BRITISH STANDARD

BS EN
1724:1999

Light conveyor belts — Test method for the determination of the coefficient of friction

The European Standard EN 1724:1998 has the status of a British Standard

ICS 53.040.20

National foreword

This British Standard is the English language version of EN 1724:1998.

The UK participation in its preparation was entrusted to Technical Committee PRI/67, Conveyor belts, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 7 and a back cover.

This British Standard, having been prepared under the direction of the Sector Committee for Materials and Chemicals, was published under the authority of the Standards Committee and comes into effect on 15 May 1999

ISBN 0 580 32160 6

Amendments issued since publication

Amd. No.	Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 1724

December 1998

ICS 53.040.20

Descriptors: belts, conveyor belts, mechanical tests, friction tests, determination, friction factor

English version

Light conveyor belts — Test method for the determination of the coefficient of friction

Courroies transporteuses légères — Méthodes d'essais pour la détermination du coefficient de frottement

Leichte Fördergurte — Prüfverfahren für die Bestimmung des Reibwertes

This European Standard was approved by CEN on 28 November 1998.

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

Ref. No. EN 1724:1998 E

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 188, Conveyor belts, the Secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 1999, and conflicting national standards shall be withdrawn at the latest by June 1999.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

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Introduction

The coefficient of friction of light conveyor belts must be seen from two different aspects being relevant for the choice of the reference material. One aspect is the friction of the underside of the belt. In practice this is not critical because it is low. Regardless whether a table of steel or of wood is used, the coefficient of friction is within the range from 0,2 to 0,3 in most cases.

Contrary to this the top face covers show values over an extended range depending on their actual function. To achieve this function the material itself can be modified as well as the surface pattern, but the test procedure shall be the same in every case. So it becomes clear that the chosen steel panel represents a compromise. Its main properties are reproducibility of the surface finish and uncritical friction behaviour against any kind of belt cover.

This standard allows comparison of all kinds of conveyor belts to obtain reliable results as a reference. This may be helpful to buyers who need guidance in choosing the right belt for their particular application.

The tests in accordance with this standard are limited to dynamic coefficients of friction (μ_D) up to 1,0 and static coefficients of friction (μ_S) up to 1,5. Higher values can show a mixture of friction, adhesion, deformation and other effects occurring especially where the surface texture is coarse and is therefore unsuitable for this test.

The method using the standardized metallic test panel is intended especially to compare the coefficients of friction of different light conveyor belts. The values received under practice conditions always depend on the frictional partners.

To determine these effects it is possible to choose a different frictional partner instead of the panel if required. This is mentioned in the test report.

1 Scope

This European Standard describes methods of test to determine the dynamic and static coefficient of friction of light conveyor belts as described in EN 873.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions for any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 873, *Light conveyor belts — Principal characteristics and applications.*

EN 10002-2, *Metallic materials — Tensile testing — Part 2: Verification of the force measuring system of the tensile testing machine.*

ISO 471:1995, *Rubber — Temperatures, humidities and times for conditioning and testing.*

ISO 554, *Standard atmospheres of conditioning and/or testing — Specifications.*

ISO 4287, *Geometrical Product Specification (GPS) — Surface texture: Profile method — Terms, definitions and surface texture parameters.*

ISO 6133, *Rubber and plastics — Analysis of multi-peak traces obtained in determinations of tear strength and adhesion strength.*

ISO 7500-1, *Metallic materials — Verification of static uniaxial testing machines — Part 1: Tensile testing machines.*

3 Definitions

For the purposes of this standard the following definitions apply.

3.1

dynamic coefficient of friction, $\mu_D = \frac{F_D}{F_N}$

where

F_D = dynamic frictional force, sliding friction;

F_N = normal force.

3.2

static coefficient of friction, $\mu_S = \frac{F_S}{F_N}$

where

F_S = static frictional force, stiction (break-away force);

F_N = normal force.

4 Principle

4.1 Dynamic coefficient of friction

A test piece cut from the full thickness of the conveyor belt in the longitudinal or transverse direction, in accordance with the scope of the test is clamped to a table. A metallic test panel subjected to a given normal force is pulled over the test piece at a defined speed. Then the μ_D-value is determined by calculation, using the dynamic frictional force (F_D) and the normal force.

