INTERNATIONAL STANDARD

ISO 17832

First edition
2009-07-01

Non-parallel steel wire and cords for tyre reinforcement

Fils d'acier et cordes non parallèles pour le renfort de pneumatiques

Reference number
ISO 17832:2009(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 International Standards. Draft International 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 17832 was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 17, *Steel wire rod and wire products*.

Non-parallel steel wire and cords for tyre reinforcement

1 Scope

This International Standard specifies the definition and requirements of non-parallel steel wire and cords for tyre reinforcement.

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 2859-1, *Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

ISO 3951-1, *Sampling procedures for inspection by variables — Part 1: Specification for single sampling plans indexed by acceptance quality limit (AQL) for lot-by-lot inspection for a single quality characteristic and a single AQL*

ISO 3951-2, *Sampling procedures for inspection by variables — Part 2: General specification for single sampling plans indexed by acceptance quality limit (AQL) for lot-by-lot inspection of independent quality characteristics*

ISO 3951-3, *Sampling procedures for inspection by variables — Part 3: Double sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

ISO 3951-5, *Sampling procedures for inspection by variables — Part 5: Sequential sampling plans indexed by acceptance quality limit (AQL) for inspection by variables (known standard deviation)*

ASTM D2229-04, *Standard Test Method for Adhesion Between Steel Tire Cords and Rubber*

ASTM D2969-04, *Standard Test Methods for Steel Tire Cords*

BISFA, *Test methods for steel tyre cords,* 1995 Edition

JIS G 3510, *Testing Methods for Steel Tire Cords*

3 Terms and definitions

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

3.1
filament (wire)
metal fibre with brass coating used as an individual element in a strand or cord

3.2
strand
group of filaments combined together to form a unit product for further processing

3.3
cord
formed structure composed of two or more filaments when used as an end product, or a combination of strands or filaments and strands

3.3.1
single-strand cord
cord formed by twisting two or more filaments together

3.3.2
M+N type cord
cord formed by twisting a number of non-concentric filaments around a number of parallel filaments

NOTE The cross-section is not round and varies along the length.

3.3.3
layer cord
cord formed by adding layers around a core (either filament(s) or a strand)

NOTE The layers can be filaments or strands.

3.3.4
multi-strand cord
cord formed by twisting two or more strands together

3.4
wrap
filament wound helically around a steel cord

3.5
direction of lay
helical disposition of the components of a strand or cord

NOTE 1 The strand or cord has an “S” or left-hand lay, when held vertically, if the spirals around the central axis of the strand or cord conform in direction of slope to the central portion of the letter “S”.

NOTE 2 The strand or cord has a “Z” or right-hand lay if the spirals conform in direction of slope to the central portion of slope of the letter “Z”.

3.6
length of lay
axial distance required to make a 360° revolution of any element in a strand or in a cord

NOTE The length of lay is expressed in millimetres.

4 Classification

4.1 Classification based on tensile strength

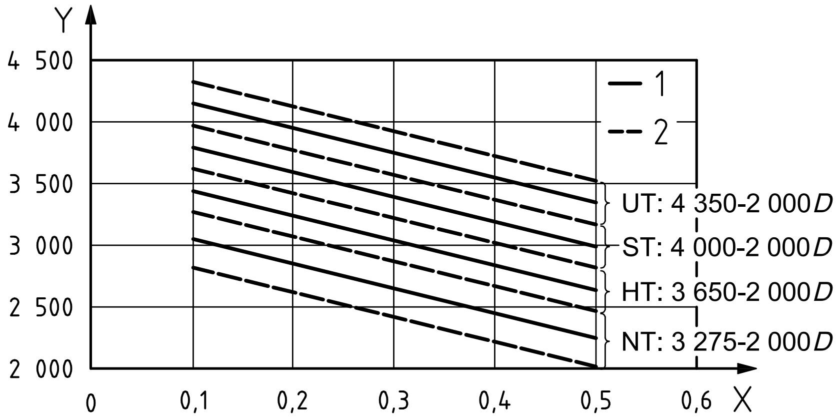
Steel cord is supplied in levels of tensile strength (Figure 1), designated as

— NT: normal standard (or regular) tensile strength cord,

— HT: high tensile strength cord,

— ST: super tensile strength cord, or

— UT: ultra tensile strength cord.



