INTERNATIONAL STANDARD

ISO 15236-1

Second edition
2016-10-15

Steel cord conveyor belts —

Part 1: Design, dimensions and mechanical requirements for conveyor belts for general use

Courroies transporteuses à câbles d'acier —

Partie 1: Exigences de conception, de dimensions et mécaniques des courroies transporteuses à usage général

Reference number
ISO 15236-1:2016(E)

COPYRIGHT PROTECTED DOCUMENT

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 41, *Pulleys and belts (including veebelts)*, Subcommittee SC 3, *Conveyor belts*.

This second edition cancels and replaces the first edition (ISO 15236-1:2005), of which it constitutes a minor revision.

ISO 15236 consists of the following parts, under the general title *Steel cord conveyor belts*:

— *Part 1: Design, dimensions and mechanical requirements for conveyor belts for general use*

— *Part 2: Preferred belt types*

— *Part 3: Special safety requirements for belts for use in underground installations*

— *Part 4: Vulcanized belt joints*

Steel cord conveyor belts —

Part 1:
Design, dimensions and mechanical requirements for conveyor belts for general use

1 Scope

This part of ISO 15236 specifies the performance and constructional requirements applicable to conveyor belts having steel cords in the longitudinal direction as reinforcement. The requirements for construction given in Clause 6 apply to the design of single belts, as well as the design of complete type series such as those covered in ISO 15236-2.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 37, *Rubber, vulcanized or thermoplastic — Determination of tensile stress-strain properties*

ISO 188, *Rubber, vulcanized or thermoplastic — Accelerated ageing and heat resistance tests*

ISO 284, *Conveyor belts — Electrical conductivity — Specification and test method*

ISO 340, *Conveyor belts — Laboratory scale flammability characteristics — Requirements and test method*

ISO 703, *Conveyor belts — Transverse flexibility (troughability) — Test method*

ISO 4649, *Rubber, vulcanized or thermoplastic — Determination of abrasion resistance using a rotating cylindrical drum device*

ISO 7590, *Steel cord conveyor belts — Methods for the determination of total thickness and cover thickness*

ISO 7622-2, *Steel cord conveyor belts — Longitudinal traction test — Part 2: Measurement of tensile strength*

ISO 7623, *Steel cord conveyor belts — Cord-to-coating bond test — Initial test and after thermal treatment*

ISO 8094, *Steel cord conveyor belts — Adhesion strength test of the cover to the core layer*

ISO 10247, *Conveyor belts — Characteristics of covers — Classification*

ISO 15236-2, *Steel cord conveyor belts — Part 2: Preferred belt types*

EN 12882, *Conveyor belts for general purpose use — Electrical and flammability safety requirements*

EN 13827, *Steel cord conveyor belts — Determination of the lateral and vertical displacement of steel cords*

3 Terms and definitions

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

3.1
edge width
b_k
thickness of rubber between the outer cord and the belt edge

Note 1 to entry: See Figure 1.

3.2
breaker
transverse reinforcement in the conveyor belt, normally of a textile material, attached both above and below, or either above or below, the layer of longitudinal cords at a distance of at least 1 mm and considered to be part of the cover

[SOURCE: ISO 7590:2009, 2.1, modified.]

Note 1 to entry: See Figure 2.

3.3
weft
transverse reinforcement in the conveyor belt, normally of steel wires, attached both above and below, or either above or below, the layer of longitudinal cords at a distance of less than 1 mm and considered to be part of the belt core

[SOURCE: ISO 7590:2009, 2.2, modified.]

Note 1 to entry: See Figure 3.

4 Symbols and units

Table 1 — Symbols and units

Symbol	Explanation	Unit
B	Belt width	mm
F_a	Pull-out force of cord per cord length	N/mm
F_{bs}	Breaking strength of cord taken from cured belt	kN
F_v	Pull-out force of cord per cord length — after thermal treatment	N/mm
K_N	Minimum (nominal) breaking strength per width of belt	N/mm
b_k	Calculated edge width	mm
b_t	Supporting belt width	mm
d	Cord diameter	mm
F	Deflection (troughability)	mm
h_m	Median cord height according to EN 13827	mm
n	Number of cords	—
s_1	Belt thickness	mm
s_2	Cover thickness carrying side	mm
s_3	Cover thickness pulley side	mm
s_4	Thickness of layer between breaker and layer of longitudinal cords	mm
s_5	Thickness of layer between weft and layer of longitudinal cords	mm
s_6	Thickness of belt core	mm
t	Cord pitch	mm

