Designation: D 6197 – 99

Standard Test Method for Classifying and Counting Faults in Spun Yarns in Electronic Tests[1]

This standard is issued under the fixed designation D 6197; 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 classifying and counting of faults in spun yarns using capacitance testers.

1.1.1 Protruding fibers or yarn hairiness, or both, are not determined as part of this method.

NOTE 1—For measuring protruding fibers or hairiness, or both, refer to Guide D 5647.

1.2 This test method provides for grading yarns by fault level and type.

1.3 This test method is applicable to all single or plied spun yarns from natural or manufactured fibers or blends of each.

1.4 The values stated in SI units are to be regarded as standard; the values in inch-pound units are provided as information only and are not exact equivalents.

1.5 *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 1776 Practice for Conditioning Textiles for Testing[2]

D 2258 Practice for Sampling Yarn for Testing[2]

D 5647 Guide to Measuring Hairiness of Yarns by the Photo-Electric Apparatus[3]

3. Terminology

3.1 *Definitions:*

3.1.1 *spun yarn, n—in a staple system*, a continuous strand of fibers held together by some binding mechanism.

3.1.2 *yarn fault, n—in textile strands*, a change in thickness sufficient to be visible to the normal human eye.

3.1.2.1 *Discussion*—In this test method, a visible change in thickness, such as an abnormal thick or thin place in the yarn resulting in a large change in yarn diameter or any foreign matter affixed to or spun into the yarn, such as a nep, is considered to be a fault. Thick faults are reported as either major or minor depending on the combination of length and diameter. The most accepted criterion for major faults (infrequent thick places) is 250 to 400 % larger than yarn diameter and 20 to 40- mm (0.8 to 1.5-in.) long . The minor faults (frequent thick places) are 100 to 150 % larger than yarn diameter and 1.0 to 40-mm (0.04 to 1.5- in.) long . The thin place classes are arranged and considered separately. The criteria for thin places may vary with manufacturers, but will generally fall in the category of less than 30 % of diameter and greater in length than 10 mm.

3.1.3 *yarn fault count, n*—the number of faults per specified length of product.

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

4. Summary of Test Method

4.1 A specimen is passed through the sensing device of a classifying instrument at a constant speed. The electronic counting instrument records the faults and classifies them according to their length and relative diameter. The faults for the most part are in the form of thick places, thin places and neps in yarns spun on various spinning systems.

5. Significance and Use

5.1 This test method is considered satisfactory for acceptance testing of commercial shipments of spun yarns by agreement between purchaser and supplier.

5.1.1 In case of a dispute arising from differences in reported test results when using this test method for acceptance testing of commercial shipments, the purchaser and supplier should conduct comparative tests to determine if there is a statistical bias between their laboratories. Competent statistical assistance is recommended for the investigation of bias. As a minimum, the two parties should take a group of test specimens that are as homogenous as possible and that are from a lot of material of the type in question. The test specimens should then be randomly assigned in equal numbers to each laboratory for testing. The average result from the two laboratories should be compared using statistical analysis and a probability level chosen by the two parties before the testing is begun. If a bias

[1] 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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[2] *Annual Book of ASTM Standards*, Vol 07.01.

[3] *Annual Book of ASTM Standards*, Vol 07.02.

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 Yarn faults are a factor in determining yarn and fabric quality.

6. Apparatus

6.1 *Electronic Measuring Device*—A capacitance or optical unit with guide alignment of the yarn in a straight path through the measuring zone.

6.2 *Control Unit*—A device that supplies the signal to operate the measuring device and, also in return, receives the registration signal from the measuring device, stores the information received, responds to this information according to a predetermined setup, and outputs computed data at the end of the test.

6.3 *Winder*—A power driven take-up device equipped with a winding drum of uniform diameter and capable of operating at constant take-up speed.

6.4 *Yarn Tensioning Device*—A unit for the control of the yarn in the measuring zone so that the yarn travels in a straight path, free from kinks, without stretching the yarn.

7. Sampling

7.1 *Lot Sample*—Unless otherwise agreed upon, as when specified in an applicable material specification, take a lot sample as directed in Practice D 2258.

7.1.1 For production test, take lot samples and laboratory samples in multiples of spindle positions on the tester.

NOTE 2—An adequate specification or other agreement between the purchaser and the supplier requires taking into account 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, an acceptable quality level, and a limiting quality level.

7.2 *Laboratory Sample*—For acceptance testing take sufficient packages from each laboratory sample unit to obtain in excess of 100 000 m of yarn, that may consist of more than one package.

7.3 *Test Specimen*—The test specimen is 100 000 m (100 000 yd) of yarn. The number of metres per package tested is dependent upon the number of testing positions used.

7.3.1 When using equipment not programmed to give individual package data, consider the lot sample as the test specimen.

8. Conditioning

8.1 Preconditioning and conditioning are not required. A temperature of 21°C (70°F) and 65 % relative humidity, maintained as constant as possible is recommended. The conditions at time of testing should be recorded.

9. Procedure

9.1 Calibrate the testing instrument as prescribed by the instrument manufacturer.

9.2 Make proper selections for material value, yarn number, and the coding plug, if one is used. Review the tables provided by manufacturer for further details.

9.3 Set the take-up mechanism to the speed of travel recommended by the tester's manufacturer. If a nonstandard set-up is used it should be reported.