Key

X filament diameter, mm

Y filament tensile strength, MPa

1 solid line indicates target value

2 dashed line indicates tolerance range

NOTE The target value is determined by agreement between the manufacturer and purchaser.

Figure 1 — Tensile strength levels

Figure 1 gives the tensile strength levels of wet-drawn filaments. The cord breaking load will be calculated from the filament number, lay length and cabling loss. For example, for cord construction 2x0,30ST 14/S:

$$F = 2 \times (f \times \cos \alpha) \times (1 - C) \quad (1)$$

where

F is the breaking load of cord construction 2x0,30ST 14/S, in megapascals;

f is the breaking load of 0,30ST, in megapascals;

α is the cabling angle, in degrees;

C is the cabling loss on tensile strength (e.g. 4 %).

4.2 Classification based on cord structure

The main classification based on cord structure is categorized by the following four structures:

— single strand cords;

— M+N cords;

— layer cords;

— multi-strand cords.

4.3 Classification based on cord type

The main classification based on cord type is categorized by the following four types:

— HE: high-elongation cord;

— OC: open cord;

— CC: compact cord;

— SE: semi-high-elongation cord.

Another detailed classification may be used if there is mutual agreement between the manufacturer and purchaser.

5 Designation and ordering

A tyre cord construction is normally defined by

— cord structure,

— cord tensile strength,

— cord type,

— length and direction of lay, and

— coating type.

5.1 Cord structure

The description of the cord structure follows the sequence of manufacture of the cord, i.e. starting with the innermost strand or wire and moving outwards.

The full description of the cord structure is given by the following formulas:

$(N \times X) \times D + (N \times X) \times D + (N \times X) \times D + D$, or

$(N \times X) \times D/(N \times X) \times D/(N \times X) \times D + D$ for compact cords, and

$(N \times N) \times D + D$

where

N is the number of strands;

X is the number of filaments;

D is the nominal diameter of wires, expressed in millimetres.

EXAMPLE 1 (1 × 3) × 0,22 + (1 × 9) × 0,22 + (1 × 15) × 0,22 + 0,15.

When N or F equals 1, they should not be included.

EXAMPLE 2 3 × 0,22 + 9 × 0,22 + 15 × 0,22 + 0,15.

If the diameter D is the same for two or more parts in sequence, it shall only be stated at the end of the sequence.

The diameter of the spiral wrap shall always be stated separately.

EXAMPLE 3 $3 + 9 + 15 \times 0{,}22 + 0{,}15$.

When the innermost strand or wire is identical to the adjacent strand or wires, the formula may be simplified by stating only the sum of the identical components and brackets need not be used.

EXAMPLE 4 $0{,}22 + 6 \times 0{,}22 + 6 \times (0{,}22 + 6 \times 0{,}22)$ becomes $7 \times 7 \times 0{,}22$.

5.2 Cord tensile strength

There are 4 levels of tensile strength: NT, HT, ST and UT as defined in 4.1.

5.3 Cord type

See Table 3.

5.4 Length and direction of lay

The sequence or order in the designation follows the sequence of manufacturing, i.e. starting with the innermost strand and moving outwards.

EXAMPLE

$3 + 9 + 15 \times 0{,}175 + 0{,}15$

5/10/16/3.5 SSZS

5 S: lay length and direction of the strand $3 \times 0{,}175$

10 S: lay length and direction of the strand $+ 9 \times 0{,}175$

16 Z: lay length and direction of the strand $+ 15 \times 0{,}175$

3,5 S: lay length and direction of the wrap

5.5 Coating type

There are 2 types of coating: high-copper coating and normal copper coating, as listed in Table 2.

6 Requirements

Specified tests are mainly conducted in accordance with internationally agreed methods for steel tyre cords, such as ASTM D2229-04, ASTM D2969-04, BISFA, JIS G 3510, etc.

6.1 Dimensions, mass and tolerances

6.1.1 Diameter of cord

The diameter of the circumscribed circle of cord, in millimetres, and detailed requirements are listed in Table 5.

6.1.2 Linear density

The linear density, i.e. the mass of a 1 m length of cord, in grams per metre (g/m), and detailed requirements are listed in Table 5.