Automotive parts - V-ribbed belts - Test methods and properties

Introduction

This standard is established based on the property specifications in **JASO E 109**:1994 "Automotive V-ribbed belts" with reference to **ISO 11749:**1995/Cor 1:2003 "Belt drive - V-ribbed belts for the automotive industry - Fatigue test".

1. Scope

This standard specifies the test method and properties of the dynamic characteristics and static characteristics of the V-ribbed belts (PK type) specified in **JASO E 109:**2011.

2. Normative reference

The following standards, when referred to in this standard, constitute a part of the specifications of this standard. As required, the most recently updated version of the applicable standard (including addenda) shall be applied.

JASO E109	Automotive parts - V-ribbed pulley grooves and belts - Dimensions
JIS B0601	Geometrical Product Specifications (GPS) - Surface texture: Profile method - Terms, definitions and surface texture parameters
JIS Z8401	Guide to the rounding of numbers

Note:

Applicable International Standard **ISO 4286:**1997, Geometrical Product Specifications (GPS) - Surface texture: Profile method - Terms, definitions and surface texture parameter (IDT)

3. Terms and definitions

Definitions of main terms used in this standard shall be based on **JASO E 109:**2011 and as follows.

3.1 Diameter over balls

The outer diameter of 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 **Table 4**.)

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 Normal bending

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

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3.7 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 Table 9.

e	: Groove pitch
α_p	: Pulley groove angle
d_e	: Effective diameter
d_B	: Checking ball or rod diameter
d_O	: Pulley outer diameter
d_{OB}	: Diameter over balls
R_t	: Radius at pulley tip
R_b	: Radius at pulley groove bottom

5. Properties

5.1 Dynamic characteristics

To test the properties of the belt, a test comprising normal bending only (test conditions A) or a test including reverse bending (test conditions B) as indicated in **6.1** shall be selected according to the pulley layout in which the belt is used. As the result of the test, there shall be no damage shown in **Figure 1** or no second tension adjustment.

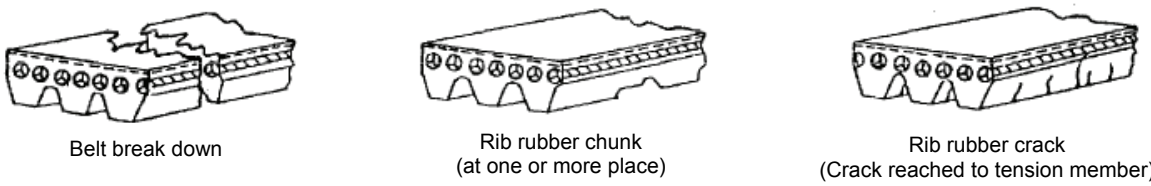

Figure 1 Damaged belts

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5.2 Static characteristics

5.2.1 Tensile characteristics

The test of the belt for tensile characteristics shall be carried out on the method in **6.2**, and the tensile strength and elongation must meet the requirements in **Table 1**.

Table 1 Tensile characteristics

Number of ribs	Tensile characteristics		
	Tensile strength	Elongation	
	Max. tensile force kN	%	Force at measurement kN
3	2.40 or over	Max. 3.0	0.75
4	3.20 or over		1.00
5	4.00 or over		1.25
6	4.80 or over		1.50
7 or over	0.80 × n[a)] or over		0.25 × n
Note:[a)] n means the number of ribs.			

5.2.2 Low temperature resistance

The test of the belt for low temperature resistance shall be carried out on the method in **6.3**, and any crack must not be developed on the belt.

6. Test methods

6.1 Dynamic characteristics

6.1.1 Test conditions

6.1.1.1 Specimens

As specimens, belts shown in **Table 2** shall be used.

Table 2 Specimens for dynamic characteristics test

Test condition	Symbol	Number of ribs	Nominal value of effective length mm
Normal bending only	A	3	850 to 1000
Normal bending and reverse bending	B	3	1050 to 1300

6.1.1.2 Test equipment

The test equipment shall be robust in structure which is not deformed by the stress it suffers. The test equipment shall have the following components and functions

a) Driving pulley and mechanism which drives it appropriately

b) Driven pulley to which appropriate load absorbing equipment can be installed

c) Load absorbing equipment which can be calibrated

d) Reverse bending idler pulley

e) Tensioning pulley which can tension the belts

f) Mechanism which can evaluate the rotational speeds of the driving pulley and driven pulley used for calculating the belt slip ratio [refer to **6.1.2 d]**] in relation to the driving pulley rotational speed with an

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accuracy of ±1 %

g) Heat insulating cover which can cover the pulley layout and temperature adjuster which can adjust the temperature inside the heat insulating cover within ±5°C

h) Pulley layout and rotational direction shown in **Table 3**

i) Because the test is conducted with the belts in different length, the following positions shall be adjustable appropriately: Driving and driven pulleys, tensioning pulley and its support (test conditions A and B), and reverse bending pulley (test conditions B).

j) Tensioning pulley and its support shall be movable freely along the tensioning force application direction shown in **Table 3** in a direction perpendicular to the plane including the axes of the driving and driven pulleys in order to absorb the belt elongation and tension the belt appropriately.

k) Tensioning pulley and reverse bending idler pulley shall be positioned so that they are equally apart from the axes of the driving and driven pulleys.

l) Driving pulley rotational speed, load, tensioning force, and test time shall be settable to the values indicated in **Table 3**.

m) Dimensions and specifications of the pulleys to be used for the test shall be those specified in **Table 4**, and other specifications and dimensions shall be in accordance with **JASO E 109**. The surface roughness on the outer surface of the reverse bending idler pulley shall be 3.2a or less as specified in **JIS B 0601**.

6.1.2 Test procedure

The test procedure shall be as follows.

a) Install the specimen to the test equipment with the rib portion facing inward.

b) Apply the force shown in **Table 3** to the tensioning pulley shaft, and rotate the specimen manually two or three turns with the tensioning pulley shaft set in movable condition before the shaft is fixed.

c) Set the ambient temperature during the test to 120±5°C. However, under a service environment where the heat resistance is not so important, the temperature may be changed to 85±5°C in accordance with the agreement between the manufacturer and the user.

d) Conduct the test under the test conditions shown in **Table 3**.

e) If the slip ratio[1)] reaches 4 %, stop the test and allow the inside of the test chamber, pulleys, and the specimen to cool down to 15 to 35°C. Then re-tension the specimen according to the procedure in **b)** to re-start the test.

f) When new pulleys are used in the test, break in those pulleys with another belt for 48 hours or more under the conditions shown in **Table 3** prior to the test.

g) Misalignment of the pulleys shall be 1/3 degrees or less.

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Note:[1)]

The slip ratio is calculated by the following formula.

$$g = \frac{I_o - I_f}{I_o} \times 100$$

$$I_o = \frac{N_{2o}}{N_{1o}}$$

$$I_f = \frac{N_{2f}}{N_{1f}}$$

Where, g : Slip ratio (%)

N_{1o} : Initial rotational speed of driving pulley without load (r/min)

N_{2o} : Initial rotational speed of driven pulley without load (r/min)

N_{1f} : Final rotational speed of driving pulley with load (r/min)

N_{2f} : Final rotational speed of driven pulley with load (r/min)

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