

SLOVENSKI STANDARD

SIST EN ISO 12004-2:2009

01-april-2009

Metallische Werkstoffe - Bleche und Bänder - Bestimmung der Grenzformänderungskurve, Teil 2: Bestimmung von Grenzformänderungskurven im Labor (ISO 12004-2:2008)

Metallic materials - Sheet and strip - Determination of forming-limit curves - Part 2: Determination of forming-limit curves in the laboratory (ISO 12004-2:2008)

Matériaux métalliques - Tôles et bandes - Détermination des courbes limites de formage - Partie 2: Détermination des courbes limites de formage en laboratoire (ISO 12004-2:2008)

Ta slovenski standard je istoveten z: EN ISO 12004-2:2008

ICS:

77.040.10 Mehansko preskušanje kovin Mechanical testing of metals

SIST EN ISO 12004-2:2009

en,fr,de

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN ISO 12004-2:2009

<https://standards.iteh.ai/catalog/standards/sist/650bc401-3654-4ee5-a71c-96bd43347dbf/sist-en-iso-12004-2-2009>

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN ISO 12004-2

October 2008

ICS 77.040.10

English Version

Metallic materials - Sheet and strip - Determination of forming-limit curves - Part 2: Determination of forming-limit curves in the laboratory (ISO 12004-2:2008)

Matériaux métalliques - Tôles et bandes - Détermination des courbes limites de formage - Partie 2: Détermination des courbes limites de formage en laboratoire (ISO 12004-2:2008)

Metallische Werkstoffe - Bleche und Bänder - Bestimmung der Grenzformänderungskurve - Teil 2: Bestimmung von Grenzformänderungskurven im Labor (ISO 12004-2:2008)

This European Standard was approved by CEN on 12 October 2008.

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 CEN Management Centre 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 CEN Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, 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.



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

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

Contents

Page

Foreword.....	3
---------------	---

iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST EN ISO 12004-2:2009](https://standards.iteh.ai/catalog/standards/sist/650bc401-3654-4ee5-a71c-96bd43347dbf/sist-en-iso-12004-2-2009)

<https://standards.iteh.ai/catalog/standards/sist/650bc401-3654-4ee5-a71c-96bd43347dbf/sist-en-iso-12004-2-2009>

Foreword

This document (EN ISO 12004-2:2008) has been prepared by Technical Committee ISO/TC 164 "Mechanical testing of metals" in collaboration with Technical Committee ECISS/TC 1 "Steel - Mechanical testing" the secretariat of which is held by AFNOR.

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 April 2009, and conflicting national standards shall be withdrawn at the latest by April 2009.

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

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, 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 the United Kingdom.

iTeh STANDARD PREVIEW (standards.iteh.ai)

Endorsement notice

The text of ISO 12004-2:2008 has been approved by CEN as a EN ISO 12004-2:2008 without any modification.

[SIST EN ISO 12004-2:2009](https://standards.iteh.ai/catalog/standards/sist/650bc401-3654-4ee5-a71c-96bd43347dbf/sist-en-iso-12004-2-2009)

<https://standards.iteh.ai/catalog/standards/sist/650bc401-3654-4ee5-a71c-96bd43347dbf/sist-en-iso-12004-2-2009>

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN ISO 12004-2:2009

<https://standards.iteh.ai/catalog/standards/sist/650bc401-3654-4ee5-a71c-96bd43347dbf/sist-en-iso-12004-2-2009>

INTERNATIONAL STANDARD

ISO
12004-2

First edition
2008-10-15

Metallic materials — Sheet and strip — Determination of forming-limit curves — Part 2: Determination of forming-limit curves in the laboratory

iTeh STANDARD PREVIEW
(standards.iteh.ai)
*Matériaux métalliques — Tôles et bandes — Détermination des courbes
limites de formage —
Partie 2: Détermination des courbes limites de formage en laboratoire*

SIST EN ISO 12004-2:2009

<https://standards.iteh.ai/catalog/standards/sist/650bc401-3654-4ee5-a71c-96bd43347dbf/sist-en-iso-12004-2-2009>



