Designation: D 6612 – 00

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

This standard is issued under the fixed designation D 6612; 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 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 D 1907. For another method of measuring variability (unevenness) in yarn, refer to Test Method D 1425.

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:*

D 123 Terminology Relating to Textiles[2]

D 1425 Test Method for Unevenness of Textile Strands Using Capacitance Testing Equipment[2]

D 1776 Practice for Conditioning Textiles for Testing[2]

D 1907 Test Method for Yarn Number by the Skein Method[2]

D 2258 Practice for Sampling Yarn for Testing[2]

3. Terminology

3.1 *Definitions*—Terms used in this test method are defined in accordance with Terminology D 123.

3.1.1 *cotton count*, *n*—an indirect yarn numbering system generally used in the cotton system equal to the number of 840-yd, lengths of yarn/lb.

3.1.2 *coefficient of variation (CV)*, *n*—a measure of the dispersion of observed values equal to the standard deviation for the values divided by the average of the values; may be expressed as a percentage of the average (%CV).

3.1.3 *denier*, *n*—the unit of linear density, equal to the mass in g/9000-m of fiber, yarn or other textile strand, that is used in a direct yarn numbering system.

3.1.4 *linear density*, *n*—mass per unit length.

3.1.5 *tex*, *n*—the unit of linear density, equal to the mass in g/1000-m of fiber, yarn or other textile strand, that is used in a direct numbering system.

3.1.6 *yarn number*, *n*—a measure of the linear density of a yarn, expressed as "mass per unit length" or "length per unit mass," depending on the yarn numbering system.

3.1.7 *yarn numbering system*, *n*—a system expressing the size of a yarn as a relationship between its length and associated mass (see also *yarn number, direct yarn numbering system*, and *indirect yarn numbering system*).

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *bad/good test (%BGT)*, *n*—an index value which shows the total spread, or greatest variation, for the test; mathematically, the difference between the highest and lowest mass readings determined in the test, expressed as a percentage of the average mass.

3.2.2 *density frequency variability (DFV)*, *n*—an index of the spacing of irregularities; mathematically, the number of times the measured mass crosses over the mean mass line from higher-to-lower values or lower-to-higher values divided by the distance over which the count is made.

3.2.3 *density spread (%DS)*, *n*—a value which indicates the degree to which the mass varies from its average; mathematically, the average of the differences between the maximum and minimum values within specified subsections, expressed as a percent based on an overall average.

[1] This test method is under the jurisdiction of ASTM Committee D13 on Textiles and is the direct responsibility of Subcommittee D13.58 on Yarn Test Methods.
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[2] *Annual Book of ASTM Standards*, Vol 07.01.

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 D 6612 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 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 D 6612 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 D 1425) 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:

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 D 2258. 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 D 2258. 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

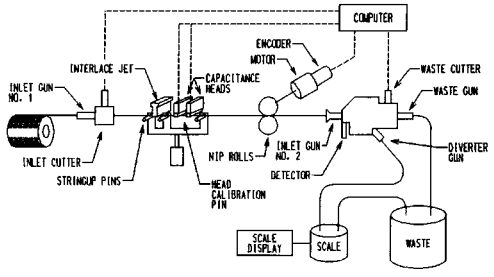

FIG. 1 ACW/DVA (Automatic-Cut-and Weigh with Density Variability Accessory) Tester