Table 1 *(continued)*

Symbol	Explanation	Unit
Δh_1	Number of cords positioned within a range of $h_m \leqq 1$ mm as a percentage of the total number of cords	%
Δh_2	Number of cords positioned within a range of h_m of from >1,0 mm to 1,5 mm and expressed as a percentage of the total number of cords	%
Δh_3	Percentage of cords with $h_m > 1{,}5$ mm	%

5 Belt design

5.1 Standard type

Conveyor belts conforming to this part of ISO 15236 contain steel cords surrounded by a layer of core rubber. This belt core is protected on top and bottom by cover layers (see Figure 1).

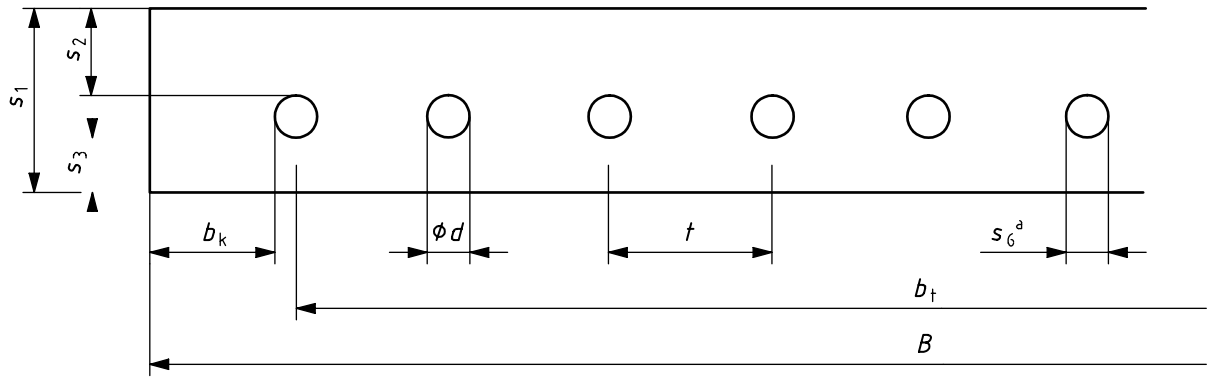
5.2 Conveyor belting having transverse reinforcements

Requirements for steel cord conveyor belts having breakers are illustrated in Figure 2 and requirements relating to weft are illustrated in Figure 3.

5.3 Belt core

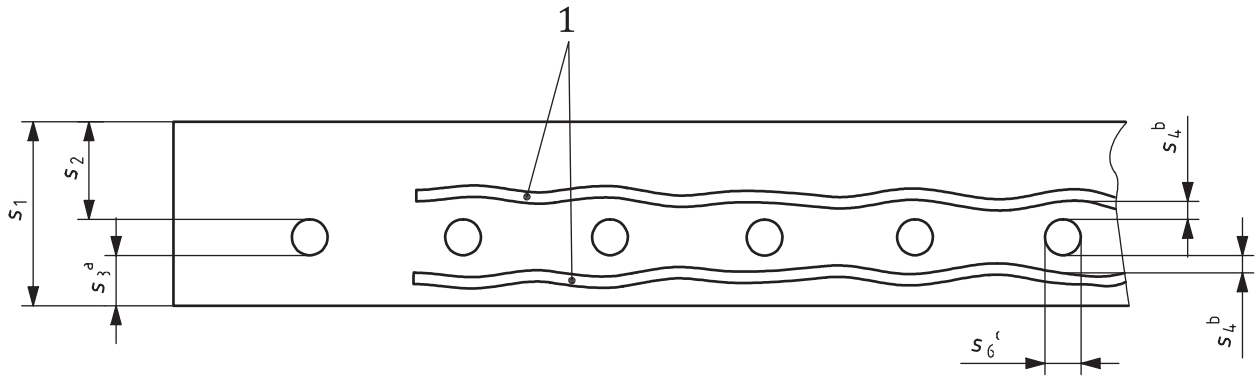
The thickness of the belt core (carcass), s_6, for all belt types is defined as follows:

$$s_6 = s_1 - s_2 - s_3$$



a $s_6 = d$.

