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Silk yarn — Specification

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Foreword

Rwanda Standards are prepared by Technical Committees and approved by Rwanda Standards Board (RSB) Board of Directors in accordance with the procedures of RSB, in compliance with Annex 3 of the WTO/TBT agreement on the preparation, adoption and application of standards.

The main task of technical committees is to prepare national standards. Final Draft Rwanda Standards adopted by Technical committees are ratified by members of RSB Board of Directors for publication and gazettment as Rwanda Standards.

DRS 443 was prepared by Technical Committee RSB/TC 029, *Textile and leather technology*.

In the preparation of this standard, reference was made to the following standard:

- 1) IS 15090 (Parts 1 to 11), Raw silk— Grading and methods of tests

The assistance derived from the above source is hereby acknowledged with thanks.

Committee membership

The following organizations were represented on the Technical Committee on *Textile and Lather Technology* (RSB/TC 029) in the preparation of this standard.

Ministry of Trade and Industry (MINICOM)

University of Rwanda-College of Science and Technology (UR-CST)

National Agricultural Export Development Board (NAEB)

Rwanda Inspectorate, Competition and Consumer Protection Authority (RICA)

HeWorks Silk Rwanda Ltd

Rene Pharmacy

UTEXRWA Ltd

OXALIS Ltd

LIXIL/SATO

Rwanda Standards Board (RSB) – Secretariat

Rwanda Standards Board(RSB) – Secretariat

PUBLIC REVIEW

Silk yarn — Specification

1 Scope

This Draft Rwanda Standard specifies the requirements, sampling and test methods for raw silk in skein or on cone or bobbin.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ASTM D2255, *Standard test method for grading spun yarns for appearance*

ASTM D5647, *Standard Guide for Measuring Hairiness of Yarns by the Photo-Electric Apparatus*

RS ISO 139, *Textiles Standard atmospheres for conditioning and testing*

ISO 2060, *Textiles — Yarn from packages — Determination of linear density (mass per unit length) — Skein method.*

ISO 2061, *Textiles — Determination of twist in yarns — Direct counting method*

ISO 2062, *Textiles — Yarn from packages — Method for determination of breaking toad and elongation at the breaking toad of single strand*

ISO 3951-4, *Sampling procedures for inspection by variables — Part 4: Procedures for assessment of declared quality levels*

ISO 6741-1, *Textiles — Fibres and yarns — Determination of commercial mass of consignments — Part 1: Mass determination and calculations*

ISO 6939, *Textiles — Yarns from packages — Method of test for breaking strength of yarn by the skein method*

ISO 15625, *Silk — Electronic test method for defects and evenness of raw silk*

ISO 16549, *Textiles — Unevenness of textile strands — Capacitance method*

ISO 17202, *Textiles — Determination of twist in single spun yarns — Untwist/retwist method*

ISO 21046, *Silk — Test method for determining the size of silk yarns*

ISO 21046, Silk — Test method for determining the size of silk yarns

ISO 17202, *Textiles — Determination of twist in single spun yarns — Untwist/re-twist method*

3 Terms and definitions

For the purposes of this standard, the following terms and definitions apply

3.1

silk

animal fibre produced by certain insects to build their cocoons and webs. They are several silkworm, but the silk produced by mulberry silkworm is the main source of manufactured silk, name mulberry silk

3.2

silk yarn

yarn made of nature silk fibres, including raw silk, tussah silk, dupion silk, thrown silk

3.3

thrown silk

silk that has been twisted or doubled and twisted

3.4

raw silk

silk filament formed by conglutinating a number of Bombyx mori cocoon baves by reeling machine according to a certain reeling technique and quality requirements

3.5

Skein

silk reeled and removed from a re-reeling machine in the form of an open band

3.6

mulberry silk

silk mainly of yellow, white or greenish yellow colour obtained from domesticated silkworm Bombyx mori of the family bombycidae which feed on mulberry leaves

