INTERNATIONAL STANDARD 5287

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Narrow V-belt drives for the automotive industry — Fatigue test

Transmissions par courroies trapézoïdales étroites pour la construction automobile — Essai de fatigue

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ISO 5287-1978 (E)

FOREWORD

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 5287 was developed by Technical Committee ISO/TC 41, *Pulleys and belts (including veebelts)*, and was circulated to the member bodies in September 1976.

It has been approved by the member bodies of the following countries :

Australia	France	South Africa, Rep. of
Austria	Germany	Spain
Belgium	India	Sweden
Bulgaria	Mexico	Turkey
Canada	Netherlands	United Kingdom
Chile	Philippines	U.S.A.
Denmark	Poland	Yugoslavia
Finland	Romania	

The member body of the following country expressed disapproval of the document on technical grounds :

Italy

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1 SCOPE AND FIELD OF APPLICATION

This International Standard lays down conditions for a fatigue test for quality control on narrow V-belts (sections AV 10 and AV 13) intended for driving the auxiliaries of internal combustion engines used for automotive purposes.

The dimensional characteristics of these belts and of the corresponding pulleys are the subject of ISO 2790.

2 REFERENCES

ISO/R 468, *Surface roughness.*

ISO 683/XII, *Heat-treated steels, alloy steels and free-cutting steels — Part 12 : Flame and induction hardening steels.*

ISO 2790, *Narrow V-belt drives for the automotive industry — Dimensions.*

3 PRINCIPLE

The test consists in determining the performances of the belt under specified conditions on the three-pulley test machine defined in this International Standard.

Conditions to be agreed between the manufacturer and the user include the power to be transmitted, the diameter of the idler pulley to be used, the number of times the belt can be re-tensioned and the minimum acceptable belt life in hours.

Belt failure occurs at that point in time at which the belt no longer satisfies the agreed conditions.

4 APPARATUS

4.1 Dynamic test machine (see figure 2)

The test machine shall consist of :

- a driving pulley and suitable mechanism for driving it;
- a driven pulley to which a suitable power-absorption unit (see below) is connected;
- an idler pulley and arrangement through which tension can be applied to the belt;
- a means of determining belt slip with an accuracy of ± 1 %.

The machine shall be of robust design so that all components will withstand, with virtually no deflection, the stresses to which they are subjected. The power-absorption unit shall be accurate and capable of calibration, for example by dead weights.

So that 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 and when necessary, in its support bracket along the line of application of the tensioning force as shown in figure 2.

In order to accommodate different lengths of belts, the position of the relevant driving members and/or the relevant driven members and the position of the idler pulley and/or its support bracket shall be adjustable so that the test layout of the pulleys is attainable for each belt length.

The line of action of the tensioning force shall bisect the belt layout angle at the idler pulley (see figure 2), shall pass through the axis centre of the idler pulley, and shall lie in the plane through the centre of the groove of the idler pulley.

4.2 Test pulleys

The pulleys shall be made of type 9 steel as defined in ISO 683/XII, and the pulley groove shall have a surface condition such that the profile statistical criterion R_a defined by ISO/R 468 is lower than 0,8 μm.

The characteristics of the test pulleys are given in the table.

5 TEST HOUSE CONDITIONS

The ambient temperature of the test house shall be between 18 and 32 °C, and the mean ambient temperature for the duration of the test shall be given with the result of the test.

The atmosphere in the vicinity of the test drive shall be free of draughts resulting from sources other than the belt drive itself.

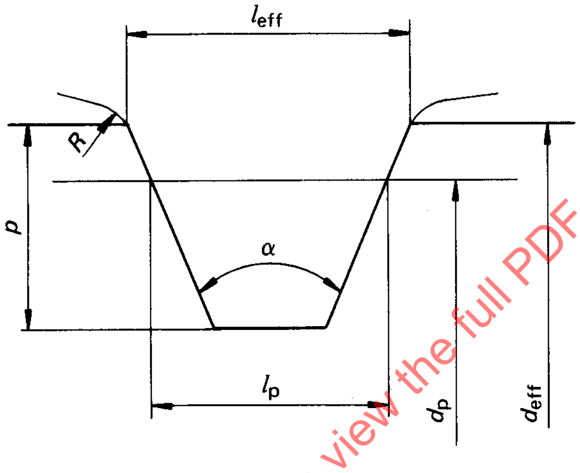

FIGURE 1 – **Test pulley**

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TABLE – **Dimensions of test pulleys**

Designation	**Symbol**	**Unit**	**Section**	
			AV 10	**AV 13**
Difference between effective diameter and pitch diameter	$d_{eff} - d_p = 2Y$	mm	3,69	5,23
Pitch width of groove	l_p	mm	8,5	11
Effective diameter of the driving pulley and of the driven pulley	d_{1eff}	mm	121 ± 0,2	127 ± 0,2
Effective diameter of the idler pulley[1)]	d_{2eff}	mm	57 – 63 – 76 ± 0,2	70 – 76 – 89 ± 0,2
Effective width	l_{eff}	mm	9,7	12,7
Groove angle	α		36° ± 30′	36° ± 30′
Minimum groove depth	p	mm	11	13,75
Minimum curve radius of the sides at the top of the groove	R	mm	0,8	0,8

1) When an idler pulley with diameter lower than the minimum effective diameter recommended by ISO 2790 is used, it should be understood that the life of the belt will be reduced.

6 TEST METHOD

6.1 Test conditions

For each test, the general layout of the pulleys relative to each other shall be as shown in figure 2, the centre distance between the driving and driven pulleys being within ± 2 mm of the value determined from the formula :

$$2{,}414\,C = L_{eff} - 0{,}785\,(3\,d_{1\,eff} + d_{2\,eff}) - (d_{1\,eff} - d_{2\,eff})$$

where

C is the centre distance between driving and driven pulleys;

L_{eff} is the effective length of the belt, measured in accordance with ISO 2790;

$d_{1\,eff}$ is the effective diameter of both driving and driven pulleys;

$d_{2\,eff}$ is the effective diameter of idler pulley.

