SVENSK STANDARD
SS-EN ISO 15349-2:2021

Olegerat stål – Bestämning av låg kolhalt – Del 2: Metod med absorption i infrarött ljus efter förbränning i induktionsugn (ISO 15349-2:2021)

Unalloyed steel – Determination of low carbon content – Part 2: Infrared absorption method after combustion in an induction furnace (with preheating) (ISO 15349-2:2021)

Svenska Institutet för Standarder

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ICS: 77.080.20

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Europastandarden EN ISO 15349-2:2021 gäller som svensk standard. Detta dokument innehåller den officiella engelska versionen av EN ISO 15349-2:2021.

Denna standard ersätter SS-EN ISO 15349-2, utgåva 1

The European Standard EN ISO 15349-2:2021 has the status of a Swedish Standard. This document contains the official version of EN ISO 15349-2:2021.

This standard supersedes the SS-EN ISO 15349-2, edition 1

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LÄSANVISNINGAR FÖR STANDARDER

I dessa anvisningar behandlas huvudprinciperna för hur regler och yttre begränsningar anges i standardiseringsprodukter.

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Ett krav är ett uttryck i ett dokuments innehåll som anger objektivt verifierbara kriterier som ska uppfyllas och från vilka ingen avvikelse tillåts om efterlevnad av dokumentet ska kunna åberopas. Krav uttrycks med hjälpverbet **ska** (eller **ska inte** för förbud).

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These instructions cover the main principles for the use of provisions and external constraints in standardization deliverables.

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A requirement is an expression, in the content of a document, that conveys objectively verifiable criteria to be fulfilled, and from which no deviation is permitted if conformance with the document is to be claimed. Requirements are expressed by the auxiliary **shall** (or **shall not** for prohibition).

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A recommendation is an expression, in the content of a document, that conveys a suggested possible choice or course of action deemed to be particularly suitable, without necessarily mentioning or excluding others. Recommendations are expressed by the auxiliary **should** (or **should not** for dissuasion).

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An instruction is expressed in the imperative mood and is used in order to convey an action to be performed. It can be subordinated to another provision, such as a requirement or a recommendation. It can also be used independently and is then to be regarded as a requirement.

Statement
A statement is an expression, in the content of a document, that conveys information. A statement can express permission, possibility or capability. Permission is expressed by the auxiliary **may**. There is no recommended opposite expression for the auxiliary may in standardization, prohibition is expressed by the use of **shall not** in accordance with the rules for requirements. Possibility and capability are expressed by the auxiliary **can** (its opposite being **cannot**).

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 15349-2

July 2021

ICS 77.080.20

Supersedes EN ISO 15349-2:2003

English Version

Unalloyed steel - Determination of low carbon content - Part 2: Infrared absorption method after combustion in an induction furnace (with preheating) (ISO 15349-2:2021)

Acier non alliés - Détermination des faibles teneurs en carbone - Partie 2: Méthode par absorption dans l'infrarouge après combustion dans un four à induction (avec préchauffage) (ISO 15349-2:2021)

Unlegierter Stahl - Bestimmung niedriger Kohlenstoffgehalte - Teil 2: Verfahren mit Infrarotabsorption nach Verbrennung im Induktionsofen (mit Vorwärmung) (ISO 15349-2:2021)

This European Standard was approved by CEN on 11 July 2021.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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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 of 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 www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 1, *Methods of determination of chemical composition,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 459/SC 2, *Methods of chemical analysis for iron and steel,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 15349-2:1999), which has been technically revised. The main changes compared to the previous edition are as follows:

— normative references have been revised;

— the precision data has been updated;

— the former Table B.3 has been deleted;

— the text has been improved editorially.

A list of all parts in the ISO 15349 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.

European foreword

This document (EN ISO 15349-2:2021) has been prepared by Technical Committee ISO/TC 17 "Steel" in collaboration with Technical Committee CEN/TC 459/SC 2 “Methods of chemical analysis for iron and steel ” the secretariat of which is held by SIS.

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 January 2022, and conflicting national standards shall be withdrawn at the latest by January 2022.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN ISO 15349-2:2003.

Any feedback and questions on this document should be directed to the users’ national standards body/ national committee. A complete listing of these bodies can be found on the CEN websites.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Endorsement notice

The text of ISO 15349-2:2021 has been approved by CEN as EN ISO 15349-2:2021 without any modification.

Unalloyed steel — Determination of low carbon content —

Part 2: Infrared absorption method after combustion in an induction furnace (with preheating)

1 Scope

This document specifies an infrared absorption method after combustion in an induction furnace for the determination of the low carbon content in unalloyed steel.

The method is applicable to carbon contents between 0,000 3 % (mass fraction) and 0,009 % (mass fraction).

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 648, *Laboratory glassware — Single-volume pipettes*

ISO 1042, *Laboratory glassware — One-mark volumetric flasks*

ISO 3696, *Water for analytical laboratory use — Specification and test methods*

ISO 14284, *Steel and iron — Sampling and preparation of samples for the determination of chemical composition*

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:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

4 Principle

Pre-heating of a test portion at low temperature followed by its combustion in presence of an accelerator at a high temperature in an induction furnace in a current of pure oxygen.

