
**Synchronous belt drives — Automotive
belts — Determination of physical
properties**

*Transmissions synchrones par courroies — Courroies pour la
construction automobile — Détermination des caractéristiques physiques*

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 12046 was prepared by Technical Committee ISO/TC 41, *Pulleys and belts (including veebelts)*, Subcommittee SC 4, *Synchronous belt drives*.

This second edition cancels and replaces the first edition (ISO 12046:1995), which has been technically revised.

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Synchronous belt drives — Automotive belts — Determination of physical properties

1 Scope

This International Standard specifies test methods for determining the physical properties of synchronous belts used in driving engine parts, such as camshafts, fuel injection pumps, balancing shafts. These test methods are intended to provide a means of characterizing synchronous belt properties for belts which are evaluated and qualified by dynamic laboratory and field testing.

NOTE The dimensional characteristics of these belts are the subject of ISO 9010.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 48, *Rubber, vulcanized or thermoplastic — Determination of hardness (hardness between 10 IRHD and 100 IRHD)*

ISO 1817, *Rubber, vulcanized or thermoplastic — Determination of the effect of liquids*

ISO 7619-1, *Rubber, vulcanized or thermoplastic — Determination of indentation hardness — Part 1: Durometer method (Shore hardness)*

ISO 7619-2, *Rubber, vulcanized or thermoplastic — Determination of indentation hardness — Part 2: IRHD pocket meter method*

3 Principle

Evaluation of the physical properties of automotive synchronous belts through standardized test methods. These test methods are independent of tooth profiles.

4 Test methods

The tests are listed in Table 1.

Table 1 — Tests

Test	Subclause No.
Hardness of rubber core	6.1
Tensile strength	6.2
Fabric adhesion	6.3
Tension-cord adhesion	6.4
Tooth shear	6.5
Resistance to high temperature	6.6
Resistance to low temperature	6.7
Resistance to oil	6.8
Resistance to ozone	6.9
Resistance to water	6.10

5 General conditions for testing

5.1 Standard environmental conditions

Standard conditions in the laboratory shall be maintained at a temperature of (25 ± 5) °C, a relative humidity of (65 ± 20) % and an atmospheric pressure of 86 kPa to 106 kPa. The test conditions should be recorded.

5.2 Standard conditions of test specimens

The test specimens shall be tested at least 24 h after vulcanization and shall be kept for at least 1 h prior to test in a room maintained under standard conditions.

5.3 Rounding off the test results

The results of each test shall be rounded off and shall be recorded according to the number of figures specified in Table 2.

Table 2 — Rounding off of results

Test	Unit	Measured test value	Test results to be obtained
Hardness of rubber core	Shore A or IRHD	Integer	Integer
Tensile strength	N	Nearest 10	Nearest 100
Fabric adhesion	N	Integer	Integer
Tension-cord adhesion	N	Nearest 10	Nearest 10
Tooth shear	N	Nearest 10	Nearest 10
EXAMPLES	Nearest tens	Nearest hundreds	
	3 474 → 3 470	3 440 → 3 400	
	3 475 → 3 480	3 450 → 3 500	

5.4 Test report

For each test, the test report shall include the following information:

- a) number of teeth, pitch, tooth profile and width of specimen;
- b) constituent materials of specimen;
- c) production code of specimen;
- d) date of test;
- e) number of specimens;
- f) test temperature, relative humidity and atmospheric pressure;
- g) type of test apparatus.

6 Static property tests

6.1 Test for hardness of rubber core

6.1.1 Test specimens

The test specimen shall be either an endless belt or a cut belt with a minimum length of 100 mm.

6.1.2 Procedure

Place the specimen, with teeth pointing downward, on a flat surface and measure the flat portion of the belt above a tooth, using a Shore type A durometer as described in ISO 9761-1, or an IRHD tester as described in ISO 48 or ISO 7619-2, or an equivalent apparatus.

6.1.3 Expression of results

Record the average of five different measurements along the belt, rounded off as in the following examples.

EXAMPLE 1

$$\frac{74 + 75 + 75 + 74 + 74}{5} = 74,4 \longrightarrow 74$$

EXAMPLE 2

$$\frac{75 + 75 + 75 + 74 + 74}{5} = 74,6 \longrightarrow 75$$

6.2 Tensile strength test

6.2.1 Test specimens

The test specimen shall be either an endless belt or two cut belts with a minimum length of 250 mm each.

6.2.2 Procedure

Mount an endless-belt test specimen, with teeth pointing upward, on two flat pulleys having an equivalent diameter ranging between 100 mm and 175 mm and which are free to rotate. Apply a tension force to the specimen at the speed of (50 ± 5) mm/min until belt separation occurs.

If two cut belts are used as test specimens, the length gripped shall be at least 50 mm with a minimum distance of 150 mm between the two grips. Apply a tension force to one specimen at the speed of (50 ± 5) mm/min until separation takes place. Repeat the test with the second specimen.

6.2.3 Expression of results

The value for the tensile strength shall be taken as half the measured value for the endless-belt specimen or the smaller of the measured values of the two cut belts. Any data obtained when the specimen separates on the pulley surface or at the gripped portion shall be discarded.

