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## 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

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](http://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](http://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 voluntary nature of standards, 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](http://www.iso.org/iso/foreword.html).

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

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.

# 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.

### 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.

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.

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

Note 1 to entry: See [Figure 3](#).

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

# 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 <a href="#">Figure 4</a>	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

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
$\Delta h_1$	Number of cords positioned within a range of $h_m \leq 1$ mm as a percentage of the total number of cords	%
$\Delta h_2$	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	%
$\Delta h_3$	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).

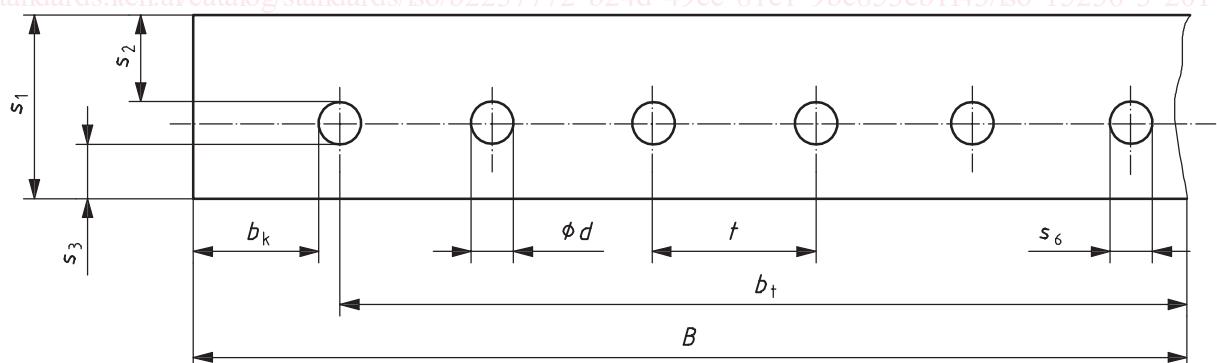
### 5.2 Conveyor belting having transverse reinforcements

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

### 5.3 Belt core

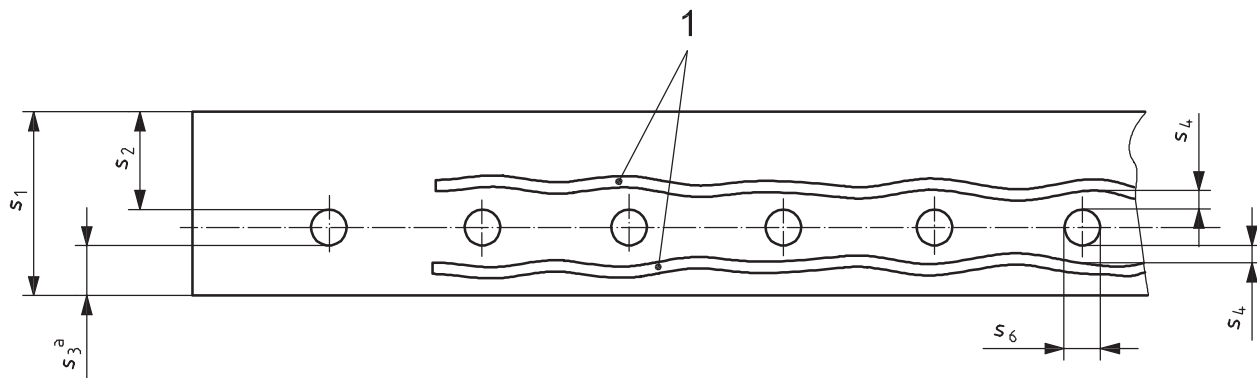
The thickness of the belt core (carcass),  $s_6$ , for all belt types is defined as follows:

$$s_6 = s_1 - s_2 - s_3$$



$$s_6 = d$$

Figure 1 — Cross section of standard belt



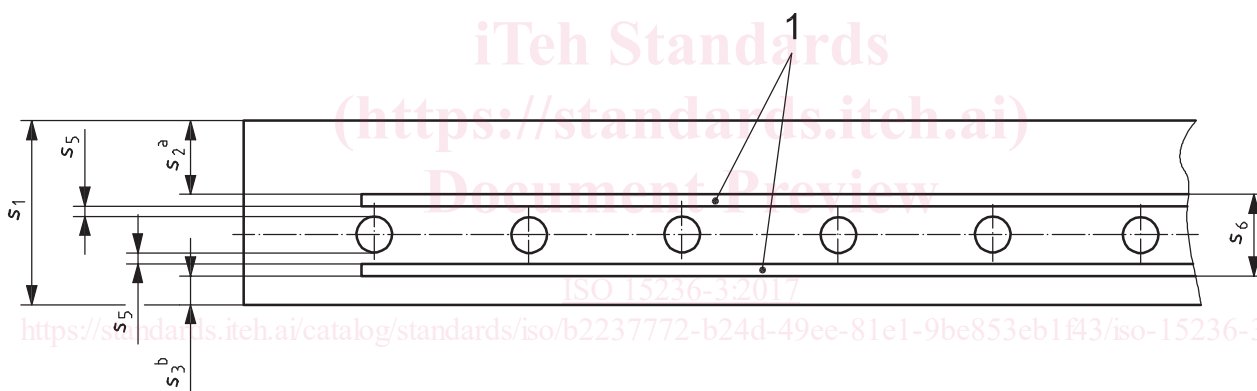
$$s_4 = W \text{ 1 mm}$$

$$s_6 = d \text{ (see Table 1)}$$

#### Key

- 1 breaker
- a Including the breaker.

Figure 2 — Belt cross section with breaker



$$s_5 = <1 \text{ mm}$$

#### 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.



**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
$+10$ $-5$	$+10$ $-7$	$+10$ $-8$	$\pm 10$	$\pm 10$	$\pm 12$	$\pm 12$	$\pm 14$	$\pm 14$	$\pm 15$	$\pm 15$	$\pm 15$	$\pm 15$	$\pm 15$	$\pm 15$

## 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 \(1\)](#):

$$b_k \approx 5 \times s_6 \quad (1)$$

### 6.3.2 Supporting belt width

The supporting belt width,  $b_t$ , is derived from [Formula \(2\)](#):

$$b_t = B - 2b_k - d \quad (2)$$

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 \(3\)](#):

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

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 \(4\)](#):

$$t = \frac{b_t}{n - 1} \quad (4)$$

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. 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  $0,05 \times$  total belt thickness measured in accordance with ISO 7590.

## 6.8 Belt length

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.