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

Transmissions par courroies -- Courroies striées pour la construction automobile -- Essai de fatigue

Ta slovenski standard je istoveten z: **ISO 11749:1995**

ICS:

43.060.10	Blok motorja in notranji deli motorja	Engine block and internal components

SIST ISO 11749:1997 **en**

INTERNATIONAL STANDARD

ISO 11749

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

Transmissions par courroies — Courroies striées pour la construction automobile — Essai de fatigue

Reference number
ISO 11749:1995(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 voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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 254:1990, *Belts drives — Pulleys — Quality, finish and balance.*

ISO 468:1982, *Surface roughness — Parameters, their values and general rules for specifying.*

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.*

ISO 6508:1986, *Metallic materials — Hardness test — Rockwell test (scales A - B - C - D - E - F - G - H - K).*

ISO 9981:1990, *Belts drives — Pulleys and V-ribbed belts for the automotive industry — Dimensions — PK profile.*

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 1 000 mm. Belts with lengths between 800 mm and 1 000 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, shall pass through the axis centre of 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:

$$M = \frac{P_s \times 9\,549}{v}$$

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.

In the case of the three- of four-pulley test machine, the belt-tensioning force, F, in newtons, applied to the idler pulley and in the case of the two-pulley test machine that applied to the driven unit, shall be such that

$$F = k \times P_t$$

where

P_t is the transmitted power, in kilowatts;

k = 60 N/kW, in the case of the three- or four-pulley test machine;

k = 110 N/kW, in the case of the two-pulley test machine.

6.2 Procedure

6.2.1 Preparation

6.2.1.1 Three- or four-pulley test machine

Method A

After mounting the belt on the pulleys, apply the specified belt-tensioning force (see 6.1) to the idler pulley and, leaving the idler pulley support bracket free to move in its slide, bring the drive up to the specified rotational frequency (see 6.1). Then apply the relevant load to the driven pulley as quickly as possible. Run the drive under these conditions for 5 min ± 15 s, not including the starting and stopping time. Stop the machine and leave it to stand for at least 10 min.

Then turn the drive manually for several revolutions of the belt and immediately lock the idler pulley support bracket in position.

Method B

After mounting the belt on the pulleys, apply the specified belt-tensioning force (see 6.1) to the idler pulley, leaving the idler pulley support bracket free to move in its slide. Then turn the drive manually for several revolutions of the belt and immediately lock the idler pulley support bracket in position.

6.2.1.2 Two-pulley test machine

Use the same procedure as in 6.2.1.1 with the movable unit taking the place of the idler pulley support.

6.2.2 Test

Start (re-start in the case of method A) the machine, bring the drive up to the specified rotational frequency, apply the test load to the driven pulley and measure the slip between the driving and driven pulleys.

The drive shall run continuously under these conditions until either the belt fails or the additional slip g exceeds by 4 % the slip measured initially.

The additional slip g, expressed as a percentage, is given by the following formula:

$$g = (i_0 - i_f) \times 100$$

where

$$i_0 = \frac{n_0}{N_0}$$

and

$$i_f = \frac{n_f}{N_f}$$

where

n_0 is the initial rotational frequency of the driven shaft;

n_f is the final rotational frequency of the driven shaft;

N_0 is the initial rotational frequency of the driving shaft;

N_f is the final rotational frequency of the driving shaft.

All rotational frequencies shall be measured under the test load.

6.2.3 Retensioning

If the additional belt slip reaches 4 % before belt failure, stop the machine and leave it to stand for at least 20 min. In the case of the three- or four-pulley test machine, unlock the idler support bracket, apply the test tension to the belt, turn the drive manually for two or three revolutions of the belt, re-lock the idler support bracket in position, as described in 6.2.1, and repeat the test specified in 6.2.2.

Repeat this procedure whenever the additional slip reaches 4 % before failure, until the belt fails.

