Designation: D6612 – 00 (Reapproved 2006)ε1

Standard Test Method for Yarn Number and Yarn Number Variability Using Automated Tester[1]

This standard is issued under the fixed designation D6612; 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.

ε[1] NOTE—Section 3 was updated editorially in August 2006.

1. Scope

1.1 This test method covers the measurement of yarn number up to 4000 dtex (3600 denier) and related variability properties of filament and spun yarns using an automated tester with capability for measuring mass variability characteristics.

1.2 Yarn number variability properties include percent density spread (%DS), coefficient of variation (%CV), density frequency variation.

NOTE 1—For determination of yarn number by use of reel and balance, refer to Test Method D1907. For another method of measuring variability (unevenness) in yarn, refer to Test Method D1425.

1.3 The values stated in either SI units or inch-pound units are to be regarded separately as standard. Within the text, the inch-pound units are in parentheses. The values stated in each system are not exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in inaccuracies of results.

1.4 *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. Referenced Documents

2.1 *ASTM Standards:*

D123 Terminology Relating to Textiles
D1425 Test Method for Unevenness of Textile Strands Using Capacitance Testing Equipment
D1776 Practice for Conditioning and Testing Textiles
D1907 Test Method for Linear Density of Yarn (Yarn Number) by the Skein Method
D2258 Practice for Sampling Yarn for Testing
D4849 Terminology Related to Yarns and Fibers

3. Terminology

3.1 For all terminology relating to D13.58, Yarns and Fibers, refer to Terminology D4849.

3.1.1 The following terms are relevant to this standard: cotton count, coefficient of variation, denier, linear density, tex, yarn number, yarn numbering system, bad/good test, density frequency variability, density spread.

3.2 For all other textile terms used in this test method, see Terminology D123.

4. Summary of Test Method

4.1 A specified length of yarn (specimen) is stripped automatically directly from the package, cut, and weighed. The yarn number is calculated by interfaced computer, displayed on a monitor, and may be printed. The yarn number can be reported in tex, denier, or cotton count units.

4.2 Simultaneously, by means of a capacitance cell, the mass of the specimen is measured in subsections and frequency of mass value crossovers are counted for calculation of variability properties: %DS, %CV, %BGT and %DFV.

5. Significance and Use

5.1 Test Method D6612 for yarn number and yarn number variability is satisfactory for acceptance of commercial shipments and is used in the trade.

5.1.1 If there are differences of practical significance between the reported test results for two or more laboratories, comparative tests should be performed by those laboratories to determine if there is a statistical bias between them, using competent statistical assistance. As a minimum, samples used for each comparative tests should be as homogeneous as possible, drawn from the same lot of material as the samples that results in disparate results during initial testing, and randomly assigned in equal numbers to each laboratory. Other fabrics with established tests values are used for this purpose. The test results from the laboratories involved should be compared appropriate statistical analysis and a probability level chosen by the two parties before testing begins, at a probability level chosen prior to the testing series. If a bias is

[1] This test method is under the jurisdiction of ASTM Committee D13 on Textiles and is the direct responsibility of Subcommittee D13.58 on Yarns and Fibers.

Current edition approved June 1, 2006. Published August 2006. Originally approved in 2000. Last previous edition approved in 2000 as D6612–00. DOI: 10.1520/D6612-00R06E01.

found, either its cause must be found and corrected, or future test results adjusted in consideration of the known bias.

5.1.2 The average results from the two laboratories should be compared using appropriate statistical analysis and a probability level chosen by the two parties before the testing is begun. If a bias is found, either its cause must be found and corrected or the purchaser and the supplier must agree to interpret future test results with consideration to the known bias.

5.2 Test Method D6612 also is used for the quality control of filament yarns.

5.3 *Indices of Variability*:

5.3.1 *Coefficient of Variation*—%CV is a standard statistical calculation and is the most common index of yarn unevenness. For most textile applications in the 80–330 dtex (70–300 denier) range, a 1.0–1.3 %CV is adequate. %CV of yarns coarser than 666 dtex (600 denier) is not routine and usually not meaningful. %CV is less discriminating that %DS.

5.3.2 *Bad/Good Test*—%BGT, which will normally be up to 20 % greater than %DS value, emphasizes the greatest spread in the entire length tested, (%DS is an average). If the value is greater than 50 % of the %DS, it suggests that there is a process that needs to be investigated.