3.7

linear density

mass per unit length of a yarn

3.8

breaking load

maximum load (or force) applied to a specimen in a tensile test carried to rupture

3.9

elongation at break

increase in length of a specimen produced by the breaking load

3.10

tenacity

tensile force per unit of linear density of the unstrained specimen

3.11

twist

number of turns about the axis of a length equal to the nominal gauge length before untwisting

3.12

twist factor

measure of the spiralling orientation of the fibres in a spun yarn or of the filaments in a filament yarn

3.13

tex

mass in grams of 1000 m of the yarn. It is expressed as a number

3.14

denier

mass in grams of 9000 meters of the yarn. It is expressed as a number

3.15

evenness

uniformity of a yarn with respect to its linear density

3.16

evenness variation

variation in mass per unit length along the length of the yarn, expressed as coefficient of variation

4 Classification

4.1 Raw silk categories

For grading purposes, raw silk shall be divided into three categories according to their sizes:

4.1.1 Category I: 2.0 tex (or 18 denier) or below

4.1.2 Category II: 2.1 to 3.7 tex (or 19 to 33 denier)

4.1.3 Category III: 3.8tex (or 34 denier) or above

The grades shall be expressed in the following order in all categories of raw silk where 4A is of the highest and E is of the lowest merit: 4A, 3A, 2A, A, B, C, D, E.

4.2 Grading in accordance with the major tests

4.2.1 The grade of a lot of size 2.6 tex (or 33 denier) and finer (categories 1 and 2) shall be determined according to the lowest respective grade of its size deviation, evenness variation I, evenness variation II, cleanness, average neatness and low neatness in accordance with table 2 and 3.

4.2.2 The grade of a lot size 3.7 tex (or 34 denier) and coarser (category 3) shall be determined according to the lower respective grade of its size deviation, maximum deviation, evenness variation I, evenness variation II, average neatness and low neatness as given in table 4.

4.2.3 In case any one or more of results fall below the limits prescribed for a grade, the lot shall be degraded to the lowest grade wherein such value is given in the classification tables.

4.3 Degrading in accordance with the auxiliary tests

In case of lot size 2.6 tex (or 33 denier) and finer if observed value for maximum deviation, evenness III, winding, tenacity, elongation or cohesion, and observed value for evenness variation III, winding, tenacity or elongation in case of a lot of size 3.7 tex (or 34 denier) and coarser, is found to be lower than the corresponding value specified in the class of auxiliary test, then the grade provisionally established in accordance with the preceding paragraph shall be lowered by as many grades as the numerical difference that exists between the required auxiliary test class and the class actually found, provided that any difference of more than one class shall be deemed as on class difference with respect to the maximum deviation and

evenness variation III of a lot of size 33 denier and finer and evenness variation III of a lot of size 34 denier and coarser.

5 Expression of raw silk size

Raw silk value is marked with lower and upper size limit. Thus its central value is nominal size.

Example

- a) 20/22 denier: indicates that the nominal size is 21 denier. The lower size limit is 20 denier and the upper size limit is 22 denier
- b) 40/44 denier: indicates that the nominal size is 42 denier, the lower size limit is 40 denier and the upper size limit is 44.

6 Requirements

6.1 General requirements

6.1.1 The yarn shall be reasonably free from snarls, slubs, thin and thick places, fuzz, bunches, loose ends, odd, knots, knots with long tails, stains, burrs, etc. However, one knot per kg of shoddy yarn shall be permissible.

6.1.2 White silk yarn shall have a uniform bleached finish. The dyed yarn shall have the required shade and free from all dyeing defects.

