Belt drive - V-ribbed belts for the automotive industry - Fatigue test


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Remdrifter – Ribbade kilremmar för bilindustrin - Utmattningsprovning


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Transmissions par courroies — Courroies striées pour la construction automobile — Essai de fatigue
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International Standard ISO 11749 was prepared by Technical Committee ISO/TC 41, Pulleys and belts (including veebelts); Subcommittee SC 1, Veebelts and grooved pulleys.

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Belt drive — V-ribbed belts for the automotive industry — Fatigue test

1 Scope

This International Standard specifies a dynamic test method for the quality control of V-ribbed belts (PK profile) which are used predominantly for accessory drive applications in the automotive industry.

The dimensional characteristics of the belts and of corresponding pulleys are the subject of ISO 9981.

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 683-1:1987, Heat-treatable steels, alloy steels and free-cutting steels — Part 1: Direct-hardening unalloyed and low-alloyed wrought steel in form of different black products,

3 Principle

Determination of the performance of a belt under specified conditions on a two-, three- or four-pulley test machine as described in clause 4.

NOTE 1 The shortest V-ribbed belt which can be tested on the four-pulley test machine (see figure 1) is approximately 1000 mm. Belts with lengths between 800 mm and 1000 mm inclusive can be tested on the three-pulley test machine (see figure 2). Shorter belts should be tested on the two-pulley test machine (see figure 3) as described in 6.2.1.2.

A number of conditions shall be agreed between the manufacturer and user, including the power to be transmitted, the minimum acceptable life, in hours, and the number of times the belt can be retensioned.

Belt failure occurs when the belt no longer satisfies the agreed conditions.

4 Apparatus

4.1 Dynamic test machine

The test machine shall be of robust design so that all components withstand, with virtually no deflection, the stress to which they are subjected.

The test machine shall consist of the following (see figures 1, 2 and 3).

4.1.1 Driving pulley and suitable mechanism for driving it.

4.1.2 Driven pulley, to which a suitable power-absorption unit is connected (4.1.3).
4.1.3 Power-absorption unit, accurate and capable of calibration, for example by dead weights.

4.1.4 Reverse bending idler pulley, only for four-pulley test machine (see figure 1).

4.1.5 Device through which tension can be applied to the belt

a) in the case of the three- or four-pulley test machine layout, an idler pulley (see figures 1 and 2);
b) in the case of the two-pulley test machine layout, a movable pulley (see figure 3).

4.1.6 Means of determining belt slip, with an accuracy of ± 1%.

The layout of the pulley and the direction of rotation are shown in figures 1, 2 and 3.

In order to accommodate different lengths, the position of relevant driving and driven members, the position of the idler pulley and its support (in the case of the three-pulley test machine) and the position of the reverse bending idler pulley (in the case of the four-pulley test machine) shall be adjustable so that the test layout of the pulleys is attainable for each belt length.

So that the tension can be satisfactorily applied to the belt, and in order to allow for belt stretch, the idler pulley and its bearing assembly shall be free to slide, as necessary, in the support bracket along the line of application of the tensioning force.

For the four-pulley test machine in such a case, the line of action of the tensioning force shall bisect the belt layout at the idler pulley and at the reverse bending idler pulley, and shall lie in the plane through the centre of the pulleys (see figure 1).

For the three-pulley test machine in such a case, the line of action of the tensioning force shall bisect the belt layout at the idler pulley, and shall lie in the plane through the centre of the idler pulley (see figure 2).

The two-pulley test machine shall be constructed so that one of the units (driven or driving) can be moved to accommodate belt lengths of up to 800 mm. A method shall be provided of locking the movable unit in position for a given tension in the belt. So that the tension can be satisfactorily applied to the belt, and in order to allow for belt stretch, the line of action of the tensioning force shall pass through the axis centre of the driven and driving pulleys and shall lie in the plane through the centre of the same pulleys (see figure 3).

4.2 Test pulleys

The pulleys shall be made from steel, as defined in ISO 683-1, with a surface hardness of 55 HRC, conforming to ISO 6508. The pulley groove shall have a surface roughness such that the arithmetical mean deviation of the profile $R_a$, defined in ISO 468, is lower that 0.8 µm.

The characteristics of the test pulleys are given in figure 4 and in table 1.

5 Test room conditions

The ambient temperature shall be

a) in a test room, between 18 °C and 32 °C; the mean ambient temperature for the duration of the test shall be given with the test result; the atmosphere in the vicinity of the test drive shall be free of draughts from sources other than the belt drive itself;
b) in a thermostatically controlled enclosure, a high temperature agreed between the manufacturer and user, maintained within ± 5 °C.

6 Test method

6.1 Test conditions

The rotational frequency of the driving pulley shall be 4 900 min⁻¹, to within ± 2 %. The power transmitted is fixed, in kilowatts, for a belt with 3 to 5 ribs, and shall be agreed between the manufacturer and user.

The driver pulley speed, in revolutions per minute, shall be used in the torque load calculation, and the torque load shall be kept constant without compensation for loss of driven pulley speed resulting from belt slippage.

The torque load, $M$, is given by the formula:

$$ M = \frac{P_s \times 9549}{v} $$

where

- $M$ is the torque load, in newton metres;
- $P_s$ is the specified power, in kilowatts;
- $v$ is the driver speed, in rotations per minute.

The test equipment shall be maintained so as to minimize parasitic loads due to bearing losses, lubricants, etc.