BS EN 1554:2012

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Conveyor belts — Drum friction testing

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National foreword

This British Standard is the UK implementation of EN 1554:2012. It supersedes BS EN 1554:1999 which is withdrawn.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.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Compliance with a British Standard cannot confer immunity from legal obligations.

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Foreword

This document (EN 1554:2012) has been prepared by Technical Committee CEN/TC 188 “Conveyor belts”, the secretariat of which is held by SNV.

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of an identical text or by endorsement, at the latest by December 2012, and conflicting national standards shall be withdrawn at the latest by December 2012.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 1554:1998.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive.

For relationship with EU Directive, see informative Annex ZA, which is an integral part of this document.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

The purpose of this European Standard is to provide a method of test that will assist conveyor belt users in assessing the degree of risk which can be anticipated from the hazard caused when a conveyor belt stalls and the driving mechanism of the conveying system continues to operate, causing localized heating of the conveyor belt through contact with the driving drum or other frictional heat source.

For recommendations concerning safety categories of conveyor belts, reference should be made to EN 12882 and EN 14973.

This document is a type C standard as stated in EN ISO 12100:2010.

1 Scope

This European Standard describes a method of test to determine the propensity of a conveyor belt to generate heat flame or glow when held stationary under a given tension, in surface contact around a rotating driven steel drum.

Means of varying the belt tension are described.

NOTE For certain belt types, due to their construction, it may not be possible to conduct this test due to the inability of the belt to comply with the requirements of 6.2.3.

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.

EN 10083-1:2006, *Steels for quenching and tempering — Part 1: General technical delivery conditions*

EN 60584-1, *Thermocouples — Part 1: Reference tables (IEC 60584-1)*

EN ISO 13850, *Safety of machinery — Emergency stop — Principles for design (ISO 13850)*

ISO 65:1981, *Carbon steel tubes suitable for screwing in accordance with ISO 7-1*

ISO 9329-1, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 1: Unalloyed steels with specified room temperature properties*

ISO 9330-1, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 1: Unalloyed steel tubes with specified room temperatures properties*

3 Principle

A test piece of conveyor belt, suitably mounted and tensioned, is wrapped half way around a rotating steel drum, simulating a stalled belt. The test is continued at specified tensions for a given time period, or until the belt breaks. The presence, or absence, of flame or glow is noted and reported and the maximum temperature of the drive drum is recorded. The test is conducted in still air or/and in moving air.

4 Apparatus

A general arrangement of a drum friction testing apparatus is shown in Figure 1.

4.1 Steel drum of external diameter (210 ± 1) mm mounted on a horizontal axis and capable of being rotated under all load conditions at (200 ± 5) rpm throughout the test. The outer shell of the drum is manufactured from tube complying with ISO 9329-1 or ISO 9330-1. The drum shaft material is of grade 2 C 22 of EN 10083-1:2006.

NOTE Experience has shown that motors of between 7,5 kW and 15 kW have proved suitable for maintaining these conditions, although for smaller motors a 'soft' start may be necessary.

Basic dimensions of the drum, shown in Figure 2, are given in order to standardize its thermal characteristics. The variation in diameter along the length of the drum shall not exceed 1 mm.

Notwithstanding the dimensions and tolerances on drum diameter and shell thickness shown in Figure 2, the effect of wear down to a minimum shell thickness of 6 mm is permissible, but the overall diameter of the drum must not thereby become less than 209 mm.