6.1.3 When coloured, raw silk yarn shall be of uniform colour, luster and feel.

6.2 Specific requirements

6.2.1 Raw silk shall comply with the requirements of tables 2-4 when tested in accordance with 6.3.

Table 2- Specific requirements for raw silk of category I and grading 2.0 tex (or 18 denier) and below

Items	Nominal size	4A	3A	2A	A	B	C	D	E
Size Deviation Tex or denier	1.3 tex (or 12 denier) and below	0.089 (0.80)	0.106 (0.95)	0.122 (1.10)	0.150 (1.35)	0.189 (1.70)	0.256 (2.30)	0.322 (2.90)	Above 0.322 (Above 2.90)
	1.4 to 1.7 tex (13 to 15 denier)	0.100 (0.90)	0.117 (1.05)	0.139 (1.25)	0.167 (1.50)	0.200 (1.80)	0.272 (2.45)	0.339 (3.05)	Above 0.339 (Above 3.05)
	1.8 to 2.0 tex (16 to 18 denier)	0.111 (1.00)	0.133 (1.20)	0.156 (1.40)	0.189 (1.70)	0.211 (2.00)	0.289 (2.60)	0.356 (3.20)	Above 0.356 (Above 3.20)
Evenness variation I	(Count)	30	34	38	42	46	48	50	Above 50

Evenness variation II	(Count)	2	3	5	7	11	15	20	Above 20
Cleanness,%		97	95	93	88	83	79	75	Below 75
Average neatness, %		94	92	90	87	82	78	74	Below 74
Low neatness, %		90	87	83	77	74	72	70	Below 70
Auxiliary tests									
Items	class	(1)	(2)	(3)	(4)	(5)	(6)		(7)
Maximum deviation	1.3 tex (or 12 denier) and below	0.23 (2.1)	0.29 (2.6)	0.33 (3.0)	0.40 (3.6)	0.52 (4.7)	0.67 (6.0)		Above 0.67 (Above 6.0)
Tex or denier	1.4 to 1.7 tex (13 to 15 denier)	0.27 (2.4)	0.31 (2.8)	0.37 (3.3)	0.46 (4.1)	0.64 (5.8)	0.72 (6.5)		Above 0.72 (Above 6.5)
	1.8 to 2.0 tex (16 to 18 denier)	0.30 (2.7)	0.36 (3.2)	0.42 (3.8)	0.51 (4.6)	0.67 (6.0)	0.81 (7.3)		Above 0.81 (Above 7.3)
Items	class	(1)		(2)	(3)	(4)	(5)	(6)	
Evenness variation III	(Count)	0		1	2	3	4	Above 4	
Items	Class	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Winding (Breaks) ^a	1.3 tex (or 12 denier)	2	4	6	9	12	25	Above 25	
	1.4 to 2.0 tex (or 13 to 18 denier)	1	3	5	8	11	14	Above 14	
Items	Class	(1)						(2)	
Tenacity g/tex (or g/denier)		33 and above (3.7)						Below 33 (below 3.7)	
Elongation		20			19		18	Below 18	
Items	Class	(1)			(2)			(3)	
Cohesion (strokes)		40			30			Below 30	
Moisture regain, %, max.		11							
^a Not applicable for silk on cone									

6.2.2 In case two or more auxiliary test classes are found to be lower than the corresponding values listed in the classes of the auxiliary tests, then the lot shall be declassified by a number equal to the highest of the numerical differences as determined above.

6.2.3 In case the result of visual inspection of a lot is found to be poor in the general finish and /or the result of the skein finish in the winding test of a lot is found to be poor, the grade of the lot shall be one below that as determined in accordance with 4.2.1.

6.2.4 In case the result of the visual inspection of a lot is found to be inferior in its general finish, or in case the number of breaks in the winding test exceeds the limits mentioned below, the lot shall be classified as E grade:

S/No.	Class	Breaks
i.	2.1 to 3.7 tex (or 19 t 33 denier)	26
ii.	3.8 to 7.7 tex (or 34 to 69 denier)	24
iii.	7.8 tex (or 70 denier) or above	22

Table 3 Specific requirements for raw silk of category II and grading 2.1 to 3.7 tex (or 19 to 33 denier)