Figure 1 — Cross section of standard belt



Key

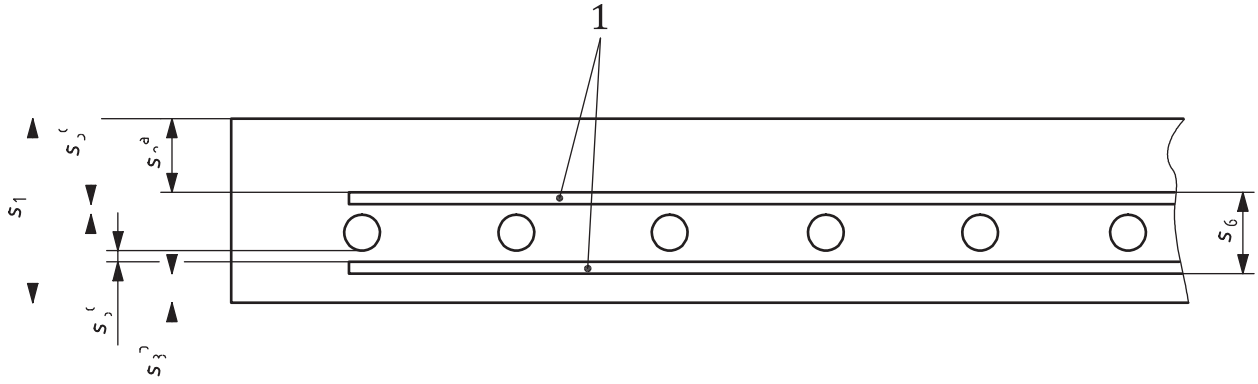
1 breaker

a Including the breaker.

b ≧1 mm.

c $s_6 = d$ (see Table 1).

Figure 2 — Belt cross section with breaker



Key

1 weft

a Above the weft.

b Below the weft.

c <1 mm.

Figure 3 — Belt cross section with weft

6 Design and construction

6.1 Belt strengths

Steel cord belts shall be manufactured in strengths of between 500 N/mm and 10 000 N/mm belt width.

The selection of preferred belt types shown in Table 2 should be used. Three groups are indicated, for low-, medium- and high-strength belts.

Table 2 — Belt types

Low	ST 500	ST 630	ST 800	ST 1000	ST 1250	ST 1600
Medium	ST 2000	ST 2250	ST 2500	ST 2800	ST 3150	
High	ST 3500	ST 4000	ST 4500	ST 5000	ST 5400	

6.2 Belt widths

The belt widths and tolerances according to Table 3 shall apply only to belts when manufactured and not to belts when tensioned on-site.

Table 3 — Belt widths, *B*

Dimensions in millimetres

B													
500	650	800	1 000	1 200	1 400	1 600	1 800	2 000	2 200	2 400	2 600	2 800	3 000	3 200
$^{+10}_{-5}$	$^{+10}_{-7}$	$^{+10}_{-8}$	±10	±10	±12	±12	±14	±14	±15	±15	±15	±15	±15	±15

6.3 Belt edge and supporting belt width

6.3.1 Edge width

The edge width shall not be less than 15 mm and not more than 40 mm. Within these limits, the calculated edge width, b_k, is approximated from Formula (1):

$$b_k \approx 5 \times s_6 \tag{1}$$

6.3.2 Supporting belt width

The supporting belt width, b_t, is derived as follows:

$$b_t = B - 2b_k - d \tag{2}$$

(see also 7.2.2).

6.4 Number of cords

Based on the minimum breaking strength of the cord, F_{bs} (see 7.1), in kilonewtons (kN), the minimum breaking strength of the belt, K_N, in newtons per millimetre (N/mm) of belt width, and on the width of the belt, B, in millimetres (mm), the minimum number of cords, n_{min}, is given by Formula (3):

$$n_{min} = \frac{K_N \times B}{F_{bs} \times 1\,000} \tag{3}$$

The actual number of cords, n, shall be greater than or equal to n_{min}.

6.5 Cord pitch

The cord pitch, t, is calculated using Formula (4):

$$t = \frac{b_t}{n-1} \tag{4}$$

The cord pitch shall be selected to the nearest 0,1 mm.