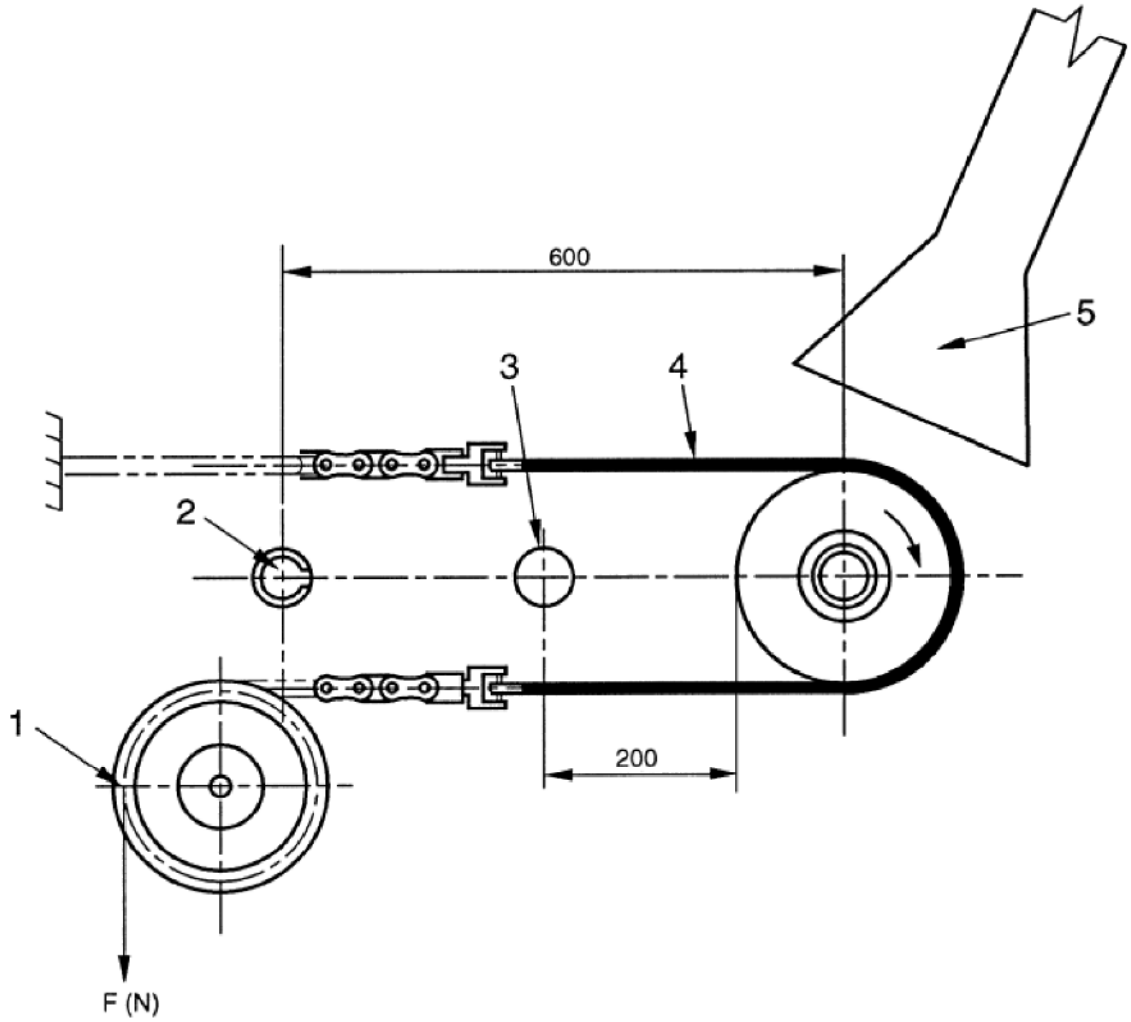
4.2 Drum temperature recording device, comprising a mineral-insulated stainless steel sheathed thermocouple having a maximum outside diameter of 2 mm and complying with EN 60584-1. The tip of the thermocouple is set not more than 0,5 mm below the surface of the drum, midway along its length.

NOTE 1 More than one thermocouple may be fitted in order to provide back-up in the event of failure.

NOTE 2 Take care to see that the effective 'cold junction' temperature is compensated for or alternatively, is measured, and the appropriate correction made.

NOTE 3 The functioning of the rotating contacts should be checked periodically by observing that there is no change in the recorded temperature when the apparatus is run without a test piece.

