
**Belt drives — Pulleys and V-ribbed
belts for the automotive industry —
PK profile: Dimensions**

*Transmissions par courroies — Poulies et courroies striées pour la
construction automobile — Profil PK: Dimensions*





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Contents

Page

| | |
|--|-----------|
| Foreword | iv |
| Introduction | v |
| 1 Scope | 1 |
| 2 Normative references | 1 |
| 3 Terms and definitions | 1 |
| 4 Symbols | 1 |
| 5 Pulleys | 2 |
| 5.1 Groove dimensions and tolerances | 2 |
| 5.2 Minimum effective diameter | 4 |
| 5.3 Tolerances on finished pulley | 4 |
| 5.3.1 Checking conditions | 4 |
| 5.3.2 Groove-to-groove diameter tolerances | 5 |
| 5.3.3 Radial and axial circular run-out | 5 |
| 5.3.4 Diameter over balls | 5 |
| 5.3.5 Groove finish | 5 |
| 5.4 Pitch diameter, d_p | 5 |
| 5.5 Designation of pulleys | 5 |
| 6 Belts | 6 |
| 6.1 Belt dimensions | 6 |
| 6.2 Measurement of the effective belt length | 8 |
| 6.2.1 Elastic belt | 8 |
| 6.2.2 Measuring fixture | 8 |
| 6.2.3 Measuring force | 8 |
| 6.2.4 Procedure | 8 |
| 6.3 Designation of belts | 9 |
| Bibliography | 10 |

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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 41, *Pulleys and belts (including veebelts)*, Subcommittee SC 1, *Friction*.

This third edition cancels and replaces the second edition (ISO 9981:1998), which has been technically revised. The main changes compared to the previous edition are as follows:

- the normative references list has been updated;
- clarification has been made where the standard is not for elastic belts;
- [5.3.5](#) has been revised to reference ISO 254 for pulley roughness;
- the current roughness values have been removed;
- the maximum pulley groove radius ([Table 2](#)) has been specified.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

A V-ribbed belt drive is composed of an endless belt with a longitudinally ribbed traction surface which engages and grips, by friction, pulley grooves of similar shape. The belt ribbed surface fits the pulley grooves to make nearly total contact.

Belt drives — Pulleys and V-ribbed belts for the automotive industry — PK profile: Dimensions

1 Scope

This document specifies the principal dimensional characteristics of V-ribbed pulley groove profiles, together with the corresponding endless V-ribbed belts of PK profile which are used predominantly for automotive accessory drive applications.

This document does not apply to the complete array of V-ribbed belts and pulleys of PH, PJ, PK, PL and PM profile for industrial and other non-automotive applications which are covered by ISO 9982. PK belt profile dimensions and tolerances are the same in both International Standards.

[6.2](#) and [6.3](#) of this document do not apply to elastic belts.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

4 Symbols

For the purpose of this document, the symbols given in [Table 1](#) apply.

Table 1 — Symbols

| Symbol | Designation | Unit |
|------------|--|------|
| b | nominal width of the belt | mm |
| b_e | effective line differential | mm |
| d_B | checking ball or rod diameter | mm |
| d_e | effective diameter | mm |
| d_o | outer diameter | mm |
| d_p | pitch diameter | mm |
| E | centre distance between the pulleys | mm |
| E_{\max} | maximum centre distance between the pulleys | mm |
| E_{\min} | minimum centre distance between the pulleys | mm |
| e | groove pitch | mm |
| F | measuring force per rib | N |
| f | distance between the outside of the rim and the axis of the first groove | mm |

