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SOUTH AFRICAN NATIONAL STANDARD

Conveyor belting — Steel cord reinforced construction

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Table of changes

Change No.	Date	Scope

Foreword

This South African standard was approved by National Committee SABS/TC 45/SC 01, *Rubber and rubber products – Conveyor belts*, in accordance with procedures of SABS Standards Division, in compliance with annex 3 of the WTO/TBT agreement.

This document was published in January 2014.

This document supersedes SANS 1366:2006 (edition 2.1).

Annex A forms an integral part of this document. Annexes B, C and D are for information only.

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Conveyor belting — Steel cord reinforced construction

1 Scope

1.1 This standard specifies the requirements for steel cord reinforced construction conveyor belting with or without secondary reinforcement, having elastomeric covers and classified according to the calculated minimum strength of the belting in kilonewtons per metre (kN/m).

1.2 It does not specify data for design of belting installations and does not include belts with speciality rubber cover components.

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. Information on currently valid national and international standards can be obtained from the SABS Standards Division.

SANS 54/ISO 188, *Rubber, vulcanized or thermoplastic – Accelerated ageing and heat resistance tests*.

SANS 971, *Conveyor belting – Methods of testing fire retardant properties of all conveyor belt constructions.*

SANS 4649/ISO 4649*, Rubber, vulcanized or thermoplastic – Determination of abrasion resistance using a rotating cylindrical drum device.*

SANS 10037/ISO 37, *Rubber, vulcanized or thermoplastic – Determination of tensile stress-strain properties.*

SANS 23529/ISO 23529, *Rubber – General procedures for preparing and conditioning test pieces for physical test methods.*

3 Definitions

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

3.1
lot
continuous length of belting of length greater than 150 m, submitted at any one time for inspection and testing

3.2
secondary belting reinforcement
textile (T) or steel (S) incorporated in one or both of the covers, and included in the thickness

NOTE This will not contribute to the belt strength.

3.3
standard test conditions
temperature of 23 °C ± 2 °C and a relative humidity of 50 % ± 4 %

4 Requirements

4.1 Class

The class of belting shall be indicated by the letters "St", followed by the breaking strength of the belting, in kilonewtons per metre of width, and shall comply with the construction as given in table 1, unless otherwise agreed by the manufacturer and purchaser (see annex A).

Table 1 — Classes and construction

1		2	3	4
Class		**Thickness of cover**	**Steel cords**	
			Nominal distance between centres (cord pitch)	**Cord diameter**
		mm, min.	mm	mm, max.
St	500	4	20,0	3,6
St	630	4	16,0	3,6
St	800	4	17,0	3,6
St	1 000	4	14,5	4,4
St	1 250	4	12,0	4,4
St	1 400	4	19,0	6,3
St	1 600	5	16,0	6,3
St	1 800	5	16,0	6,3
St	2 000	5	13,5	6,3
St	2 500	6	15,0	7,4
St	3 150	7	16,0	8,6
St	3 500	7	16,0	8,6
St	4 000	8	15,0	9,3
St	5 000	8	17,0	11,5
St	6 300	10	17,0	13,0

4.2 Type

The belting shall be one of the following types, as specified by the purchaser (see annex A):

a) **Type F**. A belt with a rubber cover that has both fire-retardant and antistatic properties, when tested in accordance with 4.8.1, 4.8.2, 4.8.3 and 4.8.4. Physical properties of rubber covers are given in table 2.

b) **Type A.** A belt with rubber covers formulated specifically for abrasion resistance and with physical properties stipulated in table 2.

c) **Type C**. A belt with a rubber cover that is suitable for the conveyance of abrasive materials under average working conditions.

d) **Type N and M**. A non-fire retardant belt with covers of varying degrees of cut and gouge resistance as defined by tensile strength and elongation at break properties stipulated in table 2.

e) **Type E.** A belt cover compound having potential energy saving attributes as defined by a measured tan δ value. This compound is for use on bottom cover only.

4.3 Components

4.3.1 Properties of covers

Covers shall be based on a rubber polymer and shall comply with the appropriate requirements given in table 2.

a) When covers are tested in accordance with 6.2, the tensile strength and elongation at break shall comply with the requirements of table 2, for the different types, as appropriate.

b) When covers have been aged in accordance with 6.3, and are tested in accordance with 6.2, the tensile strength and elongation shall not differ from the original by more than the percentages stipulated in table 2.

c) When tested in accordance with 6.4, the maximum abrasion loss of the covers shall comply with the values given in table 2, appropriate to the type.

Table 2 — Requirements for covers

1	2	3	4	5	6	7	8	9
Property								
Description	**Measuring units**	**Type F**	**Type A**	**Type C**	**Type N**	**Type M**	**Type E (bottom cover)**	**Test method section**
Tensile strength								6.2
a) Original	MPa, min	14	18	20	17	25	14	
b) After aging, % of original	%	80 to 125	80 to 120	80 to 120	80 to 120	80 to 120	80 to 120	
Elongation at break								6.2
a) Original	%, min	400	400	400	400	450	400	
b) After aging, % of original	%	80 to 120	80 to 120	80 to 120	80 to 120	80 to 120	80 to 120	
Maximum abrasion loss	mm^3	180	70	150	150	120	120	6.4

4.3.2 Lamination adhesion

When determined in accordance with 6.5, the average stripping force required to separate the cord bonder and the cover rubber (laminate) of each test piece shall be not less than 14 kN/m.

4.3.3 Cords

The cords diameter shall not exceed the appropriate maximum value given in column 4 of table 1. The breaking strength of each cord shall be such that when the finished belt strength is calculated in accordance with 4.4.2, the appropriate minimum belt breaking load is achieved. Each cord shall be constructed from either stainless steel wires or coated steel wires.

The properties of the raw cords and the steel wire from which they are manufactured, shall be determined by the manufacturer of the belting and recorded in a test certificate.

4.4 Constructional requirements

4.4.1 General

Belting shall consist of a single layer of longitudinal cords horizontally and vertically located as specified in 4.4.3.2 and 4.4.3.3, and moulded into a rubber matrix. The belting may contain secondary belting reinforcement.

4.4.2 Calculated breaking strength of belting

The total number of cords in the belting shall be multiplied by the minimum breaking strength of the cords, as specified in the cord manufacturer’s certificates and the result divided by the nominal belt width.

4.4.3 Spacing and lay of cords

4.4.3.1 General

Cords with right-hand direction of lay and cords with left-hand direction of lay shall be alternatively located in the belting as to ensure no distortion when under tension.

4.4.3.2 Horizontal location of cords

Cords shall be so spaced across the width of the belting, at the appropriate nominal intervals given in column 3 of table 1, that when the belting is tested in accordance with 6.7,

a) no part of the outer cords shall be less than 15 mm or more than 50 mm from the edge of the belting. The variation in width of edge rubber between left and right hand sides shall be not more than 10 mm; and

b) the tolerance on any individual cord spacing compared to the average cord spacing shall be ± 1,5 mm, except that 5 % of the cords may exceed this tolerance by more than 5 % of the mean spacing. No individual value of the cord spacing shall differ from the mean value by an amount that exceeds 10 % of the mean value.

4.4.3.3 Vertical location of cords

When tested in accordance with 6.8, no cord shall deviate from a plane parallel to the carrying surface of the belting by more than 1,5 mm, and not more than 5 % of the cords shall deviate from that plane by more than 1,0 mm.

4.4.4 Joints in cords

There shall be no joints in cords.

4.5 Dimensions

4.5.1 Length

The length of the belting shall be subject to a tolerance of +2 % or −0,5 % as specified by the purchaser (see annex A).

4.5.2 Width

The nominal width of the belting shall be as specified by the purchaser (see annex A) and shall preferably be one of the following widths:

> 900 mm, 1 050 mm, 1 200 mm, 1 350 mm, 1 500 mm, 1 650 mm, 1 800 mm, 2 100 mm, or 2 400 mm.

