

Automotive parts - V-ribbed pulley grooves and belts – Dimensions

Introduction

This standard is an automotive standard replacing **JASO E111** "Dimension of V-ribbed pulley grooves for automotive engines" minor-revised in 2006 and **JASO E109** "Automotive V-ribbed belts" revised in 1994 with reference to **ISO 9981**: 1998, Belt drives - Pulleys and V-ribbed belts for automotive industry - PK profile: Dimensions.

1. Scope

This standard specifies the shapes and dimensions of the grooves of the V-ribbed pulleys (hereinafter referred to as "pulley") corresponding to the PK profile V-ribbed belts (hereinafter referred to as "belt") which are used for automobiles to transfer the power, and also the major shapes and dimensions of the V-ribbed belts.

The dimensions of the pulleys in practical use are indicated in **Annex A** for reference.

Note:

As for the V-ribbed belts, **ISO 9982** and **JIS B1858** specify other types such as PH, PJ, or PL for general industry machinery other than for automobiles. However, these profiles are excluded from the scope of this standard.

2. Normative reference

The following standards, when referred to in this standard, constitute a part of the specifications of this standard. For the applicable standards with year indicated, the version at that time is valid and versions after that (including addenda) shall not be applied. For the applicable standards with no year indicated, the most recently updated version (including addenda) shall be applied.

JIS B0601 Geometrical Product Specifications (GPS) - Surface texture: Profile method - Terms, definitions and surface texture parameters

Note:

Applicable International Standard: ISO 4287: 1997, Geometrical Product Specifications (GPS) - Surface texture: Profile method - Terms, definitions and surface texture parameter (IDT)

JIS B7503 Mechanical dial gauges

JIS B7533 Dial test indicators (Lever type)

3. Definitions

Definitions of main terms used in this standard shall be as follows.

3.1 Diameter over balls

The outer diameter over balls or rods for measurement when they are installed onto a pulley. Also called "diameter over pins".

3.2 Effective diameter

The outer diameter of a pulley, when the groove pitch and groove angle are the nominal dimensions and the radius at pulley tip is the minimum dimension. (Refer to **Figure 1** and **Table 1**.)

3.3 Effective length

The length of a belt calculated from the effective pulley circumference and the centre distance when the belt is placed onto two measuring pulleys with a specified force applied.

3.4 Effective circumference

The length of the circumference with effective pulley diameter.

3.5 Groove pitch

The distance between the centre lines of two adjacent grooves of a pulley.

3.6 Rib pitch

The distance between the centre lines of two adjacent ribs of a belt.

3.7 Normal bending

A state of a belt in which the belt is placed with its rib portion (side, surface) facing inward.

3.8 Reverse bending

A state of a belt in which the belt is placed with its rib portion (side, surface) facing outward.

4. Symbol

The symbols used in this standard are as follows, in addition to those indicated in **Tables 1, 2 and 4**.

d_e	: Effective diameter
d_o	: Pulley outer diameter

5. Type

The pulleys and belts are of PK profile only.

