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Testing method for steel tyre cord —

Part 1: General requirements

Méthode d'essai pour les câbles de pneumatiques en acier —

Partie 1: Exigences générales

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Foreword

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This document was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 17, *Steel wire rod and wire products*.

A list of all parts in the ISO 23475 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Testing method for steel tyre cord —

Part 1:
General requirements

1 Scope

This document specifies test methods of steel cords which are used for tyre reinforcement. Dimension, process properties, mechanical properties and coating test method are all included.

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.

ISO 17832, *Non-parallel steel wire and cords for tyre reinforcement*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 17832 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 http://www.electropedia.org/

4 Dimension

4.1 Cord diameter

4.1.1 Measure with micrometre

4.1.1.1 Principle

Hold the sample between two parallel circular faced anvils of a micrometre. Close the movable anvil gradually and gently until it is in contact with the specimen. Read the value on the micrometre.

4.1.1.2 Apparatus

4.1.1.2.1 Micrometre

A precision disk micrometre with non-rotate spindle is suggested. This micrometre may have a hole (maximum 8 mm) in the centre of the anvils (see Figure 1).

Measuring range is from 0 mm to 25 mm. Resolution is 0,001 mm.

Anvil type: the diameter of the anvils shall be greater than one lay length (min. 20 mm in diameter). Measuring force range: <10 N. It is suggested from 3 N to 5 N.

The anvils shall be plane within 0,002 mm and parallel within 0,005 mm.

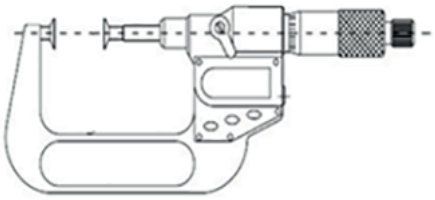

Figure 1 — Disk micrometre

4.1.1.2.2 Fusing machine

4.1.1.3 Procedure

a) Clean the surface of the anvils with clean paper. Verify whether the micrometre reads 0,000 when the anvils are closed for each measurement.

b) Fuse a specimen to a length about 150 mm and ensure that cord end is well secured with no unravelling. Place the sample in the centre of the anvils.

c) Close the movable anvil gradually and gently until it is in contact with the specimen. For normal cords, stop rotating the spindle when 3 'click' are heard and for HE, HI and OC constructions only 1 "click" is heard.

d) Axially rotate the sample between repeated measurements in order to find the maximum diameter (D_1) and minimum diameter (D_2).

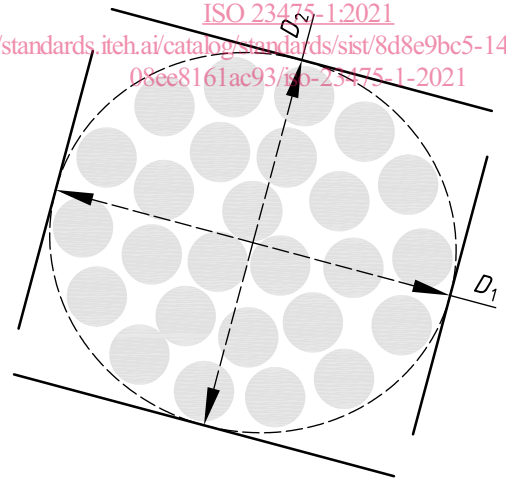

Figure 2 — Diameter test diagram

4.1.1.4 Expression of results

Calculate the average diameter (D) with Formula (1):

$$D = \frac{D_1 + D_2}{2} \tag{1}$$

where

D_1 is the maximum diameter, expressed in millimetres (mm);

D_2 is the minimum diameter, expressed in millimetres (mm);

D is the average diameter, expressed in millimetres (mm).

4.1.1.5 Test report

Report the average diameter to the nearest 0,001 mm.

4.1.2 Measure with profile projector

4.1.2.1 Principle

Specimens of a cord sample are successively put on the optical microscope. A silhouette of the cord is projected on the screen. The thickness of the specimen is measured by moving the abscissa axis of the projector.

4.1.2.2 Apparatus

4.1.2.2.1 Profile projector, with

— magnification possibility: × 10 or × 20;

— micrometre stage table: resolution 0,001 mm.