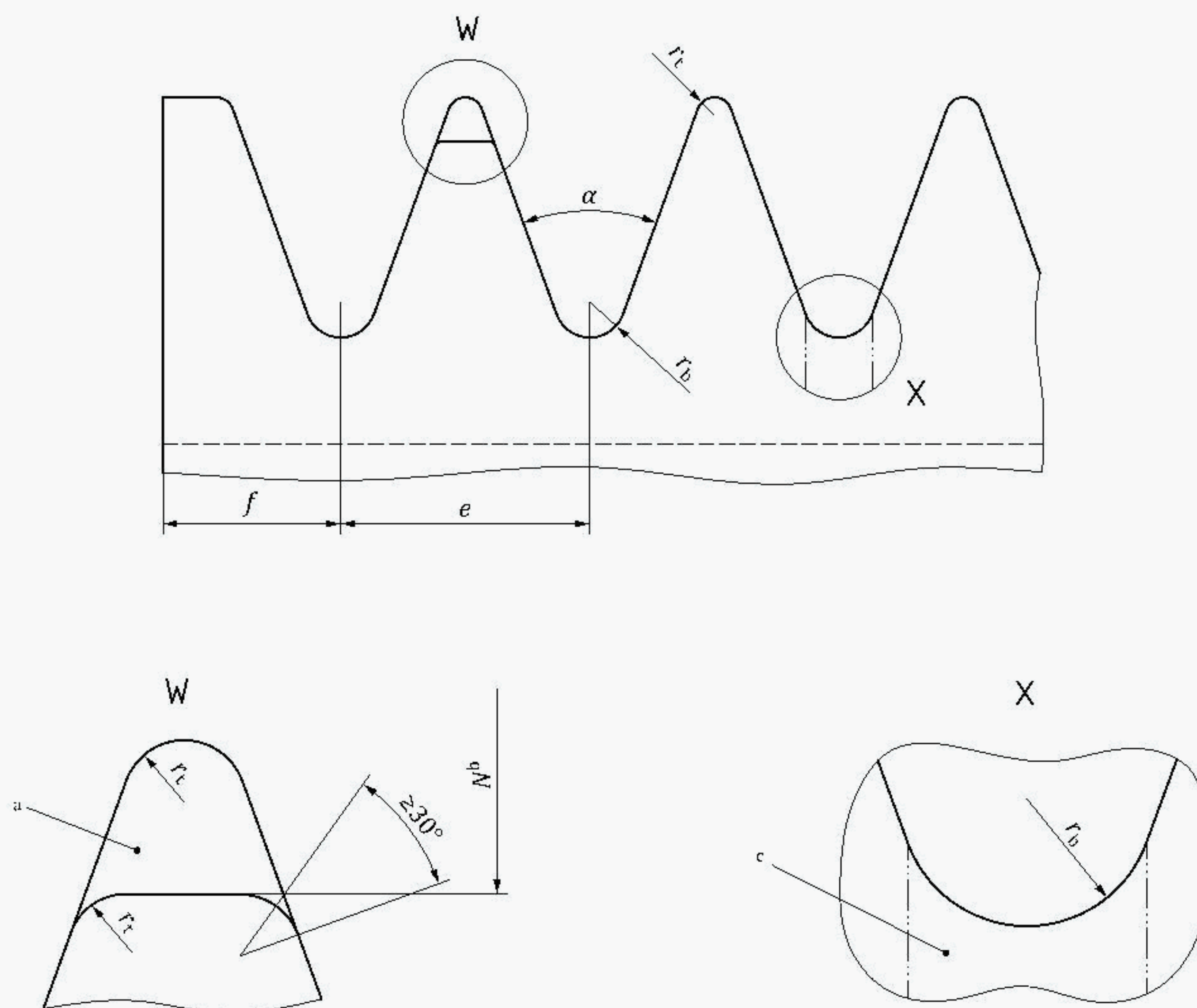
Table 1 (continued)

| Symbol | Designation | Unit |
|----------|---|---------------|
| h | belt height | mm |
| K | diameter over balls or rods | mm |
| L_e | effective length of the belt | mm |
| N | differential between diameter over balls or rods, K , and outer diameter, d_o (see Figure 2) | mm |
| n | number of ribs | — |
| p_b | rib pitch | mm |
| Ra | surface roughness | μm |
| r_b | groove radius | mm |
| r_t | transitional radius | mm |
| U_e | pulley effective circumference (at level of effective diameter) | mm |
| x | position of the ball or rod (see Figure 2) | mm |
| α | groove angle | ° |

