KENYA STANDARD

DKS 1142: 2024
ICS 59.080
SECOND EDITION

Specification for polyolefin agricultural twines

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P R E F A C E

This draft Kenya Standard has been prepared by the Hard Fibres and Related Products Technical Committee under the guidance of the Standards Projects Committee, and it is in accordance with the procedures of the Kenya Bureau of Standards.

Polyolefin agricultural twines are widely used in agriculture for binding bundles of automatic pick-up balers, or the sheaves on reaping and binding machines. To perform satisfactorily and be useful in this respect, the twines must meet the minimum requirements expected of them. This Kenya Standard specifies these minimum requirements.

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

ISO 4167-1979 (E): Polyolefin agricultural twines.

Acknowledgement is hereby made for the assistance received from these sources.

KENYA STANDARD

SPECIFICATION FOR POLYOLEFIN AGRICULTURAL TWINES

1. SCOPE

This Kenya Standard specifies the requirements, test methods and sampling for polyolefin agricultural twines.

NOTE: The term 'Polyolefin' implies principally polypropylene and high-density polyethylene.

2. NORMATIVE REFERENCES

The following referenced documents are indispensable for the application 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.

ISO 2, *Textiles — Designation of the direction of twist in yarns and related products*

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

ISO 2307 *Fibre ropes — Determination of certain physical and mechanical properties*

3. DEFINITIONS

3.1 yarn
an assembly of fibres spun into a continuous length.

3.2 strand
A product obtained by joining and twisting together several yarns or group of yarns together.

3.3 Twine
A product consisting of one or more yarns twisted together or wound to form a structure of continuous length.

3.4 **Agricultural baler twine**
A chemically treated twine intended to be used primarily in agriculture for binding the bundles on automatic pick-up balers or the sheaves on reaping and binding machines.

3.5 Package
the unit of packaging in which twines are supplied and which may be in the form of spool, coil, or ball.

3.6 Pack
A parcel of two or more spools

3.7 batch
definite quantity of twine produced under conditions which are presumed uniform.

3.8 laboratory sample
total selection of samples from a batch intended for testing in the laboratory.

3.9 polyolefin

principally polypropylene (PP) and high-density polyethylene (PE)

3.10 specimen

quantity of twine on which a test conforming to the requirements of this International Standard is carried out.

4. DESIGNATION

A twine shall be designated by

- the words “agricultural twine”,
- the number of this Standard, i.e. KS 1142,
- the material from which the agricultural twine is made, and
- the nominal runnage in metres (m) per kilogram (kg) of the agricultural twine.

EXAMPLE Designation example:

A polypropylene (PP) agricultural twine having a nominal runnage of 350 m/kg is designated as follows: agricultural twine KS 1142 - PP - 350

5. REQUIREMENTS

5.1 General requirements

5.1.1 Raw Material — The raw material used for the manufacture of twine shall consist of high-quality stabilized polyolefin granules.

5.1.2 **Make-up —** Each spool of twine shall be capable of working with continuity throughout its length. The twine shall have a Z twist in accordance with ISO 2. Twine should always be removed from the centre of a spool in an anti-clockwise direction.

5.1.3 **Freedom from defects**- The twine when visually examined shall be free from defects, which affect the appearance and utility including but not limited to knot weaknesses, yarn slippage, uneven diameter, thinning or thickening.

5.2 Specific requirements

5.2.1 Nominal Diameter — The nominal diameter shall be as declared, subject to a tolerance of ± 5 per cent. This shall be determined in accordance with ISO 2307.

5.2.2 Technical properties

The twines shall comply with the technical requirements given in Table 1 when tested in accordance with the methods specified therein.

For the minimum twine breaking force requirement, the following formula shall be used:

$$F_{\text{twine}} = \frac{31450}{n} + 8$$

where

F_{twine} is the minimum twine breaking force, in decanewtons rounded to the nearest integer;

n is the specified nominal runnage of the twine, in metres per kilogram

For the minimum average knot breaking force requirement, the following formula shall be used:

$$F_{\text{knot}} = 0.55\, F_{\text{twine}}$$

where F_{knot} is the minimum where F_{knot} is the minimum average knot breaking force, in decanewtons rounded to the nearest integer.