7 Test report

The test report shall include at least the following information:

a) a reference to this International Standard;

b) identification of the belt tested;

c) the type of machine used (if necessary, the effective diameter of the idler pulley or the exterior diameter of the reverse bending idler pulley);

d) the method used (A or B);

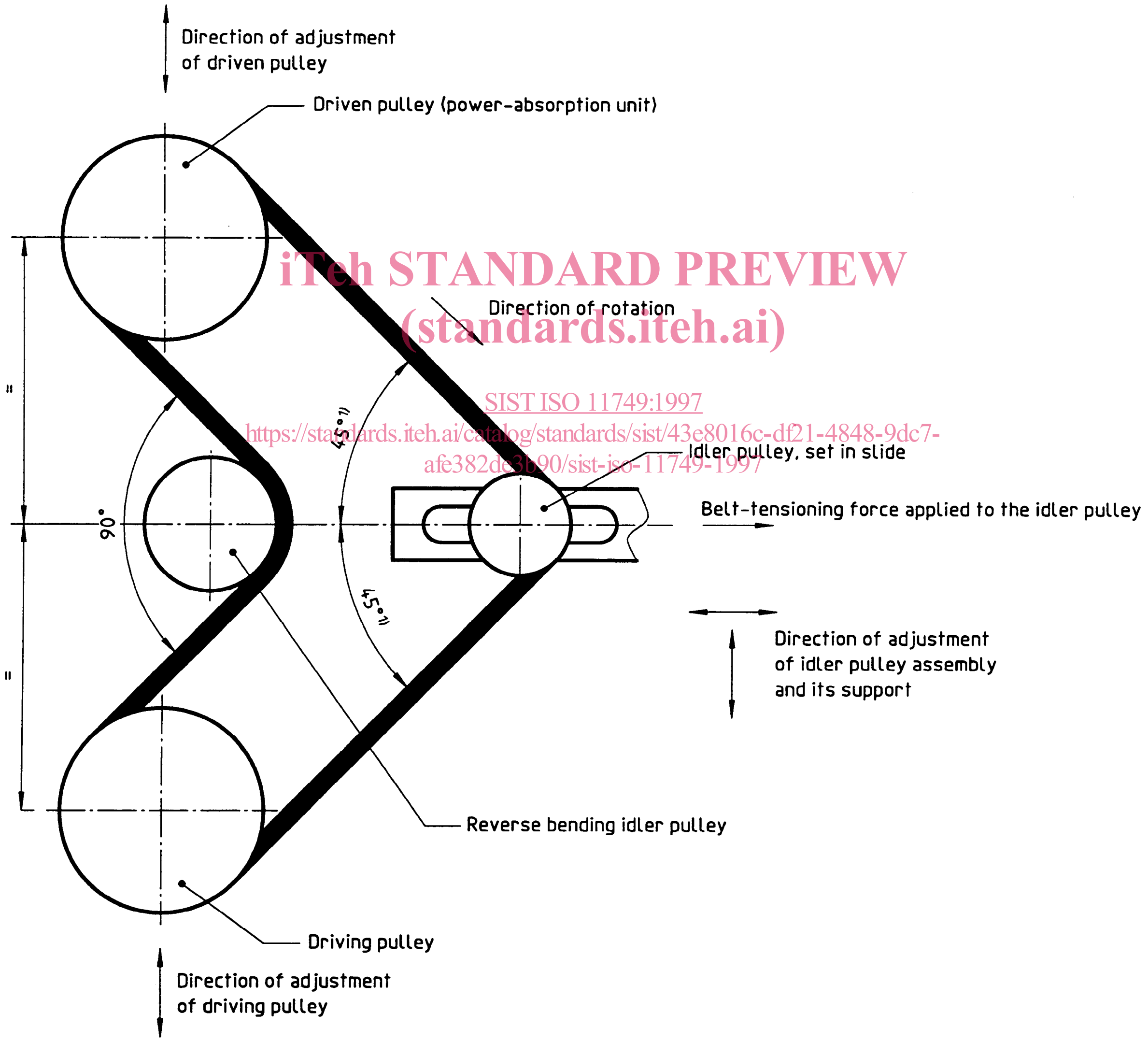
e) the number of running hours under test to satisfy the agreed conditions;

f) the transmitted power and the number of ribs;

g) the number of times and the running hours at which the belt was retensioned;

h) the mean ambient temperature during the test;

