

INTERNATIONAL STANDARD

ISO
15236-4

First edition
2004-06-15

Steel cord conveyor belts —

Part 4:

Vulcanized belt joints

Courroies transporteuses à câbles d'acier —

Partie 4: Jonctions vulcanisées des courroies



Reference number
ISO 15236-4:2004(E)

© ISO 2004

PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

STANDARDSISO.COM : Click to view the full PDF of ISO 15236-4:2004

© ISO 2004

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

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 15236-4 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).

Throughout the text of this document, read “...this European Standard...” to mean “...this International Standard...”.

ISO 15236 consists of the following parts, under the general title *Steel cord conveyor belts*:

- *Part 1: Design, dimensions and mechanical requirements for conveyor belts for general use*
- *Part 2: Preferred belt types*
- *Part 4: Vulcanized belt joints*

Contents

Page

Foreword	v
1 Scope.....	1
2 Terms and definitions	1
3 Symbols and units	1
4 Types of joints	1
5 Joint material	6
6 Making the joint.....	6
7 Marking the joint.....	7

STANDARDSISO.COM : Click to view the full PDF of ISO 15236-4:2004

Foreword

This document (EN ISO 15236-4:2004) has been prepared by Technical Committee CEN/TC 188 "Conveyor belts", the secretariat of which is held by BSI, in collaboration with Technical Committee ISO/TC 41 "Pulleys and belts (including veebelts)".

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 2004, and conflicting national standards shall be withdrawn at the latest by December 2004.

EN ISO 15236 will consist of the following parts, under the general title *Steel cord conveyor belts*:

- *Part 1: Design, dimensions and mechanical requirements for conveyor belts for general use*
- *Part 2: Preferred belt types*
- *Part 3: Special safety requirements for belts for use in underground applications*
- *Part 4: Vulcanized belt joints*
- *Part 5: Marking*

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

1 Scope

This part of EN ISO 15236 specifies design, dimensions, requirements and marking of vulcanized joints for steel cord conveyor belts.

2 Terms and definitions

For the purposes of this European Standard, the following term and definition applies.

vulcanized joint

area within which the cords from two belt lengths are joined and vulcanized through the surrounding rubber

3 Symbols and units

For the purposes of this European Standard, the symbols and units given in Table 1 apply.

Table 1 — Symbols and units

Symbol	Explanation	Unit
d	Cord diameter	mm
K_N	Nominal breaking strength of the belt	N/mm
K_{Nred}	Reduced breaking strength of the joint	N/mm
l_p	Length of cord end staggering area	mm
l_q	Length of the cord transition area	mm
l_s	Butt end clearance of the cord ends	mm
n_{st}	Number of steps	-
SG	Thickness of rubber between the cords in the joint	mm
SG_{min}	Minimum thickness of rubber between the cords in the joint	mm
t	Pitch	mm
t_{min}	Minimum spacing of the cord in the belt	mm

4 Types of joints

4.1 General

There are two types of joints differing in the way that forces are transferred from one belt length to the other:

a) stepped joints;

— where the forces are transferred by the rubber surrounding the cords.

b) finger joints;

- where the forces are transferred by the rubber surrounding the cords and by the transverse reinforcements. For this type of joint, transverse reinforcement is required.

NOTE 1 Stepped joints offer the highest possible dynamic performance but require a high amount of time, knowledge, and care in their fabrication.

NOTE 2 For both types of joint, the physical properties of the rubber, especially the adhesion to the cords, are of utmost importance for the quality of the joint.

4.2 Stepped joints

4.2.1 Design principles

The cords of the belt ends to be joined are cut free from the cover rubber in the joint area. According to an agreed joint pattern, the cords are cut or separated in steps and cut free from the core rubber where necessary. The cords of both ends are merged into each other, embedded in bonding rubber and covered with cover rubber. After vulcanizing the joint will be able to transmit forces from one belt length to the other.

Unlike joints in conveyor belts with textile reinforcements for which the belt ends are generally cut in a bias, the ends of steel cord belts are cut either in a bias or perpendicular to the belt edge or in a bias for joining.

The number of steps, the length of the joint, the length of the steps and the joint pattern, i.e. the sequence of cuts of the cords, is either specified by the belt manufacturers or is given in company standards or national standards.

