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**Metallic materials — Knoop  
hardness test —**

**Part 1:  
Test method**

*Matériaux métalliques — Essai de dureté Knoop —  
Partie 1: Méthode d'essai*





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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.

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 on 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 the following URL: [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 3, *Hardness testing*.

This second edition cancels and replaces the first edition (ISO 4545-1:2005), which has been technically revised.

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

- all references have been removed of indentation diagonals <0,020 mm;
- the resolution requirements have been defined for the measuring system;
- the lower test force limit of the Knoop hardness test has been expanded to 0,009 807 N;
- the requirements for the periodic (weekly or daily) verifications of the testing machine have been defined as normative, the maximum permissible bias value has been revised, and the requirements for the maximum permissible error in measuring a reference indentation have been revised;
- the recommendations for inspection and monitoring of the indenter have been added (moved from ISO 4545-2);
- the requirements have been revised for the approach velocity of the indenter prior to contact with the sample surface;
- the timing requirements for the test force application and the duration at maximum test force are revised to indicate target time values;
- [Figure 3](#) has been added illustrating the requirements for the minimum distance between indentations; the distances have been stated with respect to the indentation centres rather than the indentation limits, but the requirements have not changed;
- the requirements have been added to the test report for reporting the test date and any hardness conversion method used;

- [Annexes C, D](#) and [E](#) have been added concerning Knoop hardness measurement traceability, the CCM — Working group on hardness and adjustment of Köhler illumination systems, respectively.

A list of all parts in the ISO 4545 series can be found on the ISO website.



# Metallic materials — Knoop hardness test —

## Part 1: Test method

### 1 Scope

This document specifies the Knoop hardness test method for metallic materials for test forces from 0,009 807 N to 19,613 N.

The Knoop hardness test is specified in this document for lengths of indentation diagonals  $\geq 0,020$  mm. Using this method to determine Knoop hardness from smaller indentations is outside the scope of this document as results would suffer from large uncertainties due to the limitations of optical measurement and imperfections in tip geometry. ISO 14577-1 allows the determination of hardness from smaller indentations.

A periodic verification method is specified for routine checking of the testing machine in service by the user.

Special considerations for Knoop testing of metallic coatings can be found in ISO 4516.

### 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 4545-2, *Metallic materials — Knoop hardness test — Part 2: Verification and calibration of testing machines*

ISO 4545-3, *Metallic materials — Knoop hardness test — Part 3: Calibration of reference blocks*

### 3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

### 4 Principle

A diamond indenter, in the form of a rhombic-based pyramid with angles,  $\alpha$  and  $\beta$ , between opposite edges respectively equal to  $172,5^\circ$  and  $130^\circ$  at the vertex, is forced into the surface of a test piece followed by measurement of the long diagonal,  $d$ , of the indentation remaining in the surface after removal of the test force,  $F$  (see [Figures 1](#) and [2](#)).