Boards*—Rectangles of heavy cardboard, wall-board, or light plywood, at least 140 by 250 mm (5.5 by 9.5 in.) in size, finished completely in dull black. To fit the usual type of winder, there should be a rounded 20-mm (0.80-in.) notch at the center of one of the long edges to accommodate the screw of the revolving clamp. In one of the short edges there should be knife cuts or small notches to hold the ends of the yarn. One of these should be placed approximately 10 mm (0.40 in.) from the straight side of the board and the other about 20 mm (0.80 in.) from the notched side.

7.4 *Yarn Board Winder*<sup>6</sup>—A small machine to rotate a yarn board end-over-end, and fitted with a traversing guide to advance the yarn across the board as it is wound. The machine shall be capable of spacing the yarn evenly as required in Table 1 with a tolerance of  $\pm 10\%$ .

7.4.1 All parts of the tension device on the winder which comes in contact with the yarn shall be made of a smooth material, such as porcelain or metal, to prevent disturbance of the fibers in the yarn.

<sup>6</sup> A card winder similar to the one described may be obtained from the Alfred Suter Co. 5 Prel Plaza, Orangeburg, NY 10962.

## 8. Adjustment of Yarn Board Winder

8.1 Set the traversing mechanism of the winder for the required spacing, wind a trial board, and count the wraps in a width of at least 25 mm (1 in.). If the number of wraps does not conform to the tolerances specified in Table 1, adjust to the correct spacing (Note 2). On the most generally used type of machine, this adjustment may be made by changing the diameter of the friction wheel or by filing a new notch in the shaft on which the friction wheel slides.

NOTE 2—The spacing is critical in its influence on the appearance of the specimen. Closer spacing places a greater length of yarn on the board and hence, a larger number of imperfections per unit of area. Wider spacing has the opposite effect.

## 9. Sampling, Selection, and Number of Specimens

9.1 Take the lot sample as specified in the applicable material specification or as directed in Practice D 2258.

9.2 For the laboratory sample, take five packages (cones, spools, bobbins, etc.) at random from each case of the lot sample.

9.3 Prepare one specimen from each package in the laboratory sample.

## 10. Conditioning

10.1 Specimens need be neither preconditioned nor conditioned.

## 11. Preparation of Specimens

11.1 Mount a yarn board in the revolving clamp of the winder and set the traversing mechanism to give the spacing specified in Table 1 for the nominal yarn number.

11.2 If comparing two or more lots which differ slightly in yarn number and fall in different series (example: 35s and 37s), wind them to the same spacing and compare with the same series of standards. In any case, compare only yarns the numbers of which are not more than 10 % above the upper limit nor more than 10 % below the lower limit of the series of standards by which they are graded.

11.3 Mount the package to unwind freely, lead the yarn through the tension device and traversing pigtail guide, and secure the end in a notch or knife-cut near the left hand side of the board. When unwinding yarn over the end of the package, wind the board at 50 to 100 rpm using just sufficient tension to space the yarn evenly on the board. If the package must be unwound from the side, wind at a low enough speed to avoid jerking, breaking, or tangling the yarn.

11.4 Wind until the last wrap is within approximately 20 mm (0.8 in.) of the right-hand side and secure the end of the yarn near the right-hand corner.

## 12. Procedure

12.1 Place the appropriate series of Spun Yarn Appearance Standards in the grading position on the shelf or support in the yarn grading cabinet. Set one specimen at a time in front of the panel of standards and move it from side to side for comparison with the different standards from about 1 m (1 yd).

12.2 Thick places, bunches, or slubs are considered the worst defects in yarn because in practically all cases they will cause end breakage in later processing. Yarn with bunches or

slubs will not be assigned Grade A or Grade B.

12.3 When any one defect or combination of them is excessive for a grade, assign the next lower grade to the specimen.

12.4 Assign to the specimen the grade designated for the photograph which it is equal to or better than without being equal to the next higher grade. Consider the information in Section 4 in making the assignment. Also, grade the back of the specimen in a similar manner. Record the grade of the poorer side as the grade of the specimen if the two sides are as much as one grade different.

12.5 Each specimen shall be graded independently by three experienced yarn graders, and the grade reported shall be that assigned by all three graders when they are in agreement, or by two in agreement, provided the third grader does not differ by more than one grade from the grade assigned by the other two. When the range of the grades assigned by the three graders to a specific specimen is greater than one, the three graders shall review the specimen in conference and agree on the grade to be assigned, or if they cannot agree the specimen shall be rejected.

12.6 For acceptance grading of commercial shipments, recognize only the five grades: A, B, C, D, and Below Grade D. If 80 % of the specimens graded are equal to or better than the specified grade, and the remaining 20 % do not fall below the next lower grade (as based on many years of commercial grading experience), consider the lot as meeting spun yarn appearance specifications.

12.7 For quality control or research purposes, the grader may assign “plus” grades to specimens that are intermediate in appearance between one grade and the next higher grade.

## 13. Calculation

13.1 In acceptance testing, if no specimen falls more than one grade below that specified, determine the percentage of specimens that are equal to or better than the specified grade. If one or more specimens fall more than one grade below that specified, reject the lot.

13.2 For research or experimental purposes, the average quality of different lots of yarn may be compared by converting the yarn appearance grade of each specimen to its equivalent yarn appearance given in Table 2 and calculating the average yarn appearance index.

## 14. Report

14.1 State that the specimens were tested as directed in Test Method D 2255. Describe the material or product sampled and the method of sampling used.

14.2 Report the following information:

**TABLE 2 Yarn Appearance Indexes**

Grade	Index
A and above	130
B +	120
B	110
C +	100
C	90
D +	80
D	70
Below D	60



## D 2255

- 14.2.1 Grade of the poorest specimen in the lot,
- 14.2.2 Grade equalled or exceeded by at least 80 % of the specimens,
- 14.2.3 Average yarn appearance index, if determined,
- 14.2.4 Nominal yarn number,
- 14.2.5 Wrap spacing, and
- 14.2.6 Series of Spun Yarn Appearance Standards used for grading, for example, Series 3-79.

### 15. Precision and Bias

15.1 *Precision*—Experienced yarn graders working independently agree on the grade of about 67 % of the specimens

and seldom differ by more than one grade on the remaining 33 %. The averages of the grades assigned by three experienced yarn graders will agree on about 90 % of the specimens and will not differ by more than one grade for the remaining 10 %. The precision data are based on commercial grading as stated in 12.6.

15.2 *Bias*—The procedure in Test Method D 2255 for grading spun yarns for appearance has no bias because the value of such grades can be defined only in terms of a test method.

### 16. Keywords

16.1 appearance; man-made fiber; textile fibers; yarn

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