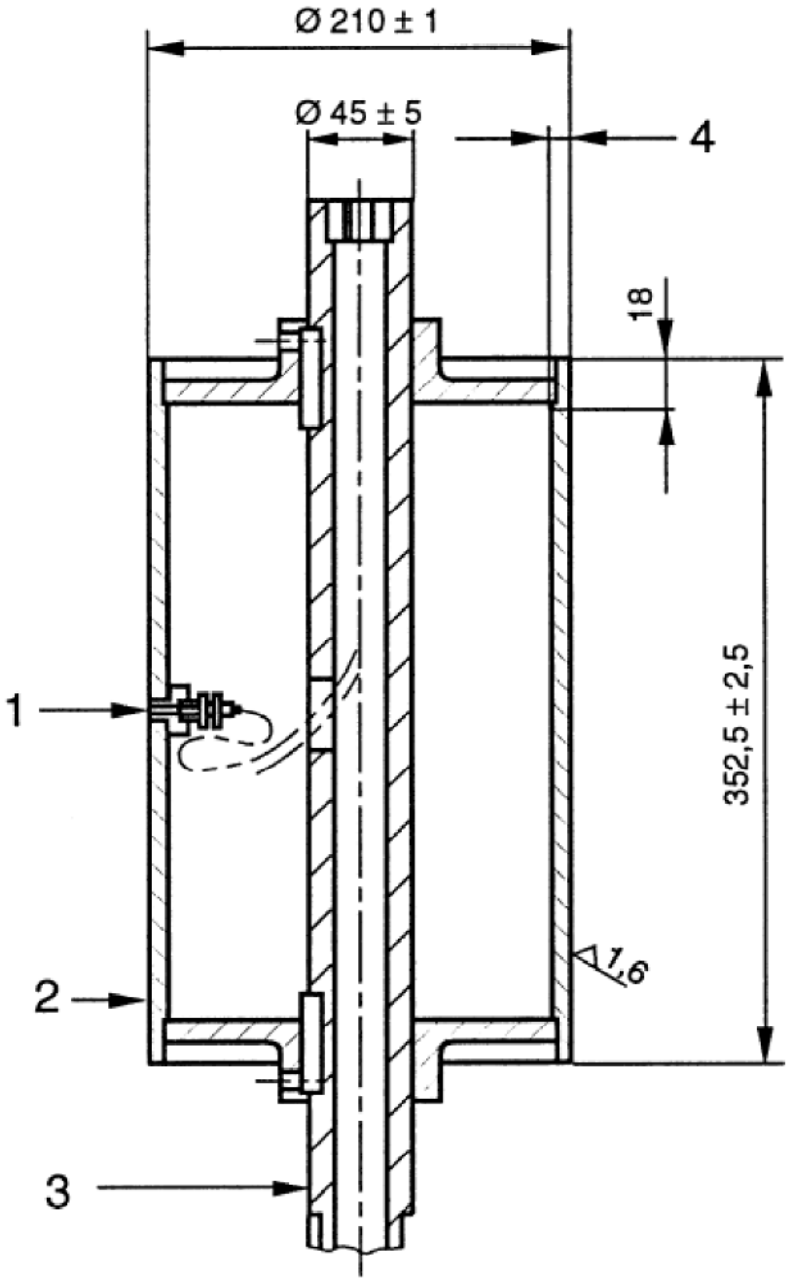
Dimensions in millimetres



Key
1 Guide pulley
2 Perforated air supply pipe
3 Anemometer
4 Test piece
5 Fume extraction hood

Figure 1 — Schematic arrangement of drum friction apparatus

Dimensions in millimetres



Key
1 Temperature probe
2 Outer shell manufactured from tube to ISO 9329-1 or ISO 9330-1
3 Shaft material grade 2 C 22 EN 10083-1:2006
4 6,375 ± 0,375 shell thickness

Figure 2 — Cross section of steel drum and thermocouple housing for drum friction test

4.3 Tensioning system, capable of applying the incremental tensions specified in 6.2.3.

4.4 Air current, having a velocity of (2,0 ± 0,1) m/s at a distance of 200 mm from the surface of the horizontal steel drum when the sample of belt is in position ready for a test.

The air supplied to the apparatus shall be at normal ambient temperature, but tests shall not be made in air at a temperature of less than 5 °C.

The air current shall be supplied from a pipe complying with DN 10 of ISO 65:1981 with 36 holes, each nominally 1,5 mm diameter at 10 mm pitch.

The distance between the centre line of the perforated pipe and the steel drum is 600 mm as shown in Figure 1.

4.5 Anemometer, positioned 200 mm from the surface of the drum on the same horizontal plane as the perforated pipe and capable of measuring the velocity of the air current to an accuracy of ± 5 %.

The speed of the air current in the extractor system provided shall be the minimum required and just sufficient to remove the fumes from the vicinity of the apparatus under the specified test conditions.

4.6 Emergency stop devices, complying with EN ISO 13850.

5 Test piece

Cut each test piece from a position not less than 50 mm from the edges of the belt and not less than 100 mm from the end of the belt. Each test piece shall be 150 mm wide and not less than 750 mm long, from positions parallel to the longitudinal direction of the conveyor belt.

NOTE The precise length of the test piece will be dependent upon the details of the tensioning system (4.3). See Figure 1.

6 Procedure

6.1 General

SAFETY WARNING — Before commencement of the test it should be verified that emergency stop devices (4.6) are functioning correctly and that all the necessary precautions have been taken to ensure the safety of the operatives conducting the test and that they are not exposed to fumes.

Thoroughly clean the surface of the steel drum to remove all traces of rust or residual debris, using abrasive paper or cloth. Ensure that the temperature of the drum does not exceed 30°C at the start of any test.

6.2 Procedure and test

6.2.1 Number of test pieces for Method A

Select four test pieces in accordance with Clause 5.

6.2.2 Number of test pieces for Method B

Select four test pieces in accordance with Clause 5.

6.2.3 Method A - Tests in still air

6.2.3.1 General

Conduct the procedures in 6.2.3.2 or 6.2.3.3, as specified in the product or safety specification. Conduct two tests with the carrying side of the belt in contact with the steel drum (4.1) and two tests with the reverse side of the belt in contact with the steel drum.

