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Light conveyor belts — Determination of the maximum tensile strength

National foreword

This British Standard is the UK implementation of EN ISO 21180:2013. It supersedes BS EN ISO 21180:2006, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PRI/67, Conveyor belts.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Foreword

This document (EN ISO 21180:2013) has been prepared by Technical Committee ISO/TC 41 "Pulleys and belts (including veebelts)" in collaboration with Technical Committee CEN/TC 188 “Conveyor belts” the secretariat of which is held by SNV.

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Endorsement notice

The text of ISO 21180:2013 has been approved by CEN as EN ISO 21180:2013 without any modification.

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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.

ISO 21180 was prepared by Technical Committee ISO/TC 41, *Pulleys and belts (including veebelts)*, Subcommittee SC 3, *Conveyor belts*.

This International Standard is based on EN 1722:1999, prepared by CEN/TC 188.

This second edition cancels and replaces the first edition (ISO 21180:2005), of which it constitutes a minor revision.

Light conveyor belts — Determination of the maximum tensile strength

1 Scope

This International Standard specifies a test method for the determination of the maximum tensile strength of light conveyor belts, according to ISO 21183-1, or of other conveyor belts where ISO 283 is not applicable.

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 7500-1, *Metallic materials — Verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Verification and calibration of the force-measuring system*

ISO 18573, *Conveyor belts — Test atmospheres and conditioning periods*

3 Terms and definitions

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

3.1
tensile load
force per unit of belt width, expressed in newtons per millimetre

Note 1 to entry: In light conveyor belt technology, the definition of tensile load deviates from that commonly used. It is measured in force per unit of belt width, in newtons per millimetre, while normally it is defined as a stress, i.e. a force per unit of cross section, in newtons per square millimetre.

Note 2 to entry: In light conveyor belt technology, the symbol for the tensile load is k and the maximum tensile strength is designated as k_{max}, expressed in newtons per millimetre.

Note 3 to entry: In EN 10002-1:2001, the symbol k is used to represent the coefficient of proportionality.

4 Symbols

The following symbols are used in this document (see also Figure 1):

F_{break} is the tensile force in the test piece at break, in newtons;

F_{max} is the maximum tensile force in the test piece, in newtons;

k_{max} is the value of F_{max} divided by the width, in millimetres, of the narrowest part of the test piece at the start of the test;

Δl is the actual increase in length of the test piece between the jaws, in millimetres, during the test;

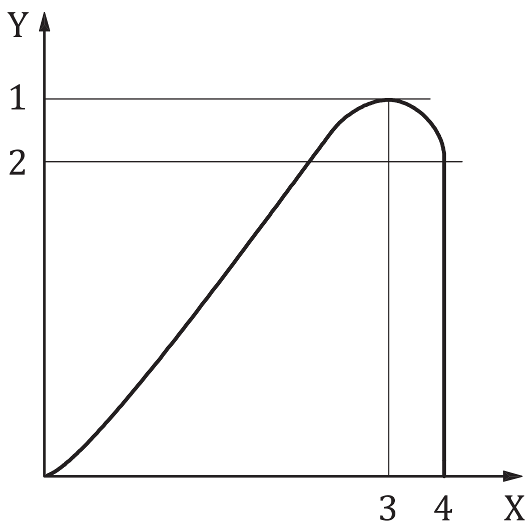
Δl_{break} is the increase in length of the test piece between the jaws, in millimetres, taken at F_{break};

Δl_{max} is the increase in length of the test piece between the jaws, in millimetres, taken at F_{max};

Δl_m is the increase in length of the distance between the datum marks (see 7.4), in millimetres;

ε_{max} is the value of Δl_{max} or Δl_m divided by the initial length of the test piece or the initial distance between the datum marks and expressed in percent.

NOTE F_{max} and F_{break} can be the same but are not necessarily so.



