SLOVENSKI STANDARD
oSIST prEN ISO 3887:2016

01-oktober-2016

Jekla - Določevanje globine razogličene plasti (ISO/DIS 3887:2016)

Steels - Determination of the depth of decarburization (ISO/DIS 3887:2016)

Stahl - Bestimmung der Entkohlungstiefe (ISO/DIS 3887:2016)

Aciers - Détermination de la profondeur de décarburation (ISO/DIS 3887:2016)

Ta slovenski standard je istoveten z: **prEN ISO 3887**

ICS:

77.040.99	Druge metode za preskušanje kovin	Other methods of testing of metals
77.080.20	Jekla	Steels

oSIST prEN ISO 3887:2016 **en,fr,de**

DRAFT INTERNATIONAL STANDARD

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Steels — Determination of depth of decarburization

Aciers — Détermination de la profondeur de décarburation

ICS: 77.040.99

ISO/CEN PARALLEL PROCESSING

This draft has been developed within the International Organization for Standardization (ISO), and processed under the **ISO lead** mode of collaboration as defined in the Vienna Agreement.

This draft is hereby submitted to the ISO member bodies and to the CEN member bodies for a parallel five month enquiry.

To expedite distribution, this document is circulated as received from the committee secretariat. ISO Central Secretariat work of editing and text composition will be undertaken at publication stage.

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ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

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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. www.iso.org/directives

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

The committee responsible for ISO/DIS 3887 is ISO/TC 17, Steel, Subcommittee SC 7, Methods of testing (other than mechanical tests and chemical analysis).

This third edition cancels and replaces the second edition (ISO 3887:2003), which has been technically revised.

Steels — Determination of depth of decarburization

1 Scope

This International Standard defines the decarburization and specifies five methods of measuring the depth of decarburization of steel products.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 6507-1, *Metallic materials — Vickers hardness test — Part 1: Test method*

ISO 9556, *Steel and iron — Determination of total carbon content — Infrared absorption method after combustion in an induction furnace*

ISO 15349-2, *Unalloyed steel — Determination of low carbon content — Part 2: Infrared absorption method after combustion in an induction furnace (with preheating)*

ISO 14594, *Microbeam analysis — Electron probe microanalysis — Guidelines for the determination of experimental parameters for wavelength dispersive spectroscopy*

ISO 14707, *Surface chemical analysis — Glow discharge optical emission spectrometry (GD-OES) — Introduction to use*

3 Terms and definitions

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

3.1
decarburization
loss of carbon from the surface zone of the steel where the loss is:

a) either partial decarburization, d_3;

b) or complete decarburization, also called ferrite decarburization, d_1, measured as the distance between the surface of the product and the point up to which carbon is below the solubility limit of carbon in ferrite so that only ferrite is present.

Note 1 to entry: The depth of complete decarburization as described in b) is determined by examination of the microstructure.