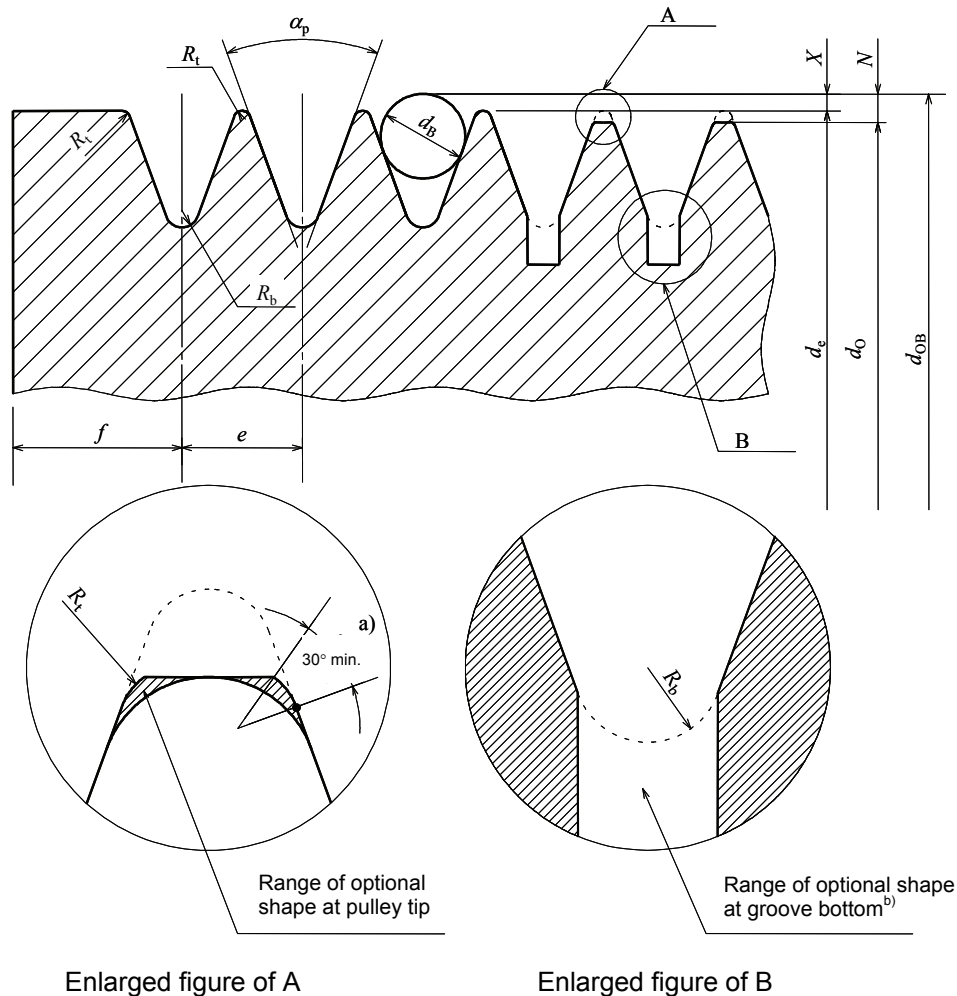
6. Required characteristics

6.1 Pulley

6.1.1 Shapes and dimensions

6.1.1.1 Dimensions and tolerances

The dimensions and tolerances of the pulley grooves are as shown in **Figure 1** and **Table 1**. The measurement method shall be according to **6.1.2**.



Note: ^{a)}

The pulley tip shall be rounded in a range of 30° minimum from the point of contact with the straight line portion of the groove.

Note: ^{b)}

The shape shown with a broken line indicates the standard shape (not optional).

Figure 1 Cross section of pulley grooves

Table 1 Dimensions and tolerances of pulley grooves

Unit: mm

Item	Symbol	Nominal dimension	Tolerance
Groove pitch	e	3.56	± 0.05 ^{a)}
Groove angle	α_p	40° ^{b)}	$\pm 1^\circ$
Radius at pulley tip	R_t	0.25	+0.18 0
Radius at pulley groove bottom	R_b	Max. 0.5	---
Distance between pulley edge and groove centre nearest to edge	f	Min. 2.5	---

Note: ^{a)}

The cumulative pitch error must be within ± 0.3 mm.

Note: ^{b)}

The nominal dimension of 40° may be changed in accordance with the working conditions of a pulley through the agreement between the manufacturer and the user.

6.1.1.2 Run-out

The run-out shall be as follows.

a) Axial circular run-out

The axial circular run-out¹⁾ shall be measured by the method specified in **6.1.2.3 a)** and shall not exceed 0.25 mm.

b) Radial circular run-out

The radial circular run-out¹⁾ shall be measured by the method specified in **6.1.2.3 b)** and shall not exceed 0.25 mm.

Note:¹⁾

The run-out in the axial direction and that in the radial direction on the contact surface between the V-ribbed belt and pulley, namely, on the straight line portion of the groove shown in Figure 1 are called "Axial circular run-out" and "Radial circular run-out", respectively.

6.1.1.3 Out-of-perpendicularity of grooves

The out-of-perpendicularity of grooves of a pulley shall be shown by the inclination of the centre lines of the groove angles, and shall not exceed 0.5° when it is measured by the method specified in **6.1.2.4**.

6.1.1.4 Diameter over balls

The relation between the diameter over balls d_{OB} and effective diameter d_e , which is used as a reference, is as shown in **Table 2**. The tolerance of the diameter over balls shall be in accordance with the agreement between the manufacturer and the user.

