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Metallic materials - Determination of forming-limit curves for sheet and strip - Part 1: Measurement and application of forming-limit diagrams in the press shop (ISO 12004-1:2020)

Táto norma obsahuje anglickú verziu európskej normy.  
This standard includes the English version of the European Standard.

Táto norma bola oznámená vo Vestníku ÚNMS SR č. 05/21

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English Version

# Metallic materials - Determination of forming-limit curves for sheet and strip - Part 1: Measurement and application of forming-limit diagrams in the press shop (ISO 12004-1:2020)

Matériaux métalliques - Détermination des courbes limites de formage pour les tôles et bandes - Partie 1: Mesurage et application des diagrammes limites de formage dans les ateliers d'emboutissage (ISO 12004-1:2020)

Metallische Werkstoffe - Bestimmung der Grenzformänderungskurven für Bleche und Bänder - Teil 1: Messung und Anwendung von Grenzformänderungsdiagrammen in Stanzereien (ISO 12004-1:2020)

This European Standard was approved by CEN on 15 October 2020.

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**CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels**

**EN ISO 12004-1:2020 (E)**

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## **European foreword**

This document (EN ISO 12004-1:2020) has been prepared by Technical Committee ISO/TC 164 "Mechanical testing of metals" in collaboration with Technical Committee CEN/TC 459/SC 1 "Test methods for steel (other than chemical analysis)" 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of an identical text or by endorsement, at the latest by May 2021, and conflicting national standards shall be withdrawn at the latest by May 2021.

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

This document supersedes EN ISO 12004-1:2008.

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, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

## **Endorsement notice**

The text of ISO 12004-1:2020 has been approved by CEN as EN ISO 12004-1:2020 without any modification.

**INTERNATIONAL  
STANDARD**

**ISO  
12004-1**

Second edition  
2020-10

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**Metallic materials — Determination  
of forming-limit curves for sheet and  
strip —**

**Part 1:  
Measurement and application of  
forming-limit diagrams in the press  
shop**

*Matériaux métalliques — Détermination des courbes limites de  
formage pour les tôles et bandes —*

*Partie 1: Mesurage et application des diagrammes limites de formage  
dans les ateliers d'emboutissage*



Reference number  
ISO 12004-1:2020(E)

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# ISO 12004-1:2020(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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 164, *Mechanical testing of metals*, Subcommittee SC 2, *Ductility testing*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 459/SC 1, *Test methods for steel (other than chemical analysis)*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 12004-1:2008), which has been technically revised.

The main changes compared to the previous edition are as follows:

- 1) The title was changed to have three elements.
- 2) [Clauses 2](#) and [3](#) were added from the previous edition, and the subsequent sections were renumbered.
- 3) The description of when to use this document (ISO 12004-1) or ISO 12004-2 was revised in the Introduction.
- 4) Throughout the document the use of engineering strain was clarified.
- 5) [Subclause 6.2](#) was extended to include what was the subsequent Clause in the previous version.
- 6) The former note was moved to part of [Clause 7](#), since it gives permission to use another method.
- 7) The text in [Annex A](#) and the figure captions in [Annex B](#) were clarified.

A list of all parts in the ISO 12004 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).



## Introduction

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

An FLD can distinguish between safe 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 of failed press shop components to determine component and process dependent FLCs

In the press shop, strain paths 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 this document and is not intended to determine one unique FLC for each material.

2) Determination of FLCs under well-defined laboratory conditions

For evaluating formability, one unique FLC for each material in several strain states can be measured. The determination of FLC must be specific and uses multiple linear strain paths. The ISO 12004-2 is intended for this type of material characterization.



# **Metallic materials — Determination of forming-limit curves for sheet and strip —**

Part 1:

## **Measurement and application of forming-limit diagrams in the press shop**

### **1 Scope**

This document specifies a procedure for developing forming-limit diagrams and forming-limit curves for metal sheets and strips of thicknesses from 0,3 mm to 4 mm.

### **2 Normative references**

There are no normative references in this document.

**koniec náhľadu – text ďalej pokračuje v platenej verzii STN**