TDC 5(3710) DTZS

TANZANIA STANDARD

Textiles – Determination of yarns strength parameters of spun yarns

Foreword

This Draft Tanzania Standard is being developed by the Sampling and Test Methods Textiles Technical Committee under supervision of the Textile and Leather Divisional Standards Committee and it is in accordance with the procedures of the Bureau.

In the preparation of this Draft Tanzania Standard, assistance has been obtained from the following standard:

IS: 1671 – 1977 – *Determination of yarn strength parameters of yarns spun on cotton system,* published by the Indian Standards Institution.

BS Handbook 11:1974 3/41 – *Determination of lea strength and lea count of spun yarns (mean and variability),* published by the British Standards Institution.

In reporting the result of a test or analysis made in accordance with this standard if the final value, calculated or observed is to be rounded off, it shall be done in accordance with TZS 4 *Rounding off numerical values.*

1. Scope

1.1 This Draft Tanzania Standard specifies methods for determination of yarn strength parameters of yarns spun on cotton system using cotton count and tex system.

1.2 In cotton count system, determination of lea breaking strength and count strength product (CSP) have been specified and in the metric system, determination of skein breaking strength, yarn strength index (YSI) and skein breaking tenacity (SBT) have been specified.

2. Normative references

For the purpose of this Draft Tanzania Standard the following references shall apply:

TZS 3, *Atmospheric conditions for testing*

TZS 4, *Rounding off numerical values*

TZS 262, *Textiles – Yarn from packages – Determination of linear density (mass per unit length) – Skein method*

TZS 263, *Textiles – Universal system for designating linear density (tex system)*
ISO 2859-1-

3. Terms and definitions

For the purpose of this Draft Tanzania Standard the following definitions shall apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:
— ISO Online browsing platform: available at https://www.iso.org/obp
— IEC Electropedia: available at https://www.electropedia.org/

3.1 breaking strength

maximum strength (or force) supported by a specimen in a tensile test carried to rupture. It is commonly expressed in grams or kilograms, or pounds.

3.2 cotton count (Ne)

linear density expressed as number of 768.1 m (840 yd) hanks per 453.6 g (1 lb) (840 yd hanks/lb) of yarn.

3.3 metric count (Nm)

metric count is expressed in numbers which indicate the length in metres per weight in grammes or the length in kilometres per weight in kilogrammes of yarn.

3.4 tex

weight in grams of 1000 m of yarn.

3.5 count strength product (CSP)

products of the breaking strength in pounds of a lea (skein) of yarn and its cotton count or the breaking strength in kilograms of a skein of yarn and its metric count.

3.6 skein

prescribed length of yarn in the form of coil made on a reel of known girth.

Note 1: Usually 109.73 m (120 yd) skein in the form of coil wound, having 80 wraps, made on 1.372 m (1.5 yd) girth reel is in use in cotton count system and is called “lea”, while skeins of 100 and 50 m made on 1 m girth reel are in use in tex system.

3.7skein breaking tenacity (SBT)

breaking strength, in grams, of a 50 m skein divided by the linear density of unstrained yarn in tex and number of strands in the skein, that is, 100. It is expressed in grams per tex.

3.8 yarn strength index (YSI)

breaking strength, in grams, of a 100 m skein divided by the linear density of unstrained yarn in tex.

4. Sampling

The sampling plan shall be done in accordance with ISO 2859-1.

5. Atmospheric conditions for conditioning and testing

5.1 The sample shall be conditioned to moisture equilibrium in a standard atmosphere of 65 ± 2 percent relative humidity and 27°C± 2°C temperature (see also TZS 3 {see clause 2}).

5.2 The tests shall be carried out in the standard atmosphere.

6. Apparatus

6.1 Testing machine A skein breaking strength testing machine working on constant-rate-of traverse (CRT) principle. Its rate of traverse shall be 300 ± 15 mm/min and the load range of the machine shall be such that the observed values would lie between 10 and 90 percent of the full scale load. The permissible error in the machine at any point in this range shall not exceed ±1 per cent. The machine shall be provided with the following arrangements:

a) two pulleys or hooks for holding the skein with sufficient space to allow the even distribution of threads without much over-lapping;

b) means for adjusting distance between the pulleys or hooks;

c) a scale or dial or autograph recording chart graduated so as to give load in grams, kilograms or pounds.

