INTERNATIONAL STANDARD

ISO 22721

Second edition
2023-07

Conveyor belts — Specification for rubber- or plastics-covered conveyor belts of textile construction for underground mining

Courroies transporteuses — Spécification pour courroies transporteuses à structure textile recouvertes de caoutchouc ou de plastique, pour utilisation dans les mines souterraines

Reference number
ISO 22721:2023(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: 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.

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 document 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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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

For an explanation of 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 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,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 188, *Conveyor belts,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces first edition (ISO 22721:2007), which has been technically revised.

The main changes are as follows:

— the warning before the Scope was removed;

— the footnote and related widths were removed from Table 3;

— editorial changes were done.

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.

Conveyor belts — Specification for rubber- or plastics-covered conveyor belts of textile construction for underground mining

1 Scope

This document specifies requirements for rubber- or plastics-covered conveyor belting of textile construction for use in underground mines and disposed on flat or troughed idlers. It is not applicable to light conveyor belts as described in ISO 21183-1.

This document does not include requirements for plastics covers. These are agreed upon by the manufacturer and purchaser, taking into account the type of plastics to be used.

Related items that are not requirements of this document, but which it is recommended be agreed upon by the manufacturer and purchaser, are included in Annex A.

Details recommended to be supplied by the purchaser of belting with an enquiry are given in Annex B.

The ability of a belt to run straight cannot be assessed until the belt is installed. Requirements for this are, therefore, outside the scope of this document; nevertheless, recommendations for lateral drift are given in Annex C.

Attention is drawn to local regulations for safety which might be in place where the belts are to be used.

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

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

ISO 252, *Conveyor belts — Adhesion between constitutive elements — Test methods*

ISO 282, *Conveyor belts — Sampling*

ISO 283, *Conveyor belts — Full thickness tensile strength, elongation at break and elongation at the reference force — Test method*

ISO 583, *Conveyor belts with a textile carcass — Total belt thickness and thickness of constitutive elements — Test methods*

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

ISO 1120, *Conveyor belts — Determination of strength of mechanical fastenings — Static test method*

ISO 4649:2017, *Rubber, vulcanized or thermoplastic — Determination of abrasion resistance using a rotating cylindrical drum device*

ISO 16851, *Textile conveyor belts — Determination of the net length of an endless (spliced) conveyor belt*

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 terminology databases for use in standardization at the following addresses:

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

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

3.1
slab belting
conveyor belting made in wide widths and long lengths for subsequent slitting and cutting into narrower widths and shorter lengths to suit individual conveyor installations

3.2
solid woven belting
conveyor belting consisting of a carcass of more than one ply, the plies being interlocked in the weave or bound together by binding threads in the course of weaving

3.3
mono-ply belting
conveyor belting with a carcass consisting of one ply of woven fabric

3.4
duo-ply belting
conveyor belting with a carcass consisting of two plies of woven fabric bonded together by an intermediate layer of elastomer of sufficient thickness to allow the incorporation of a tension element in the joint

3.5
multi-ply belting
conveyor belting with a carcass of two or more plies of woven fabric, the adjacent plies being bonded together by an intermediate layer of elastomer

3.6
primary yarn
load-carrying yarn which contributes more than 50 % of the full thickness tensile strength

3.7
secondary yarn
load-carrying yarn which contributes less than 50 % of the full thickness tensile strength

4 Construction

The carcass shall consist either of one or more plies of woven fabric, or of solid woven fabric, and shall be impregnated or coated with a rubber or plastic.

If a breaker consisting of open mesh fabric or cord fabric or cord layer is placed between the cover and carcass, or is embedded in the cover for the purpose of carcass protection, such a layer shall be considered to be part of the cover thickness and shall not be counted as a fabric ply.

If a fabric pile is integrally woven with the carcass on either one or both surfaces of the carcass, it shall be considered to be part of the carcass thickness.

NOTE The external surfaces of the conveyor belt generally consist of a specified thickness and quality of elastomeric material.

5 Length

5.1 Belting that is ordered to an open-ended length shall be supplied subject to the tolerances in accordance with Table 1.

5.2 The length of belting supplied in the spliced endless form shall be described by the term net endless length. The net endless length shall be supplied subject to the tolerances in accordance with Table 2, when measured in accordance with ISO 16851.

