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Indian Standard

METHODS OF TEST FOR CONTINUOUS FILAMENT POLYESTER AND POLYAMIDE FLAT YARN

PART 5 UNEVENNESS PERCENTAGE

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Indian Standard

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PART 5 UNEVENNESS PERCENTAGE

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Indian Standard

METHODS OF TEST FOR CONTINUOUS FILAMENT POLYESTER AND POLYAMIDE FLAT YARN

PART 5 UNEVENNESS PERCENTAGE

0. FOREWORD

0.1 This Indian Standard was adopted by the Bureau of Indian Standards on 30 September 1987, after the draft finalized by the Physical Methods of Test Sectional Committee had been approved by the Textile Division Council.

0.2 In the preparation of this standard, due weightage has been given to the testing practices followed in this field.

0.3 Assistance has been derived from ASTM Designation D 1 425-81 Standard Test Method for Unevenness of Textile Strands Using Zellweger Uster Capacitance Testing Equipment, issued by the American Society for Testing and Materials, USA. There are some other instruments which are in use in the country for determining unevenness percentage but the correlation between the results obtained by different instruments requires to be established. This work is now being taken up through inter-laboratory trials and the standard would be reviewed thereafter.

0.4 This standard forms a part of the series of standards on 'Methods of test for continuous filament polyester and polyamide flat yarn'.

0.5 In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated is to be rounded off, it shall be done in accordance with IS : 2-1960*.

1. SCOPE

1.1 This standard (Part 5) prescribes a method of test for determination of short-term variations in mass per unit length (unevenness percentage) of continuous filament polyester and polyamide flat yarn.

*Rules for rounding off numerical values (*revised*).

1.2 This method covers the indirect measurement of unevenness of the flat yarn by means of continuous runs on a suitable Uster unevenness testing instrument. The direct procedure for measuring unevenness by cutting and weighing short lengths of a flat yarn is not covered by this standard.

1.3 Low twist filament yarns should be tested after the yarn is pretwisted while testing.

2. TERMINOLOGY

2.1 Unevenness — Variation in the linear density of a continuous yarn or a portion of a yarn (*see also* coefficient of variation unevenness, mean deviation unevenness).

2.2 Coefficient of Variation Unevenness, CV Percent — The standdard deviation of the linear densities over which unevenness is measured expressed as a percentage of the average linear density for the total length within which unevenness is measured (*see also* unevenness, mean deviation unevenness).

2.3 Mean Deviation Unevenness, U Percent — The average of the absolute value of the deviations of the linear densities of the integrated lengths between which unevenness is measured and expressed as a percentage of the average linear density for the total length within which unevenness is measured (*see also* unevenness, coefficient of variation unevenness).

2.4 Length Between L_b — The length between which unevenness is measured, the equivalent of the length of yarn segments weighed in a direct method of measuring unevenness.

2.5 Length Within L_W — The length over which unevenness is measured, the total length of the yarn from which the segments weighed were sampled in a direct method of measuring unevenness. For indirect methods, the maximum value of length within is the tested length from the specific package.

2.6 Unit Length of Instrument, L_0 — The length of yarn being measured between the sensing elements any moment.

2.7 Integrator — A device that calculates the coefficient of variation unevenness or the mean deviation unevenness.

2.7.1 The term 'integrator' and 'integration' as applied to textile unevenness testing do not imply integration in the strict mathematical sense. The type of integrator, linear or quadration must be carefully selected depending upon a known irregularity of the material, that is, purely random or purely periodic.

2.8 Quadratic Integrator — An integrator that operates continuously and reports unevenness for the time during which it has been active, giving equal weight to all portions of the input (compensated-memory integrator).

2.9 Linear Integrator — An integrator that operates continuously and reports unevenness for a certain, and unchanging, time past.

The input to the integrator immediately preceeding the moment of taking a reading receives greater 'weight' than the prior input, and this 'weighting' gradually decreases with the lapse of time (fading memory integrator).

3. PRINCIPLE AND LIMITATIONS

3.1 A yarn is passed through the sensing device of an Uster unevenness tester at constant speed and a momentary value proportional to the linear density of the yarn is recorded. The Uster instruments are equipped with an integrator that calculates the unevenness automatically and the value is read while the yarn is passing through the instrument after 400 m of yarn have been tested.

3.1.1 The variation of one specific property, linear density, is termed unevenness. The method is concerned with measuring the unevenness of flat yarn.

3.1.2 Unevenness is always expressed as between successive lengths and over a total length. When the length between which unevenness is measured (L_b) is very short (8 mm of yarn), then reference is often made to short-term unevenness.

3.1.3 Unevenness can be measured by direct method or indirect methods. The direct method consists of cutting and weighing yarn segment of length L_b and is the reference method of determining unevenness. Unevenness testing instruments, as covered in this standard, use the indirect method where unevenness is determined by the measurement of yarn properties closely related to and dependent on linear density. The accuracy of the indirect method and of an instrument utilizing it can be judged by a comparison of the value of unevenness it gives with one obtained by the direct method of cutting and weighing.