Items	Nominal size	4A	3A	2A	A	B	C	D	E
Size Deviation Tex or denier	2.1 to 2.4 tex (or 19 to 22 denier)	0.128 (1.15)	0.150 (1.35)	0.178 (1.60)	0.217 (1.95)	0.261 (2.35)	0.317 (2.85)	0.383 (3.45)	Above 0.383 (Above 3.45)
	2.6 to 2.8 tex (23 to 25 denier)	0.144 (1.30)	0.167 (1.50)	0.200 (1.80)	0.244 (2.20)	0.289 (2.60)	0.333 (3.00)	0.389 (3.50)	Above 0.389 (Above 3.50)
	2.9 to 3.2 tex (26 to 29 denier)	0.156 (1.40)	0.183 (1.65)	0.217 (1.95)	0.261 (2.35)	0.306 (2.75)	0.344 (3.10)	0.394 (3.55)	Above 0.390 (Above 3.55)
	3.3 to 3.7 tex (or 30 to 33 denier)	0.167 (1.50)	0.194 (1.75)	0.228 (2.05)	0.278 (2.50)	0.328 (2.95)	0.378 (3.40)	0.428 (3.85)	Above 0.428 (Above 3.20)
Evenness variation I	(Count)	30	34	38	42	46	48	50	Above 50
Evenness variation II	(Count)	2	3	5	7	11	15	20	Above 20
Cleanness, %		97	95	93	88	83	79	75	Below 75
Average neatness, %		94	92	90	87	82	78	74	Below 74
Low neatness, %		90	87	83	77	74	72	70	Below 70
Items	class	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Maximum deviation Tex or denier	2.1 to 2.4 tex (or 19 to 22 denier)	0.38 (3.4)	0.40 (3.6)	0.48 (4.3)	0.59 (5.3)	0.70 (6.3)	0.78 (7.0)	Above 0.78 (Above 7.0)	
	2.6 to 2.8 tex (23 to 25 denier)	0.39 (3.5)	0.46 (4.1)	0.54 (4.9)	0.66 (5.9)	0.73 (6.6)	0.79 (7.0)	Above 0.79 (Above 7.1)	
	2.9 to 3.2 tex (26 to 29 denier)	0.42 (3.8)	0.50 (4.5)	0.59 (5.3)	0.70 (6.3)	0.76 (6.8)	0.80 (7.2)	Above 0.81 (Above 7.2)	

	3.3 to 3.7 tex (or 30 to 33 denier)	0.44 (4.0)	0.52 (4.7)	0.61 (5.5)	0.73 (6.6)	0.80 (7.2)	0.84 (7.6)	Above 0.84 (Above 7.6)	
Items	class	(1)			(2)	(3)	(4)	(5)	(6)
Evenness variation III	(Count)	0			1	2	3	4	Above 4
Items	Class	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Winding (breaks)		1	3	5	7	11	13	Above 13	
Items	Class	(1)						(2)	
Tenacity g/tex (or g/denier)		33 (3.7)						Below 33 (below 3.7)	
Elongation		18						Below 18	
Items	Class	(1)			(2)			(3)	
Cohesion (strokes)		60			20			Below 40	
Moisture regain, %, max		11							

Table 4-Specific requirements for raw silk of category III and classification [3.8 tex (or 34 denier) and above