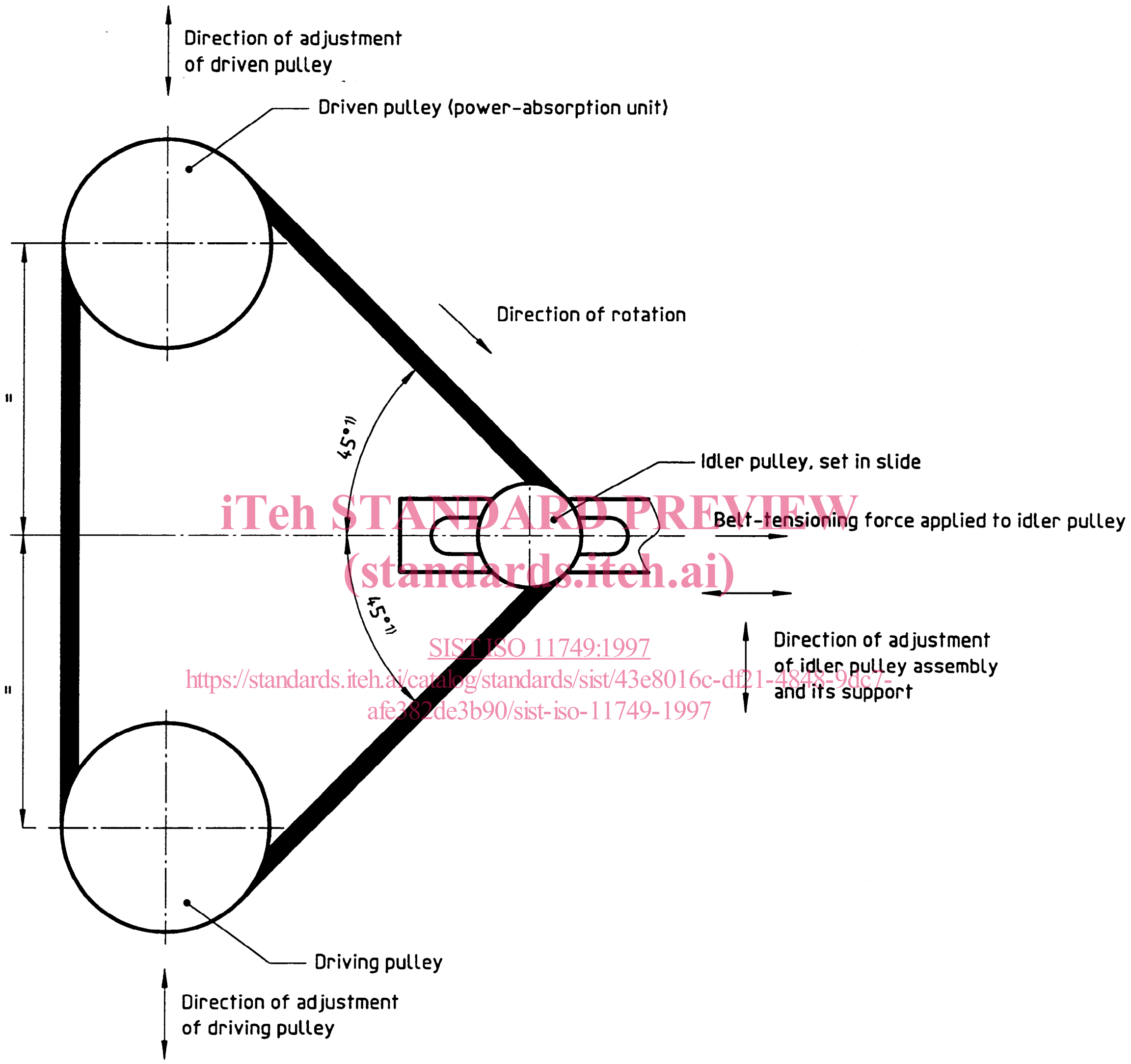
i) the date of the test.



1) 45° is specified for the initial test layout and may change slightly with retensioning during the course of the test.

NOTE — The belt, mounted on the test pulleys, shall be aligned to within ± 15′ in relation to the plane through the centre of each pulley.

Figure 1 — Four-pulley test machine layout



1) 45° is specified for the initial test layout and may change slightly with retensioning during the course of the test.

NOTE — The belt, mounted on the test pulleys, shall be aligned to within ± 15′ in relation to the plane through the centre of each pulley.

Figure 2 — Three-pulley test machine layout