

INTERNATIONAL
STANDARD

ISO
3684

Second edition
1990-03-15

**Conveyors belts — Determination of minimum
pulley diameters**

Courroies transporteuses — Détermination des diamètres minimaux des tambours



Reference number
ISO 3684 : 1990 (E)

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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 3684 was prepared by Technical Committee ISO/TC 41, *Pulleys and belts (including veebelts)*.

This second edition cancels and replaces the first edition (ISO 3684: 1976), of which it constitutes a technical revision.

© ISO 1990

All rights reserved. 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 the publisher.

International Organization for Standardization
Case postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

Conveyor belts — Determination of minimum pulley diameters

1 Scope

This International Standard establishes a method of calculating minimum pulley diameters for conveyor belts.

It applies to belts made of rubber or plastics with textile or metal carcasses, of different carcass thickness and different carcass materials, operating at any anticipated belt tension up to, but not exceeding, the maximum belt tension (RMBT).

It does not apply either to belts which have a carcass thickness of more than 20 mm or to those which have intermediate layers of rubber or plastics of more than 0,8 mm thickness between the plies.

Nor does it apply either to heat-resistant belts on conveyors for hot products at temperatures over 100 °C or to belts in service at ambient temperatures under -40 °C.

The use on conveyor belts of pulleys with diameters too small for the carcass construction may lead to premature belt failure.

NOTES

1 The values indicated in this International Standard are minimum values to be used in the absence of information provided by the conveyor belt manufacturer.

2 The calculation of the minimum pulley diameter according to this International Standard is valid for all general applications. For special purposes, the conveyor belt manufacturer may allow smaller pulley diameters. For belts which are not listed in the following tables, consult the manufacturer.

3 In the case of use of pulleys with diameters larger than those corresponding to the minimum diameter calculated for the recommended maximum belt tension, an increase of this maximum tension is not permissible.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to

agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 3: 1973, *Preferred numbers — Series of preferred numbers.*

ISO 583: 1975, *Conveyor belts — Tolerances on total thickness and thickness of covers.*

ISO 1536: 1975, *Continuous mechanical handling equipment for loose bulk materials — Troughed belt conveyors (other than portable conveyors) — Belts.*

ISO 7590: 1988, *Steel cord conveyor belts — Cover thickness measurement.*

3 Definitions

3.1 Belt structure

3.1.1 *thickness of fabric carcass, h_2* : as defined by ISO 583.

3.1.2 *thickness of steel cord carcass, d_2* : as defined by ISO 7590.

3.2 Types of pulley

Figures 1 to 4 show the different types of pulley for conveyor belts.

A: Driving pulleys and pulleys exposed to high belt tension, for example:

- main driving pulley at the head or tail;
- delivery pulleys under full tension;
- loop pulleys in the tripper;
- terminal head pulleys in the case of tail driving, etc.

B: Snub pulleys in the return run under lower tension, for example:

- terminal tail pulleys in the case of head driving;
- terminal head pulleys for downward conveying if the terminal tail pulley is braked;
- snub and bend pulleys in take-up devices.

C: Bend pulleys, for a change of direction of the belts of less than 30°.

3.3 Pulley diameter

pulley diameter: The overall diameter of the pulley, disregarding protective layers made of rubber, ceramic or similar material if they are exposed to wear.

For crowned pulleys, the smallest diameter shall be at least the specified minimum.

4 Pulley diameters

The pulley diameters follow the steps of the R10 (or R20 for 1 400 mm and 1 800 mm) series of preferred numbers given in ISO 3 (see table 1).

Table 1 — Pulley diameters

Dimensions in millimetres

| | |
|-----|---------|
| 100 | 630 |
| 125 | 800 |
| 160 | 1 000 |
| 200 | 1 250 |
| 250 | (1 400) |
| 315 | 1 600 |
| 400 | (1 800) |
| 500 | 2 000 |

This table includes, in particular, all the values fixed by ISO 1536.

5 Determination of the recommended minimum diameter

5.1 Formula

The pulley diameter, *D*, in millimetres, is given by the formula

$$D = e \times C$$

where

- e* is the thickness of the carcass, in millimetres;
- C* is the factor for the carcass material, from table 2.

Table 2 — Factor *C*

| Carcass material | <i>C</i> |
|------------------|----------|
| Cotton | 80 |
| Polyamide | 90 |
| Cotton/polyamide | 90 |
| Cotton/polyester | 98 |
| Polyester | 108 |
| Rayon | 118 |
| Steel cord | 145 |

The pulley diameters calculated using this formula shall be rounded up to the next larger standard pulley diameter (R10 or R20 series of preferred numbers according to table 1).