The calculated edge width, b_k, is given by Formula (5):

$$b_k = 0{,}5 \times [B - d - t \times (n-1)] \quad (5)$$

6.6 Thickness of covers

For standard type belts (see 5.1), the minimum thickness of either of the covers (s_2 or s_3) shall be not less than 0,7d or not less than 4 mm, whichever is the higher value.

For belts with transverse reinforcements (see 5.2), the minimum cover thickness for belts with breaker, depending on breaker design, may be higher. The minimum cover thickness for belts with a weft may be lower.

The cover thicknesses employed shall be determined taking into account cover grade and conveying conditions.

6.7 Belt thickness

The thickness, s_1, is the result of the addition of the core thickness, s_6, and the cover thicknesses s_2 and s_3.

When measured according to ISO 7590, the maximum belt thickness, s_{1max}, shall be equal to 1,1s_1, and the minimum belt thickness, s_{1min}, shall be in accordance with the following:

$s_1 \leqq 20$ mm: $s_{1min} = (s_1 - 1)$ mm

$s_1 > 20$ mm: $s_{1min} = (s_1 - 1{,}5)$ mm

The belt surfaces shall be plain and parallel and any difference in belt thickness (e.g. across the width of the belt) shall not exceed 0,05s_1.

6.8 Belt length

Belting shall be supplied subject to the tolerances on length detailed in Table 4.

Table 4 — Tolerances on belt lengths

Belt delivery condition	Maximum permissible difference between delivered and ordered lengths
For a belt delivered in one complete length	$^{+2{,}5\ \%}_{0}$
For belt delivered in several lengths	±5 % for each single length, subject to an overall tolerance for the sum of all lengths of $^{+2{,}5\ \%}_{0}$

When placing orders for belting, purchasers should specify a length of belting that includes such lengths as are required for jointing and external testing.

7 Mechanical requirements

7.1 Breaking strength of the steel cord

The breaking strength of the cord shall be proved by the test certificate of the cord manufacturer. Alternatively, if a test of the cord taken from the belt is requested, the test shall be carried out in accordance with ISO 7622-2.

The breaking strength of the cord, F_{bs}, shall at least be equal to the product of the minimum breaking strength of the belt, K_N, and the belt width, B, divided by the number of cords, n, i.e.

$$F_{bs} \geq \frac{K_N \times B}{n \times 1\,000} \tag{6}$$

7.2 Position of the steel cord in the conveyor belt

7.2.1 General

The position of the cords shall be determined according to EN 13827.

7.2.2 Horizontal position

The cords in the belt shall be rectilinear. Not more than 5 % of the steel cords shall deviate from the nominal cord pitch by more than ±1,5 mm when measured in accordance with EN 13827.

The deviation of the supporting belt width, b_t, from the arithmetic value $[(n - 1) \times t]$, shall not exceed 1 %.

7.2.3 Vertical position

The steel cords of the belt shall be in one plane. When measured in accordance with EN 13827, the value of Δh_1 shall be at least 95 %, the value of Δh_2 shall not exceed 5 % and the value of Δh_3 shall be zero.

7.3 Number and spacing of cord joints

In any individual length of conveyor belt (see 6.8), not more than 2 % of the total number of cords, n, may be joined and no individual cord shall have more than one joint.

The distance between joints in the longitudinal direction shall be greater than 10 m.

7.4 Cord pull-out force

The adhesion force between rubber and steel cord is represented in the as-delivered state by F_a and after thermal treatment by F_v.

When tested in accordance with ISO 7623, the cord pull-out forces F_a and F_v shall meet the requirements given in Table 5.

Table 5 — Performance requirements for cord-to-coating bond strength per cord length

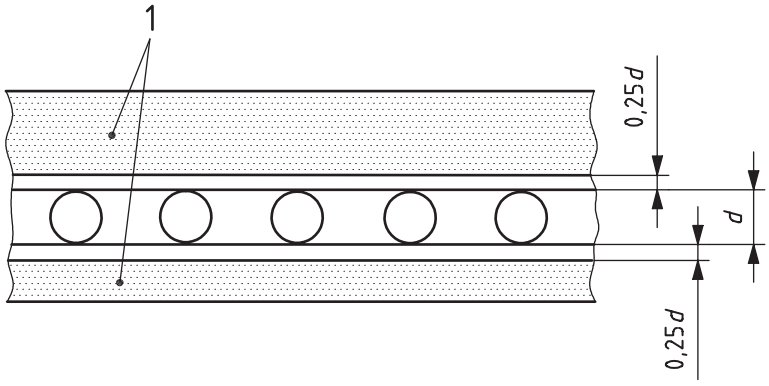
Test conditions	Cord pull-out forces	
	F_a	F_v
	N/mm	
As-delivered state	$15d + 15$	—
After thermal treatment (145 ± 5) °C for (150 ± 1) min	—	$15d + 5$