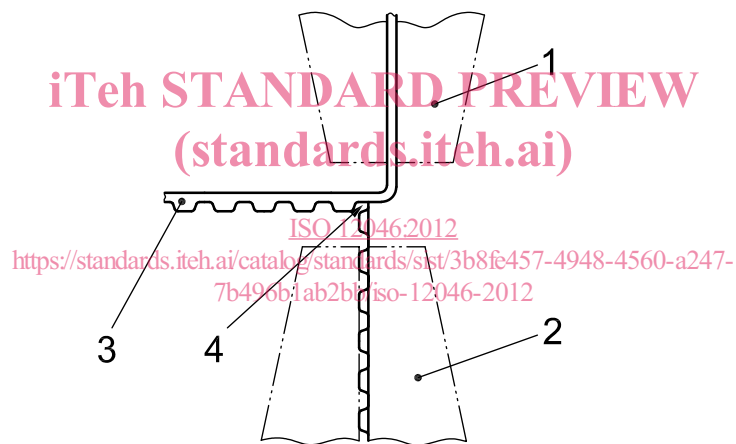
6.3 Fabric adhesion test

6.3.1 Test specimens

Two specimens with a minimum length of 100 mm shall be cut from a belt.

6.3.2 Procedure

Place each specimen in the grips of a tensile-testing device, positioning the root line of the first tooth (No. 1) between 1 and 2, as illustrated in Figure 1.



Key

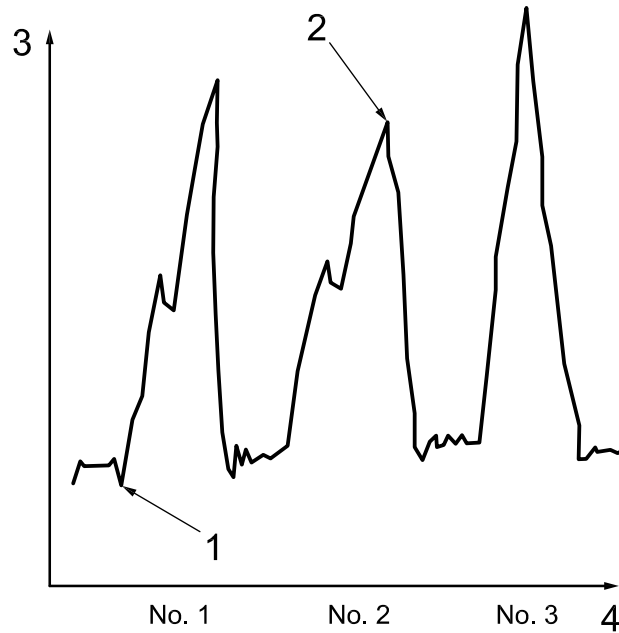
- 1 grip A of the tensile-testing device
- 2 grip B of the tensile-testing device
- 3 tooth body
- 4 root line of first tooth

Figure 1 — Installation of the specimen

Apply a tension force to the specimen using the power-actuated grip. The grip should travel uniformly at (50 ± 5) mm/min, causing the fabric to peel from the surface of the belt. Measure the adhesion force of three consecutive teeth.

6.3.3 Expression of results

The test results shall be summarized separately for adhesion at the tooth body and at the root line between teeth. Results are recorded in terms of force per millimetre width. The adhesion force at the tooth body is the lowest peak value of the two specimens, as illustrated in Figure 2. The adhesion force at the root line between teeth is the lowest value of the two specimens at the beginning of the first tooth (No. 1).



Key

- 1 tooth bottom
- 2 tooth body peak
- 3 fabric adhesion force
- 4 teeth

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Figure 2 — Adhesion results for three consecutive teeth

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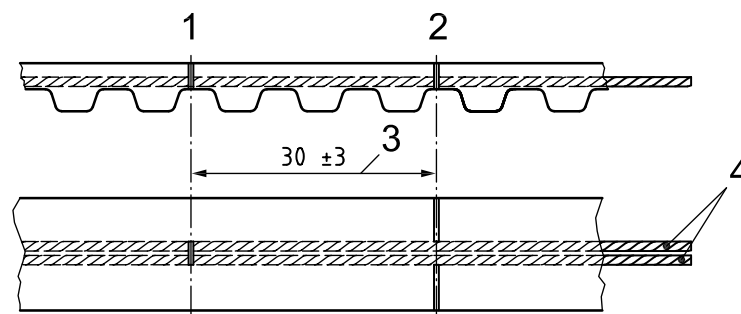
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6.4 Tension-cord adhesion test

6.4.1 Test specimens

Two specimens with a minimum length of 100 mm shall be taken from a belt. These shall be partially cut at two positions located 30 mm (see 6.4.2) apart to extract two cords, as illustrated in Figure 3.

Dimensions in millimetres



Key

- 1 cut in the two cords
- 2 cut in all but two cords
- 3 cut length
- 4 tension cords

Figure 3 — Specimen for tension-cord adhesion test