9.3.1 Verify that control unit speed selection is set to the same speed as the take-up mechanism.

9.4 Check the package to ensure that no shipping material or other contaminant is present and that no damage is apparent on the package. If contaminants or damage are detected, select another package for testing.

NOTE 3—Do not separate the length of yarn from the packages prior to testing.

9.5 Mount the package on a suitable holder. Thread the free end of the yarn directly from the package through the instrument.

9.6 Start the take-up mechanism of the tester.

9.7 Test the total predetermined yarn length, that may require more than one package.

9.8 Follow the tester instruction manual for operational procedures not outlined in this test method.

9.9 For testers not equipped with automatic data calculations, weigh the yarn tested to the nearest 0.001 kg or 0.1 oz to determine the length.

10. Calculation

10.1 For testers not equipped with automatic data output, calculate the yarn fault and express in terms of yarn faults per 100 000 m or yarn faults per 100 000 yd using Eq 1 or Eq 2 and Eq 3.

$$N_m \times \text{kg} \times 100\,000 = m \tag{1}$$

$$\text{oz} \times 52.5 \times N_e = \text{yd} \tag{2}$$

$$\frac{\textit{counter reading} \times 100\,00}{\textit{Tested length}\ \text{m (yd)}} = \frac{\textit{Yarn faults}}{100\,000\ \text{m(yd)}} \tag{3}$$

where:

N_m = yarn number, metric count,
N_e = yarn number, English cotton count
kg = kilograms, and
oz = ounces (pounds/16).

11. Report

11.1 State that the specimens were tested as directed in this test method. Describe the material or product sampled and the method of sampling used.

11.2 Report the following information:

11.2.1 Yarn number,
11.2.2 Type and model of tester,
11.2.3 Material setting of tester,
11.2.4 Yarn travel speed,
11.2.5 Length of specimen tested,
11.2.6 Major yarn faults per 100 000 m or yd,
11.2.7 Minor yarn faults per 100 000 m or yd,
11.2.8 Total yarn faults per 100 000 m or yd.

12. Precision and Bias

12.1 *Single laboratory test data*—A replicated study was performed in a single laboratory using one operator on a single instrument to measure four materials. Each material was tested

four times with no cutting. The test results by percent thickness of yarn diameter are shown in Table 1.

12.2 *Critical differences*—Same instrument.

12.2.1 *Same specimen*—When comparing totals obtained on the same specimen of yarn by the same operator using an instrument capable of reading each position independently, or else results obtained from one position, the difference should not exceed three faults.

12.2.2 *Different specimens*—Two fault totals obtained from different specimes representing the same batch of material should be considered different at the 95% probability level, if the smallest calue is less than or equal to the tabulted value for *b* located in Table 2.

12.3 *Critical differences*—Two instruments each capable of reading each position independently.

12.3.1 *Same specimen (paired test)*—Two fault totals shoud be condisered different at the approximate 95% probability level if the differnece exceeds five faults.

12.3.2 *Different specimens*—Two fault totals should be considered different at the approximate 95% prbability level, if the smallest value is less than or equal to the result obtained by rounding to the lowest whole number of the tabulated value for *b* found in Table 2 minus 10% of *b*.

12.4 *Bias*—A systematic difference exists between machines capable of reading each position independently and those that cannot. The difference becomes apparent when the number of faults occur frequent enough that more than one fault may appear simultaneously in more than one position. For this reason, comparisons between different instrument manufacturers is not recommended.

TABLE 1 Results from Repeated Trials for the Conditions Noted on the Same Length of Yarn

	Trial	+100 % to 150 %	+150 % to +400 %	TOTAL FAULTS
MATERIAL 1	1	15	4	19
Polyester	2	15	4	19
	3	18	3	21
	4	15	4	19
	Avg.	15.75	3.75	. . .
MATERIAL 2	1	170	42	212
Cotton	2	167	44	211
	3	169	42	211
	4	165	43	208
	Avg.	167.75	42.75	
MATERIAL 3	1	19	4	23
Cotton	2	19	5	24
	3	20	3	23
	4	19	4	23
	Avg.	19.25	4	. . .
MATERIAL 4	1	5	0	5
Polyester	2	3	2	5
	3	5	0	5
	4	4	1	5
	Avg.	4.25	.75	. . .

TABLE 2 Values of *b* for Critical Differences in Entanglement Counts, *a* and *b*, for Two-Sided Tests at the 95 % Probability Level[A]

r = *a* + *b*	*b*	*r* = *a* + *b*	*b*	*r* = *a* + *b*	*b*	*r* = *a* + *b*	*b*
8	0	24	6	39	12	53	18
11	1	27	7	41	13	55	19
14	2	29	8	43	14	57	20
16	3	32	9	46	15	60	21
19	4	34	10	48	16	62	22
22	5	36	11	50	17	64	23

[A]If the observed value of $b \leq$ the tabulated value, the two results should be considered significantly different at the 95 % probability level.

a = the larger of two defect counts, each of which is the total count for all specimens in a test result and each of which is based on the same number of specimens,

b = the smaller of the two defect counts taken as specified for a, and

r = a +b.

For additional values of *a* and *b* please see Table 6 in ASTM D 2906–91

13. Keywords

13.1 classification; yarn fault count; yarn faults; yarn spun