7.5 Covers — Quality classification

When tested in accordance with ISO 37 and ISO 4649, method A, the conveyor belt covers shall comply with the requirements of Table 6 with respect to a cover surface

— down to a distance from the cord surface equal to $0{,}25d$ of the cord diameter, as shown in Figure 4 (if there is no transverse reinforcement), and

— down to a distance of 0,5 mm from the transverse reinforcement, as shown in Figure 5 (if transverse reinforcement is present).

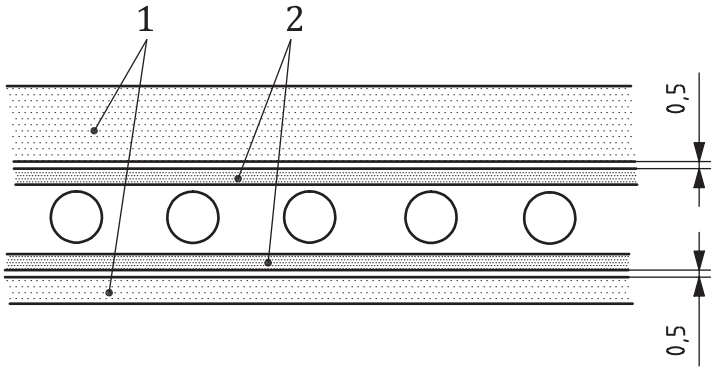


Key

1 cover grade

Figure 4 — Applicable cover grade depth of standard belt

Dimensions in millimetres



Key

1 cover grade

2 transverse reinforcement

Figure 5 — Applicable cover grade depth of belt with transverse reinforcement

Table 6 — Cover grades

Grade	Tensile strength min. (ISO 37) MPa	Elongation at break min. (ISO 37) %	Abrasion resistance max. (ISO 4649) mm^3
H	24	450	120
D	18	400	100
L	15	350	200
K[a]	15	350	200

NOTE The cover grades H, D, and L are in accordance with ISO 10247. The values will help to determine the appropriate cover compound for the application or for the materials carried. Other values, such as tear resistance, can be considered if required. Reliable assessment of the behaviour of the covers in service for wear and cut resistance cannot be determined from tensile strength, elongation, and abrasion values alone.

[a] For flame-resistant and antistatic belts in accordance with ISO 340 and ISO 284.

7.6 Ageing of covers

The median values for tensile strength and elongation at break after accelerated ageing in an air oven at 70 °C for seven days in accordance with ISO 188 shall not be lower than 75 % of the values obtained before ageing.

7.7 Adhesion

When tested according to ISO 8094, the adhesion between covers and rubber core shall be at least 12 N/mm sample width. The adhesion between transverse reinforcements and core and between transverse reinforcements and covers shall be at least 10 N/mm.

If the weft is interwoven with the cords, the test should not be carried out.

7.8 Transverse reinforcements

7.8.1 Breaker

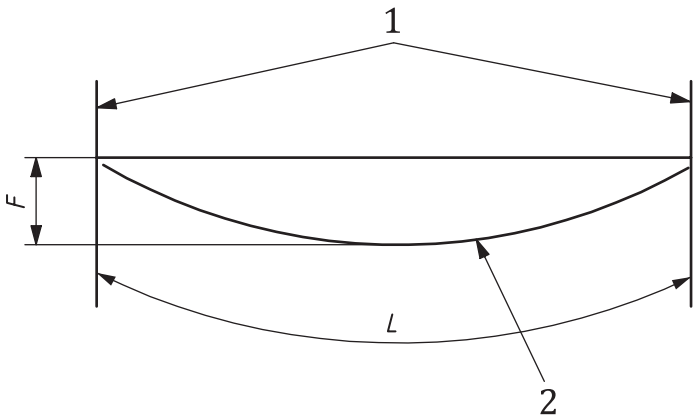
Transverse reinforcements in the cover (breaker) are applied at a distance, s_4, from the longitudinal cords ranging between 1 mm and 3 mm. The width of the breaker ply shall not be less than the belt width minus 100 mm. The distance between the edge of the breaker and the belt edge shall be at least 10 mm.