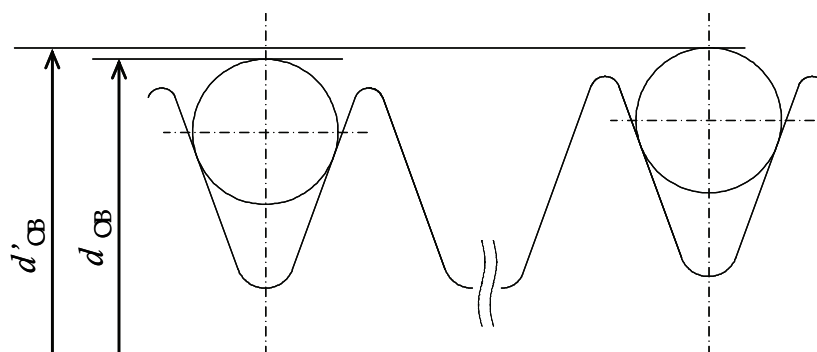
Table 2 Diameter over balls

Unit: mm

Item	Symbol	Nominal dimension	Tolerance
Diameter over balls	d_{OB}	$d_e + 2 X$	---
Checking ball or rod diameter	d_B	2.50	± 0.01
Difference between effective diameter and diameter over balls	$2X$	0.99	---
Difference between pulley outer diameter and diameter over balls	$2N$	Max. 1.68	---

6.1.1.5 Groove-to-groove diameter tolerance

The difference in the diameter over balls d_{OB} among grooves of a pulley shown in **Figure 2** (difference between d_{OB} and d'_{OB} in the figure) shall not exceed 0.15 mm.

**Figure 2 Groove-to-groove diameter tolerance**

6.1.1.6 Surface roughness

The surface roughness of the straight line portions of the grooves shown in **Figure 1** shall be 3.2a as specified in **JIS B0601**.

6.1.1.7 Minimum pulley diameter

The recommended minimum pulley diameters are listed in **Table 3**.

Table 3 Recommended minimum pulley diameters

Unit: mm

	Normal bending pulley	Reverse bending pulley
Effective diameter	55	---
Outer diameter	---	70

6.1.2 Measurement method

6.1.2.1 Measurement conditions

The shapes and dimensions of a pulley shall be measured in a completed state as a product without surface treatment such as coating and plating.

6.1.2.2 Dimensions

Measure dimensions of all portions of the grooves shown in **Figure 1** and **Table 1** with an accuracy suitable for the tolerance with a projector or a contour measuring instrument.

When using a straightedge or vernier calipers, enlarge such portions by ten magnifications or more.

6.1.2.3 Run-out

The run-out shall be as follows.

a) Axial circular run-out

Measure the axial circular run-out with a lever-type dial gauge that conforms to the provisions of **JIS B7533** in the following way as shown in **Figure 3**. Touch the tip of the probe of the dial gauge to the straight line portion of the groove and rotate the pulley by one revolution using its shaft hole or fitting surface as a reference surface. Measure the maximum and the minimum dial gauge readings and calculate the difference between two readings.

b) Radial circular run-out

Measure the radial run-out with a dial gauge that conforms to the provisions of **JIS B7503** in the following way as shown in **Figure 4**. Insert the ball or the rod with a diameter of d_b into the groove and rotate the pulley by one revolution using its shaft hole or fitting surface as a reference surface. Measure the maximum and the minimum dial gauge readings and calculate the difference between two readings.

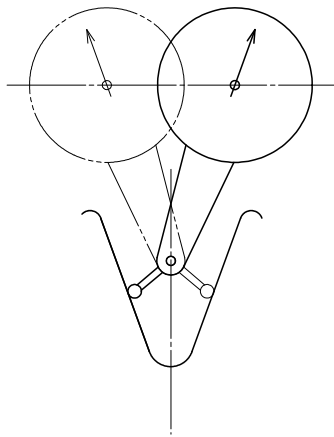


Figure 3 Axial circular run-out

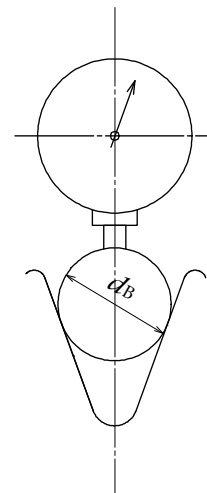


Figure 4 Radial circular run-out

6.1.2.4 Out-of-perpendicularity of grooves

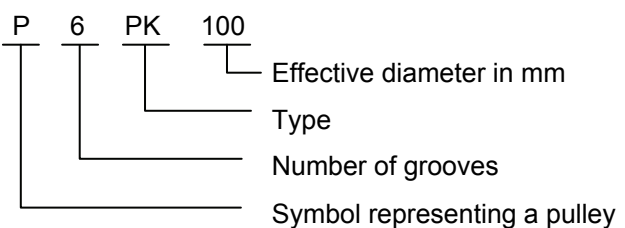
Measure the out-of-perpendicularity of the groove as an inclination of the centre lines of the groove angles against the pulley shaft hole or fitting surface with an accuracy suitable for the tolerance with a projector or a contour measuring instrument.

When using an angle measuring apparatus or the like, enlarge such portions by ten magnifications or more.