4.2 Static coefficient of friction

A metallic test panel is subjected to a normal force as in **4.1**. Additionally, a pulling force is acting on the test panel, generated by a pulling mechanism moving at a defined speed. The μ_S-value is determined by calculation, using the static frictional force (F_S) and the normal force.

5 Apparatus

Testing apparatus as shown in Figure 3 consisting of the following main parts.

5.1 *Testing table*, to clamp test piece on.

5.2 *Metallic test panel*, see Figure 4.

Dimensions:

Thickness: 0,8 mm

Width: (76 ± 0,5) mm

Length: 152 mm

Testing area: (76 ± 0,5) mm × (131,5 ± 0,5) mm = (100 ± 1) cm^2

Materials:

Steel Type: CR1/ISO 3574

Hardness: HRB 60 to HRB 70

Surface: milled

Roughness: R_a = 0,9 μm to 1,3 μm (in accordance with ISO 4287)

Because of the danger of the surface changing due to the abrasion of the test piece, the metallic test panel has to be replaced after max. 50 applications; however after one day of use at the latest.

Because the test panel is not stainless it shall be kept in the original pack until the first use in a dry place in the laboratory. The personnel shall wear clean cotton gloves and touch the panel only at the edges.

5.3 *Weight*, generating a normal force of 50 N ± 1 N together with the metallic test panel.

Dimensions:

Length: (120 ± 0,2) mm

Width: (75 ± 0,2) mm

Height: (71 ± 0,2) mm

Material:

Steel with a density of 7,85 g/cm^3

5.4 *Cable*, with a low elasticity, e.g. steel cable with a diameter of approximately 1 mm.

5.5 *Device for the measurement of the frictional force*

5.5.1 *Load cell*, with a range up to 100 N.

The force measuring system shall be in accordance with EN 10002-2 or ISO 7500-1, Class of machine 3 or better, (e.g. Class of machine 2).

5.5.2 *Recording instrument*, to record the signal of the load cell.

5.6 *Pulling mechanism*, for example a tensile testing machine to produce a uniform relative motion between test piece and metallic test panel.

The deflection roller (see Figure 3) shall have a diameter of 40 to 50 mm and ball bearings to ensure smooth rotation.

The pulling cable shall be parallel to the sliding surface.

6 Test piece

6.1 Test piece material

Test piece material must be new, unused ("virgin"), but not tested earlier than five days after manufacture. It shall be free of any kind of contamination or superficial damage.

6.2 Number and dimensions of test pieces

Three test pieces shall be cut from the full thickness of the conveyor belt in the longitudinal and/or transverse direction, in accordance with the scope of the test, one from the middle of the belt, the others 100 mm from each of the belt edges.

If both surfaces of the belt are to be tested more test pieces shall be taken accordingly.

The test pieces must measure 600 mm long × 100 mm wide.

Each test piece shall be used only once.

6.3 Conditioning

Before testing expose the test pieces to the test room climate, (23 ± 2) °C and (50 ± 5) % relative humidity, in accordance with ISO 471 and ISO 554, for at least 24 h.

7 Procedure

— Check the test room climate (23 ± 2) °C and (50 ± 5) % relative humidity, in accordance with ISO 471.

— Adjust the testing table to the horizontal position in the longitudinal and transverse directions.

— Clamp the test piece to the table.

— Check if the metallic test panel is free of rust; (visual control).

— Clean the metallic test panel by using pure acetone and a soft tissue which is not dissolved by the acetone and does not leave any residue on the panel. Let the acetone evaporate and polish the panel afterwards with a new dry tissue. Then place the panel on the test piece.

— Connect the cable to the panel and put the weight on it.

— Measurement of μ_D:

speed of the pulling mechanism: (1 000 ± 20) mm/min;

NOTE This speed may be slower if the maximum speed of the machine is less than 1 000 mm/min, but not below (500 ± 20) mm/min.

path of motion: 300 mm.

— Measurement of μ_S:

speed of the pulling mechanism: (100 ± 10) mm/min;

measurement to be stopped as soon as test panel begins to move.