6.2.3.2 Method A1 - Test in still air with fixed end load

Pass the test piece through an arc of 180 ° around the steel drum ensuring the belt is in contact with the drum throughout the 180 °. Ensure that one end is rigidly secured and the other end attached to the tensioning system as shown in Figure 1. Apply a force of 343 N.

Rotate the drum at (200 ± 5) rpm in a direction away from the rigidly secured end of the test piece (i.e. similar to the forward direction of a conveyor drive). Maintain the force of 343 N for 60 min or until the test piece breaks.

Record the maximum surface temperature of the drum during the test.

Examine the test piece for any flame or glowing during and after the test.

If after 60 min the belt is unbroken, remove the belt from the drum and examine in subdued light the surface of the belt which has been in contact with the drum, for any sign of glow.

6.2.3.3 Method A2 - Test in still air with increasing end load

Pass the test piece through an arc of 180 ° around the steel drum ensuring that the belt is in contact with the drum throughout the 180 °. Ensure that one end is rigidly secured and the other end attached to the tensioning system as shown in Figure 1. Apply a force of 343 N.

Rotate the drum at (200 ± 5) rpm in a direction away from the rigidly secured end of the test piece (i.e. similar to the forward direction of a conveyor drive). Maintain the force of 343 N until the test piece breaks. If the test piece has not broken after 60 min on test, increase the force as follows whilst the drum is still rotating at (200 ± 5) rpm:

a) Increase the force by 343 N to 686 N for a further 30 min;

b) If the test piece has still not broken, increase the force by a further 343 N to 1029 N for a further 30 min, or until the test piece breaks;

c) If the test piece has still not broken, increase the force by a further 343 N to 1372 N for a further 10 min, or until the test piece breaks;

d) If the test piece has still not broken, increase the force by a further 343 N to 1715 N, the test being continued at 1 715 N until a total time of 150 min has elapsed from commencement of the test, or until the test piece breaks.

Record the maximum surface temperature of the drum during the test.

Examine the test piece for any flame or glowing during and after the test.

If after 150 min the belt is unbroken, remove the belt from the drum and examine in subdued light the surface of the belt which has been in contact with the drum, for any sign of glow.

6.2.4 Method B - Tests in moving air

6.2.4.1 General

Conduct the procedures in 6.2.4.2 or 6.2.4.3, as specified in the product or safety specification. Conduct two tests with the carrying side of the belt in contact with the steel drum (4.1) and two tests with the reverse side of the belt in contact with the steel drum.

6.2.4.2 Method B1 - Tests in moving air with fixed end load

Repeat the procedure in 6.2.3.2 in an air current having a velocity of (2,0 ± 0,1) m/s at a temperature of not less than 5 °C (see 4.4).

Examine the test piece for any flame or glowing during the test. If the test piece has broken, leave the two pieces within the influence of the air current (see 4.4) until either flame or glowing occurs, or until it is clear that neither is possible. Terminate the test at this point.

If after 60 min the belt is unbroken, remove the belt from the drum and examine, in subdued light, the surface of the belt which has been in contact with the drum, for any sign of glow.

6.2.4.3 Method B2 - Tests in moving air with increasing end load

Repeat the procedure in 6.2.3.3 in an air current having a velocity of (2,0 ± 0,1) m/s at a temperature of not less than 5 °C (see 4.4).

Examine the test piece for any flame or glowing during the test. If the test piece has broken, leave the two pieces within the influence of the air current (see 4.4) until either flame or glowing occurs, or until it is clear that neither is possible. Terminate the test at this point.

If after 150 min the belt is unbroken, remove the belt from the drum and examine, in subdued light, the surface of the belt which has been in contact with the drum, for any sign of glow.

7 Test report

The test report shall include the following particulars:

a) reference to this European Standard;

b) the belt tension used and the time to break (if any); if the belt did not break at the tension specified, report "Belt did not break";

c) the presence or absence of any flame or glowing in each test;

d) the maximum temperature of the surface of the drum in each test;

e) the method used , A1, A2, B1 or B2.

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42/EC

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive for machinery, 2006/42/EC.

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this standard confers, within the limits of the scope of this standard, a presumption of conformity with Essential Requirements:

1.5.5 Extreme temperatures

1.5.6 Fire

of that Directive and associated EFTA regulations.

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

Bibliography

[1] EN 12882, *Conveyor belts for general purpose use — Electrical and flammability safety requirements*

[2] EN 14973, *Conveyor belts for use in underground installations — Electrical and flammability safety requirements*

[3] EN ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction (ISO 12100:2010)*

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