In addition to practical experience, the quality of a stepped joint can be evaluated by the calculation of the stresses of the rubber and the cords within the joint or by static and dynamic testing methods.

4.2.2 Rubber gap in the joint

The rubber filling the gap between two adjacent cords from different lengths is strained most and receives the highest stresses. A minimum distance $SG_{\min}$ of the cords within the joint therefore has to be kept, as follows.

$$SG_{\min} \geq 1,2 + (0,1 \times d)$$

4.2.3 Butt end clearance

For cords meeting in the joint, the distance of the butt ends, l_s , shall be approximately $4 \times d$ but not less than $3 \times d$.

4.2.4 Steps

Joints shall be carried out as 1-step, 2-step, 3-step, or 4-step joints, although higher numbers of steps are permitted.

According to the number of steps determined, the cords shall be cut in a sequence repeated throughout the belt width.

4.2.5 Interlaced stepped joint

It is characteristic of this type of joint that it contains a larger number of cords than the belt itself.

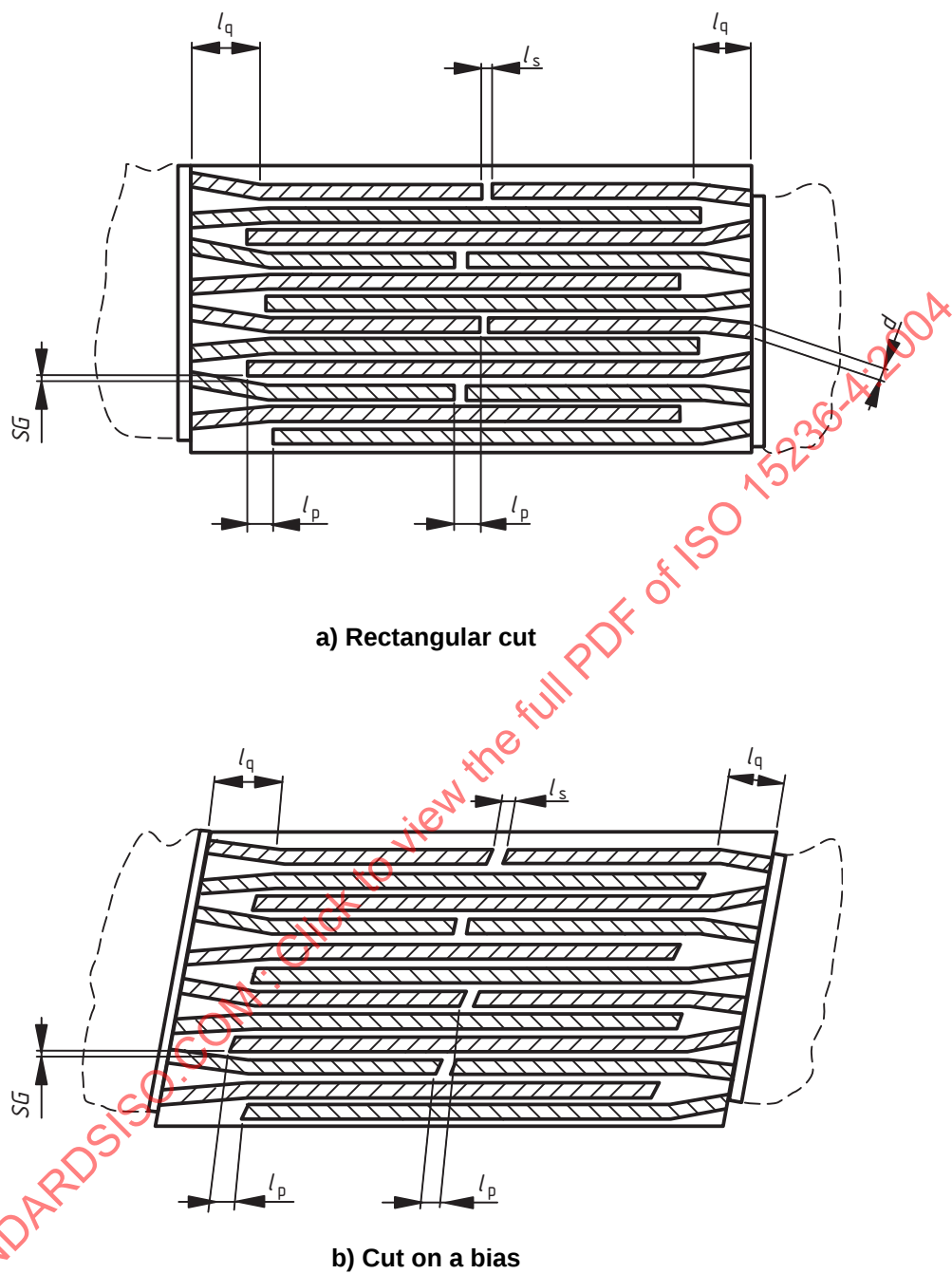
On both sides of the joint, a length, l_q , shall be allowed for transition of the cords, l_q being a function of the cord diameter. Preferred transition lengths of the cords are given in Table 2. Transition lengths shall be not less than 16 x the cord diameter.