Items	Nominal size	4A	3A	2A	A	B	C	D	E
Size Deviation Tex or denier	3.8 to 5.4 tex (or 34 to 49 denier)	0.289 (2.60)	0.344 (3.10)	0.406 (3.65)	0.494 (4.45)	0.589 (5.30)	0.689 (6.20)	0.794 (7.15)	Above 0.794 (Above 7.15)
	5.6 to 7.7 tex (50 to 69 denier)	0.417 (3.75)	0.489 (4.40)	0.578 (5.20)	0.706 (6.35)	0.833 (5.50)	0.978 (8.80)	1.128 (10.15)	Above 1.128 (Above 10.15)
	7.8 tex (70 denier) and above	0.494 (4.45)	0.583 (5.25)	0.689 (6.20)	0.844 (7.60)	0.944 (8.50)	1.144 (10.30)	1.350 (12.15)	Above 1.350 (Above 12.15)
Maximum deviation Tex or denier	3.8 to 5.4 tex (or 34 to 49 denier)	0.81 (7.3)	0.88 (7.9)	0.94 (8.5)	1.03 (9.3)	1.11 (10.0)	1.18 (10.6)	1.29 (11.6)	Above 1.29 (Above 11.6)
	5.6 to 7.7 tex (50 to 69 denier)	0.94 (8.5)	1.02 (9.2)	1.10 (9.9)	1.19 (10.7)	1.26 (11.3)	1.30 (11.7)	1.34 (12.1)	Above 1.34 (Above 12.1)
	7.8 tex (70 denier) and above	1.03 (9.3)	1.11 (10.0)	1.18 (10.6)	1.28 (11.5)	1.33 (12.0)	1.38 (12.4)	1.44 (13.0)	Above 1.44 (Above 13.0)
Evenness variation I	(Count)	30	34	38	42	46	48	50	Above 50

Evenness variation II	(Count)	2	3	5	7	11	20	28	Above 28
Cleanness,%		97	95	93	88	83	79	75	Below 75
Average neatness, %		94	92	90	87	82	78	74	Below 74
Low neatness, %		90	87	83	77	74	72	70	Below 70
Items	class	(1)			(2)	(3)	(4)	(5)	(6)
Evenness variation III	(Count)	0			1	2	3	4	Above 4
Items	Class	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Winding (breaks)	3.8 to 7.7 tex (or 34 to 69 denier)	0	2	3	6	9	12	Above 12	
	7.8 tex (or 70 denier) and above	0	1	2	5	8	11	Above 11	
Items	Class	(1)						(2)	
Tenacity g/tex (or g/denier)		33 (3.7)						Below 33 (below 3.7)	
Elongation		18						Below 18	
Moisture regain, %, max		11							

6.2.1 Yarn linear density

The linear density of the yarn shall be determined in accordance with ISO 2060.

6.2.2 Evenness, cleanness and neatness

The evenness of the yarn and yarn faults shall be determined in accordance with ISO 15625.

6.2.3 Yarn size, size deviation and maximum deviation

Yarn size, size deviation and maximum deviation, conditioned size and CV size shall be determined in accordance with ISO 21046.

6.2.4 Breaking load, tenacity and elongation at break

The breaking load of single strands and elongation at break shall be determined in accordance with ISO 2062.

6.2.5 Skein breaking strength

The skein breaking strength of the yarn shall be determined in accordance with ISO 6939.

6.2.6 Yarn twist

The number of turns per unit length shall be determined in accordance with ISO 17202. The direction for twist shall be indicated by the capital letter "S" or "Z"

6.2.7 Moisture regain

Moisture regain shall be determined in accordance with ISO 6741-1.

7 Packing and marking

7.1 Packing

7.1.1 Suitable number of skeins prepared shall be made into neat books, each weighing approximately 5kgs of equal dimensions on a long skein book making machine. Each such book shall be neatly tied with separate cotton bands at three or five different places and wrapped in light packaging paper. Twelve such books of 5kgs shall be carefully wrapped in a cotton shirt and jute cloth and packed into a bale. Skeins shall be uniform in circumference, width and mass; free from reel arm gums; the beginning of raw silk thread shall be capable of being unwound from skein with the least possible amount of waste.

7.1.2 The net mass of silk in a bale shall be 30kgs.

7.2 Marking

Individual units shall be identified and marked with the following information

- a) name of material;
- b) manufacturer's name, trademark or other means of identification;
- c) linear density;
- d) batch number;
- e) mass of consignment, in accordance with ISO 6741-1;
- f) end use of yarn, e.g. weaving or knitting; and
- g) storage conditions.