Key

X elongation of test piece, Δl (mm)

Y tensile force, F (N)

1 F_{max}

2 F_{break}

3 Δl_{max}

4 Δl_{break}

Figure 1 — Dynamometer graph

5 Principle

A test piece, cut from the full thickness of the conveyor belt in the longitudinal direction, is tested and the tensile force recorded as a function of the belt elongation. From that graph, the maximum tensile strength is determined by calculation.

6 Apparatus

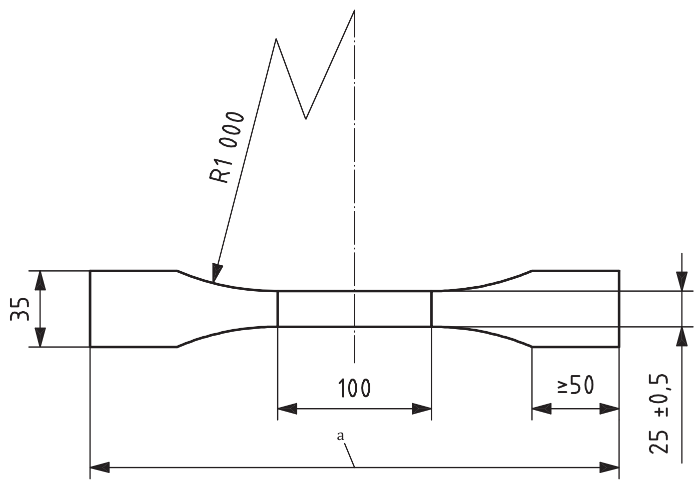
6.1 Tensile testing machine (dynamometer), capable of applying a load suitable for the maximum tensile strength of the test piece and with a force-measuring system, in accordance with ISO 7500-1, class of machine 3 or better (e.g. class of machine 2).

7 Test pieces

7.1 Shape and dimensions

The test pieces shall be cut from the full thickness of the conveyor belt in the longitudinal direction. Their shape and dimensions shall be in accordance with Figure 2. The test pieces shall not be tested sooner than five days after manufacture.

Dimensions in millimetres



a 220 + (2 × length of a jaw).

Figure 2 — Shape and dimensions of test piece

For certain types of belt construction, the shape of the test pieces illustrated in Figure 2 might produce abnormal and unequal stress distributions in the threads, causing systematic slip in the grips, giving misleading results. Under such circumstances, the test may be conducted using test pieces of a different shape (see, for example, ISO 1421 and ISO 13934-1).

7.2 Number and selection

Five test pieces shall be taken in the longitudinal direction of the conveyor belt.

The test pieces shall be selected in accordance with Figure 3.

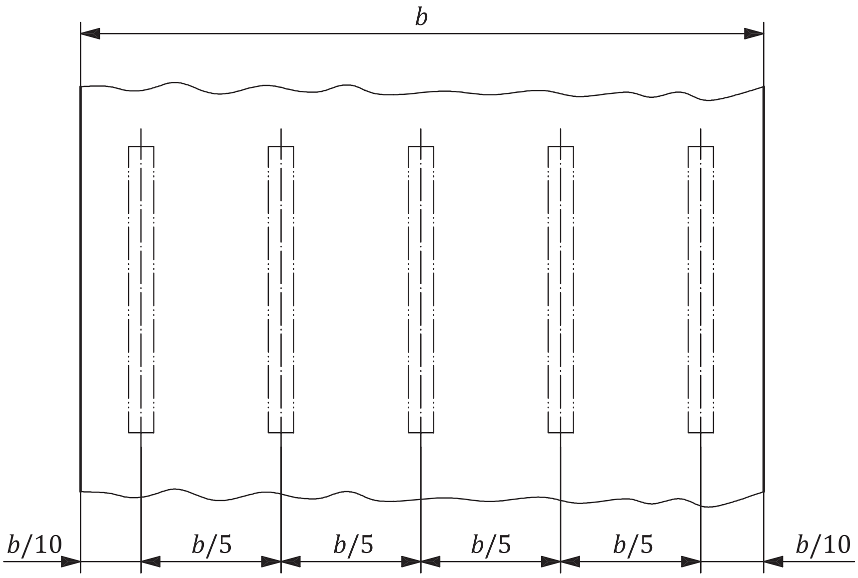


Figure 3 — Distribution of test piece selection

7.3 Conditioning

Before testing, condition the test pieces in accordance with ISO 18573, Atmosphere B, for 24 h, except that if the light conveyor belt consists of materials with a high absorption of moisture, e.g. cotton or polyamide, condition the test pieces for 48 h.