Table 2 — Transition length of cords

D (mm)	l_q (mm)
$\geq 6,0$	100
$>6,0 - \leq 8,5$	150
$>8,5 - \leq 10,0$	200
$>10,0 - \leq 11,5$	250

NOTE Cord end staggering where l_p is 50 mm is beneficial.

Part of a 2-step interlaced joint rectangular cut and cut on bias is shown in Figure 1.



Key
See Table 1 for explanation of symbols

Figure 1 — Part of 2-step interlaced joint rectangular cut and cut on a bias

4.2.6 Plain stepped joint

4.2.6.1 Minimum cord spacing in the belt

Plain stepped joints shall contain the same number of cords in the joint as in the belt itself. The minimum cord spacing of the belt $t_{\min}$ shall, therefore, be as follows.

$$t_{\min} = d + SG_{\min}$$

NOTE Smaller spacings will reduce the quality of the joint and should be avoided.

4.2.6.2 Breaking strength of the joint

The actual breaking strength of a joint may be calculated from the number of adhesion areas between the ends of opposite belts.

$$K_{Nred} \geq \frac{n_{st}}{n_{st} + 1} \times K_N$$

4.2.6.3 Cord pattern

Plain stepped joints shall be either “organ pipe joints” or “fir tree joints” as illustrated in Figure 2.

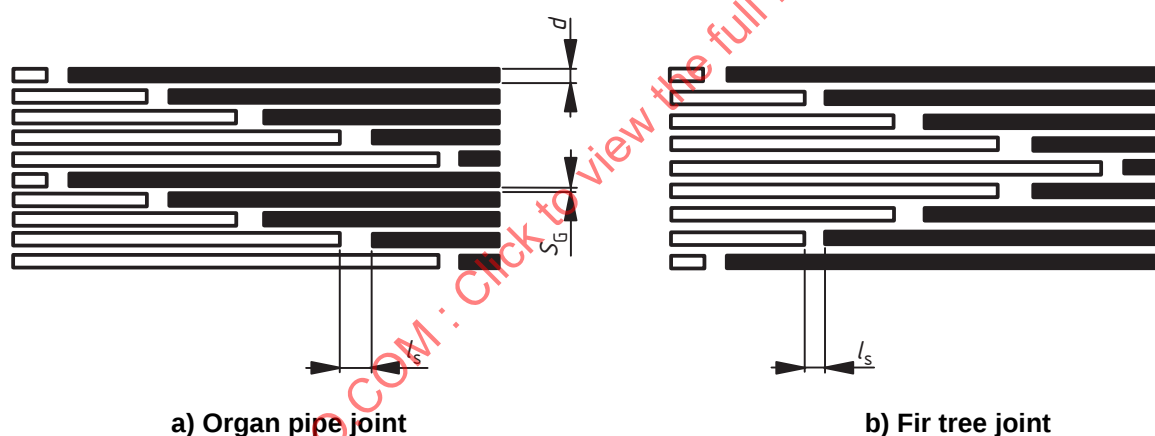


Figure 2 — Parts of typical 4-step plain stepped joints

4.2.7 Transverse reinforcements¹⁾

The peak stresses on the material in the joint can be reduced by transverse reinforcements in the splice, i.e. the stresses are equalized. Transverse reinforcements shall end at least 50 mm from the cover transition area.

1) A calculation shows lower stresses for the “organ pipe” type than for the “fir tree” joint.