



SLOVENSKI STANDARD
oSIST prEN ISO 18203:2022
01-januar-2022

Jekla - Določevanje in preverjanje cementacijske in kalilne globine (ISO 18203:2016)

Steel - Determination of the thickness of surface hardened layers (ISO 18203:2016)

Stahl - Bestimmung der Dicke gehärteter Randschichten (ISO 18203:2016)

Acier - Détermination de l'épaisseur des couches durcies superficielles (ISO 18203:2016)

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77.080.20	Jekla	Steels

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INTERNATIONAL
STANDARD

ISO
18203

First edition
2016-12-01

**Steel — Determination of the
thickness of surface-hardened layers**

*Acier — Détermination de l'épaisseur des couches durcies
superficielles*

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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).

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).

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 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.

The committee responsible for this document is ISO/TC 17, *Steel*, Subcommittee SC 7, *Methods of testing (other than mechanical tests and chemical analysis)*.

This first edition of ISO 18203 cancels and replaces ISO 2639:2002, ISO 3754:1976 and ISO 4970:1979, which have been technically revised.

Introduction

In the past, there are three ISO standards for measuring surface-hardened layer. Because those standards employed almost the same principle of measuring, it is intended to make it easy for maintenance of the standards and application of test by integrating these three standards.

The method of estimating uncertainty of measurement is not included in this document. In future revision, uncertainty of measurement may be reflected based on real applications to this test.

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Steel — Determination of the thickness of surface-hardened layers

1 Scope

This document specifies a method of measuring the case hardening depth, surface hardening depth, nitriding hardness depth and total thickness of surface hardening depth obtained, e.g. thermal (flame and induction hardening, electron beam hardening, laser beam hardening, etc.) or thermochemical (carbonitriding, carburizing and hardening, hardening and nitriding, etc.) treatment.

NOTE Surface-hardened layer can be produced by mechanical method (shot blasting, shot peening, etc.). The depth of these layers is generally shallow. Measuring a profile of hardened depth may require lower test force of hardness test.

2 Normative reference

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 4545-1, *Metallic materials — Knoop hardness test — Part 1: Test method*

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

ISO 6507-1, *Metallic materials — Vickers hardness test — Part 1: Test method*

ISO 6507-2, *Metallic materials — Vickers hardness test — Part 2: Verification and calibration of testing machines*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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>

3.1

case hardening depth

CHD

perpendicular distance between the surface and the layer having a hardness of 550 HV in accordance with ISO 6507-1 or equivalent Knoop hardness in accordance with ISO 4545-1

Note 1 to entry: For steels which present a hardness greater than 450 HV at a distance of three times the case hardening depth (determined with a limiting hardness value of 550 HV) from the surface, a limiting hardness value greater than 550 HV, in steps of 25 units, can be selected for the determination of the case hardening depth by agreement between interested parties.

Note 2 to entry: In general, case hardening consists of carburizing or carbonitriding followed by quench hardening (see ISO 4885).

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3.2 surface hardening depth SHD

distance between the surface and the layer where HV is equal to the value specified by the term “hardness limit”

Note 1 to entry: Hardness limit is a function of the minimum surface hardness required for the part, given by the following formula:

$$\text{hardness limit (HV)} = A \times \text{minimum surface hardness (HV)}$$

Note 2 to entry: 0,80 is usually used for A. Other values can be applied.

Note 3 to entry: SHD measurement should be applied for parts which, in the surface hardened condition, have a hardness less than (hardness limit – 100 HV) at a distance $3 \times \text{SHD}$ from the surface. Where these conditions are not satisfied, the definition of SHD should be agreed between interested parties.

Note 4 to entry: Recommended hardness limit values are listed in [Table 1](#).

Table 1 — Recommended hardness limit values of SHD

Minimum surface hardness HV	Hardness limit HV
300 to 330	250
335 to 355	275
360 to 385	300
390 to 420	325
425 to 455	350
460 to 480	375
485 to 515	400
520 to 545	425
550 to 575	450
580 to 605	475
610 to 635	500
640 to 665	525
670 to 705	550
710 to 730	575
735 to 765	600
770 to 795	625
800 to 835	650
840 to 865	675

3.3 compound layer thickness CLT

thickness of the surface layer formed during the thermochemical treatment and made up of the chemical compounds formed by the elements introduced during the treatment and certain elements from the base metal

3.4

nitriding hardness depth NHD

distance from the surface of nitride layer to the point where the material hardness limit is 50 HV above core hardness

Note 1 to entry: The core hardness is determined by at least three hardness measurements and rounded to the nearest multiple of 10 HV.

3.5

total thickness of surface hardening depth THD

distance from the examined surface to the limit that shows the same hardness as the matrix hardness

Note 1 to entry: The distance is often measured by the microstructural method, which is the distance from the surface examined to the limit beyond which no visible structure variation is detected, as compared with the structure of the unaffected metal. The microstructural method does not measure as deep as the hardness method.

4 Symbols, abbreviations and designations

The symbols and abbreviations used in this document and their corresponding designations are given in [Table 2](#).

Table 2 — Symbols, abbreviations and designations

Symbol/ abbreviation	Unit	Designation
d_i	mm	distance of the centre of each impression from the surface
Δd	mm	distance of the centre of two adjacent impression
CHD	mm	case hardening depth
SHD	mm	surface hardening depth
CLT	μm	compound layer thickness
NHD	mm	nitriding hardness depth
THD	mm	total thickness of surface hardening depth
H_{limit}	HV	hardness limit

5 Principle

The case hardening depth, surface hardening depth and nitriding hardness depth are determined from the gradient of hardness on a cross-section normal to the surface.

They are derived graphically from a curve representing the variation in hardness as a function of the distance from the surface of the part.

The total thickness of surface hardening depth is determined from the structure variation observed by micrographic method or by measuring hardness variation.

Compound layer thickness is determined from the chemical compound layer observed by microscopic method.

6 Apparatus

The hardness testing machine for determining Vickers hardness shall be verified and calibrated in accordance with ISO 6507-2.