The actual width shall not differ from the nominal value by more than ± 1 % of the nominal value.

4.5.3 Thickness of covers

The thickness of each cover, i.e. top and bottom, determined in accordance with 6.8, shall be at least the value specified by the purchaser (see annex A), which shall be at least equal to the appropriate minimum given in column 2 of table 1, and shall preferably be one of the following values:

> 4,0 mm; 5,0 mm; 6,0 mm; 7,0 mm; 8,0 mm; 9,0 mm; 10,0 mm; 12,0 mm; 16,0 mm; or 20,0 mm.

NOTE 1 When cover thickness above 20,0 mm is specified by the purchaser, the thicknesses should preferably be selected from the R10 series of preferred numbers given in SANS 742.

NOTE 2 In-operation cover thickness should not be less than 4 mm or 70 % of the cord diameter, whichever is greater.

NOTE 3 Cover thickness includes secondary reinforcement and safety objects such as belt rip protection devices.

4.5.4 Thickness of belting

The nominal thickness of the belting shall be the sum of the thicknesses of the top and bottom covers plus the cord diameter. When tested in accordance with 6.9, the thickness shall not differ from the nominal value by more than 10 % of that nominal value.

4.6 Workmanship and finish

4.6.1 Workmanship

Workmanship shall be in accordance with sound manufacturing practice. The belting shall be substantially rectangular in cross-section and free from defects (such as voids and blisters) that would impair its long-term serviceability.

4.6.2 Finish

The belting shall be properly finished and all flash shall have been removed. Surface blemishes (patches) shall be limited in number and size. A lifetime guarantee shall be applicable to repairs that may be made during manufacturing.

4.7 Other requirements

4.7.1 Pull-out force of steel cords

4.7.1.1 As received. When the pull-out force is tested in accordance with 6.10, the force required to pull out the cords from the matrix shall be at least equal to the value determined through the following relationship, for the particular cord diameter used in the manufacture of the belting:

$$F_a = (14 \times d) + 24$$

where

F_a is the pull-out force per unit length, in kilonewtons per metre (kN/m); and

d is the cord diameter, in millimetres (mm).

4.7.1.2 After reheating. When the pull-out force is tested in accordance with 6.11, the force required to pull out the cords from the matrix shall be at least equal to a value determined through the following relationship, for the particular cord diameter used in the manufacture of the belting:

$$F_v = (14 \times d) + 14$$

where

F_v is the pull-out force per unit length, in kilonewtons per metre (kN/m); and

d is the cord diameter, in millimetres (mm).

4.7.1.3 Dynamic cord pull-out fatigue resistance. When tested in accordance with 6.12, using a cyclic load ranging between 3,6 % to 36 % of the nominal "as received" pull-out strength for a given cord diameter, there shall be no cord pull-out before completion of 10 000 cycles.

4.7.1.4 Cord elastomeric compound penetration. When tested in accordance with 6.13, the pressure differential shall not change by more than 5 kPa in 60 s.

4.7.2 Adhesion of secondary belting reinforcement

In belting that contains secondary belting reinforcement, the adhesion between the cover and the secondary reinforcement, when tested in accordance with 6.14, shall be at least 5,0 kN/m.

4.7.3 Troughability

The troughability of the belting, determined in accordance with 6.15, shall be at least equal to the value given in column 3 of table 4 appropriate to the troughing angle specified by the purchaser (see annex A).

Table 4 — Troughability

1	2	3
Troughing angle degrees		**Troughability**
Over	**Up to and including**	(F/L) min.
0	20	0,08
20	35	0,14
35	45	0,18
45	60	0,26
NOTE 1 The troughability values are the minimum values for belting working on three equal length idlers. NOTE 2 The minimum for an intermediate troughing angle is the value obtained by linear interpolation between the appropriate adjacent values.		

4.8 Flame retardancy (Type F belting)

4.8.1 Flame resistance

When the belting is tested in accordance with SANS 971, it shall be self-extinguishing to an extent such that

a) the total duration of flame and glow for a set of six test pieces is less than 45 s,

b) the duration of flame and glow for an individual test piece does not exceed 15 s, and

c) there is no appearance or reappearance (as relevant) of flame or glow when a test piece is subjected to the air draught 60 s after it has been removed from the flame.

4.8.2 Electrical conductivity

The electrical resistance of each surface of the belting, determined in accordance with SANS 971, shall not exceed $3 \times 10^{8}\ \Omega$.

NOTE Resistance is measured to determine conductivity of the belting.

4.8.3 Drum friction test

When the belting is tested in accordance with SANS 971, it shall not show any sign of flame or glow. The temperature of the drum shall not exceed 325 °C.

4.8.4 Flame propagation test

When performing the fire propagation test in accordance with SANS 971 the belt shall meet one the following requirements:

a) the length of the test piece that remains undamaged across the whole width of the test piece shall be not less than 600 mm; or

b) the maximum average temperature rise shall not exceed 140 °C, the length of belting consumed by mass shall not exceed 1 250 mm and the length of the test piece that remains undamaged shall be not less than 50 mm across the whole width of the conveyor belt.

5 Sampling and compliance with this standard

5.1 General

This clause applies to the sampling for inspection and testing before acceptance or rejection of single lots (consignments) in cases where no information about the implementation of quality control or testing during manufacture is available to help in assessing the quality of the lot. It is also used as the procedure for adjudicating in cases of dispute.

5.2 Sampling

The following sampling procedure shall be applied in determining whether a lot complies with the relevant requirements of this standard. The sample(s) so taken shall be deemed to represent the lot for all properties other than workmanship and length.

After checking for compliance with 4.5 and clause 7, from across the full width of the belting that constitutes the lot, cut one sample of length approximately 2 m.

5.3 Compliance with this standard

The lot shall be deemed to comply with the requirements of this standard if

a) it complies with the requirements for length (see 4.5.1), workmanship (see 4.6), packing (see 7.1), and marking (see 7.2),

b) on inspection and testing, the sample taken in accordance with 5.1 is found to comply with all the other relevant requirements of this standard, and

c) any deviation from the requirements of this standard during the manufacturing process of the belt, shall be subject to the submission of a concession request by the manufacturer for approval by the customer.

NOTE 1 For quality verification of steel cord reinforced conveyor belting (see annex B).

NOTE 2 For notes to users and designers (see annex C).

6 Methods of test

6.1 Conditioning

Using the procedure given in SANS 23529, condition all test specimens for at least 24 h under standard test conditions (see 3.3) before testing them, and conduct the tests under these conditions.

6.2 Tensile strength and elongation at break of covers

Prepare the test specimens in accordance with SANS 23529, and test according to SANS 10037 to determine the tensile strength of the cover material after conditioning and ageing, in accordance with 6.3, followed by conditioning.

6.3 Ageing

Use SANS 54, ageing for 168 h ± 1 h at 70 °C ± 1 °C.

6.4 Abrasion resistance

Use the procedure given in SANS 4649.

Check for compliance with 4.3.1(c).

6.5 Determining laminate adhesion

6.5.1 Apparatus

A suitable tensile testing machine having an autographic recorder is required. The machine shall be capable of exerting a steady rate of strain without interruption and of measuring the test force with an error of not more than ± 2 %. The rate of separation of the jaws of the tensile testing machine shall be 100 mm/min ± 10 mm/min.

6.5.2 Test specimens

Three test pieces 150 mm long and at least 25 mm wide, and containing not less than two cords, shall be cut from the belt. The laminate to be tested shall be cut from the plane of the adhering surface to enable it to be stripped from the belt in the testing machine.

6.5.3 Procedure

6.5.3.1 For each test piece, cut back the laminate at an angle of approximately 30° to the surface so that it can be gripped in one jaw and the remainder of the belt can be gripped in the other jaw.

