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

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

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

Partie 2: Détermination des courbes limites de formage en laboratoire

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Contents

Page

Foreword	iv
Introduction	vi
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Symbols	1
5 Principle	2
6 Test pieces and equipment	3
6.1 Test pieces.....	3
6.1.1 Thickness of test pieces.....	3
6.1.2 Test piece geometry.....	3
6.1.3 Test piece preparation in test area.....	4
6.1.4 Number of different test piece geometries.....	4
6.1.5 Number of tests for each geometry.....	4
6.2 Application of grid.....	4
6.2.1 Type of grid.....	4
6.2.2 Grid application.....	5
6.2.3 Accuracy of the undeformed grid.....	5
6.3 Test equipment.....	5
6.3.1 General.....	5
6.3.2 Strain determination.....	7
6.3.3 Nakajima test.....	7
6.3.4 Marciniak test.....	9
7 Analysis of strain profile and measurement of $\varepsilon_1 - \varepsilon_2$ pairs	11
7.1 General.....	11
7.2 Evaluation using section lines (position-dependent measurement).....	11
7.2.1 General.....	11
7.2.2 Position and processing of measurements.....	12
7.2.3 Extraction of the “bell-shaped curve” and determination of the inner limits for the best-fit curve through experimental points.....	13
7.2.4 Definition of outer limits for best-fit windows and evaluation of the inverse best-fit parabola on the “bell-shaped curve”.....	14
8 Documentation	15
9 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 section line data	24
Annex H (normative) Flowchart from measured strain distributions to FLC values	25
Bibliography	27

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).

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).

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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 12004-2:2008), 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) [Clause 2](#) and [Clause 3](#) were added from the previous edition, and the subsequent clauses were renumbered.
- 3) The descriptions of when to use ISO 12004-1 or ISO 12004-2 (this document) was revised in the Introduction.
- 4) Permissions and requirements were clarified in [6.1.3](#), [6.1.5](#), [6.2.2](#), [6.2.3](#), [6.3.2](#), [6.3.3.3](#), [6.3.4.3](#), [7.2.2](#), and [7.2.3](#).
- 5) In [6.3.1](#), the punch velocity range was expanded and permission for exceptional cases in aluminium alloys, as well as steel, was added.
- 6) Clarification was added that although the Nakajima method is known to have non-linear strain paths ([6.3.3.1](#)), it is still acceptable. Clarification as to why the failure is required to be near the apex of the dome was added to [6.3.3.3](#). In [6.3.3.3](#), the “validity of test” requirement for the Nakajima test was made explicit in a similar format to that shown for the Marciniak test in [6.3.4.4](#). In [6.3.3.3](#) and [6.3.4.4](#), a statement regarding rejection of specimens not meeting the valid test requirements was added.

- 7) The “Measuring instrument” clause (4.3.5 in the previous edition) was removed since it is a repetition of the “Measurement instrument” section of [6.3.2](#) but had a different accuracy requirement. The required accuracy is now shown as originally described in [6.3.2](#).
- 8) The requirement on the second derivative range was clarified in [7.2.3\(c\)](#), and the requirements in the keys of [Figures 8](#) and [9](#) were changed to match [7.2.3\(c\)](#).
- 9) The permission to use other methods of measurement was moved from [7.2.1](#) to [7.1](#) and was clarified.
- 10) The statement regarding the “time-dependent method” was removed from [7.1](#) but now a statement admitting the use of other methods including both the “time-dependent method” or “time and position dependent methods” appears in [Clause 5](#).
- 11) In [7.2.2](#), the method of selecting the section line locations based on the crack position was clarified, and permission was added to use the maximum strain location, as long as the test validity requirements are still met.
- 12) The use of the procedure in [7.2.3](#) when extracting the “bell-shaped curve” for use in evaluating the section lines using the position-dependent method has been changed to being required rather than just suggested. This seems to be consistent with the original intent.
- 13) In [Annex A](#), the method was changed to be required rather than proposed. [Annex C](#) was clarified to show that the procedure is required. Clarification to the text of [Annex D](#) was added, and its use is explicitly permitted. In [Annex E](#), explicit permission to use a regression using in-house functions was added, as well as the requirement that the function be reported.
- 14) Editorial changes and clarifications were made throughout the document.

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.

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