INTERNATIONAL STANDARD

ISO 4167

Second edition
2006-03-01

Polyolefin agricultural twines

Ficelles agricoles en polyoléfines

Reference number
ISO 4167:2006(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 4167 was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 248, *Textiles and textile products*, in collaboration with Technical Committee ISO/TC 38, *Textiles*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 4167:1979), of which it constitutes a technical revision.

Polyolefin agricultural twines

1 Scope

This International Standard specifies the principal properties of polyolefin agricultural twines, the test methods which permit their verification, and the form of delivery for the twines.

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*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
agricultural twine
simple yarn intended to be used in agriculture, notably for binding the bundles on automatic pick-up balers or on similar machines

3.2
batch
definite quantity of twine produced under conditions which are presumed uniform

3.3
laboratory sample
total selection of samples from a batch intended for testing in the laboratory

3.4
polyolefin
principally polypropylene (PP) and high density polyethylene (PE)

3.5
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 International Standard, i.e. ISO 4167,

— 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 ISO 4167 - PP - 350

5 Raw materials

The raw material used for the manufacture of twine shall consist of polyolefin. Adequate stabilization against degradation by sunlight shall be incorporated.

Any ultraviolet (UV) inhibitor system as well as colour pigment may be used.

Used colour pigment and stabilizers should not be toxic.

NOTE Attention is drawn to the fact that in some areas of the world, a more stringent level of stabilization may be necessary than in others.

The colour of the twine shall be distinguishable from straw and grass.

6 Manufacture

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.

7 Technical properties

The methods used for measuring the technical properties of the agricultural twine shall be as given in Table 1.

Table 2 shows indicative characteristics of some twines only; others shall be calculated in accordance with the formulae in this clause and in 9.1.5.

In order to assure a minimum quality level, the following formulae are given for determining the technical characteristics of the agricultural twines.

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

$$F_{\text{twine}} = \frac{31\,450}{n} + 8$$

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, in accordance with the procedure given in 9.1.

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 average knot breaking force, in decanewtons rounded to the nearest integer.

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

Table 1 — Technical properties of polyolefin agricultural twines

Relevant property		Values of properties Example: Agricultural twine ISO 4167 - PP - 350	Method of test
Linear density	tex	$2\,857\ ^{+249}_{-211}$	See 9.1.
Runnage	m/kg	350 ± 28	See 9.1.
Minimum twine breaking force	daN [1)]	98	See 9.2.
Minimum average knot breaking force	daN [1)]	54	See 9.3.

1) 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	tolerance	nominal, n	tolerance	F_{twine}	F_{knot}
	tex	tex	m/kg	m/kg	daN	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

8 Sampling

8.1 Number of spools in a laboratory sample

Each 50 t or part thereof in a consignment of twine of the same code number shall represent a batch for testing using the following sampling formula:

$$S = 0{,}25\sqrt{N}$$

where

S is the number of spools sampled, rounded to the nearest integer;

N is the number of spools in a batch of 50 t or less.

8.2 Selection of sample

For each batch, the laboratory sample shall be made up as follows.

Select at random the required number of spools, each one taken from the different bales of the batch.

9 Test method

9.1 Determination of linear density and runnage

9.1.1 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.

9.1.2 Apparatus

9.1.2.1 **Balance**, accurate to 0,5 g.

9.1.2.2 **Wrap-reel** of known perimeter.

9.1.3 Specimens

9.1.3.1 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.

9.1.3.2 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.

9.1.4 Procedure

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

9.1.5 Expression of results

9.1.5.1 Calculation of linear density

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

$$\rho_l = \frac{1\,000\ m_1}{30}$$

where

m_1 is the mass of the specimen in grams.

9.1.5.2 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.

9.1.5.3 Check test

If a specimen is outside the tolerance (see Clause 7 and 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.

9.2 Determination of breaking force

9.2.1 Principle

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

9.2.2 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.

9.2.3 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.

9.2.4 Procedure

9.2.4.1 Check that the speed of movement of the moving grip of the machine is constant and equal, in millimetres per minute, within $\pm$ 10 %, to the length, in millimetres, of the specimen between the grips.

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

9.2.4.3 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.

9.2.4.4 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.

9.2.5 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.

9.3 Determination of knot breaking force

9.3.1 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.