For the nominal runnage tolerance requirement, a tolerance of ± 8 % rounded to the nearest integer shall be allowed.

Table 1 — Technical properties of polyolefin agricultural twines

Parameter	Values of properties Example: Agricultural twine PP - 350	Test method
Linear density, tex	$2\,857\ ^{+249}_{-211}$	Annex A
Runnage, m/kg	350 ± 28	Annex A
Minimum twine breaking force, daN	98	Annex B
Minimum average knot breaking force, daN	54	Annex C

Note: The SI unit of force is the newton. A force of 1 decanewton (daN) corresponds to that exerted by a mass of 1,02 kg.

Table 2: Indicative characteristics of some twines

Designation/ end use	Linear density, ρ_l		Runnage of the twine		Minimum twine breaking force	Minimum average knot breaking force
	nominal tex	tolerance tex	nominal, *n* m/kg	tolerance m/kg	*F*twine daN	*F*knot daN
Round bales	1 176	+ 103 – 87	850	± 68	45	25
Round bales	1 724	+ 149 – 127	580	± 46	62	34
Conventional bales	2 326	+ 199 – 171	430	± 34	81	44
Conventional bales	2 857	+ 249 – 211	350	± 28	98	54
Conventional bales	3 448	+ 297 – 253	290	± 23	116	64
Big bales	6 667	+ 579 – 494	150	± 12	218	120
Big bales	7 692	+ 641 – 549	130	± 10	250	137

6 Labelling

6.1 Unit labelling

Each coil shall be supplied with the following information:

a. Manufacturer's name and/or registered trademark
b. the declaration 'Polyolefin baler twine'
c. nominal linear density in tex
d. nominal diameter in millimetres
e. coil length in metres.
f. coil mass in kilograms.
g. country of manufacture
h. Designation of the twine

7 Packaging

7.1 Unit packaging

Each coil shall be packed in a suitable material to protect it from soiling and other forms of contamination.

7.2 Bulk packaging

Coils of the same type shall be packed in suitable containers so as to protect them from damage or contamination during transportation, handling and storage.

Each carton box shall have a clearly legible label with the following information:

a. Manufacturer's name and/or registered trademark.
b. Designation of the twine
c. Number of spools in each container.
d. Gross mass of each container, in kg.
e. Country of origin

8 Sampling

8.1 Lot
Coils of the same design and quality shall constitute a lot (*see* Table 3, Column 1).

8.2 Box sampling
From the lot, sample boxes shall be selected at random as per Table 3, Column 2.

8.3 Selected samples
At least two rolls of baler twines shall be selected from each sample box. This shall be done by opening the box in a manner so as to enable easy and quick sampling and selecting one sample from the first half near the top and the second sample from the second half of the box. These shall constitute selected samples as given in Table 3, Column 3.

8.4 Test samples
All the selected samples shall be examined for the defects. If found free from defects, half of the samples in Table 3, Column 3 shall be selected at random as test samples. These shall constitute laboratory samples as given in Table 3, Column 4.

8.5 Reference samples
Half of the samples in Table 3, Column 3 shall be preserved as reference samples for use in case of a dispute or for retesting, as the case may be. These shall constitute reference samples given in Table 3, Column 5.

Table 3 — Sampling plan

Lot in boxes	Sample boxes	Selected samples	Laboratory samples	Reference samples
(1)	(2)	(3)	(4)	(5)
1 to 3	1	2	1	1
4 to 9	2	4	2	2
10 to 27	3	6	3	3
28 to 81	4	8	4	4
82 to 243	7	14	7	7
244 to 729	10	20	10	10
730 to 2 187	15	30	15	15
Above 2 188	20	40	20	20

Annex A
(Normative)
Determination of linear density and runnage

A1. Principle

Specimens of specified length are weighed under specific conditions and then the linear density and the runnage (or length in metres per kilogram) are calculated.