6.5.3.2 Mount the test piece in the tensile testing machine and strip the laminate from the belt with the force being continuously recorded. From the recording, determine the average stripping force of the test piece and divide by the width of the test piece.

Check for compliance with 4.3.2.

6.5.4 Calculations

From the recording, determine for each specimen the average force required to strip the laminate from the belting, calculate the adhesion in kilonewtons per metre of width, and record the average of the three results as the adhesion of the secondary reinforcement in the belting.

6.6 Cord breaking force

6.6.1 Apparatus

A suitable tensile testing machine having an autographic recorder is required. The machine shall be capable of exerting a steady rate of strain without interruption and of measuring the test force with an error of not more than ± 2 %. The rate of separation of the jaws of the tensile testing machine shall be 100 mm/min ± 10 mm/min.

6.6.2 Test specimens

6.6.2.1 Cord preparation

Cut steel cord to a suitable length for testing purposes. Do not use any heat during the cord cutting operation. High temperatures will cause premature failure due to wire annealing.

6.6.2.2 Cord seizing

Using soft annealed iron wire, seize the cord as shown in figure 1. Do not use any other type of wire composite for seizing. The seizing length shall be at least equal to twice the cord diameter.

Care shall be taken to prevent damage to the outer strands when the cord is clamped.

Figure 1 — Cord-seizing length

6.6.2.3 Cord brooming

The length of the broom shall be at least equal to five times the cord diameter.

Secure the cord directly below the seizing band, to allow the cord to be un-laid up to the seizing.

Un-lay strands outwards to an included angle not exceeding 60° as shown in figure 2.

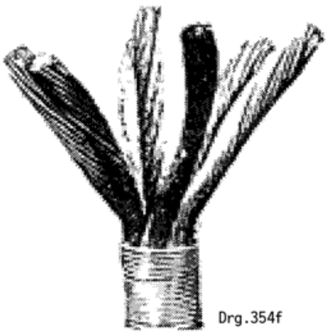


Figure 2 — Cord broom

Proceed to un-lay each strand, completely down to the seizing to form a broom, being cautious not to disturb or change the lay of the wires and strands under the seizing band (see figure 3).

The wires shall NOT be straightened.

The open broom shall be thoroughly cleaned and degreased using a suitable solvent. Ensure that the solvent is confined to the broom and does not extend into the cord.

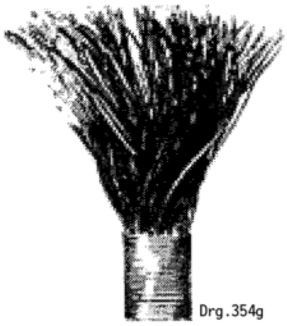


Figure 3 — Cord-open broom

6.6.2.4 Socket/mould/sample preparation

After cleaning and drying the wire broom should be placed centrally into a suitable socket or mould in preparation for resin pouring.

6.6.2.5 Resin preparation and pouring

Using suitable self curing resin mix, with a curing temperature not exceeding 120 °C and a minimum compression strength of 130 N/mm^2, pour mixed resin into the socket/mould and allow to cure and then to cool to ambient temperature.

6.6.2.6 Testing

Ensure that the test specimen is properly aligned in the tensile machine jaws and set the crosshead speed to 100 mm/min ± 10 mm/min. Increase tension until cord failure occurs and record the highest force applied.

6.7 Cord spacing

6.7.1 Apparatus

6.7.1.1 A suitable graduated measuring tape with length greater than the width of the belting.

6.7.1.2 A pair of vernier calipers.

6.7.2 Test specimen

Cut a rectangular test piece across the full belt width at 90° to the belt edge, of length approximately 150 mm.

6.7.3 Procedure

6.7.3.1 Using the steel tape, measure the distance between the left hand sides of the two outer cords (see example figure 4).

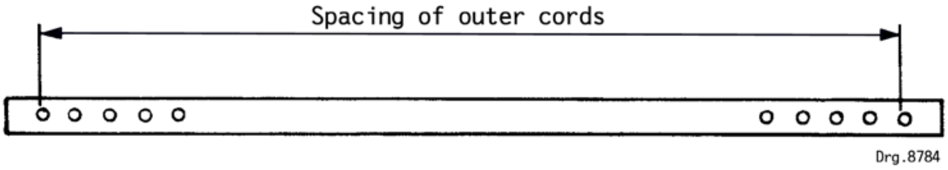


Figure 4 — Belting cross-section

6.7.3.2 Calculate, using the following equation, the mean cord spacing and record its value to the nearest 0,5 mm:

$$M = \frac{c}{n-1}$$

where

M is the mean cord spacing;

c is the spacing of the outer cords, in millimetres; and

n is the number of cords.

6.7.3.3 Using the steel vernier gauge and dividers (or vernier calipers) determine and record the following:

a) the distance between each outer cord and the adjacent edge of the belting;

b) the spacing of each cord, being the distance between the left-hand sides of each pair of adjacent cords;

c) the number, and the percentage of the total number, of the cord spacings that differ from the nominal value by more than ± 1,5 mm;

d) the number of cord spacings that differ from the mean value by an amount of more than 5 % of the mean value; and

e) the number of cord spacings that differ from the mean value by an amount greater than 10 %.

6.8 Cover thickness and location of cords in belting

6.8.1 Apparatus

6.8.1.1 Clamp

A rigid clamp for holding the test specimen against a smooth flat surface.

6.8.1.2 Gauge

A vernier height gauge.

6.8.2 Test specimen

6.8.2.1 From across the full width of the belting, cut one specimen of width 150 mm ± 2 mm at right angles to its edges and square to its carrying surface.

6.8.2.2 Apply one coat of white water-base paint to one of the cut faces of the specimen. Allow to dry and then, starting at a point one-sixteenth of the belt width, *W*, from one end of the cut and painted face, mark on that face eight measuring positions, at intervals equal to one-eighth of the belt width, *W*.

6.8.3 Procedure

6.8.3.1 Cover thickness

6.8.3.1.1 With the carrying surface uppermost, clamp the test specimen against a smooth flat surface.

6.8.3.1.2 At each of the marked positions, measure the vertical distance (l), from the flat surface to the nearest edge of the nearest cord (see figure 6).

6.8.3.1.3 Calculate the thicknesses, *a* and *b*, of each of the two covers as follows, and record the values expressed to the nearest 0,25 mm:

$$a = \frac{l_1 + l_2 + l_3 + l_4 + l_5 + l_6 + l_7 + l_8}{8}$$

$$b = h - a - d$$

where

a is the thickness of cover A (see figure 5), in millimetres;

b is the thickness of cover B (see figure 5),in millimetres;

h is the thickness of belting (see 6.9.3), in millimetres;

d is the cord diameter (see 4.3.3), in millimetres;

e is the cord pitch (see figure 5), in millimetres;

f is the cord distance from the edge of belting (see figure 5), in millimetres.

$\frac{l_1 + l_2 + l_3 + l_4 + l_5 + l_6 + l_7 + l_8}{8}$ is the mean of eight values of *(l)* measured, in millimetres.

