INTERNATIONAL STANDARD

ISO 15236-3

Second edition
2017-03

Steel cord conveyor belts —

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

Courroies transporteuses à câbles d'acier —

Partie 3: Exigences de sécurité particulières aux courroies utilisées dans des installations souterraines

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Foreword

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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).

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This document was prepared by Technical Committee ISO/TC 41 *Pulleys and belts (including veebelts)*, Subcommittee SC 3, *Conveyor belts*.

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This second edition cancels and replaces the first edition (ISO 15236-3:2007), of which it constitutes a minor revision with the following changes:

— the references have been updated;

— Table 3 has been expanded to include belt widths from 1 800 to 3 200.

A list of all parts in the ISO 15236 series can be found on the ISO website.

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Steel cord conveyor belts —

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

1 Scope

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

Steel cord belts in accordance with this document are intended for use underground in coal mines and in other applications where the highest demands for safety against fire and explosion hazards have to be complied with.

NOTE At present, the requirements can only be met by the use of compounds based on chloroprene rubber for the covers, as well as for the bonding rubber.

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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 indicated applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

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

ISO 2062, *Textiles — Yarns from packages — Determination of single-end breaking force and elongation at break*

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*

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

EN 14973, *Conveyor belts for use in underground installations — Electrical and flammability safety requirements*

3 Terms and definitions

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

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ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

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

Note 1 to entry: See Figure 2.

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

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

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Note 1 to entry: See Figure 3.

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

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4 Symbols and units

See Table 1.

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
e	See Figure 4	mm
F	Deflection (troughability)	mm
h_m	Median cord height according to EN 13827	mm
n	Number of cords	—
s_1	Nominal belt thickness (see ISO 7590)	mm
s_2	Cover thickness carrying side	mm
s_3	Cover thickness pulley side	mm

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Table 1 *(continued)*

Symbol	Explanation	Unit
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 spacing/pitch	mm
Δh_1	Number of cords positioned within a range of $h_m \leq 1$ 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 document 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.

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5.3 Belt core

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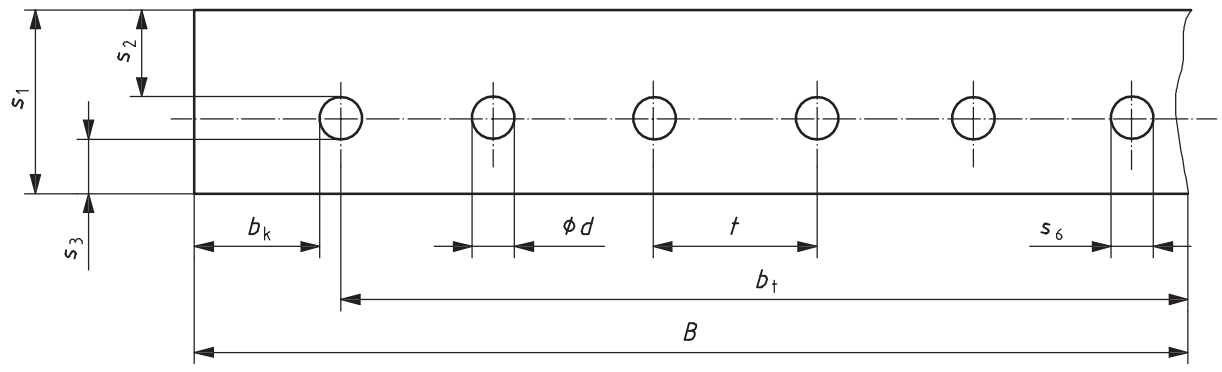
The thickness of the belt core (carcass), s_6, for all belt types is defined as follows:

