INTERNATIONAL STANDARD

ISO 22721

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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

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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.

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 Standards. Draft 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 22721 was prepared by the European Committee for Standardization (CEN) in collaboration with Technical Committee ISO/TC 41, *Pulleys and belts (including veebelts)*, Subcommittee SC 3, *Conveyor belts*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

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

WARNING — Users of this International Standard should be aware that relevant electrical and flammability safety requirements are given in EN 14973, which specifies safety classes for belts intended for use in underground installations. When contracts are entered into for the purchase of belts for use in underground mining, compliance with both this International Standard and the relevant class in EN 14973 should be specified. Attention is drawn to local regulations for safety which might be in place where the belts are to be used.

1 Scope

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

This International Standard does not include requirements for plastics covers. These will need to be 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 International Standard, 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 International Standard; nevertheless, recommendations for lateral drift are given in Annex C.

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 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*[1)]

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

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

ISO 4649:2002, *Rubber, vulcanized or thermoplastic — Determination of abrasion resistance using a rotating cylindrical drum device*

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

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

EN 14973:2006, *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.

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 textile fabric

3.4
duo-ply belting
conveyor belting with a carcass consisting of two plies of woven textile 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 textile 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

1) To be published. (Revision of ISO 583-1:1999 and ISO 583:1990)

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 will generally consist of a defined 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
300 400 450 [a] 500	± 7,5 mm
600 650 750 [a] 800 900 [a] 1 000 1 050 [a] 1 200 1 350 [a] 1 400 1 500 [a] 1 600 1 800 2 000	± 1,5 %

[a] Width that should only be used for replacement belting in existing installations and not be used as a basis for future new designs.

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.

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 4649:2002, Method A
These values will 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 $\leqslant$ 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 are not permitted 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
$\leqslant$ 1 200	0	1
$>$ 1 200 et $\leqslant$ 1 600	1	2
$>$ 1 600 et $\leqslant$ 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 the same ply. Longitudinal joints shall be at least 100 mm from the edge of the carcass and at least 200 mm from the joint in the other 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 (3.2), 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, shall, determined in accordance with ISO 283, 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	Minimum adhesion between covers and carcass	
		Covers 0,8 mm to 1,5 mm thick	Covers more than 1,5 mm thick
	N/mm	N/mm	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

When tested in accordance with ISO 703, the minimum values for the troughability ratio F/L 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 $\frac{F}{L}$
$\leqslant$ 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
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 International Standard, i.e. ISO 22721;

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);

f) number of plies or belt type (see Clause 3);

g) top cover thickness in millimetres;

h) bottom cover thickness, in millimetres (where relevant, see Clause 4);

i) cover classification (see Table 4), where appropriate;

j) safety category according to EN 14973.

16.2 The following are examples of use of the designation when ordering belts.

EXAMPLE 1 Multi-ply belt

A 400 m long belt, 1 200 mm wide, textile material in the longitudinal direction (warp) of polyester (E) and in the transverse direction (weft) of polyamide (P), having a minimum full thickness tensile strength of 1 000 N/mm belt width, with five plies and a top cover thickness of 4 mm, a bottom cover thickness of 2 mm, a cover classification of H in accordance with Table 4, and conforming to the safety requirements of EN 14973:2006, class A:

400 m × 1 200 mm textile conveyor belt, ISO 22721, EP 1 000/5, 4+2H, class A

EXAMPLE 2 Duo-ply belt

A 200 m long belt, 1 000 mm wide, having a combined polyester and polyamide warp (EP) and a polyamide weft (P), having a minimum full thickness tensile strength of 1 250 N/mm, with 2 plies and a top and bottom cover thickness of 1,5 mm, conforming to the safety requirements of EN 14973:2006, class B2:

200 m × 1 000 mm textile conveyor belt, ISO 22721, EPP 1 250/2, 1,5+1,5, class B2

EXAMPLE 3 Mono-ply belt

A 150 m long, 1 200 mm wide mono-ply belt, having a polyester warp (E) and a polyamide weft (P), a minimum full thickness tensile strength of 630 N/mm belt width and a top cover thickness of 6 mm, a bottom cover thickness of 2 mm, and a cover classification of D in accordance with Table 4, conforming to the safety requirement of EN 14973:2006, class C2:

150 m × 1 200 mm textile conveyor belt, ISO 22721, EP 630/1, 6+2D, class C2

EXAMPLE 4 Solid woven belt

A 300 m long, 1 600 mm wide solid woven belt, having a combined polyester and polyamide warp (EP), a polyamide cotton weft (PB) and an integrally woven cotton (B) warp pile, with a minimum full thickness tensile strength of 1 250 N/mm belt width and a top and bottom cover thickness of 1,5 mm, conforming to the safety requirement of EN 14973:2006, class C1:

300 m × 1 600 mm textile conveyor belt, ISO 22721, EP(B)PB 1 250/1SW, 1,5+1,5, class C1

Table 10 — Code designation of yarn

Code letter	Yarn
B	Cotton
P	Polyamide
E	Polyester
D	Aramid
If a fabric contains a secondary yarn, its identity should be indicated by the use of bracketed characters to designate yarn type.	

17 Identification

It shall be possible to identify the name of the manufacturer of the conveyor belt, its conformance with this International Standard, its safety category according to EN 14973 and the date of manufacture. The manner in which this data is identified shall be decided by the manufacturer or by agreement with the purchaser.

If it is decided to mark the conveyor belt using impression moulding, the depth of the impression should not exceed 1,5 mm and the characters should be between 20 mm and 80 mm high, repeated at a longitudinal spacing not exceeding 25 m.

Annex A
(informative)

Items to be agreed between manufacturer and purchaser

The following items should be agreed between the manufacturer and the purchaser:

a) For certain long haul conveyors — the maximum elongation at the reference force.

b) Plastics belts — identification of plastics belts.

c) Testing — if testing is not to be carried out by the manufacturer, this should be agreed between the manufacturer and the purchaser when the order is placed.

d) Conditions of use — if the conveyor belting is not for conventional use.

e) Any particular characteristics not specified by this International Standard.

Annex B
(informative)

Helpful information to be supplied by the purchaser

B.1 Applicability

When ordering belting, purchasers should define their requirements by reference to Clause 16 (designation).

B.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;

b) belt width, in millimetres;

c) belt length, in metres;

d) belt speed, in metres per second;

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

f) method of take-up and amount available;

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

h) whether drive pulleys are lagged or bare;

i) pitch and angle of carrying idlers, including transition distances;

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

k) type of belt joint;

l) motor power installed;

m) type of start;

n) safety category required, according to EN 14973, i.e. A, B1, B2, C1 or C2.

B.3 Additional information for a new installation

If applicable, the following additional information should be supplied wherever possible:

a) material to be conveyed;

b) conditions, i.e. wet, dry, sticky, greasy, abrasive, whether hot or cold, temperature (if known), or a description of conditions, and if cleaners are required;

c) bulk density of material;