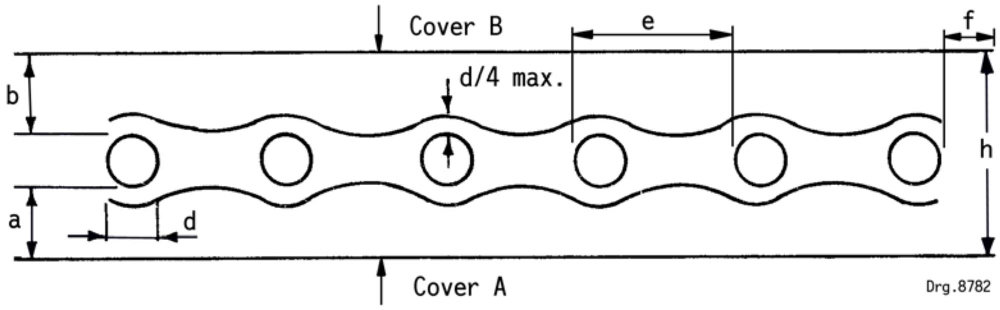


Figure 5 — Cover thickness

6.8.3.2 Vertical location of cords

6.8.3.2.1 Calculate and express to the nearest 0,25 mm, the mean positions of the centre-line of the cords (see figures 5 and 6) from the formula

$$S = a + \frac{d}{2}$$

where

a and d	are as given in 6.8.3.1.3; and
S	is the mean distance of the centre-line of the cords from the surface of cover A, in millimetres.

6.8.3.2.2 Using the vernier height gauge, scribe on the white cut face of the test specimen horizontal lines at the vertical distances S_1, S_2, S_3 and S_4 from the smooth flat surface (see figure 6)

where

$$S_1 = S - \frac{d}{2} - 1{,}5 \text{ mm, i.e. } a - 1{,}5 \text{ mm;}$$

$$S_2 = S - \frac{d}{2} - 1{,}0 \text{ mm, i.e. } a - 1{,}0 \text{ mm;}$$

$$S_3 = S + \frac{d}{2} + 1{,}0 \text{ mm, i.e. } a + d + 1{,}0 \text{ mm; and}$$

$$S_4 = S + \frac{d}{2} + 1{,}5 \text{ mm, i.e. } a + d + 1{,}5 \text{ mm.}$$

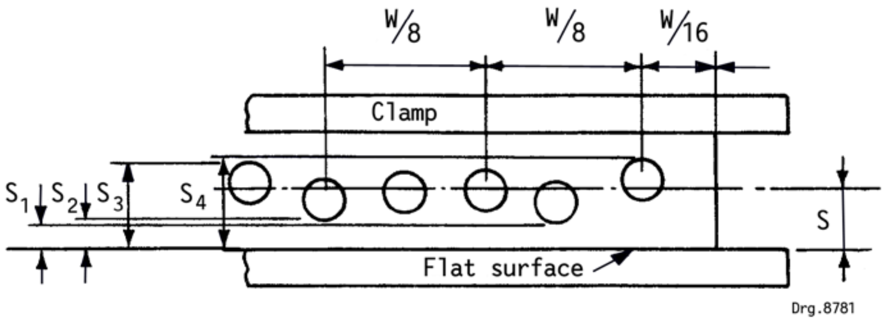


Figure 6 — Location of cords

6.8.3.2.3 Count and record the number of cords

a) whose surfaces extend beyond the outer two lines, i.e. the lines at heights S_1 and S_4 (representing the limit of 1,5 mm deviation), and

b) whose surfaces extend beyond the inner two lines, i.e. the lines at heights S_2 and S_3 (representing the limit of 1,0 mm deviation).

6.8.3.2.4 Count the total number of cords in the belting and calculate and record the result obtained in 6.8.3.2.3(a) and 6.8.3.2.3(b) above as a percentage of that number.

6.9 Thickness of belting

6.9.1 Apparatus

A micrometer dial gauge that

a) is firmly held in a rigid stand over a flat baseplate of diameter at least 50 mm,

b) has a scale graduated in unit divisions of 0,02 mm,

c) is fitted with a pressure plate, of diameter 10,0 mm to 12,0 mm, that has a plane bearing surface that is parallel to the upper surface of the baseplate, and

d) is so loaded as to exert a pressure of 20,0 kPa on the specimen under test.

6.9.2 Test specimen

6.9.2.1 From across the full width of the belting, cut one specimen in length 150 mm ± 2 mm. Then place the specimen on a flat surface under standard test conditions (see 3.3) for a period of at least 24 h.

6.9.2.2 After conditioning the specimen (see 6.1), mark three measuring points on the carrying surface at the positions shown in figure 7 with the centre measurement centralized across the belt width.

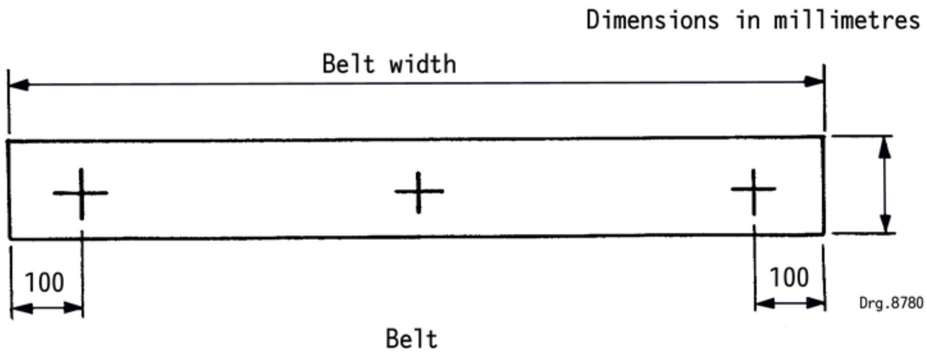


Figure 7 — Measurement of thickness

6.9.3 Procedure

With the specimen so laid flat on the baseplate of the apparatus that a measuring point is centred under the pressure plate, measure the thickness of the belting at that point. Repeat the measurement at each of the other points (in turn) and record the mean of the three results as the thickness of the belting.

6.10 Pull-out force

6.10.1 Apparatus

A suitable tensile testing machine having an autographic recorder is required. The machine shall be capable of exerting a steady rate of strain without interruption and of measuring the test force with an error of not more than ± 2 %. The rate of separation of the jaws of the tensile testing machine shall be 100 mm/min ± 10 mm/min.

6.10.2 Test specimens

From the sample, cut three full-thickness specimens each containing five cords or three cords (as relevant), and of one of the shapes shown in figure 8(a) and figure 8(b) or of the shape shown in figure 9, the test length, L_2, being accurately known. In a test specimen shaped as in figure 8(a), remove the covers over a length of 100 mm from the end(s) of a test piece to enable the specimen to be gripped in the jaws of the testing machine.

6.10.3 Procedure

Mount the specimen under test centrally in the jaws of the machine, apply the strain steadily and record the maximum force registered before the centre cord is extracted.

Calculate the pull-out force per unit length from the following formula:

$$F_a = \frac{F}{L_2}$$

where

F_a is the pull-out force per unit length, in kilonewtons per metre (kN/m);

F is the maximum applied force before extraction, in newtons (N); and

L_2 is the length of test specimen, in millimetres (mm).