5 Pulleys

5.1 Groove dimensions and tolerances

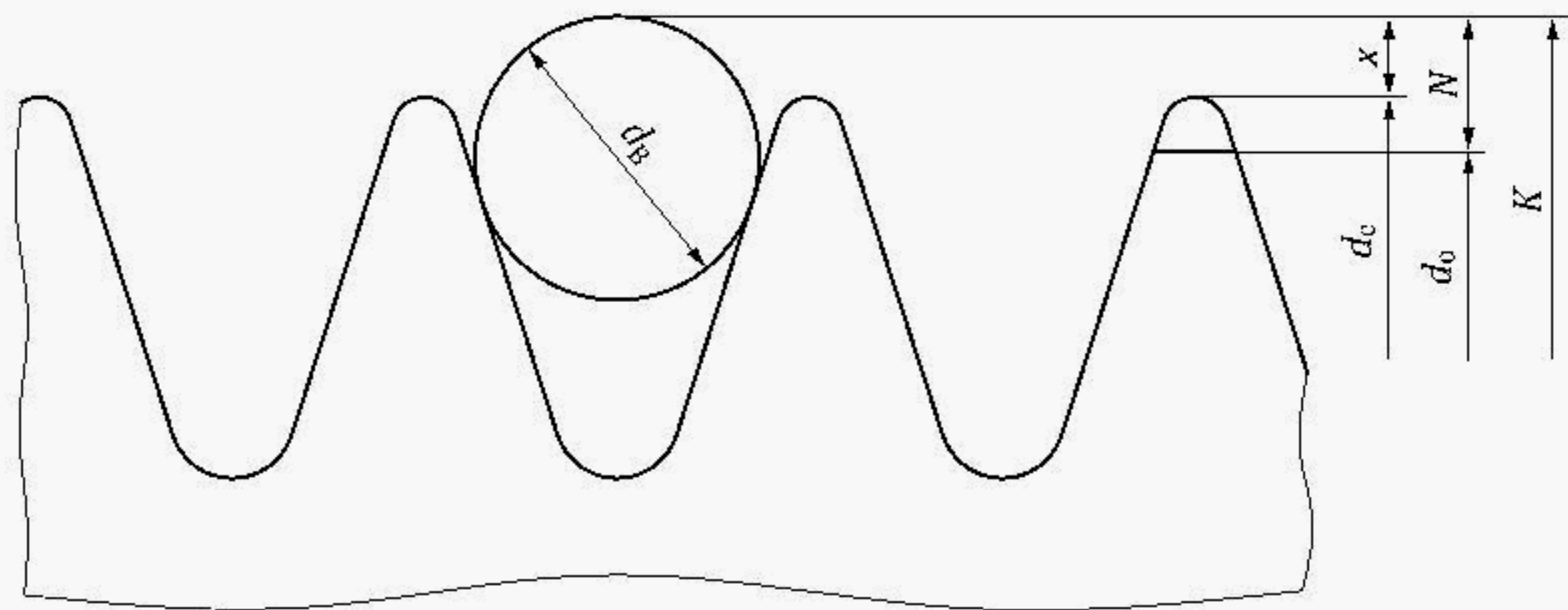
The groove dimensions of PK pulleys are shown in [Figures 1](#) and [2](#), and given in [Table 2](#).



- a The actual configuration of the tip profile may lie anywhere between the maximum and minimum indicated. Any configuration shall have a transitional radius r_t corresponding to a 30° minimum arc tangent to the groove sidewall.
- b See [Figure 2](#).
- c The configuration of the groove bottom below r_b is optional.

NOTE View W represents the pulley tip profile and view X represents the pulley groove bottom.

Figure 1 — Cross-section of pulley grooves



- Key**
- d_e effective diameter
 - d_o outer diameter
 - K diameter over balls or rods
 - d_B checking ball or rod diameter

Figure 2 — Pulley diameters

Table 2 — Dimensions of PK pulley grooves

| Dimension | Tolerance | Value | Unit |
|---|-------------------|-------|------|
| Groove pitch, e | $\pm 0,05^{a,b}$ | 3,56 | mm |
| Groove angle, α^c , for measuring | $\pm 0^\circ 15'$ | 40 | ° |
| Groove angle, α^c , for testing and actual use | $\pm 1^\circ$ | 40 | ° |
| r_t | $+0,18$ 0 | 0,25 | mm |
| r_b | max. | 0,5 | mm |
| Checking ball or rod diameter, d_B | $\pm 0,01$ | 2,5 | mm |
| $2x$ | nom. | 0,99 | mm |
| $2N^d$ | max. | 1,68 | mm |
| f | min. | 2,5 | mm |

^a The tolerance on e applies to the distance between the axes of two consecutive grooves.

^b The sum of all deviations from the nominal value e for all grooves in any one pulley shall not exceed $\pm 0,3$.

^c The centreline of the groove shall make an angle of $90^\circ \pm 0,5^\circ$ with the axis of the pulley.

^d N is not related to the nominal diameter of the pulley but is measured from the actual ride position of the ball or rod in the pulley.

5.2 Minimum effective diameter

The minimum recommended effective diameter, d_e , for PK pulleys is 45 mm.

5.3 Tolerances on finished pulley

5.3.1 Checking conditions

Profile, diameter and run-out tolerances shall be checked on the finished pulley without surface coating.