5.2 Influence of the type of pulley

In order to take the type of pulley into account, it is possible to choose smaller standard pulley diameters from the series of preferred numbers according to table 3.

Table 3 — Diameters according to pulley type

| Type of pulley (see 3.2) | Pulley diameter |
|--------------------------|---|
| A | Standard pulley diameter according to 5.1 |
| B | One step lower in the R10 series of standard pulley diameters than the diameter for type of pulley A (but see 5.4.1) |
| C | Two steps lower in the R10 series of standard pulley diameters than the diameter for type of pulley A (but see 5.4.2) |

5.3 Influence of belt tension

In order to take the effect of belt tension (as a percentage of the recommended maximum belt tension, RMBT) into account, it is possible to choose smaller standard pulley diameters from the series of preferred numbers according to table 4.

Table 4 — Diameters according to belt tension

| Percentage of the recommended maximum belt tension used | Pulley diameter |
|---|--|
| over 60 % up to 100 % of RMBT | Standard pulley diameter according to 5.1 |
| over 30 % up to 60 % of RMBT | One step lower in the R10 series of standard pulley diameters than the pulley diameters for "60 % up to 100 %" |
| up to 30 % of RMBT | Two steps lower in the R10 series of standard pulley diameters than the pulley diameter for "60 % up to 100 %" (but see 5.4.1 and 5.4.2) |

5.4 Combination of influences and limitations

The possibilities for reducing the pulley diameters because of the influence of the type of pulley according to 5.2, and the belt tension according to 5.3, may be considered at the same time. However, pulley diameters which are too small shall be avoided. For this reason, the following limitations shall be observed.

5.4.1 No pulley of type B for a conveyor belt shall have a diameter smaller than two steps in the R10 series of standard

diameters below that which results from 5.1 (pulley type A at 60 % to 100 % of RMBT).

5.4.2 No pulley of type C for a conveyor belt shall have a diameter smaller than three steps in the R10 series of standard diameters below that which results from 5.1 (pulley type A at 60 % to 100 % of RMBT).

For example:

Table 5 — Pulley diameters

Dimensions in millimetres

| Percentage of the recommended maximum belt tension used | Pulley types | | |
|---|--------------|-----|-----|
| | A | B | C |
| over 60 % up to 100 % of RMBT | 1 000 | 800 | 630 |
| over 30 % up to 60 % of RMBT | 800 | 630 | 500 |
| up to 30 % of RMBT | 630 | 630 | 500 |

6 Summary

In table 6, the minimum pulley diameters have been calculated in accordance with clause 5, for different carcass thicknesses and materials, for different types of pulleys and for different belt tensions. The table does not constitute a limitation on larger pulley diameters, which may result in longer service from the belting used.