7.4 Preparation

On the longitudinal axis of the test piece, draw two datum marks equidistant from the centre and (100 ± 0,5) mm apart (see Figure 2).

8 Procedure

Place the ends of the test piece between the jaws of the tensile testing machine (6.1) such that the test piece is straight without using force. Ensure that the free length between the jaws is 220 mm ± 5 mm and that there is no slippage of the test piece in the jaws during the test.

Slippage can be minimized by rubbing rosin on the portion of the test piece that will be in the jaws, removing any excess rosin and enclosing both sides of the rosin-coated test piece with coarse emery cloth. The emery cloth should be folded over the ends of the test piece with the coarse side of the cloth next to the rosin-coated surfaces.

Exert a continuous (uninterrupted) tensile stress on the test piece, at a rate of (100 ± 10) mm/min.

Record the tensile force as a function of the belt elongation. Continue at least until the maximum tensile force F_{max} is reached or, optionally, until breakage occurs. If testing until breakage occurs, observe whether the break occurs between the two datum marks on the test piece. If any test pieces break outside this central portion or if they slip in the jaws, do not take these results into account when calculating the mean, but repeat the test using new test pieces.

9 Calculation and expression of results

Read the maximum tensile force, F_{max}, from the graph, as shown in Figure 1.

Divide F_{max} by the smallest width of the test piece (25 mm), thus giving the maximum tensile strength k_{max}:

$$k_{max} = \frac{F_{max}}{25\,\text{mm}}\ \text{N/mm}$$

If required, calculate the elongation ε_{max} taking place at F_{max} from Δl_m (in millimetres) and record it as a percentage as follows:

$$\varepsilon_{max} = \frac{\Delta l_m}{100\,\text{mm}} \times 100\,\%$$

If no measuring device for Δl_m (in millimetres) is available, ε_{max} may also be calculated from Δl_{max} as follows:

$$\varepsilon_{max} = \frac{\Delta l_{max}}{220\,\text{mm}} \times 100\,\%$$

However, this method has the disadvantage of having the result being influenced by the different widths of the test piece (25 mm to 35 mm) and is only correct if there has been no slippage of the test piece in the jaws of the apparatus.

If the test was continued until breakage occurred, k_{break} and ε_{break} may analogously be determined from F_{break}.

Calculate the individual k_{max} values of all five test pieces and take the arithmetical mean of the five values. Use the same procedure for the calculation of ε_{max}, if required. Determine the values for the breaking conditions in the same way, if applicable.

10 Test report

The test report shall include the following information:

a) a complete designation of the tested conveyor belt material and the manufacturing date;

b) reference to this International Standard, i.e. ISO 21180;

c) test room temperature and relative humidity;

d) conditioning period;

e) results of the test in accordance with Clause 9;

f) date of the test.

Bibliography

[1] ISO 283, *Textile conveyor belts — Full thickness tensile strength, elongation at break and elongation at the reference load — Test method*

[2] ISO 1421, *Rubber- or plastics-coated fabrics — Determination of tensile strength and elongation at break*

[3] ISO 13934-1, *Textiles — Tensile properties of fabrics — Part 1: Determination of maximum force and elongation at maximum force using the strip method*

[4] ISO 21183-1, *Light conveyor belts — Part 1: Principal characteristics and applications*

[5] EN 10002-1:2001, *Metallic materials — Tensile testing — Part 1: Method of test at ambient temperature*

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