5.3.2 Groove-to-groove diameter tolerances

The variation in diameters between the grooves in any one pulley shall not exceed 0,15 mm. This variation is obtained by comparing the diameters over balls or rods.

5.3.3 Radial and axial circular run-out

Radial and axial circular run-outs shall not exceed 0,25 mm full indicator movement (FIM). Run-out in the two directions is measured separately with a ball mounted under spring pressure to ensure contact with the groove as the pulley is rotated.

5.3.4 Diameter over balls

The tolerances on the diameters over balls, K , shall not exceed $\pm 0,6$ mm.

5.3.5 Groove finish

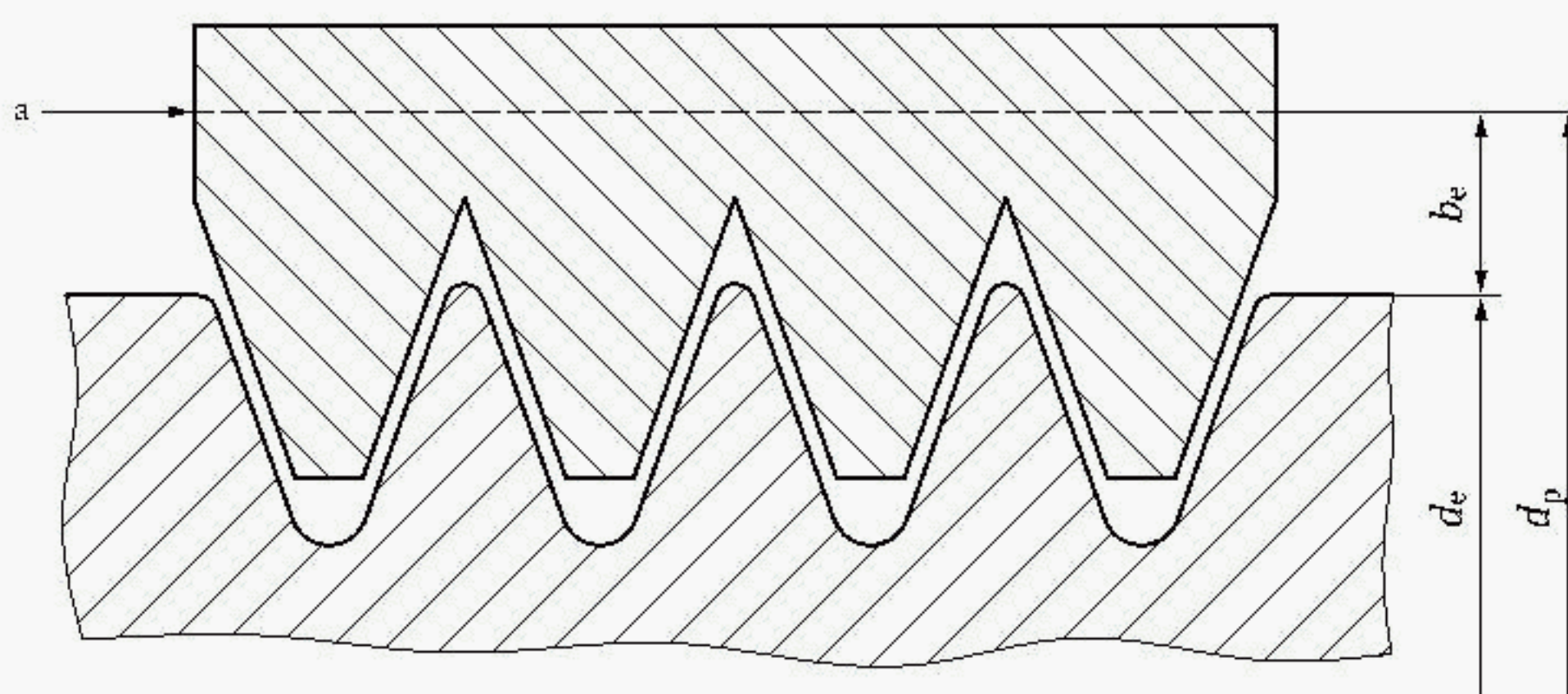
The pulley grooves shall have a surface roughness $Ra \leq 3,2$ μm . See ISO 254 and ISO 4287 for definitions and the method of measurement.

5.4 Pitch diameter, d_p

The fit of a V-ribbed belt in the corresponding pulley is shown in [Figure 3](#). The true pitch diameter of a V-ribbed pulley is slightly larger than the effective diameter and its exact value is determined with the particular belt being used.

