



**SLOVENSKI STANDARD**  
**SIST EN ISO 3928:2007**  
**01-januar-2007**

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**Sintrane kovine brez trdin - Preskušanci za preskus utrujenosti (ISO 3928:1999)**

Sintered metal materials, excluding hardmetals - Fatigue test pieces (ISO 3928:1999)

Sintermetallwerkstoffe, ausgenommen Hartmetalle - Probekörper für die Ermüdungsprüfung (ISO 3928:1999)

Matériaux métalliques frittés, à l'exclusion des métaux-durs - Eprouvettes pour essais de fatigue (ISO 3928:1999)

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**Ta slovenski standard je istoveten z: EN ISO 3928:2006**

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**ICS:**

77.040.10	Mehansko preskušanje kovin	Mechanical testing of metals
77.160	Metalurgija prahov	Powder metallurgy

**SIST EN ISO 3928:2007**

**en**

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ICS 77.160; 77.040.10

English Version

Sintered metal materials, excluding hardmetals - Fatigue test  
pieces (ISO 3928:1999)

Matériaux métalliques frittés, à l'exclusion des métaux-durs  
- Eprouvettes pour essais de fatigue (ISO 3928:1999)

Sintermetallwerkstoffe, ausgenommen Hartmetalle -  
Probekörper für die Ermüdungsprüfung (ISO 3928:1999)

This European Standard was approved by CEN on 9 March 2006.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

## Foreword

The text of ISO 3928:1999 has been prepared by Technical Committee ISO/TC 119 "Powder metallurgy" of the International Organization for Standardization (ISO) and has been taken over as EN ISO 3928:2006 by Technical Committee CEN/SS M11 "Powder metallurgy", the secretariat of which is held by CMC.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 2006, and conflicting national standards shall be withdrawn at the latest by October 2006.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

**Endorsement notice**  
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The text of ISO 3928:1999 has been approved by CEN as EN ISO 3928:2006 without any modifications.

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**Sintered metal materials, excluding  
hardmetals — Fatigue test pieces**

*Matériaux métalliques frittés, à l'exclusion des métaux-durs — Éprouvettes  
pour essais de fatigue*

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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 3.

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 3928 was prepared by Technical Committee ISO/TC 119, *Powder metallurgy*, Subcommittee SC 3, *Sampling and testing methods for sintered metal materials (excluding hardmetals)*.

This second edition cancels and replaces the first edition (ISO 3928:1977) which has been technically revised.

Annex A of this International Standard is for information only.

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# Sintered metal materials, excluding hardmetals — Fatigue test pieces

## 1 Scope

This International Standard specifies:

- the die cavity dimensions used for making fatigue test pieces by pressing and sintering, together with certain dimensions of the test piece obtained from such a die;
- the dimensions of the test pieces machined from sintered and powder forged materials.

This International Standard is applicable to all sintered metals and alloys, excluding hardmetals.

## 2 Pressed and sintered test pieces for fatigue test by reverse bend and axial testing

### 2.1 General

The pressed and sintered piece may also be subjected to further treatment, such as sizing, polishing or heat treatment. If such treatments are applied, they shall be stated in the test report. In a metallographically examined cross section of a test piece, in the gauge region, the piece shall show no micro-lamination greater than 0,25 mm in length. Corners shall be broken in the gauge area.

### 2.2 Test piece specification: unnotched

Figure 1 a) shows a drawing of the unnotched test piece. The flatness and parallelism of 0,1 mm are mandatory. The other dimensions are advisory. Burrs shall be avoided.

### 2.3 Test piece specification: notched

Figure 2 a) shows a drawing of the notched test piece. The flatness and parallelism of 0,1 mm are mandatory. The other dimensions are advisory. Burrs shall be avoided. The tooling radius 5,5 mm of the die is subject to wear, then the corresponding radius dimension of the test piece shall be reported.

## 3 Die specifications

### 3.1 General

The die should preferably be of hardmetal and its surface finish shall be such as to allow compression of test pieces under normal conditions. The die may include a small exit taper to facilitate ejection and avoid cracks or microlaminations in the test pieces. Die cavity may be tapered 0,01 per side to aid ejection. Die bore may be enlarged by 0,5 % for tooling to be used for repressing.

The die should be well supported with shrink rings (of internal diameter  $120 \text{ mm}^{+0,01}_0 \text{ mm}$ ), so as to minimize lateral expansion during compacting. Such support decreases the possibility of cracking of the specimen at ejection. To reduce the incidence of cracks in the specimen, it is recommended to use top punch hold down during ejection.

