INTERNATIONAL STANDARD

ISO 10917

First edition
1995-02-15

Synchronous belt drives — Automotive belts and pulleys — Fatigue test

Transmissions synchrones par courroies — Poulies et courroies pour la construction automobile — Essai de fatigue

Reference number
ISO 10917:1995(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 10917 was prepared by Technical Committee ISO/TC 41, *Pulleys and belts (including veebelts)*, Subcommittee SC 4, *Synchronous belt drives*.

Annex A of this International Standard is for information only.

International Organization for Standardization
Case Postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

Synchronous belt drives — Automotive belts and pulleys — Fatigue test

1 Scope

This International Standard specifies a fatigue test for the quality control of synchronous drive belts (principally types ZA and ZB) intended for driving automotive timing and valve mechanisms and, under certain circumstances, for driving auxiliaries of internal combustion engines, whether mobile or static.

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

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 9011:1987, *Synchronous belt drives — Automotive pulleys.*

3 Principle

Determination of the performance of a belt under specified conditions on the test machine described in clause 4.

A number of conditions have to be agreed between the manufacturers and users, including the power to be transmitted, the tensioning force, the test temperature, the preparation method 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 1)

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

The test machine consists of the following items.

4.1.1 Driver pulley, flanged on both sides, and a suitable mechanism for driving it.

4.1.2 Driven pulley, to which a suitable power absorption unit (4.1.3) is connected.

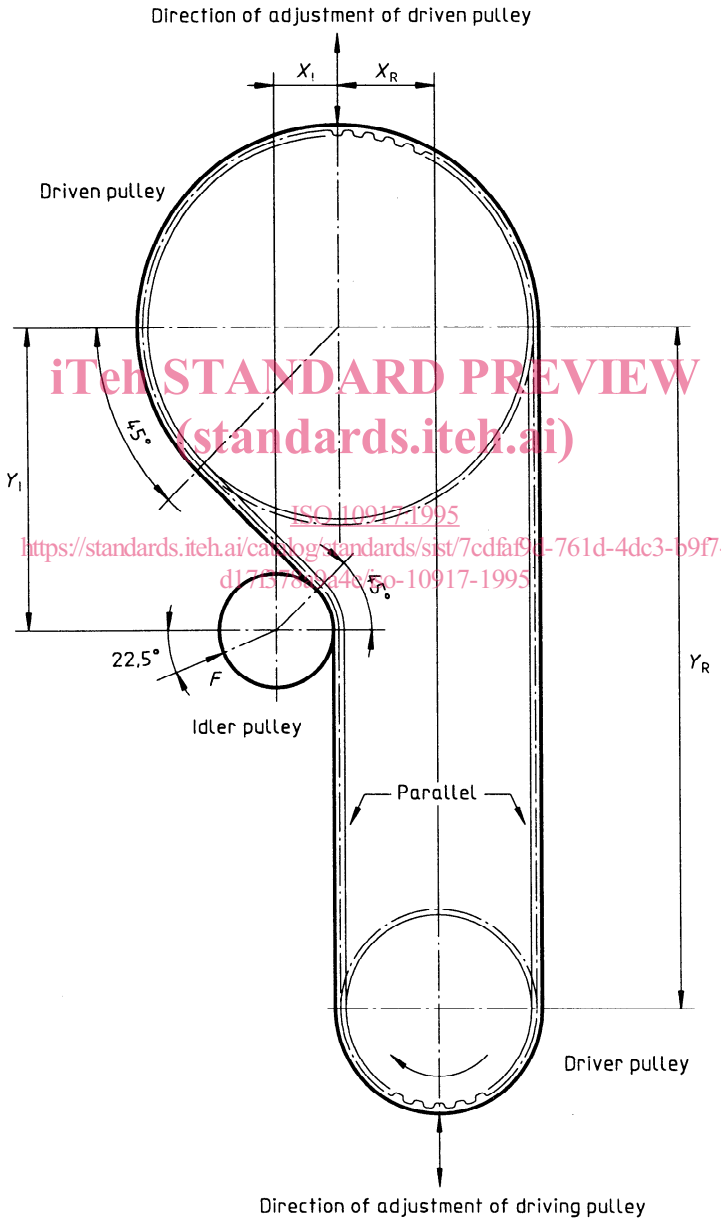
4.1.3 Power absorption unit, capable of maintaining the test load within ± 2 % for the duration of the test and capable of being calibrated, for example by dead weights.

In order that tension can be satisfactorily applied to the belt, the idler pulley (4.1.4) and its bearing assembly and the belt shall be free to move as and when necessary in the support bracket along the line of application of the tensioning force F, as shown in figure 1.

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

Assuming the coordinate of the driven pulley to be 0;0, the coordinates of the other two pulleys may be determined from the formulae given in table 1.