A nominal value of the effective line differential, b_e , of 2 mm may be used to calculate the speed ratio. If more precision is required, the belt manufacturer should be consulted.

Further information is given in the ISO 8370 series.



a Position of the pitch zone.

Figure 3 — Determination of pitch diameter

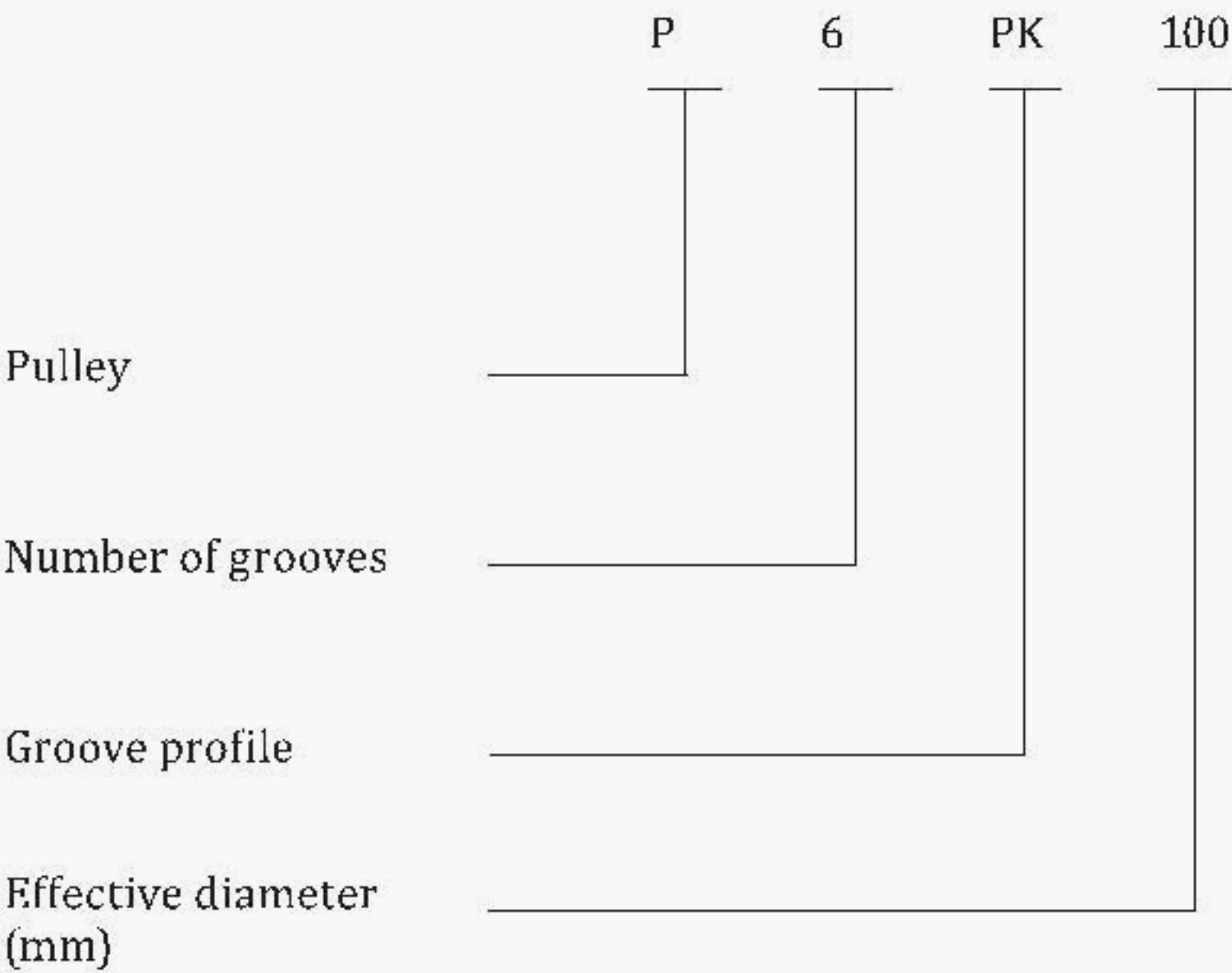
5.5 Designation of pulleys

A V-ribbed pulley for the automotive industry is characterized by the number of grooves, the profile and the effective diameter. It is designated by a series of numbers and letters as follows:

- a) the first letter "P" means "Pulley";
- b) the first set of numbers indicates the number of grooves;

- c) the second set of letters indicates the groove profile;
- d) the second set of numbers indicates the effective diameter, in millimetres.