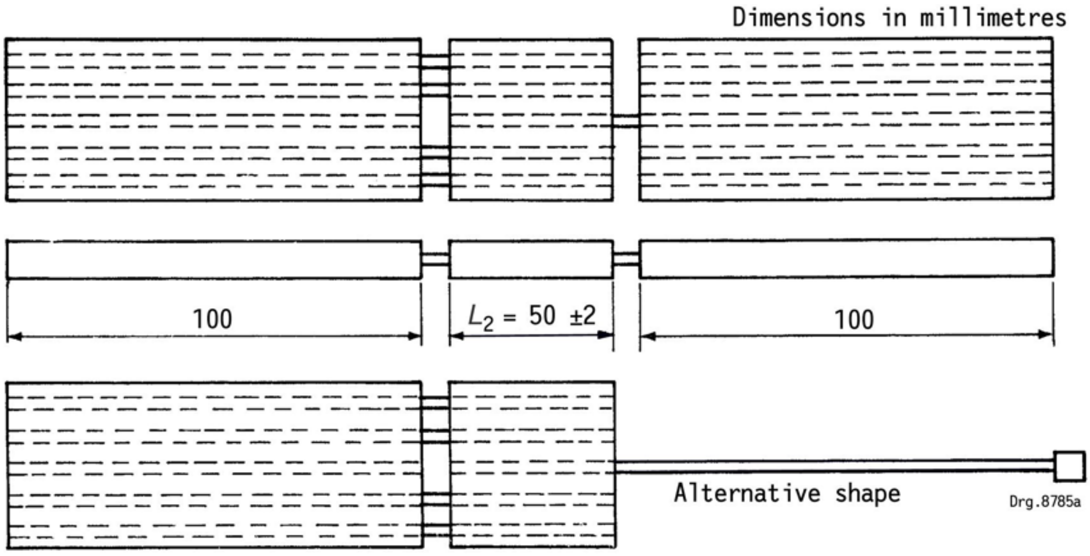


Figure 8(a) — Common shape

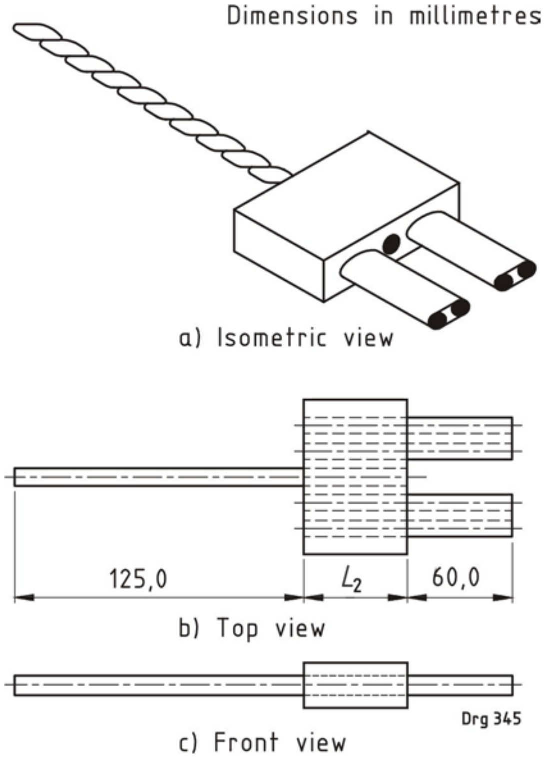


Figure 8(b) — Alternative shape

Figure 8 — Test specimen for pull-out force

6.11 Pull-out force after reheating

6.11.1 Apparatus

6.11.1.1 A suitable tensile testing machine, having an autographic recorder is required. The machine shall be capable of exerting a steady rate of strain without interruption and of measuring the test force with an error of not more than ± 2 %. The rate of separation of the jaws of the tensile testing machine shall be 100 mm/min ± 10 mm/min.

6.11.1.2 Oven. An oven maintained at a temperature of 140 °C ± 5 °C and equipped with means for suspending test specimens that they do not come within 10 mm of each other.

6.11.2 Test specimens

Prepared as in 6.10.2.

6.11.3 Procedure

Heat the test specimens in the oven for 150 $^{-1}_{+5}$ min, allow them to cool, and as soon as possible after they reach room temperature, proceed as described in 6.10.3.

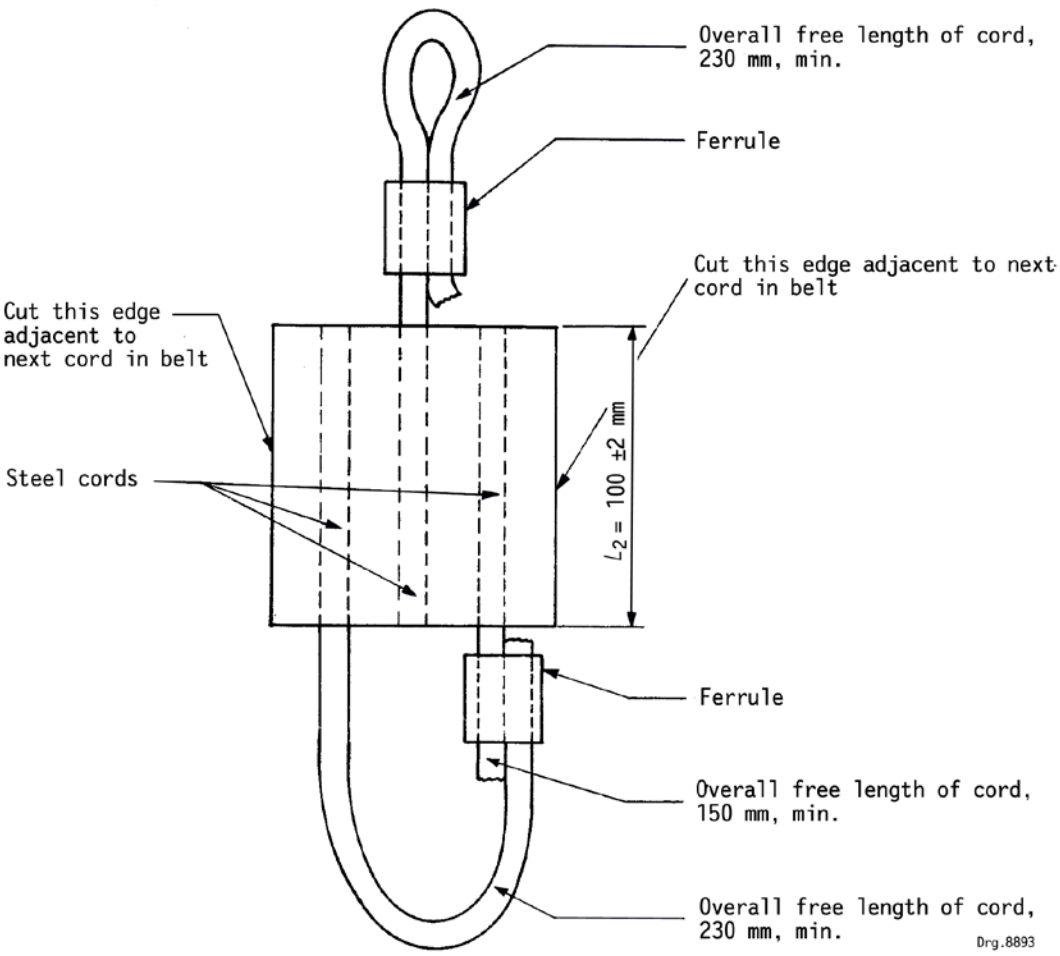


Figure 9 — Test specimen for pull-out force

6.12 Dynamic cord pull-out fatigue resistance

6.12.1 Apparatus

A suitable testing machine which can accommodate the test piece and which is capable of applying a steady cyclic tensile loading is required. The cyclic load ranges from 3,6 % to 36 % of the nominal static pull-out strength for a given cord diameter (see figure 10).

6.12.2 Test specimens

A test piece shall be cut from a full thickness section of the belting containing five cords. The test piece shall be cut to the arrangement shown in figure 8(a) or figure 8(b). The test length (L_2) shall be 100 mm ± 2 mm. The covers may be removed 100 mm from the end of the test piece to facilitate the use of conventional grips.

6.12.3 Procedure

6.12.3.1 Mount the test piece centrally in the jaws of the machine.

6.12.3.2 Steadily apply the cyclic load and release it with a pause at the high and low levels (see figure 10). The time for one completed cycle shall be between 5 s and 10 s.

