

**Metallmaterjalid. Katusekatted ja sise- ja välisseina
kattematerjalid. Stantsimiskõverate määramine.
Osa 2: Stantsimiskõverate määramine laboris**

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

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

Käesolev Eesti standard EVS-EN ISO 12004-2:2008 sisaldab Euroopa standardi EN ISO 12004-2:2008 ingliskeelset teksti.

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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)

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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of an identical text or by endorsement, at the latest by April 2009, and conflicting national standards shall be withdrawn at the latest by April 2009.

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Endorsement notice

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

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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.

Metallic materials — Sheet and strip — Determination of forming-limit curves —

Part 2: Determination of forming-limit curves in the laboratory

1 Scope

This part of ISO 12004 specifies the testing conditions to be used when constructing a forming-limit curve (FLC) at ambient temperature and using linear strain paths. The material considered is flat, metallic and of thickness between 0,3 mm and 4 mm.

NOTE The limitation in thickness of up to 4 mm is proposed, giving a maximum allowable thickness to the punch diameter ratio.

For steel sheet, a maximum thickness of 2,5 mm is recommended.

2 Symbols and abbreviated terms

For the purposes of this document, the symbols and terms given in Table 1 apply.

Table 1 — Symbols and abbreviated terms

Symbol	English	French	German	Unit
e	Engineering strain	Déformation conventionnelle	Technische Dehnung	%
ε	True strain (logarithmic strain)	Déformation vraie (déformation logarithmique)	Wahre Dehnung (Umformgrad, Formänderung)	—
ε_1	Major true strain	Déformation majeure vraie	Grössere Formänderung	—
ε_2	Minor true strain	Déformation mineure vraie	Kleinere Formänderung	—
ε_3	True thickness strain	Déformation vraie en épaisseur	Dickenformänderung	—
σ	Standard deviation	Ecart-type	Standardabweichung	—
D	Punch diameter	Diamètre du poinçon	Stempeldurchmesser	mm
D_{bh}	Carrier blank hole diameter	Diamètre du trou du contre-flan	Lochdurchmesser des Trägerblechs	mm
$X(0), X(1)$ $X(m) \dots X(n)$	X-position	Position en X	X-Position	mm
$f(x) = ax^2 + bx + c$	Best-fit parabola	Parabole de meilleur fit	Best-Fit-Parabel	—
$\frac{f(x)}{1/(ax^2 + bx + c)}$	Best-fit inverse parabola	Parabole inverse de meilleur fit	Inverse Best-Fit-Parabel	—