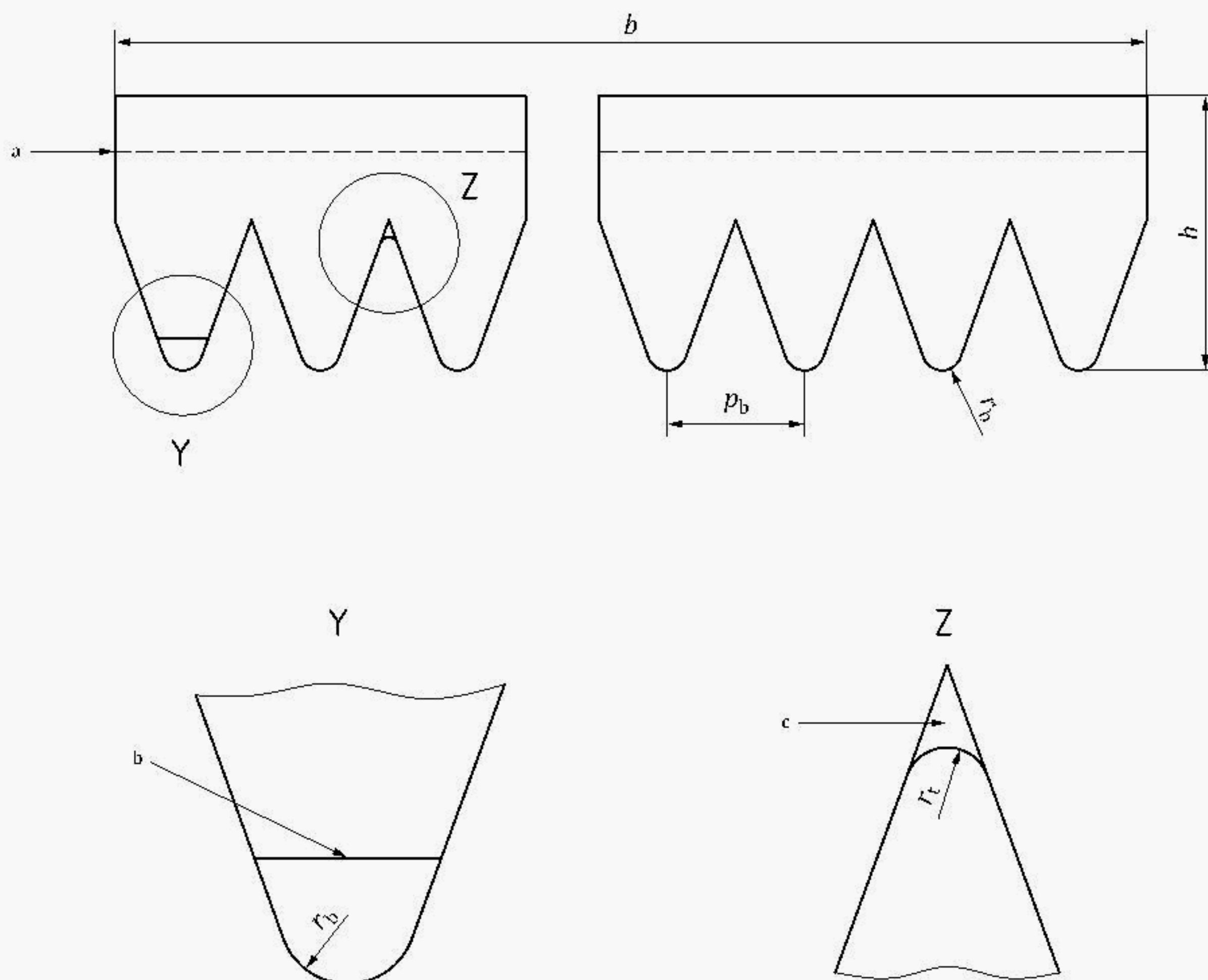
EXAMPLE



6 Belts

6.1 Belt dimensions

The dimensions of the PK belts are shown on [Figure 4](#) and given in [Table 3](#).



- a Position of the pitch zone.
- b The flat belt tip is optional.
- c The configuration of the belt groove bottom may lie anywhere between the maximum and the minimum indicated.

NOTE 1 View Y represents the belt rib tip and view Z represents the belt groove bottom.

NOTE 2 Nominal width of the belt $b = n \times p_b$, where n is the number of ribs.