6.12.3.3 Continue the test until the sample fails or 10 000 cycles are completed, whichever occurs first.

6.12.3.4 Check for compliance with 4.7.1.3.

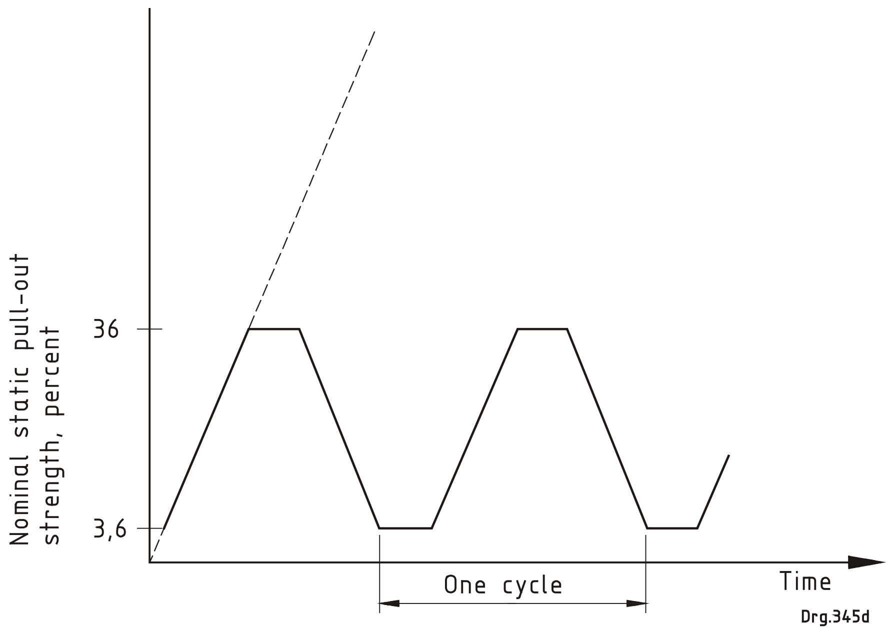


Figure 10 — Typical cyclic loading pattern

6.13 Cord rubber compound penetration test

6.13.1 Apparatus

A measuring apparatus consisting of a clamping device into which the test piece is placed, sealing both ends of a single cord into the test circuit is required. A suitable clamping device is shown in figure 11.

The test circuit includes an air pressure supply, primary and secondary side tubes which can be clamped at each end of the sample, a pressure transducer, pressure gauge and a chart recorder (see figure 12).

The air supply on the inlet side of the test piece is kept under a constant pressure of 100 kPa. The volume of tubes supplying air on the inlet side is approximately 10 times larger than that of those tubes used on the outlet side of the test piece.

6.13.2 Test specimens

The test piece shall be a maximum of 400 mm long, full belt thickness and including at least one cord for its full length (see figure 13). Care should be taken to ensure that the cord to be tested is totally surrounded by the rubber compound.

6.13.3 Procedure

6.13.3.1 Clamp the test piece so that the same cord is sealed into the circuit at each end.

6.13.3.2 Establish a pressure differential of 100 kPa across the test sample and monitor this pressure differential for 60 s. Record the value of the pressure differential for the full 60 s period. The pressure drop in the given time period is a measure of how well the rubber has penetrated through the wire filaments of the steel cord.

Check for compliance with 4.7.1.4.

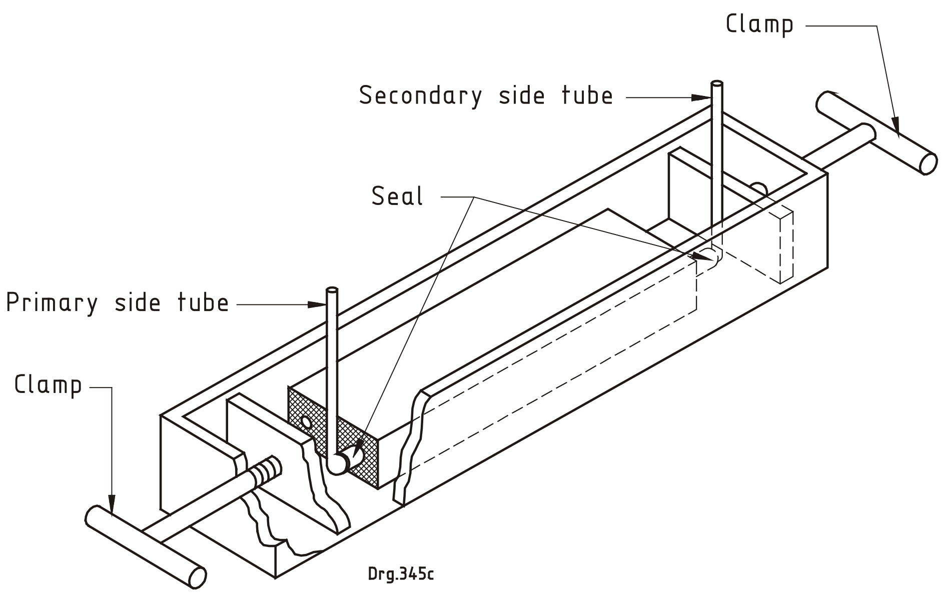


Figure 11 — Typical clamping device

Dimensions in millimetres

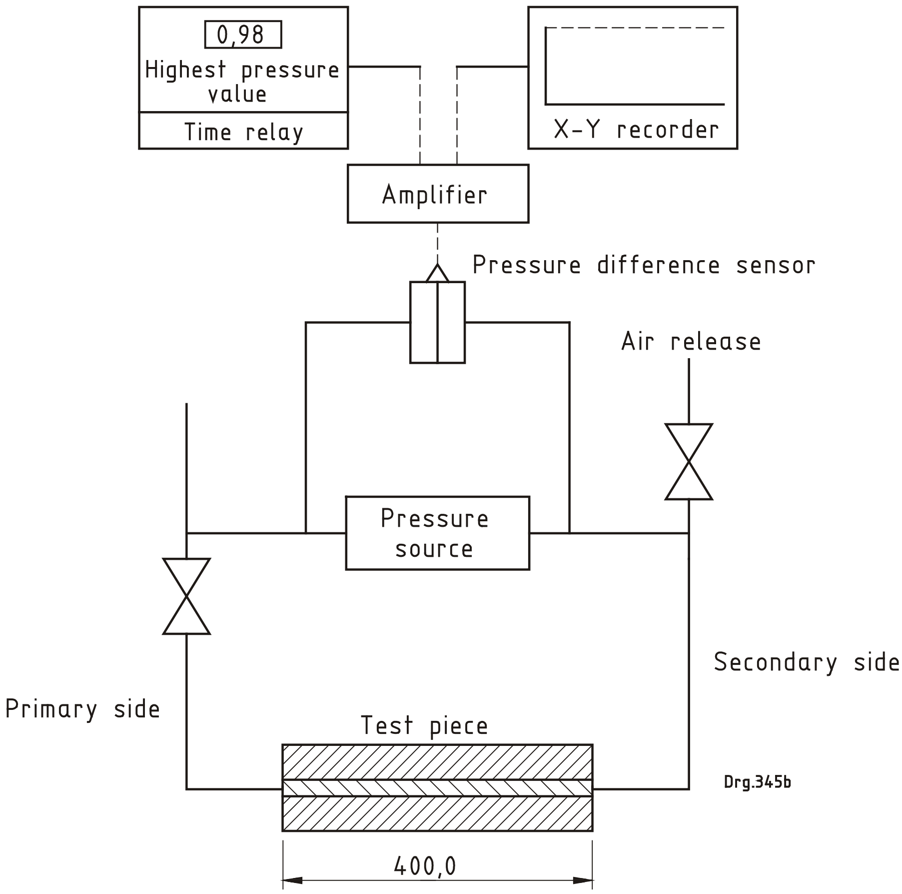


Figure 12 — Typical test circuit for determining cord elastomeric compound penetration