It is recommended that, when placing orders for belting, purchasers specify a length of belting that includes such lengths as are required for testing and any additional lengths necessary for vulcanized joints.

Table 1 — Tolerances on open-end lengths of belting

Belt delivery condition	Maximum permissible difference between delivered length and ordered length [%]
Slab belting	±5
As one length	+2,5 0
In several lengths: for each single length for the sum of all lengths	±5 +2,5 0

Table 2 — Tolerances on net endless lengths of belting

Length of belt	Tolerance
≤ 15 m	±50 mm
> 15 m and ≤ 20 m	±75 mm
> 20 m	±0,5 %

6 Width

The width of the belting and its associated tolerance shall be in accordance with Table 3.

Table 3 — Widths and tolerances on width of conveyor belting

Nominal width of belting [mm]	Tolerance on width
300 400 500	±7,5 mm
600 650 800 1 000 1 200	±1,5 %
1 400 1 600 1 800 2 000	

7 Rubber cover

7.1 If the rubber cover is designated as class H, D or L, it shall conform to the appropriate requirements given in Table 4, and, after ageing for 168 h at 70 °C in accordance with ISO 188, the values obtained for tensile strength and elongation at break shall not vary from the original unaged values by more than 25 % of those values. If the rubber cover is designated as class K or V, hot air aging test requirements should be agreed upon by the manufacturer and purchaser.

7.2 If the thickness of the rubber cover, measured in accordance with ISO 583, is between 0,8 mm and 1,6 mm, the thickness of the test piece used, in accordance with ISO 37 shall be the maximum obtainable and a tolerance of − 15 % shall be permitted on values of tensile strength and elongation at break given in Table 4.

Table 4 — Classification of conveyor belt rubber covers

Cover class	Minimum tensile strength of rubber cover [N/mm^2]	Minimum elongation at break [%]	Maximum abrasion loss in relative volume [mm^3]
H	24	450	120
D	18	400	100
K	20	400	200
L	15	350	200
V	17	350	175
Test method	ISO 37	ISO 37	ISO 4649:2017, Method A
These values help to determine the appropriate cover compound for the application or for the materials carried. Other values, such as tear resistance, may 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. The cover grades H, D and L are in accordance with ISO 10247. If other cover materials or qualities are required for a particular application (e.g. safety, oil resistance or heat resistance), the cover properties need to be agreed between the purchaser and the manufacturer.			

8 Tolerances on total belt thickness and cover thickness

8.1 Tolerance on total belt thickness

If the mean of the 3, 5 or 8 values of total belt thickness, measured in accordance with ISO 583, is 10 mm or less, the maximum permissible difference between the maximum thickness and the minimum thickness shall not be greater than 1 mm. For solid woven belting, the maximum permissible difference shall be not greater than 1,5 mm.

If the mean of the 3, 5 or 8 values of the total belt thickness, when measured by the method described in ISO 583, is greater than 10 mm, the maximum permissible difference between the maximum thickness and the minimum thickness shall be not greater than 10 % of the mean value. For solid woven belting, the maximum permissible difference shall be less than 15 %.

8.2 Tolerance on cover thickness

When measured by one of the methods described in ISO 583, the mean value of the cover thickness shall not be less than the specified thickness by more than the amounts given in Table 5.

Table 5 — Tolerance on cover thickness

Property	Requirements		
	Plus	Minus	
		Specified thickness < 4 mm	Specified thickness > 4 mm
Maximum permissible deviation of specified thickness of each cover	1 mm	0,2 mm	5 % of specified thickness

9 Transverse fabric joints in multi-ply belting

9.1 General

Transverse joints shall be at an angle of between 45° and 70° to the centre line of the belt.

9.2 Outer plies

Neither outer ply shall have more than one transverse joint per 100 m length of belt.

9.3 Inner plies

No inner ply shall have more than two transverse joints per 100 m length of belt.

9.4 Adjacent plies and non-adjacent plies

Transverse joints in adjacent plies and non-adjacent plies shall be not less than 3 m apart.

9.5 Joints in same ply

Transverse joints in the same ply shall be 5 m apart or more.