Figure 4 — Cross-section of belt

Table 3 — PK belt dimensions

| Dimension | Tolerance | Value | Unit |
|--|-----------|--------|------|
| Rib pitch, p_b | — | 3,56 | mm |
| r_b | min. | 0,5 | mm |
| r_t | max. | 0,25 | mm |
| Belt height, h | \approx | 4 to 6 | mm |
| NOTE Rib pitch and belt height are shown as reference dimensions only. Cumulative rib pitch tolerance is an important value but it is frequently affected by the tension at which the belt operates and the modulus of the tension member. | | | |

6.2 Measurement of the effective belt length

6.2.1 Elastic belt

The method given in 6.2 is not applicable for elastic belts.

6.2.2 Measuring fixture

The effective belt length shall be determined by placing the belt on a measuring fixture as shown in Figure 5 which is composed of the following elements:

- Two pulleys of equal diameter, one of which is fixed and the other movable.
Their profile shall comply with Figure 1 and Table 2, and their recommended effective diameter shall be determined from the values given in Table 4.
The roughness of the pulleys is $Ra \leq 1,6 \text{ }\mu\text{m}$ as defined in ISO 254:2011, 5.2. This value is also given in Table 4.
- Device for applying a total measuring force to the movable pulley.
- Device for the centre distance between the two pulleys.

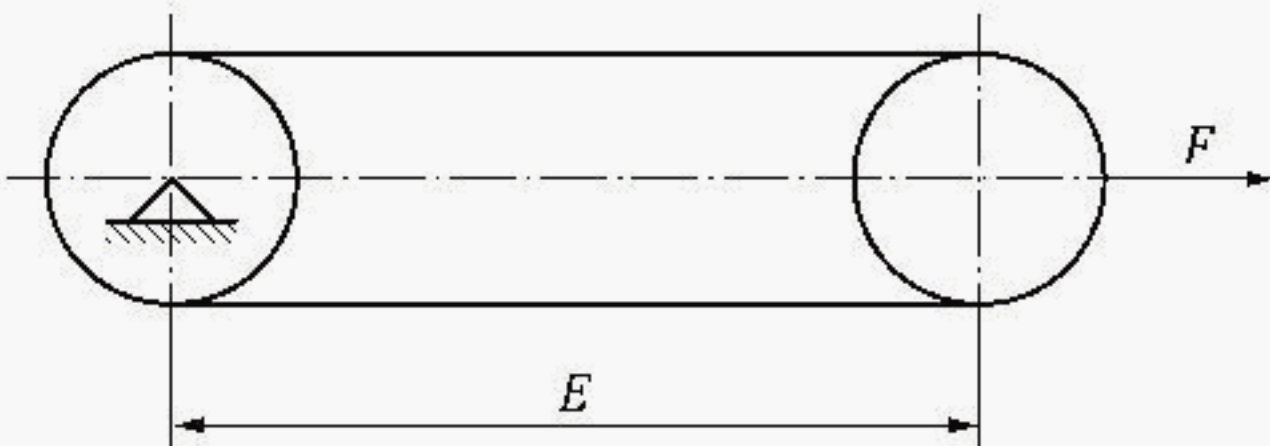


Figure 5 — Measuring fixture to determine effective length

6.2.3 Measuring force

The measuring force to be applied for measuring the effective length of belts is given in Table 4.

Table 4 — Measuring pulley and measuring force

| Dimension | Tolerance | Value | Unit |
|--|------------|------------|---------------|
| Pulley effective circumference (at level of effective diameter), U_e | — | 300 | mm |
| Diameter over balls or rods, K | $\pm 0,13$ | 96,48 | mm |
| Measuring force per rib, F | — | 100 | N |
| Roughness of pulleys, Ra | — | $\leq 1,6$ | μm |

6.2.4 Procedure

To measure the effective length of a belt, rotate the belt at least two revolutions to seat it properly and to divide the total force equally between the two strands of the belt.

Then, measure the centre distance between the pulleys, E , and calculate the effective length, L_e , of the belt using Formula (1).