Dimensions in millimetres

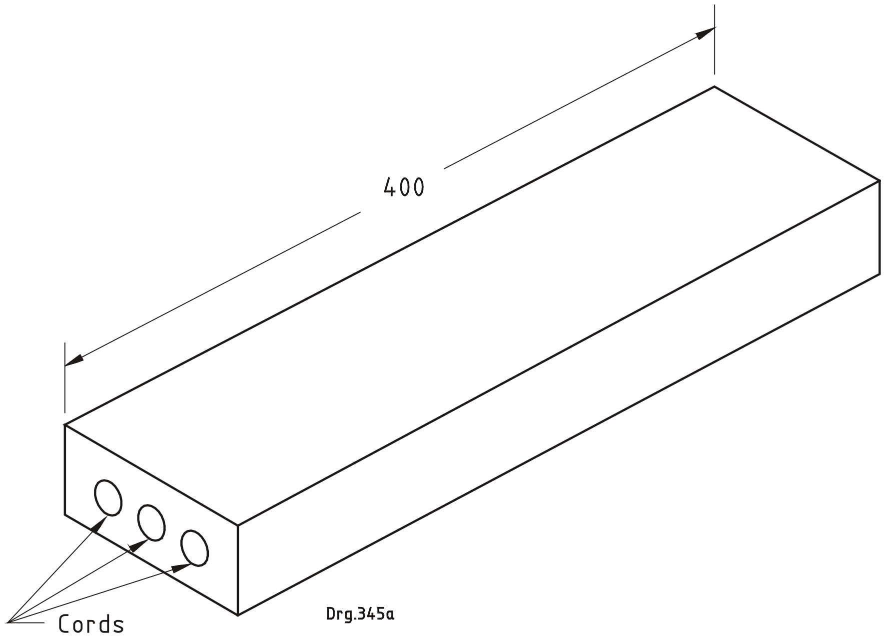


Figure 13 — Test piece with three cords

6.14 Adhesion of secondary belting reinforcement

6.14.1 Apparatus

A suitable tensile testing machine having an autographic recorder is required. The machine shall be capable of exerting a steady rate of strain without interruption and of measuring the test force with an error of not more than ± 2 %. The rate of separation of the jaws of the tensile testing machine shall be 100 mm/min ± 10 mm/min.

6.14.2 Test specimens

Three test pieces 150 mm long and at least 25 mm wide and containing not less than two cords, shall be cut from the belt. The laminate to be tested shall be cut from the plane of the adhering surface to enable it to be stripped from the belt in the testing machine.

6.14.3 Procedure

6.14.3.1 At one end of a specimen, separate a cover from the secondary belting reinforcement for a distance great enough to ensure adequate gripping in the jaws of the testing machine. Measure the width of the test specimen.

6.14.3.2 Mount the test piece in the tensile testing machine and strip the covers from the secondary reinforcement with the force being continuously recorded. From the recording, determine the average stripping force of the test piece and divide by the width of the test piece.

6.14.4 Calculation

From the recording, determine for each specimen the average force required to strip the cover from the secondary reinforcement, calculate the adhesion in kilonewtons per metre of width, and record the average of the three results as the adhesion of the secondary reinforcement in the belting.

6.15 Troughability

6.15.1 Apparatus

6.15.1.1 Clamps

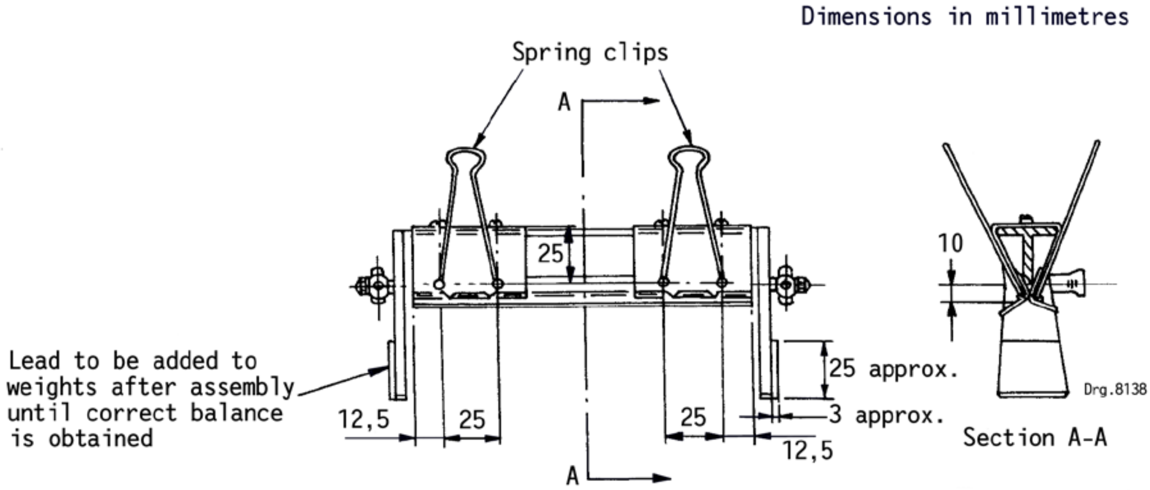
Two clamps (see figure 14) such that

a) each holds an end of the test specimen across a width of at least 140 mm and to a depth into the clamp not exceeding 15 mm,

b) they prevent curvature across the ends of the test specimen,

c) they are balanced about a horizontal axis of rotation, and

d) they permit suspension of the test specimen such that the horizontal axis of rotation of each clamp coincides with a line across the clamped end of the test specimen midway between its top and bottom surfaces.



NOTE This design of clamp is not mandatory but should conform to the requirements of the method.

Figure 14 — Clamp

6.15.1.2 Suspension frame

A suspension frame (see figure 15) that

a) maintains the axes of rotation of the clamps parallel and in the same horizontal plane;

b) permits such free rotation of each clamp that frictional forces are reduced to a negligible value; and

c) can be adjusted to ensure that the suspending forces act through the axes of rotation of the clamps.

6.15.1.3 Measuring device

A measuring device that does not exert such force that a specimen will be deformed, and that is capable of giving readings that are accurate to 0,01 mm.

6.15.1.4 Rule

A steel rule graduated in millimetres.