A2. Apparatus

A.2.1 Balance, accurate to 0,5 g.

A.2.2 **Wrap-reel** of known perimeter.

A3. Specimens

A.3.1 Selection

Select 30 m of twine from each spool, in the following manner.

- Directly from the centre of each spool, in an anti-clockwise direction, draw the first 10 m of twine and discard it.

- Draw 30 m of twine and wind it as adjacent turns (without overlapping) on the wrap-reel, exercising just sufficient tension on the twine to maintain straightness.

Each specimen of 30 m constitutes a test piece.

A.3.2 Conditioning

The tests shall be carried out in an ambient atmosphere, provided that the twine has been kept in conditions which do not damage its original properties.

In the case of dispute, leave the specimens for 24 h in the standard temperature atmosphere for testing as specified in ISO 139 [temperature (20 ± 2) °C, relative humidity (65 ± 2) %], before continuing with the tests.

A.4 Procedure

Weigh each specimen to the nearest 0,5 g. Let m_1 be the mass obtained, in grams.

A.5 Expression of results

A.6 Calculation of linear density

For each specimen, calculate the linear density, ρ_l, in tex rounded to the nearest integer, using the following formula:

$$\rho_l = \frac{1000\, m_1}{30}$$

Where:

m_1 is the mass of the specimen in grams.

A.7 Calculation of runnage

Calculate the runnage, *L*, in metres per kilogram rounded to the nearest integer of twine, using the following formula:

$$L = \frac{10^6}{\rho_l}$$

where ρ_l is the linear density in tex rounded to the nearest integer.

A.8 Check test

If a specimen is outside the tolerance (see Table 2), a check test shall be carried out on another spool.

If the result of the check test is found to be within limits of the permitted tolerances, the result of the check test shall be adopted for the value of the linear density.

Annex B
(Normative)
Determination of twine breaking force

B.1 Principle

The force (expressed in decanewtons) required to break a specimen of specified length is measured under known conditions.

B.2 Apparatus

Tensile testing machine having a constant rate of traverse with a mobile grip. This testing machine shall comprise:

— two devices for gripping the ends of the test piece.

— a device for maintaining the rate of traverse constant.

— a device for indicating or recording continuously the force applied.

B.3 Specimens

After determining the runnage, draw directly from the centre of each spool in an anti-clockwise direction, and without cutting the twine, 10 specimens spaced 5 m from each other and of sufficient length so that once they are mounted in the testing machine, the free length of the specimen between the gripping devices (see 9.2.2) is a minimum of 250 mm.

Each specimen shall be identified by reference to the spool from which it has been drawn.

B.4 Procedure

B.4.1 Check that the speed of movement of the moving grip of the machine is constant and equal, in millimetres per minute, within ± 10 %, to the length, in millimetres, of the specimen between the grips.

B.4.2 Before mounting the specimen between the grips, ensure that the axes of the latter are a minimum of 250 mm apart.

B.4.3 Mount the specimen in the machine so that it coincides with the axis of pull, taking care to avoid loss of twist other than that inevitably lost in drawing off the twine from the spool.

B.4.4 Start the machine and apply the force continuously until the specimen breaks. If a specimen breaks in the grips, or as a result of damage caused by them, remove it and start the test again with a new specimen.

B.5 Expression of results

For the breaking force test, take into consideration only the results obtained when the break occurs between the grips of the testing machine.

Calculate the breaking force by obtaining the arithmetical mean of the 10 results retained and express this breaking force in decanewtons.

If any one of the 10 specimens from a sample spool fails to reach the minimum breaking force specified in Table 2 for the twine being tested, the result shall be rejected, and another spool of twine sample used in its place.

This retest procedure shall be applied to all sample spools representing a batch.

Should any test result from the retest sample spool or spools fail to reach the minimum breaking force requirement, the batch represented by the sample spools shall be deemed not to comply with this International Standard.