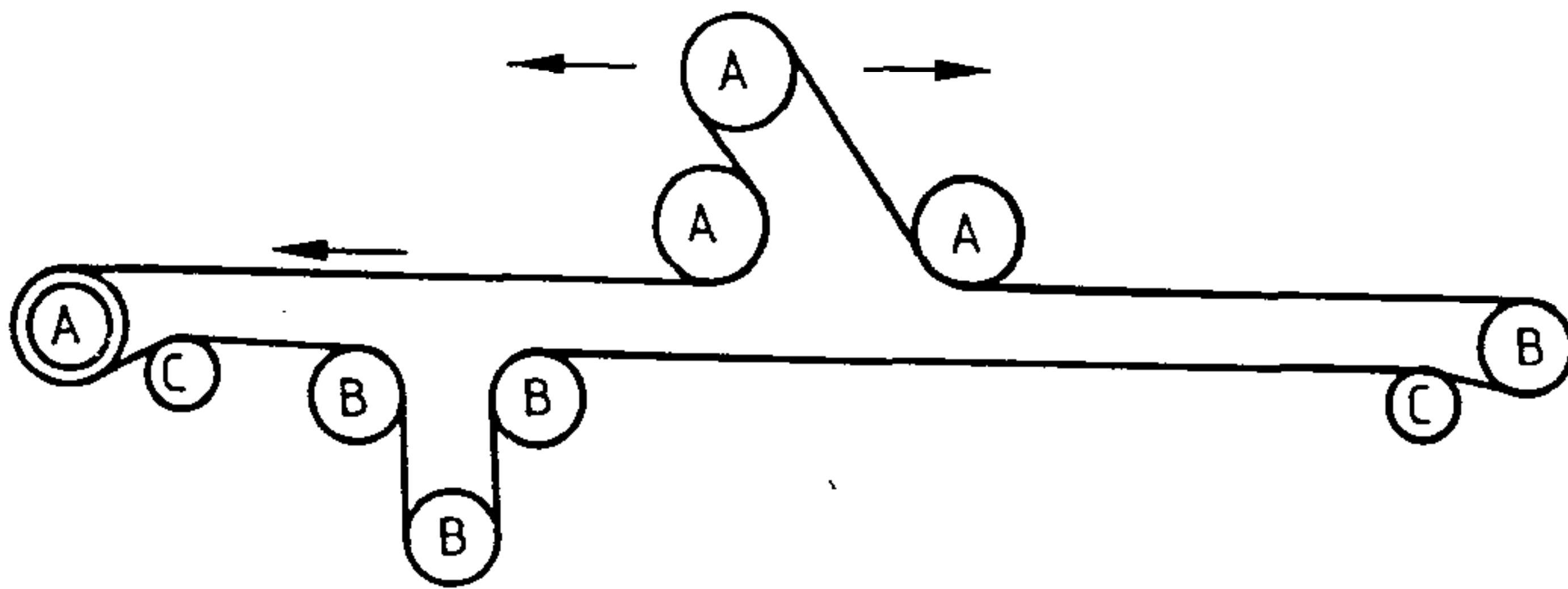


Figure 1

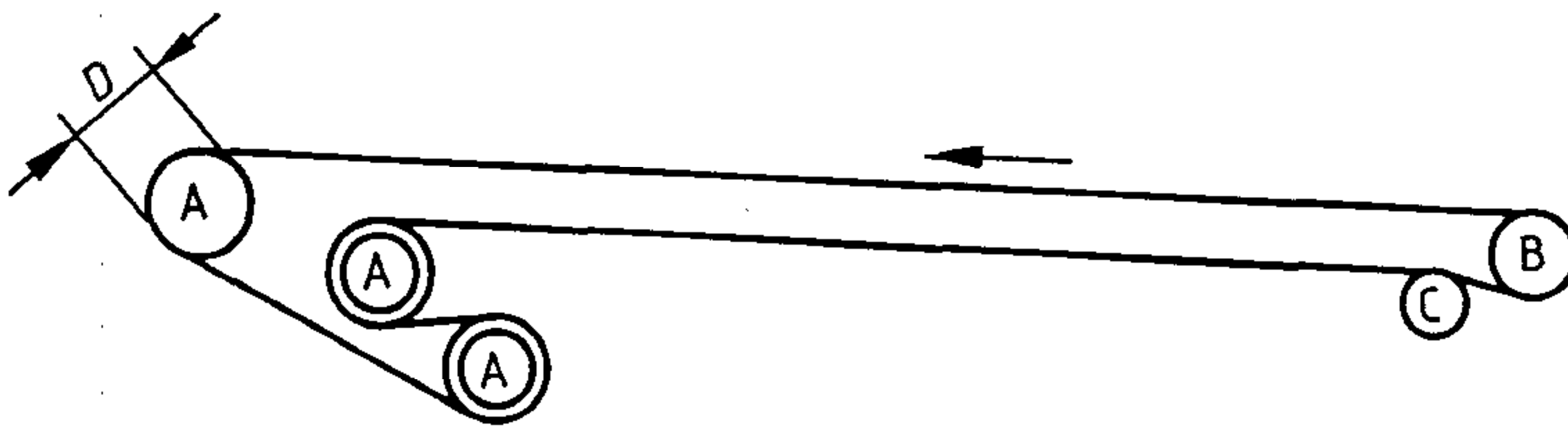


Figure 2

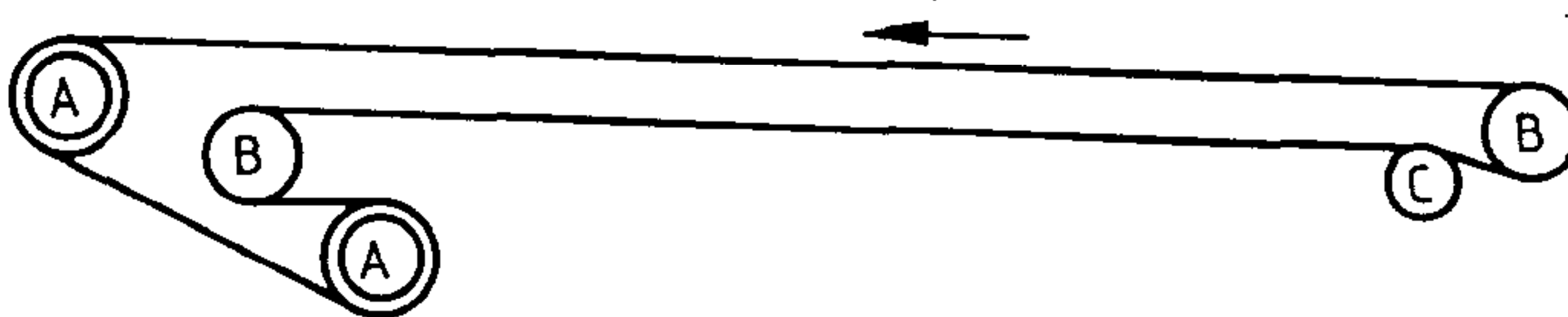


Figure 3

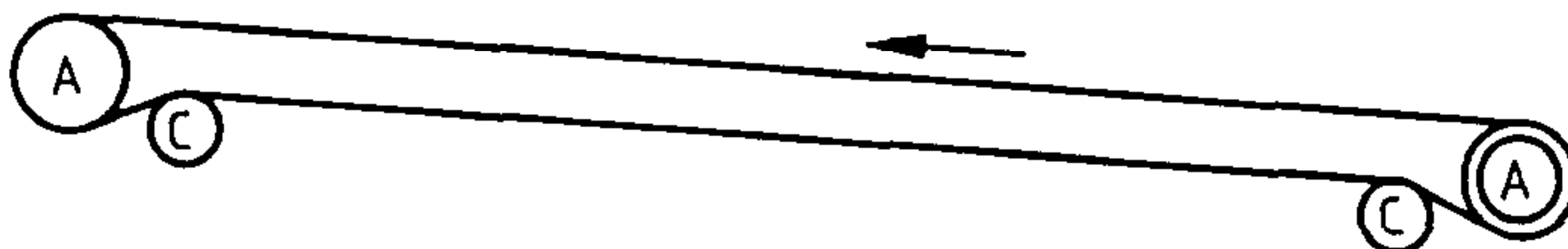


Figure 4

⊙ = Driving pulley

○ = Non-driving pulley

Table 6 — Summary

Dimensions in millimetres

| | | Material of the warp | | | | | | | | | | | | Percentage of the RMBT used | | | | | | | | | | | |
|------|------|------------------------------|------|------|--------------------------------|------|------|------------------|------|------|-----------|------|------|-----------------------------|------|------|------------|------|-------|-----------------------|-------|----------------------|-------|------------|-------|
| | | Cotton | | | Polyamide and cotton/polyamide | | | Cotton/polyester | | | Polyester | | | Rayon | | | Steel cord | | | Types of pulley | | | | | |
| | | C = 80 | | | C = 90 | | | C = 98 | | | C = 108 | | | C = 118 | | | C = 145 | | | over 60 % up to 100 % | | over 30 % up to 60 % | | up to 30 % | |
| | | Recommended minimum diameter | | | | | | | | | | | | | | | | | | | | | | | |
| | | Carcass thickness | | | | | | | | | | | | | | | | | | | | | | | |
| from | to | from | to | from | to | from | to | from | to | from | to | from | to | from | to | from | to | from | to | A | B | C | A | B | C |