3.1.4 The Uster unevenness testing instruments measure those properties of the yarn which change the capacitance when the yarn passes between the plates of a capacitor.

3.1.5 A number of mathematical concepts are used to express the unevenness of yarn. They are all based on the coefficient of variation or its square. There is, therefore, some advantage in using an unevenness testing instrument that gives the coefficient of variation and thereby fits into the general mathematical scheme.

4. APPARATUS

4.1 Capacitance-Type Unevenness Testing Instrument — A suitable Uster unevenness tester using automatic integrator or any other suitable instrument which can satisfy the requirements The instrument shall have the following accessories provided.

4.1.1 *Package Holders, Guides, Tension Devices and Take-up Mechanism* — Which allow for or assist in, uniform delivery of the yarn at the specified speed without undue acceleration or deceleration and at a reasonably constant tension.

4.1.2 *Recorder* — To give a permanent chart record of the test details and to depict the unevenness. It is a means to record all unevenness.

4.2 Pretwisting with constant tension material feeding facilities for low-twist filament yarns to impart false-twist into low-twist filament yarn while it passes between the sensing elements at a uniform tension.

5. ATMOSPHERIC CONDITIONS FOR CONDITIONING AND TESTING OF SAMPLE

5.1 The test sample shall be conditioned to a state of moisture equilibrium from dry side in standard atmosphere at 65 ± 2 percent relative humidity and 27 ± 2°C temperature (*see also* IS : 6359-1971*) and tested in the same atmosphere.

NOTE — When a test sample has been left in such a way as to expose as far as possible, all portions of it to the standard atmosphere for 24 hours, the test sample shall be deemed to have reached a state of moisture equilibrium.

6. PROCEDURE

6.1 Calibrate the unevenness testing instrument as prescribed by the instrument manufacturer.

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

6.2 Mount the package on a suitable holder. Thread the free end of the yarn through the sensing elements of the tester and through the take-up mechanism. If a low twist yarn is to be tested, pass it through a device imparting false twist.

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*Method for conditioning of textiles.

6.3 Set the take-up mechanism to yarn speed of 100 m/min or to speed of travel as agreed to between the buyer and the seller. If a recorder is used, set the yarn to chart speed 10 cm/min with test time limited to four minutes.

6.4 Start the take-up mechanism of the tester and recorder, if used. Adjust the controls of the tester to record on the central part of the recorder chart or on the central part of the instrument meter or both.

6.5 Turn on the integrator. Test a total yarn length of at least 400 m in one uninterrupted run, unless otherwise agreed upon by the purchaser and the seller. Record the meter unevenness value.

6.6 Follow the unevenness tester instruction manual for operational procedures not outlined in this method.

7. CALCULATIONS

7.1 The CV percentage and U percentage can be estimated from the chart by converting the line of the record into a frequency distribution. U percentage can also be estimated by the use of a planimeter. Normally, however, CV percentage or U percentage will be read from the integrator (*see* **6.5**).

7.2 If more than one value of CV percentage or U percentage is obtained for individual packages, then calculate arithmatic mean of values of unevenness for each package.

7.3 Calculate the average of CV percentage or U percentage for all packages.

7.4 If required, calculate the coefficient of variation or the standard deviation (or both) of the CV percentage or U percentage values obtained for each package.

8. REPORT

8.1 State that the specimens were tested as directed in the standard. Describe the material or product sampled.

8.2 Report the following information.

8.2.1 Number of specimens tested.

8.2.2 Instrument used and type of integrator, if used.

8.2.3 Yarn travel speed.

8.2.4 Length of specimen tested.

8.2.5 Chart speed or yarn-to-chart speed ratio and method of chart calculation, if chart is used.

8.2.6 Type of setting used, that is, normal, inert or half inert.

8.2.7 Atmospheric conditions used, if not standard.

8.2.8 Average value of unevenness obtained as CV percentage or U percentage.

8.2.9 Coefficient of variation or standard deviation, or both, if calculated.

8.2.10 The values of length between L_b and length within L_w.

NOTE — The preferred way of writing the unevenness is to put L_b and L_w values in parentheses (L_b, L_w) after CV percentage or U percentage.

Example — CV (8 mm, 100 m) to be read as follows:

'Coefficient of variation unevenness between 8 mm lengths within 100-m lengths'.

9. SAMPLING

9.1 Samples shall be drawn in accordance with the procedure laid down in IS : 7703 (Part 4)-1981*.

*Methods of test for continuous filament polyester and polyamide flat yarn : Part 4 Sampling.

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INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	*Unit*	*Symbol*
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	*Unit*	*Symbol*
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	*Unit*	*Symbol*	*Definition*
Force	newton	N	1 N = 1 $kg.m/s^2$
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volts	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2

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