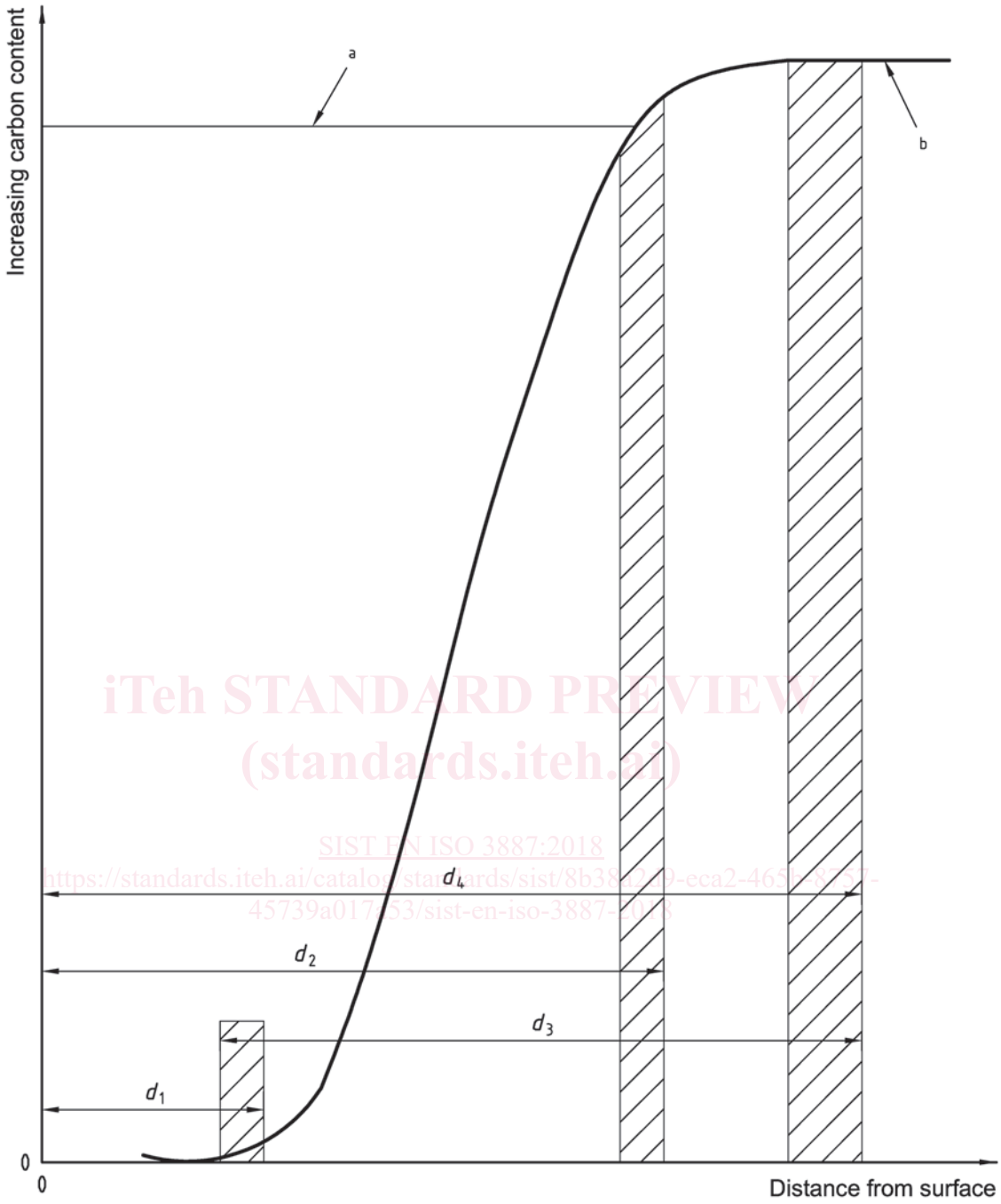
3.2
depth of functional decarburization
d_2
distance between the surface of the product and the point at which the carbon content or hardness is at the level where the performance of the product would be unaffected by a reduction in carbon (i.e., at the minimum level specified in the product standard)

3.3
depth of total decarburization
d_4
distance between the surface of the product and the point at which the carbon content is that of the unaffected core, the sum of the partial and the complete decarburization $d_3 + d_1$ being designated by the letters DD and expressed in millimetres, e.g., DD = 0,08 mm

Note 1 to entry: The various bands of decarburization are shown schematically in Figure 1. The boundaries separating the various types of decarburization are shown as hatched bands with the width of the band illustrating the practical variability in measurements due to the uncertainty of interpretation.

3.4
depth profile of carbon content
the curve indicating the relationship between the perpendicular distance from the surface of steel material and the carbon concentration

3.5
depth profile of hardness
the curve indicating the relationship between the perpendicular distance from the surface of steel material and the hardness



Key

a minimum carbon content specified in the product standard

b core carbon content

If the product has undergone a process involving carburization, the definition of the "core" shall form the subject of an agreement between the parties concerned.

The permissible depth of decarburization shall be specified in the appropriate standard covering the product or shall be the subject of an agreement between the parties concerned.

Figure 1 — Carbon content as a function of the distance from the surface: schematic representation for a typical decarburized steel

4 Sampling

4.1 Samples should be taken at locations that are representative of the bulk specimen. The location and number of samples taken depend on the nature of the material to be tested and will be defined upon agreements between the manufacturer and purchaser.

4.2 Specimens for the microscopical methods or for micro-indentation hardness tests or by electron probe microanalysis should be cut from the bulk specimen perpendicular to the longitudinal axis of the product so that measurements are made on a transverse plane. This procedure permits the determination of the variation of decarburization around the periphery of the specimen. For specimens up to about 2,5 cm diameter, the entire cross-section is polished and examined. For larger cross-sections, one or more specimens shall be prepared to assess variations in surface decarburization. The sampling scheme for large sections should be determined upon mutual agreement between the manufacturer and purchaser.