| 1,3 | 1,2 | 1,1 | 1,1 | 1,1 | 1,2 | 1,1 | 1,2 | 1,1 | 1,2 | 1,1 | 1,2 | 1,1 | 1,2 | 1,1 | 1,2 | 1,1 | 1,2 | 1,1 | 1,2 | 100 | 100 | 100 | 100 | 100 | 100 |
| 1,6 | 1,4 | 1,3 | 1,3 | 1,3 | 1,6 | 1,3 | 1,6 | 1,3 | 1,6 | 1,3 | 1,6 | 1,3 | 1,6 | 1,3 | 1,6 | 1,3 | 1,6 | 1,3 | 1,6 | 125 | 125 | 125 | 125 | 125 | 100 |
| 2,1 | 1,8 | 2,2 | 1,7 | 2 | 1,7 | 2 | 1,7 | 2 | 1,5 | 1,8 | 1,4 | 1,6 | 1,4 | 1,6 | 1,4 | 1,6 | 1,4 | 1,6 | 200 | 200 | 200 | 200 | 200 | 125 | 100 |
| 2,6 | 2,3 | 2,7 | 2,1 | 2,5 | 2,3 | 2,1 | 2,5 | 2,3 | 1,9 | 2,3 | 1,7 | 2,1 | 1,7 | 2,1 | 1,7 | 2,1 | 1,7 | 2,1 | 250 | 250 | 250 | 250 | 250 | 160 | 125 |
| 3,2 | 2,8 | 3,5 | 2,6 | 3,2 | 2,9 | 2,6 | 3,2 | 2,9 | 2,4 | 2,9 | 2,2 | 2,6 | 2,2 | 2,6 | 2,2 | 2,6 | 2,2 | 2,6 | 315 | 315 | 315 | 315 | 315 | 200 | 160 |
| 4 | 3,6 | 4,4 | 3,3 | 4 | 3,7 | 3,3 | 4 | 3,7 | 3 | 3,7 | 2,7 | 3,3 | 2,2 | 3,3 | 2,2 | 3,3 | 2,2 | 3,3 | 400 | 400 | 400 | 400 | 400 | 250 | 200 |
| 5,1 | 4,5 | 5,5 | 4,1 | 5,1 | 4,6 | 4,1 | 5,1 | 4,6 | 3,8 | 4,6 | 3,4 | 4,2 | 2,8 | 4,2 | 2,8 | 4,2 | 2,8 | 4,2 | 500 | 500 | 500 | 500 | 500 | 315 | 250 |
| 6,3 | 5,6 | 7 | 5,2 | 6,4 | 5,8 | 5,2 | 6,4 | 5,8 | 4,7 | 5,8 | 4,3 | 5,3 | 3,5 | 5,3 | 3,5 | 5,3 | 3,5 | 5,3 | 630 | 630 | 630 | 630 | 630 | 400 | 315 |
| 7,9 | 7,1 | 8,8 | 6,5 | 8,1 | 7,4 | 6,5 | 8,1 | 7,4 | 5,9 | 7,4 | 5,4 | 6,7 | 4,4 | 6,7 | 4,4 | 6,7 | 4,4 | 6,7 | 800 | 800 | 800 | 800 | 800 | 500 | 400 |