$$L_e = E_{\text{max}} + E_{\text{min}} + U_e$$

(1)

where

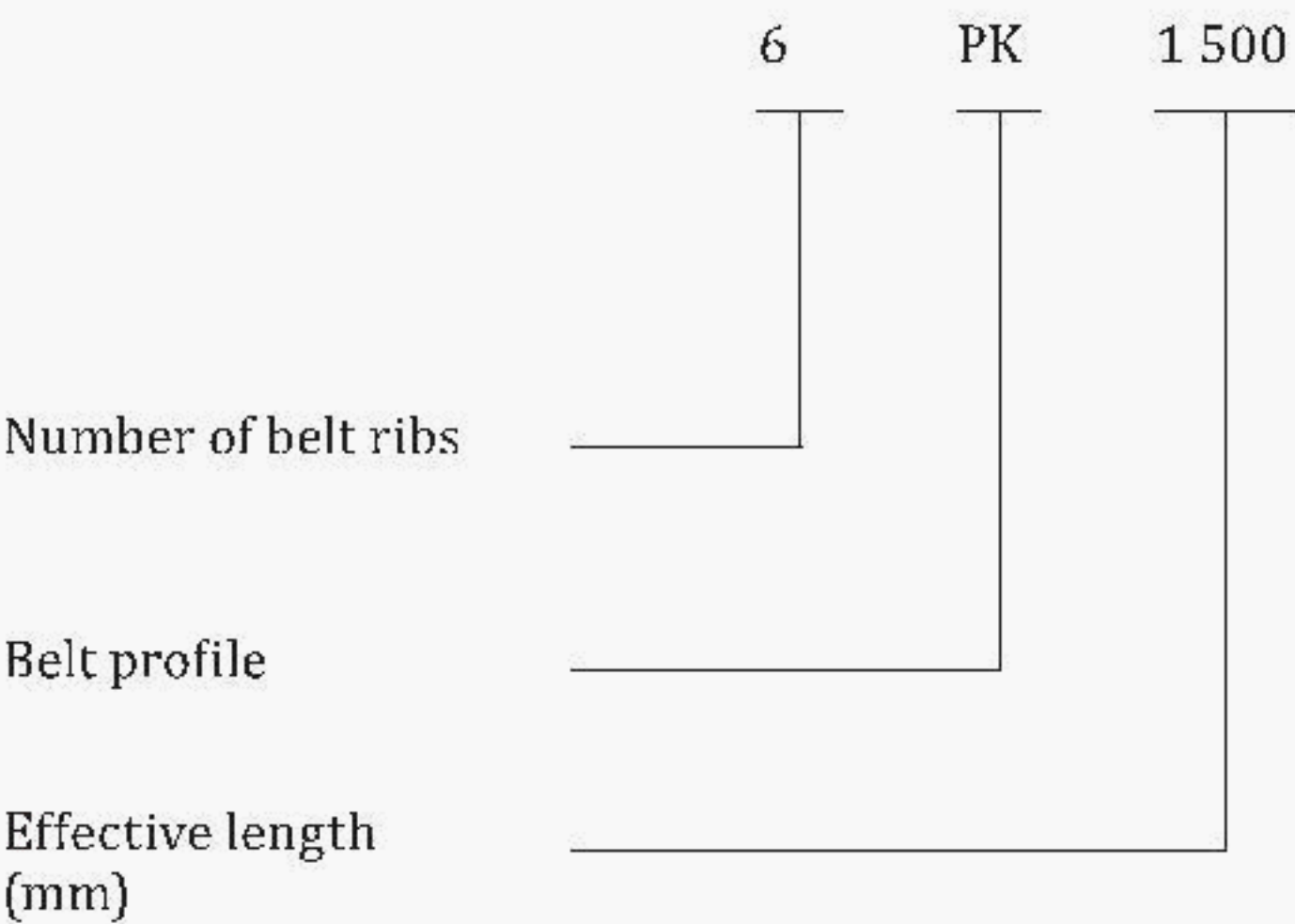
- U_e is the effective circumference of the measuring pulleys;
- E_{max} is the maximum centre distance between the pulleys;
- E_{min} is the minimum centre distance between the pulleys.

6.3 Designation of belts

A V-ribbed belt for the automotive industry is characterized by the number of belt ribs, the profile and the effective length. It is designated by a series of numbers and letters as follows:

- a) the first set of numbers indicates the number of belt ribs;
- b) the letters indicate the belt profile;
- c) the second set of numbers indicates the effective length, in millimetres.

EXAMPLE



Bibliography

- [1] ISO 254:2011, *Belt drives — Pulleys — Quality, finish and balance*
- [2] ISO 1081, *Belt drives — V-belts and V-ribbed belts, and corresponding grooved pulleys — Vocabulary*
- [3] ISO 4287, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Terms, definitions and surface texture parameters*
- [4] ISO 8370, *Belts drives — Dynamic test to determine pitch zone location — Part 2: V-ribbed belts*
- [5] ISO 9982, *Belt drives — Pulleys and V-ribbed belts for industrial applications — PH, PJ, PK, PL and PM profiles: dimensions*