6.1.3 Designation of pulleys

The pulleys are designated in order of the number of grooves, belt type, and nominal value of the effective diameter.

Example V-ribbed pulley for automotive industry



6.2 Belts

6.2.1 Construction

The belt must be endless with the construction as shown in **Figure 5**.

The construction with three ribs is shown in **Figure 5** as an example.

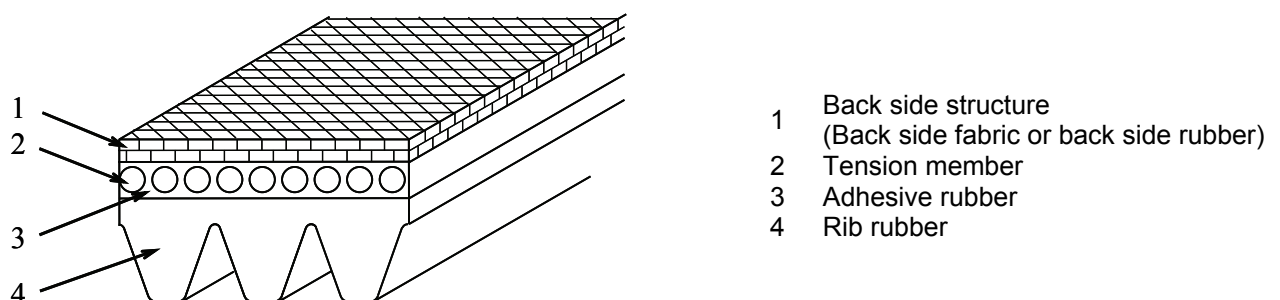


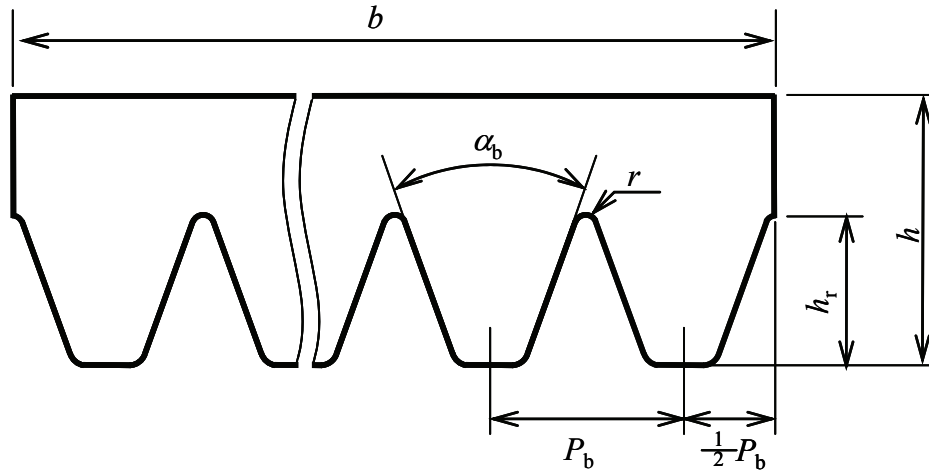
Figure 5 Construction

6.2.2 Nominal dimensions

6.2.2.1 Nominal dimensions of belt cross sections

The nominal dimensions of belt cross sections and tolerance are listed in **Table 4**.

Table 4 Belt cross sections



Unit: mm

Item	Symbol	Nominal dimension	Tolerance
Rib pitch nominal value	P_b	3.56	
Edge position with reference to end rib	$1/2 P_b$	1.78 ^{a)}	± 0.38
Rib angle	α_b	40(°)	
Radius at groove bottom	r	Max. 0.25	
Belt width	b	$3.56 \times n$ ^{b)}	
Belt height (Reference)	h	4 to 6	
Rib height (Reference)	h_r	Max. 3.3	

Note: ^{a)}

The nominal dimensions and tolerances may be changed in accordance with the working conditions of a pulley through the agreement between the manufacturer and the user.

Note: ^{b)}

n means the number of ribs.

6.2.2.2 Lengths

The length of a belt is indicated by the effective length and measured by the method in **6.2.5.2**, and the length shall be within the tolerance in **Table 5**. In general, the nominal values of the effective length are the multiple of 10 mm.

Table 5 Tolerances of effective lengths

Unit: mm

Nominal value of belt effective length	Tolerance
UP through 1000	± 5.0
Over 1000 to and incl. 1200	± 6.0
Over 1200 to and incl. 1500	± 8.0
Over 1500 to and incl. 2000	± 9.0
Over 2000 to and incl. 2500	± 10.0
Over 2500 to and incl. 3000	± 11.0