4.1.4 Idler pulley and **arrangement** through which tension can be applied to the belt.



F = belt-tensioning force

Figure 1

Table 1 — Formulae for pulley coordinates

Pulley coordinates		General formula	Values for ZA and ZB types only mm
Driven pulley	X_N	0	0
	Y_N	0	0
Idler pulley	X_I	$-0{,}5d$	$-25{,}0$
	Y_I	$-(0{,}707D_N + 0{,}207d)$	$-91{,}805$
Driver pulley	X_R	$+0{,}25D_N$	28,8
	Y_R	$-\left(\frac{L}{2} - 1{,}270\,9D_N + 0{,}010\,65d\right)$	$-\left(\frac{L}{2} - 145{,}89\right)$

d = pitch diameter of idler pulley, in millimetres

L = pitch length of belt, in millimetres

N = number of teeth in driven (large) pulley

P = pitch of belt teeth, in millimetres

$D_N = \frac{NP}{\pi}$

NOTE — Refer to table 2 for actual values of d, P and N to calculate coordinate values for types other than ZA and ZB.

4.2 Test pulleys

The pulleys shall be made from steel, as defined in ISO 683-1, treated if required to give a surface hardness of 55 HRC, in accordance with ISO 6508. The pulley teeth shall have a surface condition such that the arithmetical mean deviation of the profile R_a, defined in ISO 468, is lower than 0,4 µm.

The face of the idler pulley which makes contact with the back of the belt shall have a surface condition less than 0,8 µm by the same criteria. It should be noted that cast iron pulleys will wear under the highly loaded conditions of the accelerated tests described and thus give scattered results. New pulleys may reduce the test life of a belt as a certain amount of "polishing" of the pulley by the belt takes place. It is suggested that new pulleys be run with a disposable belt of the same length as the test belt for a minimum of 48 h prior to commencing the test.

The characteristics of the test pulleys are given in table 2.

5 Test method

5.1 Test conditions

For each test, the general layout of the pulleys relative to each other shall be as shown in figure 1.

The rotational frequency of the driving pulley shall be within ± 2 % of 6 000 min^{-1} for both ZA and ZB belts.

The temperature of the test cell shall be maintained within ± 5 °C of the agreed temperature during the dynamic phase of the test. A temperature-sensing device should be located at the following coordinates (refer to figure 1):

$$X_T = X_I$$

$$Y_T = Y_I - (d/2 + 25)$$

5.2 Procedure

5.2.1 Preparation method

Clean all pulleys before each test.

After mounting the belt on the pulleys, apply the test tension to the belt. Bring the drive up to the test speed. Run the drive under these conditions for 5 min ± 15 s, not including starting and stopping the machine.

Then rotate the drive manually for several revolutions of the belt. Retension the belt to the agreed tension and lock the idler pulley-support bracket.

5.2.2 Alternative preparation method

Clean all pulleys before each test.

After mounting the belt on the pulleys, apply the test tension to the belt and rotate the drive manually for several revolutions of the belt. Ensure the test tension is still present after manual rotation and lock the idler pulley-support bracket.

The use of the preparation method specified in either 5.2.1 or 5.2.2 shall be agreed by the manufacturer and user.

5.2.3 Determination

Start the machine, bring the drive up to the test speed and apply the test load to the driven pulley. The drive shall be run continuously under these conditions until the agreed minimum belt life is reached or the belt fails.

When removing a belt from the test machine at the conclusion of the test, the condition of each pulley and its associated bearings and the security of the locked tensioning idler bracket should be checked to ensure that the belt failure was not caused by a mechanical failure or by a damaged pulley.

6 Test report

The test report shall include at least the following information:

a) reference to this International Standard;

b) date of test;

c) type and size of belt tested;

d) mean ambient temperature during test;

e) transmitted power;

f) initial tension force;

g) preparation method (5.2.1 or 5.2.2); and either

h) number of running hours under test to satisfy the agreed conditions, and

i) final belt tension, or

j) belt life, in hours, until failure, and

k) reason for belt failure.

Table 2 — Dimensions and characteristics of test pulleys

Parameter		Symbol	Unit	Belt types ZA and ZB	
				Driver pulley	Driven pulley
				$\frac{\text{Driven } D_N}{\text{Driver } D_N} = 2$	
Pitch		P	mm	9,525	9,525
Number of teeth		N		19	38
Pitch circumference	NP	C_p	mm	180,98	361,95
Pitch circle diameter	$\frac{NP}{\pi}$	D_N	mm	57,61	115,21
Pitch line differential		a	mm	0,686	0,686
Outside diameter	$D_N - 2a$	D	mm	$56{,}23\ ^{+0{,}10}_{0}$	$113{,}84\ ^{+0{,}13}_{0}$
Width		W	mm	1)	1)
Pitch-to-pitch tolerances	Adj		mm	0,03	0,03
	90°		mm	0,1	0,13
Groove dimensions				As described in ISO 9011	As described in ISO 9011
Radial runout	max.	TIR2)	mm	0,13	0,13
Axial runout	max.	TIR2)	mm	0,1	0,11
Parallelism	max.		mm	$\frac{\text{Width}}{1000}$	$\frac{\text{Width}}{1000}$
Taper	max.		mm	$\frac{\text{Width}}{1000}$	$\frac{\text{Width}}{1000}$

NOTES

1 The idler pulley in all cases has a nominal pitch circle diameter of 50 mm, that is, the outside diameter is 47 mm ± 0,1 mm and its width is the same as those of the driver and driven pulleys.

2 For belt types other than ZA and ZB, refer to the belt manufacturers for details.

1) Width as necessary to accomodate test belts.

2) Total indicator reading.

Annex A
(informative)

Bibliography

[1] ISO 9010:1987, *Synchronous belt drives — Automotive belts.*

This page intentionally left blank