6.2 Wrap-reel A skein winder having a girth of 1.37 2m (1.5 yd) or 1 m and capable of reeling known length of yarn (see annex A).

6.3 Yarn tensioning device – An adjustable tensioning device capable of giving a reeling tension that will result in skeins of specified length when measured on a skein gauge. The adjustment in reeling tension may be made, for example, by making more than one wrap around thread guides or by passing the yarn around tensioning bars. The reeling tension shall be the same at all reeling positions and may be checked as follows:

- The yarn is wound from the same package at different reeling positions. The length of the skeins when measured on a skein gauge shall not differ by more than 0.1 percent.

6.4 Skein-gauge – A gauge for checking the length of the skein under a load of 0.5 gf/tex (5 mN/tex) and expressing the length as a plus or minus deviation from the nominal length. The sensitivity of the skein gauge shall be sufficient to permit rejection of skeins falling outside ± 0.25 percent tolerances. The skein-gauge length may be adjustable or non-adjustable. A nonadjustable skein gauge can be used when its nominal length differs by not more than 0.4 per cent from the measured perimeter of the reel.

Note 2: For details of skein-gauge, see annex B.

7. Preparation of test specimens

7.1 Prepare skeins of 109.73 m (120 yd), 100 m or 50 m as required, following the procedure as described in annex A.

7.2 Prepare at least 30 test specimens and condition them as in clause 5.

8. Procedure

8.1 Bring the pulleys or the hooks of the testing machine to the zero position. Take the conditioned skein of yarn and fix it on the pulleys or hooks. Carefully separate the yarn on the pulleys or hooks to avoid the individual strands overlapping each other.

8.2 Start the machine and carry the test to rupture. Record the skein breaking strength in kilograms or pounds as indicated on the scale, dial or recording chart.

8.3 Determine the mass in grams of the broken skein and calculate the linear density of yarn in cotton or metric count or tex system as the case may be (see TZS 262 – see clause 2).

8.4 Determine the skein breaking strength and linear density of yarn of the remaining specimens following the procedure as laid down in 8.1 to 8.3.

9. Calculations

9.1 Calculate the average breaking strength and average linear density of all the observations taken (see 8.2, 8.3 and 8.4).

Calculate the coefficient of variation (CV) of all the breaking strength values taken.

9.2 Cotton count system

Count strength product (CSP) – Calculate the count strength product or count strength product corrected to nominal count, correct to a whole number, from the following formulae:

a) $CSP = L_1 \times N_e$

b) $CSP\ (corrected) = L_{1C} \times N^1_e$

where

L_1 = average breaking strength, in pounds (kg x 2.2), of the (skein) (see 9.1);

N_e = average cotton count (see 9.1);

L_{1C} = average breaking strength, in pounds (kg x 2.2), corrected to nominal count (see annex C); and

N^1_e = nominal cotton count.

9.3. Tex system

9.3.1 Skein breaking tenacity (SBT) – Calculate the tenacity or tenacity of yarn corrected to nominal linear density, correct to one decimal place, by the following formula:

a) SBT in grams per tex = $\frac{L2\times1000}{t\times2\times50} = \frac{L2\times10}{t}$

b) SBT (corrected) = $\frac{L2c \times 10}{t1}$

where

L_2 = average breaking load of 50 m skein in kg (see 9.1);

t = average linear density of yarn, in tex (see 9.1);

L_{2C} = average breaking strength of 50 m skein, in kg, corrected to nominal linear density (see annex C); and

t_1 = nominal linear density, in tex.

9.3.2 Yarn strength index (YSI) – Calculate the yarn strength index or yarn strength index corrected to nominal linear density, correct to a whole number by the following formulae:

a) YSI = $\frac{L3 \times 1000}{t}$

b) YSI (corrected) = $\frac{L3c \times 1000}{t1}$

Where

L_3 = average breaking strength of 100 m skein, in kg (see 9.1);
t = average linear density of yarn, in tex (see 9.1);
L_{3C} = average breaking strength of 100 m skein, in kg, corrected to nominal linear density (see annex C); and
t1 = nominal linear density, in tex.

> **Note 3**: – It has been found that for a given yarn, the yarn strength index and count strength product are numerically the same for all practical purposes. However, to calculate the yarn strength index of a skein from the count strength product of a lea (or vice versa), the specified, observed or calculated breaking strength value of the skein shall be converted into breaking strength value of a lea (or vice versa), using the formula given in annex D.