Reference number
ISO 12004-2:2008(E)

© ISO 2008

ISO 12004-2:2008(E)

PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST EN ISO 12004-2:2009](https://standards.iteh.ai/catalog/standards/sist/650bc401-3654-4ee5-a71c-96bd43347dbf/sist-en-iso-12004-2-2009)

<https://standards.iteh.ai/catalog/standards/sist/650bc401-3654-4ee5-a71c-96bd43347dbf/sist-en-iso-12004-2-2009>

**COPYRIGHT PROTECTED DOCUMENT**

© ISO 2008

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

Foreword.....	iv
Introduction	v
1 Scope	1
2 Symbols and abbreviated terms	1
3 Principle	2
4 Test pieces and equipment.....	3
5 Analysis of strain profile and measurement of $\varepsilon_1 - \varepsilon_2$ pairs	10
6 Documentation	15
7 Test report	16
Annex A (normative) Second derivative and “filtered” second derivative	17
Annex B (normative) Calculation of the width of the fit window.....	18
Annex C (normative) Evaluation of the inverse best-fit parabola on the “bell-shaped curve”	19
Annex D (normative) Application/Measurement of grid — Evaluation with magnifying glass or microscope.....	21
Annex E (informative) Tables of experimental data for validation of calculation programme.....	22
Annex F (normative) Representation and mathematical description of FLC.....	23
Annex G (informative) Examples of critical cross-sectional data.....	24
Annex H (normative) Flowchart from measured strain distributions to FLC values	25
Bibliography	27

ISO 12004-2:2008(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.

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 12004-2 was prepared by Technical Committee ISO/TC 164, *Mechanical testing of metals*, Subcommittee SC 2, *Ductility testing*.

This first edition of ISO 12004-2, together with ISO 12004-1, cancels and replaces ISO 12004:1997 which has been technically revised.

ISO 12004 consists of the following parts, under the general title *Metallic materials — Sheet and strip — Determination of forming-limit curves*:

- Part 1: Measurement and application of forming-limit diagrams in the press shop
- Part 2: Determination of forming-limit curves in the laboratory

Introduction

A forming-limit diagram (FLD) is a diagram containing major/minor strain points.

An FLD can distinguish between safe points and necked or failed points. The transition from safe to failed points is defined by the forming-limit curve (FLC).

To determine the forming limit of materials, two different methods are possible.

- 1) Strain analysis on failed press shop components to determine component and process dependent FLCs:

In the press shop, the strain paths followed to reach these points are generally not known. Such an FLC depends on the material, the component and the chosen forming conditions. This method is described in ISO 12004-1.

- 2) Determination of FLCs under well-defined laboratory conditions:

For evaluating formability, one unique FLC for each material in several strain states is necessary. The determination of the FLC has to be specific and it is necessary to use different linear strain paths. This method should be used for material characterization as described in ISO 12004-2.

For this part of ISO 12004 (concerning determination of forming-limit curves in laboratory), the following conditions are also valid.

- Forming-limit curves (FLCs) are determined for specific materials to define the extent to which they can be deformed by drawing, stretching or any combination of drawing and stretching. This capability is limited by the occurrence of fracture, localized necking. Many methods exist to determine the forming limit of a material; however, it should be noted that results obtained using different methods cannot be used for comparison purposes.
- The FLC characterizes the deformation limit of a material in the condition after a defined thermo-mechanical treatment and in the analysed thickness. For a judgement of formability, the additional knowledge of mechanical properties and the material's history prior to the FLC-test are important.

To compare the formability of different materials, it is important not only to judge the FLC but also the following parameters:

- a) mechanical properties at least in the main direction;
- b) percentage plastic extension at maximum force, according to ISO 6892-1;
- c) r -value with given deformation range, according to ISO 10113;
- d) n -value with given deformation range, according to ISO 10275.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN ISO 12004-2:2009

<https://standards.iteh.ai/catalog/standards/sist/650bc401-3654-4ee5-a71c-96bd43347dbf/sist-en-iso-12004-2-2009>