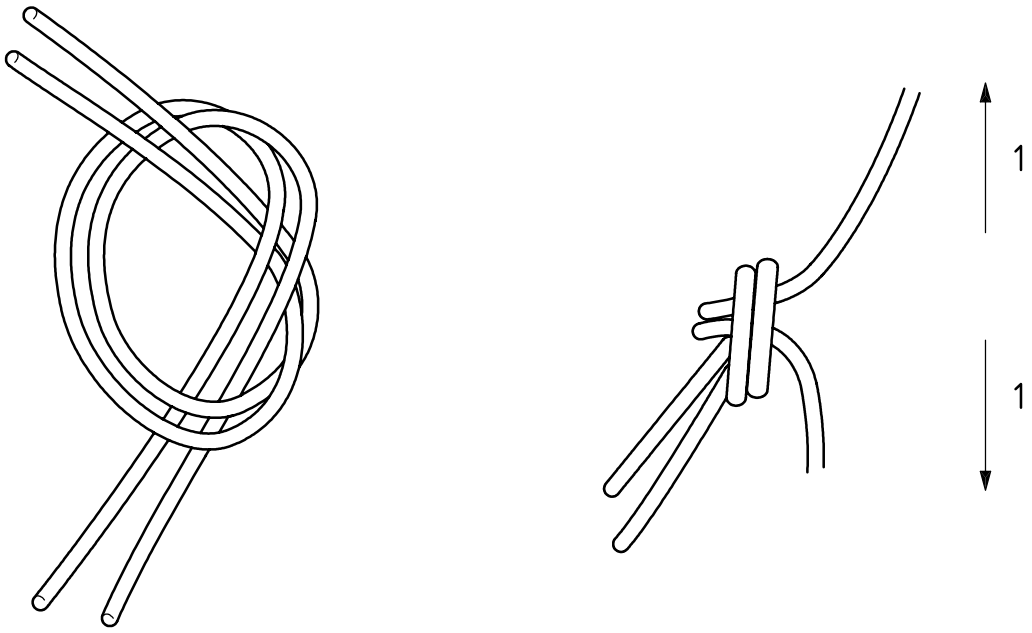
9.3.2 Apparatus

See 9.2.2.

9.3.3 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

9.3.4 Procedure

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

9.3.4.2 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.

9.3.4.3 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.

9.3.4.4 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.

9.3.5 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.

9.4 Test report

The test report shall include the following particulars:

a) reference to this International Standard, i.e. ISO 4167;

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.

10 Form of delivery

The twines shall be delivered in spools.

The maximum dimensions of the spools for twine conforming to this International Standard shall be as given in Table 3, according to the type of bale.

Table 3 — Maximum dimensions of the spools

Type of bale	Maximum height mm	Maximum diameter mm
Round bales	280	260
Conventional bales	280	260
Big bales	320	300

The spools of twine shall be put in packs or cartons.

Packs should be secured for normal handling during transportation and storage.

11 Marking

Each pack or carton shall carry the following minimum indications:

— the nominal runnage of the packaged agricultural twine;

— the number of this International Standard, i.e. ISO 4167.

NOTE Attention is drawn to the fact that laws or regulations may be in force in the countries in which the agricultural twine is sold. These may request an indication on the theoretical gross mass or net mass of the package (nominal mass in kilograms) and/or the nominal length in metres of the packaged twine.

12 Make up of batches for sale

When the sale is made by mass, the gross mass of a batch shall not be less than the mass invoiced[1)] by more than:

— 2 % if the batch is composed of fewer than 50 bales;

— 1 % if the batch is composed of from 50 to 99 bales;

— 0,5 % if the batch is composed of from 100 to 199 bales;

— 0,2 % if the batch is composed of from 200 to 499 bales;

— 0,1 % if the batch is composed of 500 bales or more.

When the sale is made by bale, no tolerance is allowed on the number of bales.

1) The mass invoiced is the total of the theoretical gross masses of the delivered bales (package included).

Annex A
(informative)

Recommendations for the care and handling of baler twine

A.1 Type of knot

The recommended knot to be used is described in 9.3.1.

A.2 Machine parts

The surface of machine operating parts should be in good condition and all parts should be smooth and free from rust and paint, to avoid unnecessary abrasion or breakage of the twine.

A.3 Handling

Spools and packs of twine should be handled with care and stored the right way up, otherwise doming of the spool may result.

A.4 Local abrasion

Unprotected spools should not be thrown on the ground or against hard objects since abrasion scars may cause considerable weakening of the twine.

A.5 Storage

Twines should be stored in a cool dry place to prevent damage caused by damp and heat.

ICS 59.080.50

Price based on 11 pages