Transformation of carbon into carbon dioxide and/or carbon monoxide.

Measurement by infrared absorption of the carbon dioxide and/or carbon monoxide evolved from the sample and carried by a current of pure oxygen.

The calibration is carried out using sucrose or calcium carbonate.

5 Reagents

During the analysis, unless otherwise stated, use only reagents of recognized analytical grade and only water with a low content of organic matter, i.e. grade 2 water as specified in ISO 3696.

5.1 Water, free from carbon dioxide.

Boil water for 30 min, cool to room temperature and bubble oxygen (5.2) or a high purity inert gas through it for 15 min. Prepare just before use.

5.2 Oxygen, minimum purity 99,95 % (volume fraction).

When the presence of organic contaminants is suspected in oxygen, an oxidation catalyst [copper(II) oxide or platinum] tube heated to a temperature above 450 °C shall be used prior to the purifying unit.

The pressure of oxygen in the furnace is controlled by a pressure regulator designed especially for this purpose.

5.3 Pure iron, containing less than 0,000 3 % (mass fraction) of carbon or having a very low and known carbon content.

5.4 Solvent, appropriate for cleaning greasy or dirty test samples, for example, acetone.

5.5 Accelerator, common accelerators are copper, tungsten-tin mixture, iron, tungsten or nickel. Copper, tungsten-tin mixture or tungsten containing less than 0,000 3 % carbon (mass fraction) may be used.

Copper plate or pellet type tin and granular tungsten mixture containing less than 0,000 3 % (mass fraction) of carbon or having a very low and known carbon content.

Plate shape or granular copper (about 0,1 g/plate) should be used after the following treatment. Heat the copper plate at 450 °C to 600 °C for 10 min in a current of oxygen or air and cool in a desiccator without grease. This treatment shall be carried out just before use.

If necessary, wash three times with acetone by decantation to remove organic contaminants and dry at room temperature.

Pellet type tin (about 0,2 g/pellet) and granular tungsten, 1,68 mm (12 mesh) to 0,853 mm (20 mesh) should be used after the following treatment. Heat the tungsten at 450 °C in air for 10 min and cool in a desiccator without grease. Clean the tin for more than 5 min with hydrochloric acid in an ultrasonic cleaner, rinse with water and dry in air. These treatments shall be carried out just before use.

5.6 Sucrose, standard solutions

Weigh, to the nearest 0,1 mg, the masses of sucrose ($C_{12}H_{22}O_{11}$) indicated in Table 1, previously dried at 100 °C to 105 °C for 2,5 h and cooled in a desiccator, and transfer to a series of seven 100 ml beakers.

Add 30 ml of water (5.1) to dissolve, transfer quantitatively into a series of 100 ml one-mark volumetric flasks, dilute to the mark with water (5.1) and mix.

Table 1 — Standard solution series of sucrose

Standard solution reference number	Mass of sucrose g	Corresponding mass of added carbon µg	Carbon content in 1 g of the test portion % mass fraction
1	0 [a]	0	0
2	0,010 0	4,21	0,000 42
3	0,025 0	10,53	0,001 05
4	0,060 0	25,26	0,002 53
5	0,120 0	50,53	0,005 05
6	0,180 0	75,79	0,007 58
7	0,240 0	101,1	0,010 11

[a] Zero member.

5.7 Calcium carbonate

Dry calcium carbonate [minimum purity: 99,9 % (mass fraction)] at 180 °C for 1 h and cool in a desiccator before use.

5.8 Magnesium perchlorate, anhydrous, [$Mg(ClO_4)_2$], particle size: from 0,7 mm to 2,0 mm.

Phosphorous pentoxide may also be used by some instrument manufacturers.

5.9 Inert ceramic (attapulgus clay), impregnated with sodium hydroxide, particle size: from 0,6 mm to 1,2 mm.

6 Apparatus

The apparatus required for combustion in an induction furnace and the subsequent infrared absorption measurement of the evolved carbon dioxide and/or carbon monoxide may be obtained commercially from a number of manufacturers. Follow the manufacturer's instructions for the operation of the instrument.

Common features of such systems are described in Annex A.

All laboratory glassware shall be class A, in accordance with ISO 648 or ISO 1042, as appropriate.

Ordinary laboratory apparatus and the following should be used.

6.1 Ceramic crucible, capable of withstanding combustion in an induction furnace.

Just before use, ignite the crucibles in an electric furnace in a current of oxygen or air for not less than 2 h at more than 1 200 °C and keep in a desiccator or closed container before use.

For the determination of low carbon contents, it is advisable to ignite the crucibles at 1 350 °C in a current of oxygen.

6.2 Tin capsule, about 6 mm in diameter, 18 mm in height, 0,3 g in mass and approximately 0,4 ml in volume of known and very low carbon content less than 0,000 3 % (mass fraction) of carbon or having very low and known carbon content.

Tin capsules should be used after the following treatment.

Rinse the capsule in hydrochloric acid (ρ approximately 1,19 g/ml, diluted 1 + 1) for 5 min while shaking frequently, wash it thoroughly with water and dry. Store it in a clean glass bottle.