10. Report

10.1 The test report shall state that the test procedures were conducted in accordance with this Draft Tanzania Standard

10.2 The report shall include the following information:

a) type of material;

b) number of specimens tested;

c) breaking strength of skein (109.73 m (120 yd), 50 m or 100 m)

OR

breaking strength of skein corrected to nominal count/linear density;

d) coefficient of variation (CV) of breaking strength values;

e) count strength product (CSP)/count strength product (CSP) corrected to nominal count (correct to a whole number);

OR

yarn strength index (YSI)/yarn strength index (YSI) corrected to nominal linear density (correct to a whole number);

OR

skein breaking tenacity (SBT)/skein breaking tenacity (SBT) corrected to nominal linear density (correct to a whole number).

Annex A

Preparation of skeins

A.1 Apparatus

A wrap reel having a girth of 1.372 m (1.5 yd) or 1 m shall be used to reel off the skeins. The wrap reel shall be fitted with thread guides fixed on a horizontal bar which has a traverse of about 25 mm. The wrap reel shall also be provided with a counting device to indicate the length of yarn reeled out and a bell to ring just before the last revolution or a reel that automatically stops after the required number of revolutions.

A.2 Procedure

A.2.1 Mount a test package on the wrap-reel. Pass the end through the thread guides taking care that the yarn shall be kept under sufficient tension to avoid kinks, curls and slack in the yarn on the one hand and stretch on the other (see note) and lead it to the reel.

Note: If necessary the yarn may be wound full one turn around the thread guide.

A.2.2 Start the wrap-reel. Running it at uniform speed, reel out a skein of required length. Cut and tie the trailing end of the skein to its end leading end.

Annex B

Skein gauge

B. 1 Apparatus

The gauge consists essentially of two round metal pegs of about 1.25 m diameter and 5 cm to 6 cm long, located in the same vertical plane. One of the pegs is fixed to the rigid frame of the instrument and the other is carried on the lever of a simple loading system, the fulcrum of which is a low friction bearing, which is also carried on the frame. At least one of the pegs should be free to rotate about its axis.

B.2 Procedure

Place the skein without bunching, around the two pegs, and apply the appropriate load, for example, by hanging a weight on the end of the lever arm. The girth of the skein is indicated on a scale attached to the frame of the instrument, by a pointer attached to the lever arm or by an index line on the end of the lever arm. If L is the actual girth of the wrap reel, d the diameter of the pegs and D the distance between the axes of the pegs when the indicator registers on the scale the actual girth of the wrap reel, then:

$$D = \frac{L}{2} - \frac{\pi d}{2}$$

Annex C

Correction for nominal yarn count/linear density

To obtain the average breaking strength corrected to nominal yarn count or linear density, use the following procedure:

C.1 Arrange the values of linear density and the corresponding breaking strength of all the observations as obtained in 8, in the ascending order of the yarn count/linear density.

C.2 Find the average linear density and the average breaking strength of:

	Indirect system		Direct system		
				50m skein	100m skein
The first three skeins	N_{e1}	L_1'	t_1	L_2'	L_3'
The last three skeins	N_{e2}	L_1''	t_2	L_2''	L_3''
All the skeins	N_e	L_1	t	L_2	L_3

C.3 Calculations

a) $K_1 = \frac{L1'-L1''}{Ne2-Ne1}$

b) K_2 (50m skein) $= \frac{L2''-L2'}{\frac{1}{t1}-\frac{1}{t2}}$

c) K_2 (100m skein) $= \frac{L3''-L3'}{\frac{1}{t1}-\frac{1}{t2}}$

C.4 Find the average breaking strength corrected (L_1, L_{2C} or L_{3C}) to nominal count N_e' or to nominal linear density t', by the following formula:

a) $L_{1C} = L_1 - K_1 (N_e' - N_e)$

b) $L_{2C} = L_2 - K_2 (\frac{1}{t} - \frac{1}{t'})$

c) $L_{3C} = L_3 - K_3 (\frac{1}{t} - \frac{1}{t'})$

Annex D

Conversion of breaking strength values

To convert observed breaking strength value, in lb, of a lea of 109.73 m (120 yd) into breaking strength, in kg of a skein (100 m), use the following empirical formula:

$$L_1 = 0.5848\ L_2 + 0.5000$$

Where

L_1 = breaking strength, in kg of skein mode on a 1 m reel, and

L_2 = observed breaking strength, in lb, of lea mode on 1.5 yd reel.