7.8.2 Weft

Transverse reinforcements as a part of the carcass (weft) are applied at a distance, s_5, of less than 1 mm from the layer of longitudinal cords. The width of the weft shall not be less than the belt width minus 50 mm. The distance between the edge of the weft and the edge of the belt shall be at least 5 mm.

7.9 Troughability

Testing shall be carried out in accordance with ISO 703. The troughability is characterized by the ratio of the deflection, F, to the belt width, L (see Figure 6), as given in Table 7.



Key

1 suspension filament

2 belt sample

Figure 6 — Suspension of sample

Table 7 — Minimum values of *F*/*L* for belt conveyors of three idlers of equal length, according to ISO 703

Troughing angle of side idlers	*F*/*L*
20°	0,08
25°	0,10
30°	0,12
35°	0,14
40°	0,16
45°	0,18
50°	0,20
55°	0,23
60°	0,26

7.10 Tracking

Steel cord conveyor belting, when running on a perfectly aligned conveyor and loaded centrally, shall not deviate from the central track by more than ±40 mm for a belt width up to 800 mm; for belt width over 800 mm, it shall not deviate by more than ±5 % or by more than ±75 mm, whichever is the lesser value.

7.11 Safety requirements

Each conveyor belt shall comply with one of the safety categories specified in EN 12882.

For applications where hazards from fire and/or explosions are likely, additional steps can be taken to increase safety such as

— automatic fire extinguishers, and

— automatic control of temperature, belt slip, belt tension, mechanical overload, etc.

8 Sampling

If a certificate pertaining to the tests required by Clause 7 is to be provided, take a sample between two successive lengths to represent both lengths.

If additional tests are required, take samples of not less than 450 mm length in the full width distributed approximately equally over the belt length up to the number of samples given in Table 8.

Table 8 — Number of samples

Belt length	Number of samples
≦200 m	1 (if requested)
≧200 m ≦500 m	1
>500 m ≦1 000 m	2
>1 000 m ≦2 000 m	3
>2 000 m ≦3 500 m	4
>3 500 m ≦5 000 m	5
>5 000 m ≦7 000 m	6
>7 000 m ≦10 000 m	7
for each addition 5 000 m	1

9 Designation

The symbol ST shall signify the material (steel cords) used for the tension member in the longitudinal direction. This symbol shall be followed by the nominal breaking strength of the belt in newtons per millimetre (N/mm) belt width (see Table 2).

Breaker transverse reinforcements shall be designated by the cover thickness followed by T (for textile) or S (for steel).

Weft transverse reinforcements shall be designated by the letter S (for steel) or T (for textile), after the ST sign, to indicate the material of the weft and the place where it is applied.

The belt type, in accordance with ISO 15236-2, shall be designated by A1, A2 or B1, as appropriate.

EXAMPLE 1 A 1 400 m steel cord conveyor belt (ST) of 2 200 mm width, a minimum breaking strength of 3 500 N/mm belt width, covers of 10 mm on the carrying side and 7 mm on the pulley side, of grade H and type A1:

1 400 m steel cord conveyor belt, ISO 15236-1 - 2 200 ST 3 500/10 + 7 H + A1

EXAMPLE 2 A 900 m steel cord conveyor belt (ST) of 1 400 mm width, a minimum breaking strength of 2 500 N/mm belt width, covers of 10 mm on the carrying side and 6 mm on the pulley side, of grade D, with transverse reinforcements (breaker) in the covers of carrying and pulley sides, consisting of textile material and type A2.

900 m steel cord conveyor belt, ISO 15236-1 - 1 400 ST 2 500/10T + 6T D + A2

EXAMPLE 3 A 1 000 m steel cord conveyor belt (ST) of 1 000 mm width, a minimum breaking strength of 800 N/mm belt width, covers of 6 mm on the carrying side and 3 mm on the pulley side of grade L, with transverse reinforcements (weft) on the carrying and pulley sides, consisting of steel and type B1.