8 Calculation and expression of results

8.1 Dynamic friction, μ_D

The μ_D-value shall be determined as a median, preferably in accordance with ISO 6133.

The values registered during the last 200 mm of the path of motion shall be used.

$$\mu_D = \frac{F_D}{F_N}$$

where

F_D is the median of the dynamic frictional force;

F_N is the normal force.

8.2 Static friction, μ_S

For the static coefficient of friction the first peak of the graph represents μ_S.

$$\mu_S = \frac{F_S}{F_N}$$

where

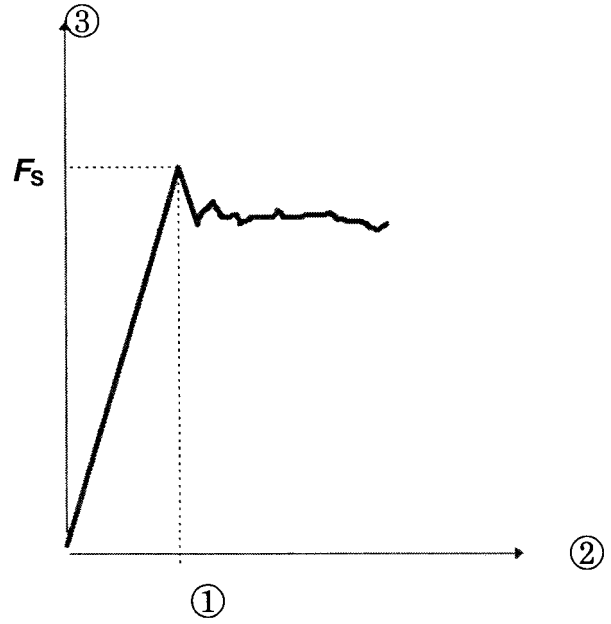
F_S is the static frictional force (break-away force);

F_N is the normal force.

8.3 Examples of the recorded graph of μ_S (force/path diagrams)

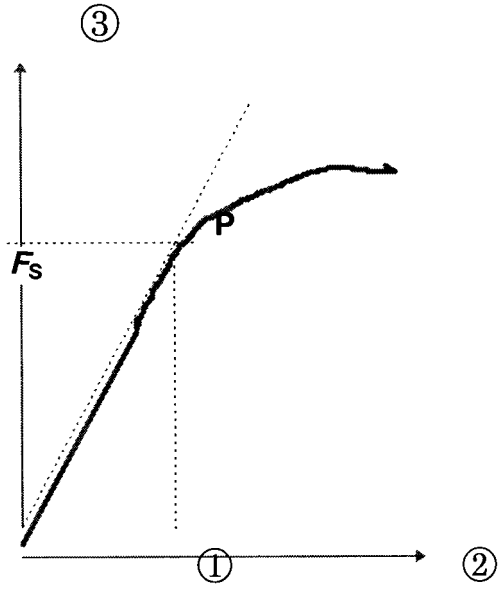
If the recorded graph shows a peak like Figure 1, the force F_S can be read off very easily and the μ_S-value can be calculated.

If the graph looks like Figure 2, the μ_S-value should be determined by noting the force F_S at the point P where the curve deviates from the initial straight line.



1 = start of test panel motion
2 = path of pulling mechanism
3 = force

Figure 1 — Typical example of recorded graph of μ_S with force peak



1 = start of test panel motion
2 = path of pulling mechanism
3 = force

Figure 2 — Example of untypical graph of μ_S without peak

9 Test report

The test report shall include the following particulars:

a) the values of every single measurement, (rounded to two decimal places);

b) the arithmetic mean value, (rounded to two decimal places);

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

d) reference to this EN standard (and details of any possible deviations);

e) test room temperature and relative humidity;

f) conditioning period;