5.3.3 *Density Spread*—%DS is equivalent to the Uster % unevenness (Test Method D1425) and is an indication of short-term variability. Yarns with extreme values are more likely to cause trouble in subsequent yarn processes, which makes this perhaps the most useful index. The minimum achievable and maximum tolerance spread for a yarn product will depend on the yarn manufacturing process and end use. A spread of 3–4 % generally is, for most textile applications, in the range of 160–550 dtex (150 to 500 deniers). More critical applications, such as those using finer yarns, may require lower values.

5.3.4 *Density Frequency Variability*—DFV is an index of spacing variability, whereas the others are indices of magnitude or unevenness. Frequency variability can induce resonance in high-speed processing and is a common source of barre, dye streaks, or patterned unevenness in fabrics.

6. Apparatus

6.1 *Automatic Yarn Numbering Instrument (ACW),* (automatic-cut-and-weigh) ACW with interfaced computer (see Fig. 1)

6.2 *Density Variability Accessory (DVA),*[3] with yarn number ranges:

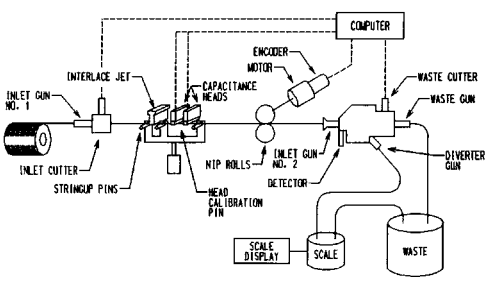

FIG. 1 ACW/DVA (Automatic-Cut-and Weigh with Density Variability Accessory) Tester

6.2.1 *Low (9.7-mm slit)*, up to 30 dtex (up to 27 denier).

6.2.2 *Medium (1.2-mm slit)*, 31–239 dtex (25–215 denier).

6.2.3 *High (2.2-mm slit)*, 240–1333 dtex (216–1200 denier).

6.2.4 *Ultra-High (3.2-mm slit)*, 1334–4000 dtex (1201–3600 denier).

6.3 *Calibration Weights*, 2-g and others as needed to cover the tex (denier) ranges of interest.

7. Sampling

7.1 *Lot Sample*—As a lot sample for acceptance testing, take at random the number of shipping units directed in an applicable material specification or other agreement between the purchaser and the supplier, such as an agreement to use Practice D2258. Consider shipping cases or other shipping units to be the primary sampling units.

NOTE 2—An adequate specification or other agreement between the purchaser and the supplier requires taking into account the variability between shipping units, between packages or ends within a shipping unit, and between specimens from a single package to provide a sampling plan with a meaningful producer's risk, consumer's risk, acceptable quality level, and limiting quality level.

7.2 *Laboratory Sample*—As a laboratory sample for acceptance testing, take at random from each shipping unit in the lot sample the number of packages directed in an applicable material specification or other agreement between the purchaser and the supplier, such as an agreement to use Practice D2258. Preferably, the same number of packages should be taken from each shipping unit in the lot sample. If differing numbers of packages are to be taken from shipping units in the lot sample, determine at random, which shipping units are to have each number of packages drawn.

7.3 *Test Specimen*—Test one specimen from each package of filament yarn and five specimens from each package of spun yarns. A 240-m specimen is needed for variability parameters. see Table X1.1 for the lengths of yarn for yarn number specimen lengths.

8. Conditioning

8.1 Condition the packages in the standard atmosphere for testing textiles, which is 21 ± 1° (70 ± 2°F) and 65 ± 2 % relative humidity, for not less than 4 h, see Practice D1776.

9. Preparation and Calibration of Apparatus

9.1 Set up the tester as prescribed in Appendix X1.

10. Procedure

10.1 Check each package for cleanliness, overthrown ends and any package formation, which might interfere with the free running of the yarn from the package.

10.2 String up the yarn, input sample and specimen information, and test the specimen as directed in the manufacturer's manual. The tester is automatically controlled. See the appendix for default operation condition values.

10.3 The computer software calculates the yarn number and compares this value to the capacitance head estimate of the yarn number. If the two agree within specified limits, the system proceeds, otherwise the test is aborted.