The rotational frequency of the driving pulley, to within ± 2 %, shall be 4 900 min^{-1} for AV 10 belts and 4 700 min^{-1} for AV 13 belts.

The belt tensioning force applied to the idler pulley shall be such that

$$F = K \times P$$

where

F is the belt tensioning force, in newtons;

P is the transmitted power, in kilowatts;

K = 60 N/kW

6.2 Procedure

6.2.1 *Preparation*

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 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, by means of a dial indicator mounted in contact with the idler pulley support bracket, note the maximum limits of travel of the idler pulley.

Immediately lock the idler pulley support bracket in the position midway between the two limits of travel.

6.2.2 *Test*

Re-start 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 the slip measured initially by 4 %.

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

where

$$i_0 = \frac{n_0}{N_0} \text{ and } i_f = \frac{n_f}{N_f}$$

n_0 being the initial rotational frequency of the driven shaft;

n_f being the final rotational frequency of the driven shaft;

N_0 being the initial rotational frequency of the driving shaft;

N_f being the final rotational frequency of the driving shaft.

All rotational frequencies are measured under the test load.

6.2.3 *Re-tensioning*

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

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

6.2.4 *Records*

Record the following particulars :

- the number of running hours under test to satisfy the agreed conditions;
- the transmitted power;
- the diameter of the idler pulley;
- the number of times the belt is re-tensioned;
- the mean ambient temperature during the test.

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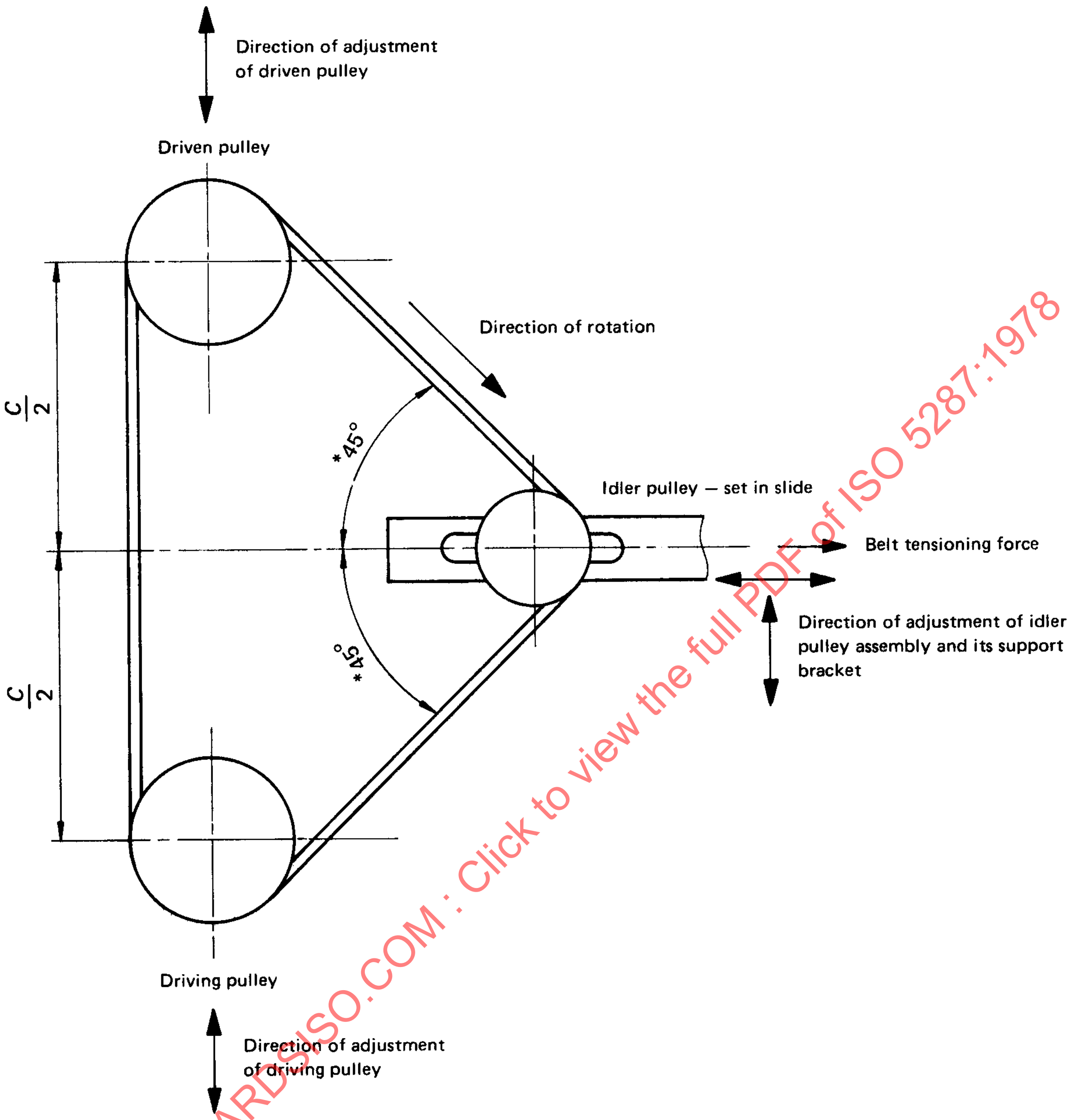

FIGURE 2 – **Test machine layout**

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* 45° is specified for the initial test layout, and may change slightly with re-tensions 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 groove.