4.3 Specimens for chemical analytical methods shall be of sufficient length so that the weight of incremental turnings is adequate for chemical analysis or the size of milled surfaces is large enough for sparking yet small enough to fit in the specimen holder.

5 Measuring methods

5.1 General

The choice of the method and its accuracy depend on the degree of decarburization, the microstructure, the carbon content of the product examined and the shape of the component.

The usual methods employed on finished products are:

— a micrographic method (see 5.2);

— a method for measuring the microindentation hardness (Vickers or Knoop) for steels in the hardened or quenched and tempered condition (see 5.3);

— a method for the determination of the carbon content by chemical or spectrographic analysis (see 5.4);

— a method for measuring the depth profile of the carbon content by electron probe microanalysis (EPMA) (see 5.5);

— a method for measuring the depth profile of the carbon content by glow discharge optical emission spectrometry (GDOES) (see 5.6).

The inclusion of several methods of measurement, each having its own sphere of application, avoids the necessity for further heat treatment. The sample shall be examined in the as-delivered condition. Nevertheless if, by agreement between the parties concerned, a supplementary heat treatment is applied, every precaution shall be taken to prevent changes in mass percentage and/or in the distribution of carbon, i.e., a small sample, a short austenitization time, a neutral atmosphere.

The measuring method shall be agreed upon in writing by the parties concerned, unless it is defined in the product standard.

5.2 Micrographic method

5.2.1 General

Unless otherwise specified, this method shall only be applied in situations where changes in the carbon content are reflected by resulting variations in microstructure.

This method is especially valid for steels showing an annealed, normalized, as-rolled, or as-forged structure. It may apply, with reservations, for products showing a hardened or tempered structure where the interpretation of the structural variations becomes difficult.

5.2.2 Selection and preparation of the sample

The micrographic polishing, carried out by applying the usual methods, shall not round the edges. In order to achieve this, the sample may be mounted or held in a clamp, and the surface of the product may, if necessary, be protected by a metallic deposit obtained by electroless or electrolytic plating. Automatic/semi-automatic preparation techniques are recommended, where possible.

Etching in a solution of 1,5 % to 4 % nitric acid in ethanol (nital) or 2 % to 5 % picral will reveal the structure of the steel.

5.2.3 Measurement

As a rule, the reduction in the carbon content can be determined for:

a) ferrite and pearlite: from the decrease in the amount of pearlite;

b) pearlite and hypereutectoidally developed carbides: from the decrease in the amount of hypereutectoidally developed carbides and/or of pearlite;

c) ferrite matrix with dispersed carbides: from the decrease in the amount of carbides in the ferrite matrix.

Hardened or quenched and tempered microstructures can be assessed by this method if the change in the carbon content leads to clear changes in the microstructure.

This method can also be applied for other structural conditions, e.g., for hardened or quenched and tempered microstructures, but only if a distinct boundary exists within the characteristic structure, which is decisive for the depth of decarburization.

The distance from the surface to the point at which the structure does not differ from that of the core shall be measured (total decarburization). The measurement shall be conducted using a suitably calibrated equipment.

The choice of magnification depends on the depth of decarburization and shall be chosen by the assessor unless specifically agreed upon between the parties. It is recommended that the maximum magnification that allows the full extent of decarburization to be viewed is adopted. A magnification of × 100 is recommended as a useful magnification for the majority of instances.

A preliminary examination of the whole surface at low magnification ensures that any great variation in the depth of decarburization along the periphery will be observed for further evaluation.

The deepest and uniform decarburization zone is selected from the preliminary examination of the surface of the section. There are two methods of measurement to be recommended. The choice of measurement methods shall be in accordance with the agreement between the purchaser and manufacturer. The first method is called worst field method, which is also the simplest one, adequate for many purposes. At least five measurements of the depth of decarburization are conducted at the deepest and uniform decarburization zone and the average is reported. The second method is called average method. Beginning at the deepest and uniform decarburization zone, the first measurement point, the surface is divided into parts of equal size, at the ends of which the depth of decarburization shall also be measured. Unless otherwise agreed, four individual measured values shall be determined. The depth of total decarburization of the sample (see 3.3) is defined as the average of these measurements. Measuring points that are affected by surface defects shall not be taken into account when determining the average.