8 Sampling

The sampling shall be done in accordance with ISO 3951-4.

PUBLIC REVIEW

Annex A (normative)

Winding test

A.1 Test sample

The sample for the test shall be 10 skeins in the case of a lot consisting of skeins of approximately 70 g each and 5 skeins in the case of a lot consisting of skeins of approximately 140 g each.

A.2 Atmospheric conditions for conducting the test

The test shall be carried out in a standard atmosphere at 65 ± 2 % relative humidity and 27 ± 2 °C temperature.

A.3 Conditioning of the test sample

Prior to test, the test sample shall be conditioned to moisture equilibrium in a standard atmosphere at 65 ± 2 % relative humidity and 27 ± 2 °C temperature for 24 hours.

A.4 Apparatus

A.4.1 Winding Frame: the winding frame shall be equipped to drive the bobbins from both ends and shall be capable of being adjusted to run at uniform winding speed of 110, 140 or 165 m/min depending on yarn size.

A.4.1.1 Swifts: the swifts used in the shall be automatic, self centering, pin-hub swifts, and each swift shall weigh about 530 g.

A.4.1.2 Bobbins: the bobbins used for the test shall be smooth and well balanced so as to give regular tension and uniform angular speed. The dimensions shall be as per table A.2

Table A.2-Bobbins dimensions

S/N	Characteristics	Size
i.	Diameter of head	60 mm
ii.	Diameter of barrel	38 mm
iii.	Length between heads	85 mm
iv.	Weight	105 g

A.4.2 Stop watch

A.5 PROCEDURE

One half of the sample skeins shall be wound from the outer surface of the skeins and the other half from the inner surface of the skeins. In case of 140 g skeins, 3 skeins shall be wound from the outer surface and the other 2 skeins from the inner surface or vice-versa. The sample skeins shall be put on the swifts with care to ensure that each skein is in good condition.

The average winding speed, the breaks counting period and the time of the preliminary winding operation for winding test shall be determined according to the size under test as per table A.1

Table A.1 Average speed and winding period for winding test

Size under test	Preliminary winding	Average speed (metre/min.)	Winding period(minutes)	
			70 g skeins	140 g skeins
1.3 tex (or 12 denier) or finer	10	110	60	120
1.4 to 1.9 tex (13-18 denier)	10	140	60	120
2.0 to 3.7 tex (19-33 denier)	10	165	60	120
3.8 to 7.7 tex (34-69 denier)	5	165	30	60
7.8 tex (70 denier) or coarser	5	165	20	40

The preliminary winding operation is applicable only for the winding from the inner surface, and the breaks occurring during a specific period shall be counted and recorded.

In the case of winding skeins of approximately 140 g each, the winding for the first half of the winding period shall be done on a set of 5 bobbins and the second half of the winding period shall be done on another set of 5 bobbins so as to prepare 10 bobbins in total.

A.6 Records

The record shall show the number of breaks in respect of each skein by a frequency distribution chart and the total number of breaks occurring in 10 sample skeins in the case of skeins of approximately 70 g each and in 5 sample skeins in the case of skeins of approximately 140 g each during the specific period. The results of the winding test shall be recorded as per table A.3.

Table A.3-Record and report of winding test of raw silk

S/N	Characteristics	Value recorded
i.	Mark of the lot :	
ii.	Serial No. of bales in the lot:	
iii.	Starting time:	
iv.	Ending time:	
v.	Total time :	

vi.	Nominal denier of the lot:	
vii.	Speed of the machine (m/min):	
	Skein No.	Breaks
		Preliminary winding
		Winding period
	1.	
	2.	
	3.	
	4.	
	5.	
	6.	
	7.	
	8.	
	9.	
	10.	
	Breaks for 10 skeins per hour of winding:	
	Remarks :	
	Date:	

PUBLIC REVIEW

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- [1] ISO 10290 *Textiles — Cotton yarns — Basis for specification*

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