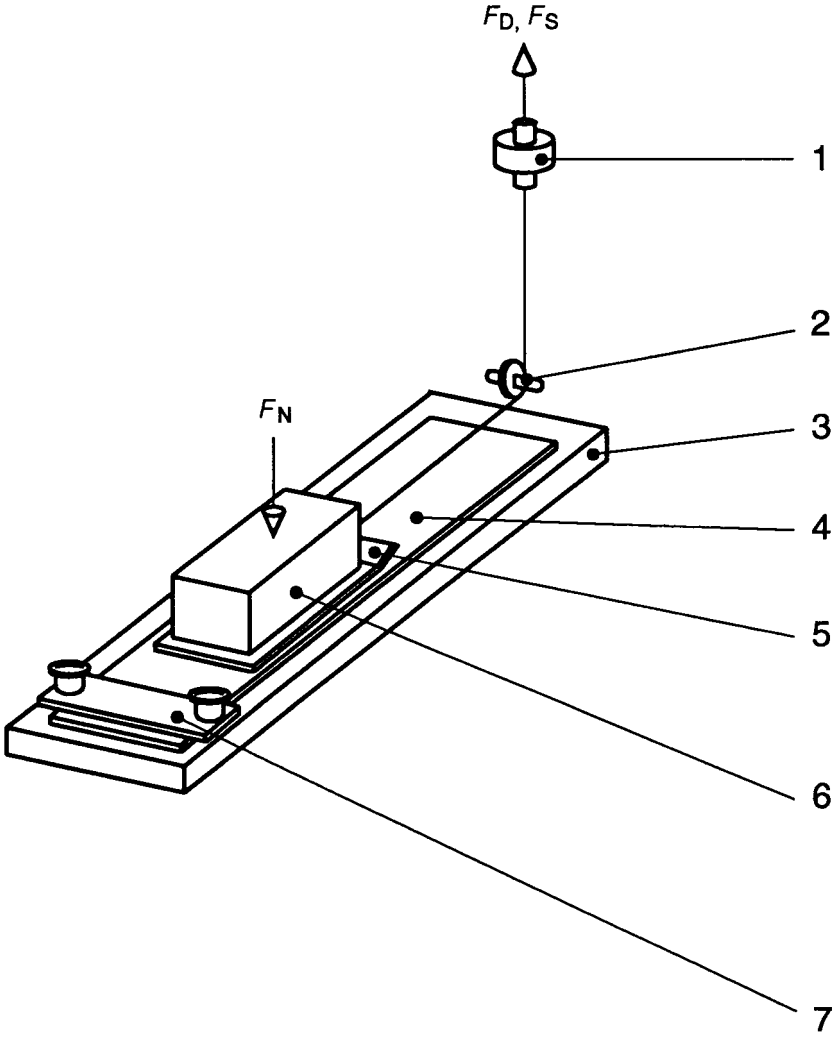
g) designation and manufacturer of metallic test panel;

h) if applicable, the material used instead of metallic test panel;

i) test speed for determination of μ_D-value if different from 1 000 mm/min;

j) the separate values for the undersides and the top face covers;

k) date of test.



Key

1) load cell
2) deflection roller
3) test piece table
4) test piece
5) metallic test panel
6) weight
7) clamp

Figure 3 — Friction testing apparatus

Dimensions in millimetres

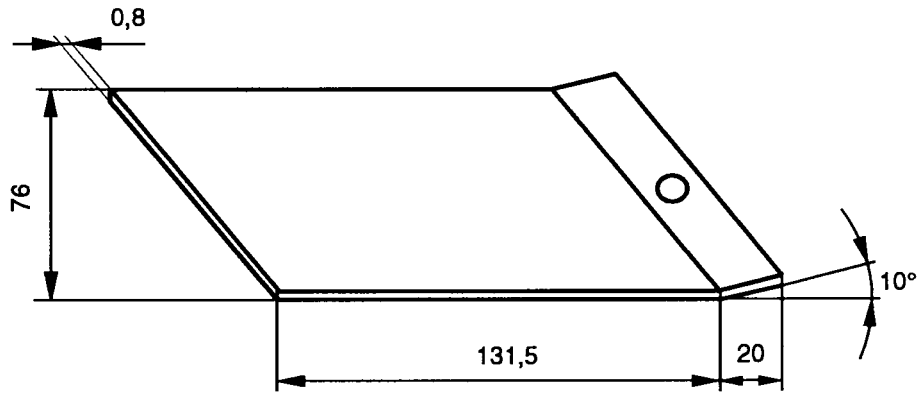


Figure 4 — Metallic test panel

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