$$s_6 = s_1 - s_2 - s_3$$



$$s_6 = d$$

Figure 1 — Cross section of standard belt

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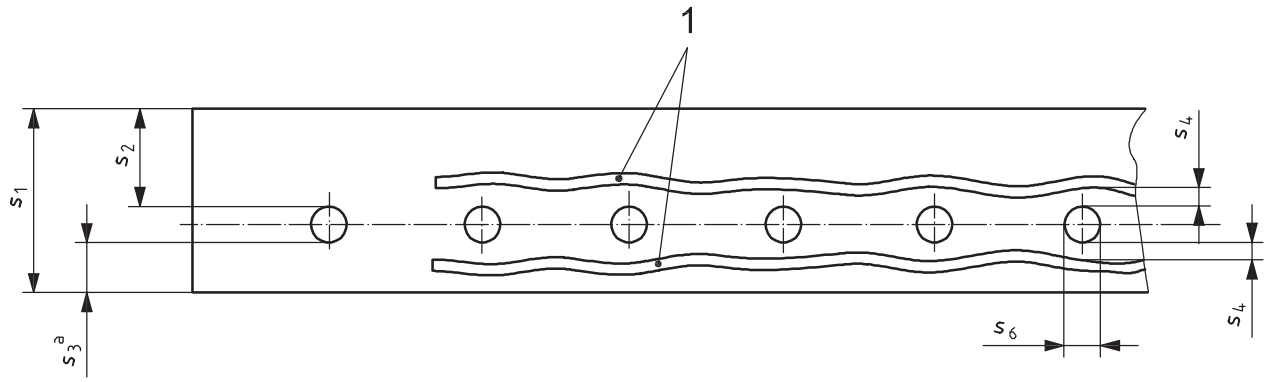


s_4 = W 1 mm

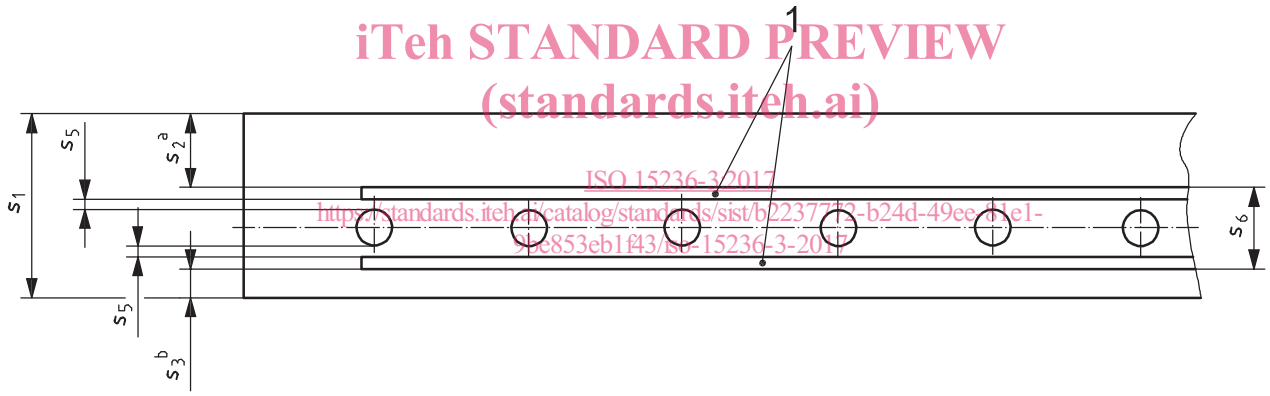
s_6 = d (see Table 1)

Key

1 breaker

a Including the breaker.

Figure 2 — Belt cross section with breaker



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s_5 = <1 mm

Key

1 weft

a Above the weft.

b Below the weft.

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 8 000 N/mm belt width.

The selection of preferred belt types shown in Table 2 should be used.

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Table 2 — Belt types

ST 1000	ST 1250	ST 1600	ST 2000	ST 2500	ST 3150
ST 3500	ST 4000	ST 4500	ST 5000	ST 5400	

6.2 Belt width

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):

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

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6.3.2 Supporting belt width

The supporting belt width, b_t, is derived from Formula (2):

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

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.

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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. The sum of the cover thicknesses (s_2 + s_3) influences the flammability of the belt and therefore a minimum value has to be observed, the tolerance on which shall be +1 mm and −0,5 mm, when measured according to ISO 7590.

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 shall be (s_1 + 2) mm.

The belt surfaces shall be plain and parallel and any difference in belt thickness (e.g. at the edges and across the belt centre) shall not exceed 0,05 × total belt thickness measured in accordance with ISO 7590.

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6.8 Belt length

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

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

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 $^{+2,5\ \%}_{0}$

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.

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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.

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

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.

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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.

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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 critical for the transmission of forces in a steel cord reinforced conveyor belt and its joints.

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. For thermal treatment, a temperature of (145 ± 5) °C for (150 ± 1) min shall be used, except that, when testing belts that are intended to be repaired and/or reconditioned several times or intended to be spliced during service, a temperature of (155 ± 5) °C for (240 ± 1) min shall be used.

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