4.1.2.2.2 Sample holder, a frame on which two magnets are fixed in order to position the test specimen.

4.1.2.2.3 Fusing machine

4.1.2.3 Procedure

a) Fuse a specimen to a length about 100 mm, ensure that fuse is securely tied in order to prevent the cord ends from any unravelling. Put the specimen on the sample holder and ensure that is fixed by magnets.

b) Bring the sample into sample holder and adjust the focal distance. Make the sample being projected on the screen.

c) Rotate the sample until the maximum profile is being projected on the screen. Move the micrometre table until the horizontal reference line contacts two consecutive waves (see Figure 3).

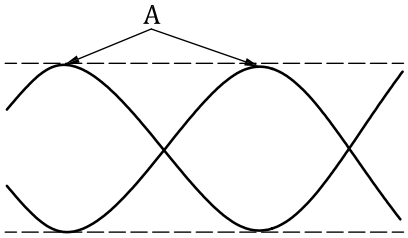

Figure 3 — X-axis contacts the two consecutive waves

d) Reset the micrometre. Move the stage until the X-axis contacts the opposite wave (see Figure 4). Record the reading as maximum diameter ($D_{1)}$. If there are two waves on the opposite side, measure the bigger one.

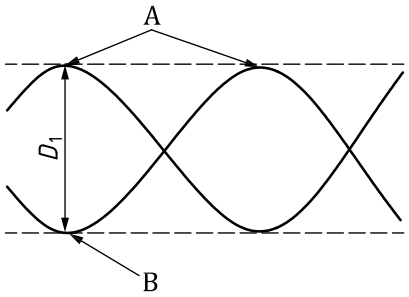

Figure 4 — X-axis contacts the other side wave

e) Turn the specimen through 90° until a minimum diameter is obtained, record the minimum diameter D_2. Repeat the steps c) and d) and record the reading as minimum diameter (D_2). If there are two waves on the opposite side, measure the bigger one (see Figure 5).

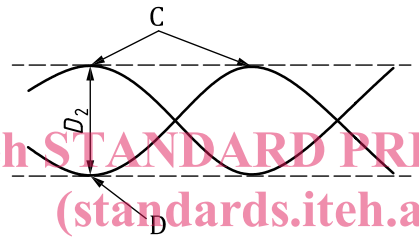

Figure 5 — Minimum diameter

4.1.2.4 Expression of results

Calculate the average diameter (D) of the two readings with Formula (1).

4.1.2.5 Test Report

Report the average diameter to the nearest 0,001 mm.

NOTE This test method is generally used for open cords and HI cords or for other cord types that are sensitive to radial compression when using a micrometre.

4.2 Unravelled filament diameter

4.2.1 Principle

A sample is held between two parallel blade anvils of a micrometre. The movable anvil is closed gradually and gently until it is in contact with the specimen. Read the value on the micrometre.

4.2.2 Apparatus

4.2.2.1 Blade micrometre (see Figure 6)

— Measuring range is from 0 mm to 25 mm. Resolution is 0,001 mm.

— Anvil type: blade.

— Measuring force: <10 N. It is suggested from 3 N to 5 N.

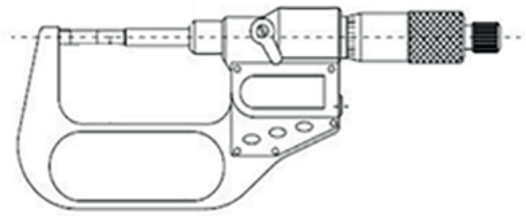

Figure 6 — Blade micrometre

4.2.2.2 Nipper pliers

4.2.3 Procedure

a) Clean the surface of the anvils with clean paper. Verify whether the micrometre reads 0,000 when the anvils are closed for each measurement.

b) Cut the wire approximately 100 mm in length. Position the specimen in the centre of the anvils.

c) The movable anvil is closed gradually and gently until it is in contact with the specimen. Read the value after 3 'click' are heard.

d) Measure on the same section of the specimen until the maximum diameter (D_1) and minimum diameters (D_2) are found.

4.2.4 Expression of results

Calculate the average diameter (D) of the two readings with Formula (2):

$$D = \frac{(D_1 + D_2)}{2} \tag{2}$$

where

D_1 is the maximum diameter, expressed in millimetres (mm);

D_2 is the minimum diameter, expressed in millimetres (mm);

D is the average diameter, expressed in millimetres (mm).

4.2.5 Test report

Report the average diameter to the nearest 0,001 mm.

4.3 Linear density

4.3.1 Principle

A straight section of the cord of a predefined length, generally 1 m, is weighted using an analytical balance.

4.3.2 Apparatus

4.3.2.1 Analytical balance, which can be read to the nearest 0,001 g.