| 10,1 | 8,9 | 11,1 | 8,2 | 10,2 | 9,2 | 8,2 | 10,2 | 9,2 | 7,5 | 9,2 | 6,8 | 8,4 | 5,6 | 8,4 | 5,6 | 8,4 | 5,6 | 8,4 | 1 000 | 1 000 | 1 000 | 1 000 | 1 000 | 630 | 500 |
| 12,6 | 11,2 | 13,8 | 10,3 | 12,7 | 11,5 | 10,3 | 12,7 | 11,5 | 9,3 | 11,5 | 8,5 | 10,5 | 7 | 10,5 | 7 | 10,5 | 7 | 10,5 | 1 250 | 1 250 | 1 250 | 1 250 | 1 250 | 800 | 630 |
| 15,7 | 13,9 | 15,5 | 12,8 | 14,2 | 12,9 | 12,8 | 14,2 | 12,9 | 11,6 | 12,9 | 10,6 | 11,8 | 8,7 | 11,8 | 8,7 | 11,8 | 8,7 | 11,8 | 1 400 | 1 400 | 1 400 | 1 400 | 1 400 | 1 000 | 800 |
| 17,6 | 15,6 | 17,7 | 14,3 | 16,3 | 14,8 | 14,3 | 16,3 | 14,8 | 13 | 14,8 | 11,9 | 13,5 | 9,7 | 13,5 | 9,7 | 13,5 | 9,7 | 13,5 | 1 600 | 1 600 | 1 600 | 1 600 | 1 600 | 1 000 | 800 |
| 20 | 17,8 | 20 | 16,4 | 18,3 | 16,6 | 16,4 | 18,3 | 16,6 | 14,9 | 16,6 | 13,6 | 15,2 | 11,1 | 15,2 | 11,1 | 15,2 | 11,1 | 15,2 | 1 800 | 1 800 | 1 800 | 1 800 | 1 800 | 1 250 | 1 000 |
| | | | 18,4 | 20 | 18,5 | 18,4 | 20 | 18,5 | 16,7 | 18,5 | 15,3 | 16,9 | 12,5 | 16,9 | 12,5 | 16,9 | 12,5 | 16,9 | 2 000 | 2 000 | 2 000 | 2 000 | 2 000 | 1 250 | 1 000 |

Example of reading: Carcass belt with polyester warp of 4 mm thickness, working on a driving pulley (type A) at 75 % of RMBT: recommended minimum diameter = 500 mm.

ISO 3684 : 1990 (E)

UDC 621.85.051 : 621.867.2

Descriptors : conveyors, belt conveyors, belts, conveyor belts, pulleys, dimensions, diameters.

Price based on 5 pages