1 000 m steel cord conveyor belt, ISO 15236-1 - 1 000 ST S/S 800/6 + 3 L + B1

10 Ordering data

The minimum requirements of the customers are length, width, breaking strength, cover gauges, cover quality.

For purchasers placing orders with more than one manufacturer or for replacement belting, more detailed information is required for compatibility, such as pitch, number of cords, and possibly cord diameter, as well as whether the belt is to be of the standard type or equipped with breaker plies or weft. Attention should be drawn to ISO 15236-2 regarding preferred types.

11 Marking

11.1 Steel cord conveyor belts are generally long-lasting products. Therefore, the marking should be durable and the use of imprints is recommended. As this might have the negative effect of increasing the noise generated when the belt passes the idlers, the method of marking should be agreed between the manufacturer and purchaser.

11.2 Steel cord conveyor belts shall be marked with at least the following information:

a) number of this part of ISO 15236 and the year of publication, i.e. ISO 15236-1:2016;

b) name of belt manufacturer;

c) symbol ST followed by the breaking strength, expressed in newtons per millimetre (N/mm), e.g. ST 2 500 (see 6.1 and Clause 9);

d) type of belt in accordance with ISO 15236-2, e.g. A1 or B2;

e) thickness of covers, expressed in millimetres, including type of breaker or weft;

f) last two digits of year of manufacture;

g) belt identification number, with no more than five digits.

11.3 The height of the marking shall be between 20 mm and 80 mm. If imprints are used, they shall be at least 1 mm deep for covers having a thickness of up to 6 mm and at least 3 mm deep for covers having a thickness of more than 6 mm.

11.4 Belts shall be marked on the top cover, approximately 50 mm from the edges for belts up to 800 mm wide and approximately 100 mm from the edges for belts more than 800 mm wide. The distance between adjacent marks shall not exceed 15 m. For belts up to 1 400 mm wide, marking on one belt edge is sufficient.

11.5 The information given in 11.2 shall also be marked on the outside of the reel on which the conveyor belt is supplied, in addition to any information required by the purchaser.

Annex A
(informative)

Helpful information to be supplied by the purchaser

A.1 Applicability

When ordering, belting purchasers should define their requirements by reference to Clause 10 (ordering data).

A.2 Replacement belting

When the belt is to be replaced on an existing conveyor, the following information should be supplied:

a) details of existing belt, i.e. cord diameter, pitch, number of cords, cover thickness, transverse reinforcement, cover grade;

b) belt width in millimetres;

c) belt speed in metres per second;

d) pulley diameters, in millimetres, indicating any that are crowned;

e) method of take-up and amount available;

f) type of drive, including coupling and configuration of drive;

g) whether drive pulleys are lagged or bare;

h) pitch, length and angle of carrying idlers;

i) profile sketch, indicating position of drive, take-up, tripper, and vertical/horizontal curve radii;

j) belt length, in metres;

k) type of belt joint;

l) motor power installed;

m) type of start;

n) safety category required according to EN 12882, i.e. 1, 2A, 2B, 3A, 3B, 4, 5A, 5B, or 5C;

o) head and tail transition distance;

p) rip prevention/detection system.

A.3 Additional information for new installation

Where applicable, and if possible, the following additional information should be supplied:

a) material to be conveyed;

b) conditions — wet, dry, sticky, greasy or abrasive, if hot or cold, and stating temperature if known or describing conditions, whether cleaners are required;

c) bulk density of material;

d) size of largest lumps (three dimensions), in millimetres;

e) average size of materials, in millimetres;

f) approximate screen analysis of material (see ISO 7806 and ISO 9045);

g) method of handling the material immediately prior to feeding the belt;

h) whether the feed is to be regulated, and type of feeder preferred;

i) conveyor duty in terms of mass per hour per day, stating day length in hours;

j) method of discharging conveyor;

k) amount of lift or fall, in metres;

l) initial length, in metres (centres of head and tail pulleys);

m) position of drive;

n) description of power supply, i.e. voltage, whether AC or DC;

o) contour sketch of proposed installation;

p) preferred idler arrangement and troughing angle;

q) environmental conditions;

r) any special features or test requirements.

Bibliography

[1] ISO 7806, *Industrial plate screens — Codification for designating perforations*

[2] ISO 9045, *Industrial screens and screening — Vocabulary*

ICS 53.040.20

Price based on 15 pages