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Second edition
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Unalloyed steel — Determination of low carbon content —

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

Aciers 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)

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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).

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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.

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.