### 3.2 Die specifications for unnotched test pieces

The recommended die cavity is shown in Figure 1 b).

### 3.3 Die specifications for notched test pieces

The recommended die cavities are shown in Figure 2 b).

## 4 Machined test pieces

Many types of machined test piece may be used according to the different known procedures of fatigue testing (rotating beam, axial loading, reverse bending, etc.) except that it is not recommended to machine test pieces with square or rectangular cross sections.

An example of the rotating beam piece, is given in Figure 3.

Figure 4 shows an example of a test piece for axial loading fatigue testing.

The machined test pieces shall be ground over their active length, using a diamond wheel, and lapped longitudinally in order to remove all traces of circumferential scratches. Final polishing should be in the longitudinal direction (no circumferential scratch lines should be visible); try to achieve a smooth blend with no undercut.

Cold work and stresses from machining significantly increase the yield strength of austenitic stainless steel. Annealing or stress relieving may be required to duplicate the as-sintered structure. Any such heat treatment shall be reported.

Practical experience with fatigue testing of carefully machined test pieces of circular cross section has shown that their endurance limits may be 20 % to 30 % higher than those obtained on unmachined, as-moulded test pieces with square or rectangular cross sections.

Use progressively lighter machining passes to minimize residual stresses. Diameter in gauge length should be uniform within  $\pm 0,025$  mm.

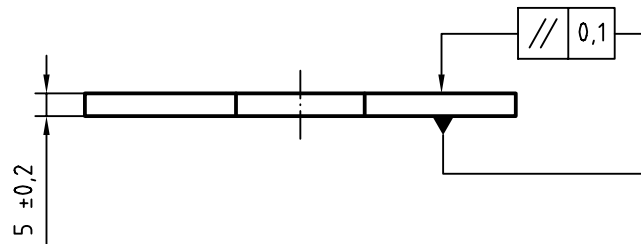
## 5 Identification of test pieces

For the identification of test pieces, the following shall be stated:

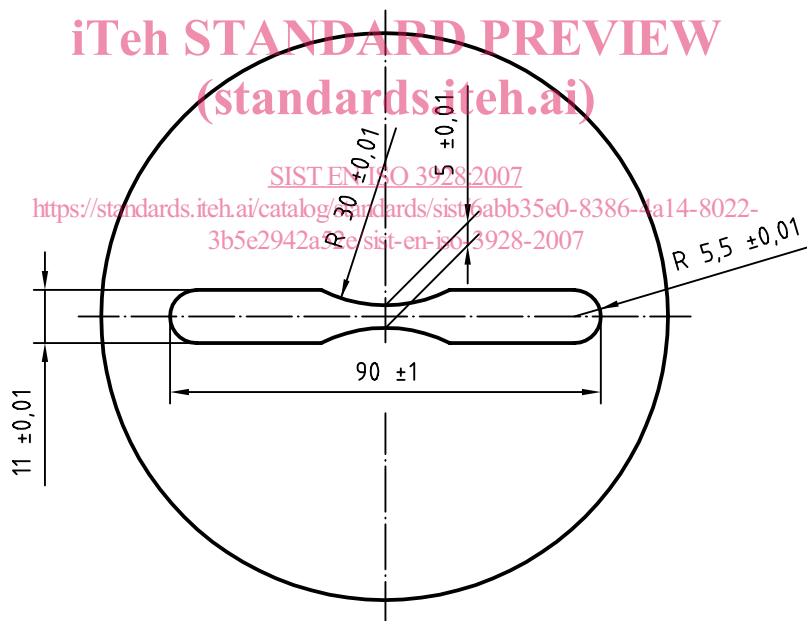
- a) reference to this International Standard, i.e. ISO 3928;
- b) type of material;
- c) density of test piece;
- d) dimensions of test piece (thickness);
- e) when pressed and sintered test pieces are made according to clause 2, the nature of any finishing treatment shall be stated and also, preferably, the material and surface finish of the compacting tool;
- f) form of test piece, i.e. figure number;
- g) die material, i.e. tool steel or hardmetal/carbide;
- h) whether as-sintered or heat treated;
- i) hardness of test piece according to heat treatment;
- j) bottom of notch radius used on notched test piece, Figure 2.



Dimensions in millimetres



a) Test piece



b) Die

Figure 1 — Unnotched test piece and compacting die for use with unnotched fatigue test pieces