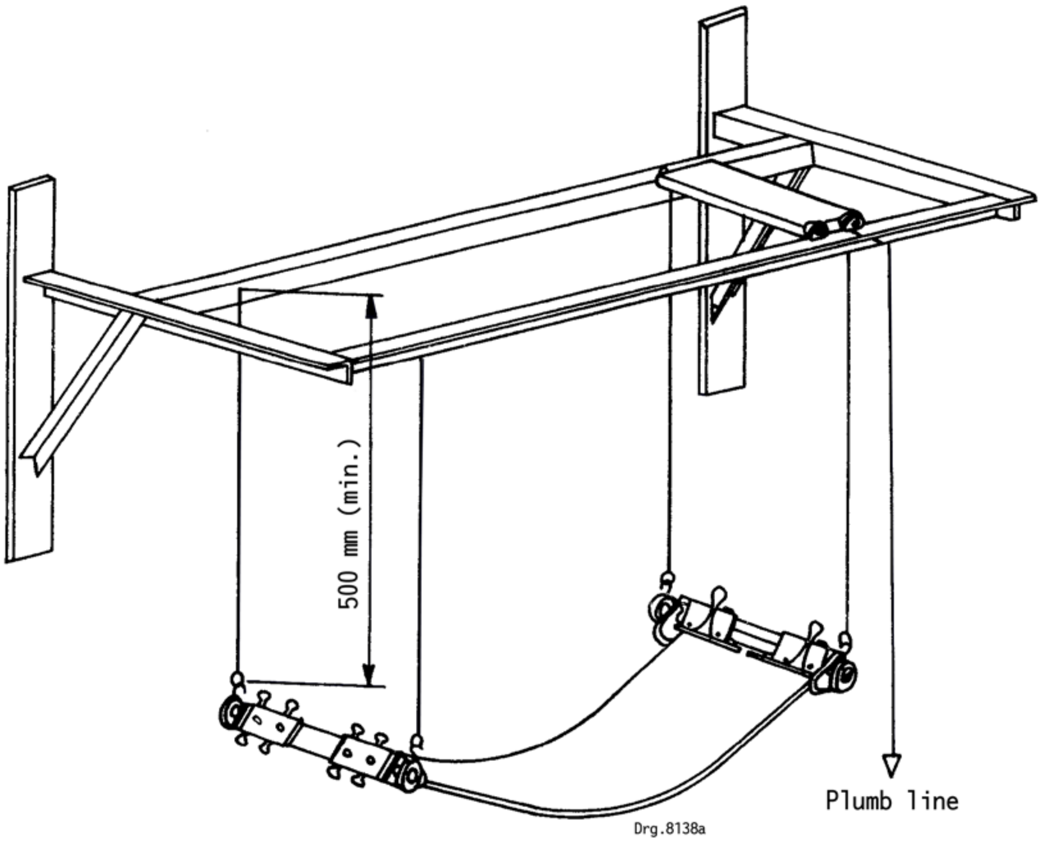


Figure 15 — Apparatus for measuring troughability

6.15.2 Test specimen

From across the full width of the belting, cut one specimen of width 150 mm ± 2 mm. Then place the specimen on a flat surface under standard test conditions (see 3.5) for a period of at least 24 h.

6.15.3 Procedure

Measure the length and thickness of the specimen. With the carrying face of the specimen uppermost and so supporting the specimen along its length or width (as relevant) that it does not sag, clamp its ends in the clamps.

Remove the support and allow the specimen to fall, under its own weight, from the flat to the troughed position, adjusting the apparatus so that the suspending forces act vertically throughout the period of the test. After 5 min, use the measuring device to measure the distances A_1 and A_2 as shown in figure 16.

6.15.4 Calculation

To calculate troughability (T_r), we firstly need to calculate the deflection of the specimen (D).

$$D = A_1 - A_2 + \frac{t}{2} \quad \text{(see figure 16)}$$

where

D	is the deflection of the specimen, in millimetres;
A_1 and A_2	are the distances in 6.15.3, in millimetres; and
t	is the thickness of the specimen, in millimetres.

Then calculate the troughability as follows:

$$T_r = \frac{F}{L}$$

where

T_r is the troughability; and

L is the length of the specimen, in millimetres.

Record the result obtained as the troughability of the belting.

Check for compliance with 4.7.3.

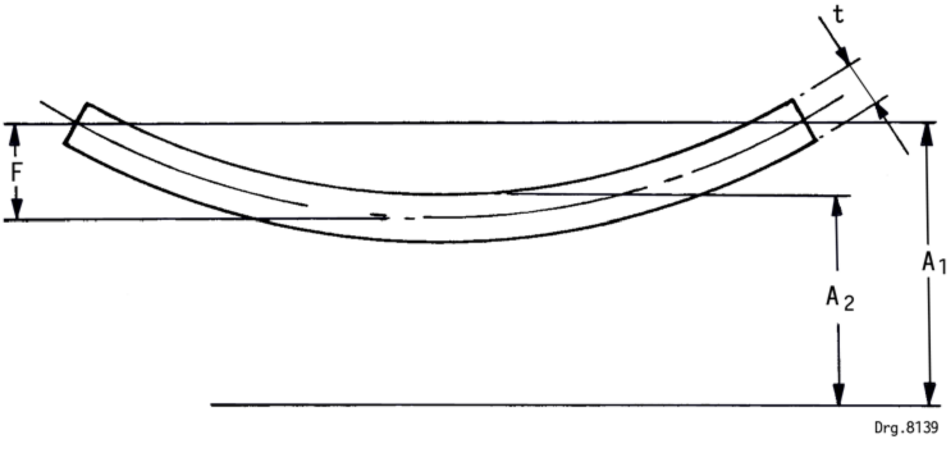


Figure 16 — Reference level for measuring troughability

7 Packing and marking

7.1 Packing

Each length of belting shall be rolled onto a centre core and so packed as to prevent it from being damaged during normal transportation and storage.

7.2 Marking

Belting shall bear, on the bottom cover, the following information, neatly and legibly embossed, with letters, at intervals of no more than 20 m, 50 mm to 100 mm from one edge, parallel to the edge (see figure 17):

a) the standard to which the belting was manufactured;

b) the manufacturer's trade name or the trademark of the product (or both);

c) the class of belting preceded by the letters "St" and the type of secondary reinforcement, where appropriate;

d) the type and thickness of top cover followed by type and thickness of bottom cover;

e) width in millimetres;

f) in the case of type F belting, the words "FIRE-RETARDANT";

g) month and year of manufacture; and

h) a unique manufacturer's ID, serial or roll number.

SANS 1366	**XX**	**St 2000**	**t (N)**	**t (E)**	**2100**	**F**	**10/2005**	**25126**	**P**
Standard to which belt was manufactured	Manufacturer's trade name or trademark (or both)	Class	Top cover thickness and type	Bottom cover thickness and type	Belt width	In the case of F belting	Month/Year of manufacture	Serial No. or ID No.	Roll No.

Figure 17 — Example of marking

Annex A
(normative)

Notes to purchasers

The following requirements shall be specified in tender invitations and in each order or contract:

a) the class of belting (see 4.1);

b) the type (see 4.2);

c) the length(s) required, including any extra length required for testing and splicing (see 4.5.1);

d) the nominal width of the belting (see 4.5.2);

e) the cover thickness (see 4.5.3); and

f) the troughing angle (see 4.7.3).

Annex B
(informative)

Quality verification of steel cord reinforced conveyor belting

When a purchaser requires ongoing verification of steel cord reinforced conveyor belting, it is suggested that, instead of concentrating solely on evaluation of the final product, he also direct his attention to the manufacturer's quality system. In this connection, it should be noted that SANS 9001 covers the provision of an integrated quality system.

Annex C
(informative)

Notes to users and designers

Recommended minimum pulley diameters for use with the classes of belting covered by the standard are given in table C.1. The use of flat faced (non-crowned) pulleys is recommended.

Table C.1 — Recommended minimum pulley diameters

1	2	3	4
Class	**Pulley diameter** mm, min.		
	Type A[a]	**Type B**[b]	**Type C**[c]
St 500 St 630 St 800	500 500 500	400 400 400	315 315 315
St 1 000 St 1 250 St 1 400 St 1 600	800 800 1 000 1 000	630 630 800 800	500 500 630 630
St 2 000 St 2 500 St 3 150	1 000 1 250 1 250	800 1 000 1 000	630 800 800
St 4 000 St 5 000 St 6 300	1 400 1 600 2 000	1 250 1 400 1 600	1 000 1 250 1 400

[a] **Pulley type A**: High tension type driving pulleys, e.g. tandem drive, single drive, head drive, and tripper pulleys; high tension type non-driving pulleys.

[b] **Pulley type B**: Low tension type non-driving pulleys, e.g. tail, take-up, or high tension snub/bend pulleys that have a wrap angle ≤ 30°.

[c] **Pulley type C**: Low tension type non-driving pulleys, e.g. bend, low tension snub that have a wrap angle ≤ 30°.

Annex D
(informative)

Lateral drift (straight running)

The conveyor belting, when running on a correctly aligned conveyor and loaded centrally, should not deviate from the central track by more than +-40 mm, for a belt width up to and including 800 mm, or by more than +-5 % (+- 75 mm max) of the belt width for widths over 800 mm.

Bibliography

ISO 5285, *Conveyor belts – Guidelines to storage and handling*.

SANS 485, *Conveyor belting – Splicing of steel cord reinforced conveyor belting.*

SANS 742/ISO 3*, Preferred numbers – Series of preferred numbers.*

SANS 9001/ISO 9001, *Quality management systems – Requirements*.

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