Annex C
(Normative)
Determination of knot breaking force

C1. Principle

The force (expressed in decanewtons) required to break a specimen containing a thumb knot tied as shown in Figure 1 and not its mirror image is measured under prescribed conditions.

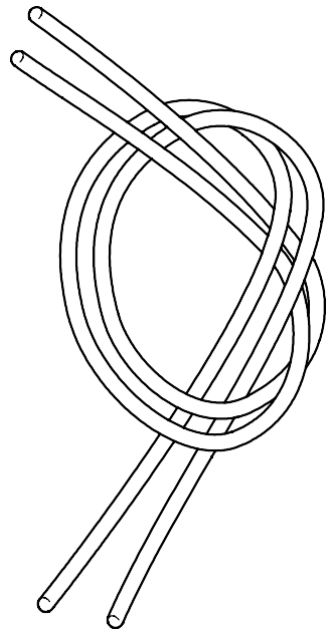
C2. Apparatus

See B.2.

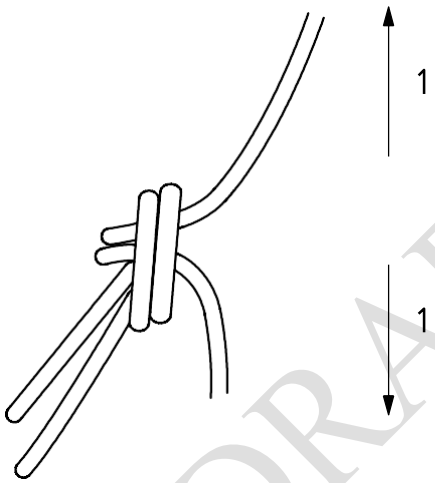
C.3 Specimens

After determining the twine breaking force, draw directly from the centre of each spool, in an anti-clockwise direction, 10 specimens spaced 5 m from each other and of sufficient length so that once they contain a thumb knot and are mounted in the testing machine, the free length of the specimen between the gripping devices shall be a minimum of 250 mm.

Each specimen shall be identified by reference to the spool from which it has been drawn.



a) Knot loosely tied



b) Knot drawn tight

The ends diverge at 180° to the grips, as shown.
The twine is loaded to rupture in this manner.

Key
1 to the grip

Figure 1 — Tying of thumb knot

C.4 Procedure

C.4.1 Before mounting the specimen between the grips, check that the axes of the latter are a minimum of 250 mm apart.

C.4.2 Check that the speed of movement of the moving grip of the machine is constant and numerically equal, in millimetres per minute, within ±10 % to the length, in millimetres, of the specimen between the grips.

C.4.3 Mount the specimen containing the knot between the grips in such a way that the knot is approximately equidistant from the grips. Draw the knot tight before loading is commenced, taking care to preserve the twist during this operation.

C.4.4 Start the machine and apply the force continuously until the specimen breaks. If a specimen breaks in the grips, or as a result of damage caused by them, remove it and start the test again with a new specimen. If, due to knot slippage, breaking does not occur, the test is not valid and shall be repeated with a new specimen; this fact shall be reported in the test report.

C.5 Expression of results

For the knot breaking force test, take into consideration only the results obtained when the break occurs clear of the grips of the testing machine.

Calculate the breaking force by obtaining the arithmetical mean of the 10 results retained and express this breaking force in decanewtons.

If a sample spool fails to reach the minimum average knot breaking force specified in Table 1, reject the result and sample another spool of twine in its place.

This retest procedure shall be applied to all sample spools representing a batch.

Should the calculated arithmetical mean of 10 results from the retest sample spool or spools fail to reach the minimum average knot breaking force requirement, the batch represented by the sample spools shall be deemed not to comply with this International Standard.

C.6 Test report

The test report shall include the following particulars:

a) reference to this Standard, i.e. KS 1142;

b) designation of the twine.

c) the results obtained.

d) any operating details not stated in this International Standard and any possible incidents likely to have had an effect upon the results.