9.6 Mono-ply, duo-ply and solid woven belting

Transverse joints should not be used in mono-ply, duo-ply or solid woven belting.

10 Longitudinal fabric joints

10.1 Multi-ply belting

10.1.1 Spacing of joints

Longitudinal joints shall be at least 100 mm from the edge of the carcass. Each longitudinal joint shall be at least 100 mm from the joints in the other plies. The longitudinal joints in one ply of any piece of belting shall be separated by at least 300 mm where the width of the belting permits two joints in the same ply.

10.1.2 Number of joints

Except for folded edge constructions, the maximum number of longitudinal joints in the plies shall be in accordance with Table 6.

Table 6 — Maximum number of longitudinal joints

Width of belt [mm]	External plies	Internal plies
≤ 1 200	0	1
> 1 200 and ≤ 1 600	1	2
> 1 600 and ≤ 2 000	2	2

10.2 Fabric joints in duo-ply belting

There shall be no fabric joints in duo-ply belting having a width up to 1 600 mm. Duo-ply belting having a width greater than 1 600 mm may have one joint in one ply. Longitudinal joints shall be at least 100 mm from the edge of the carcass and at least 200 mm from the joint in another ply.

Any longitudinal joint should be at least 100 mm from the bend area of trough, i.e. wherever an angle is formed between adjacent idler rollers. To achieve this, details of the structure on which the belt is to be installed will need to be provided by the purchaser to the manufacturer.

10.3 Longitudinal joints in solid woven and mono-ply belting

There shall be no longitudinal fabric or carcass joints in solid woven or mono-ply belting.

11 Elongation

The elongation of the finished belting in the longitudinal direction at the reference force (ISO 283:2023, 3.3), tested in accordance with ISO 283, shall be not greater than 4 %.

12 Full thickness tensile strength

The full thickness tensile strength in the longitudinal direction of the finished belting, expressed in newtons per millimetre of belt width and determined in accordance with ISO 283, shall be not less than the value chosen in accordance with Table 7. That value shall be part of the belt designation according to Clause 16.

Tested in accordance with ISO 1120, the minimum static value for disconnectable mechanical fastenings shall be:

— 60 % of the nominal full thickness tensile strength up to 1 250 N/mm, and

— 50 % of the nominal full thickness tensile strength above 1 250 N/mm.

Minimum dynamic values should be agreed between manufacturer and purchaser.

Table 7 — Minimum full thickness tensile strength

Tensile strength [N/mm]	160	200	250	315	400	500	630
	800	1 000	1 250	1 600	2 000	2 500	3 150

13 Adhesion

The adhesion strength, determined in accordance with ISO 252, shall be not less than the value in accordance with Table 8.

Table 8 — Minimum adhesion strength of belts with synthetic filament carcass

Value	Minimum adhesion between adjacent plies [N/mm]	Minimum adhesion between covers and carcass	
		covers 0,8 mm to 1,5 mm thick [N/mm]	covers more than 1,5 mm thick [N/mm]
Mean value of results	6	3,2	4,5
Lowest graphically recorded peak value in all tests	5,5	2,4	3,5
Except for the adhesion between adjacent plies in solid woven belts, the highest recorded peak value in all the tests should not exceed 20 N/mm, in order to avoid difficulties in preparing the belt end for splicing.			

14 Troughability

The minimum values for the troughability ratio F/L, tested in accordance with ISO 703, shall be in accordance with those given Table 9, relative to the values for the angle of inclination given.

Table 9 — Minimum troughability

Angle of inclination of side rollers	Minimum value for ratio $\frac{F}{L}$
< 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

Key

F vertical deflection in the test piece, in millimetres, corrected for belt thickness

L length of test piece, in millimetres, when laid flat, equivalent to installed width of conveyor belt

15 Sampling

Sampling shall be conducted in accordance with ISO 282.

16 Designation

16.1 Belting shall be designated by reference to the following conveyor belt characteristics:

a) reference to this document, i.e. ISO 22721:2023;

b) required length in metres;

c) required width in millimetres (see Table 3);

d) fibre type of the carcass, in both the warp and weft directions (see Table 10 and 16.2);

e) nominal full thickness tensile strength in N/mm of belt width (see Table 7);