



SLOVENSKI STANDARD SIST-TP CEN/TR 10261:2013

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Nadomešča:
SIST-TP CEN/TR 10261:2008

Železo in jeklo - Evropski standardi za določevanje kemijske sestave

Iron and steel - European standards for the determination of chemical composition

Eisen und Stahl - Europäische Normen für die Bestimmung der chemischen
Zusammensetzung

Aciers et fontes - Normes européennes pour la détermination de la composition chimique

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Ta slovenski standard je istoveten z: **CEN/TR 10261:2013**

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ICS:

77.040.30	Kemijska analiza kovin	Chemical analysis of metals
77.080.01	Železne kovine na splošno	Ferrous metals in general

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English Version

Iron and steel - European standards for the determination of chemical composition

Aciers et fontes - Normes européennes pour la détermination de la composition chimique

Stahl und Eisen - Europäische Normen für die Bestimmung der chemischen Zusammensetzung

This Technical Report was approved by CEN on 10 June 2012. It has been drawn up by the Technical Committee ECISS/TC 102.

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Foreword

This document (CEN/TR 10261:2013) has been prepared by Technical Committee ECISS/TC 102 “Methods of chemical analysis for iron and steel”, the secretariat of which is held by SIS.

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

This document supersedes CEN/TR 10261:2008.

In comparison with the previous edition of CEN/TR 10261:2008, the following significant technical changes were made:

- Title;
- Clause 2, Definitions – added;
- In 3.1, for nitrogen, addition of EN ISO 15351:2010 and EN ISO 4945:2009;
- In 3.1, for silicon, addition of EN ISO 439:2010;
- In 3.1, for titanium, addition of EN 10211:1995;
- In 3.2, for Al, Cr, Co, Cu, Mn, Mo, Ni, P, Sn and V, addition of EN 10351:2011;
- In 3.2, for C and S, addition of EN ISO 15350:2010;
- In 4.1.9.1, Principle of the method - reworded for technical correction;
- 4.1.12.3, Summary of EN ISO 15351:2010, added;
- 4.1.12.4, Summary of EN ISO 4945:2009, added;
- 4.1.15.3, Summary of EN ISO 439:2010, added;
- 4.1.17.1, Summary of EN 10211:1995, added;
- 4.2.1.1, Summary of EN 10351:2011, added;
- 4.2.4.1, Summary of EN ISO 15350:2010, added;
- Annex A, updated;
- Annex C, the concentration ranges are represented in three different graphics: one for the referee methods, one for the routine methods and one for all the methods available.

CEN/TR 10261:2013 (E)**1 Scope**

This Technical Report lists, under Clause 3, the European Standards, which are currently available for the determination of the chemical composition of steel and iron. In Clause 4, it provides details of the range of application and gives the principle of the method for each standard.

Items which are under preparation as European Standards or as CEN Technical Reports by ECISS/TC 102 are available on the webpage of CEN, through the link <http://www.cen.eu/cen/Sectors/TechnicalCommitteesWorkshops/CENTechnicalCommittees/Pages/WP.aspx?param=733643&title=ECISS/TC%20102>.

Annex A contains a list of other European Standards and CEN Technical Reports applicable for the determination of the chemical composition of steels and irons.

Annex B contains a list of withdrawn Euronorms, together with the corresponding replacement European Standards, if any.

Annex C gives graphical representations of the concentration ranges of the methods available in this Technical Report. Figure C.1 gives the concentration ranges of the referee methods, Figure C.2 gives the concentration ranges of the routine methods and Figure C.3 represents the fields of application of all the methods available.

Annex D provides a trilingual key of the abbreviations used in the Figures given in Annex C.

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2 Terms and definitions

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

[SIST-TP CEN/TR 10261:2013](https://standards.iteh.ai/catalog/standards/sist/d4431bc0-21e4-4537-a498-2fb2bf37ccfd/sist-tp-cen-tr-10261-2013)

2.1 referee method <https://standards.iteh.ai/catalog/standards/sist/d4431bc0-21e4-4537-a498-2fb2bf37ccfd/sist-tp-cen-tr-10261-2013>

stoichiometric method or a method calibrated against pure metals or stoichiometric compounds, which is to be used for certification analysis or in case of arbitration

2.2 routine method

method calibrated against reference materials or certified reference materials, or against standard solutions commercially available, which is widely used for control purposes (day to day analysis)

3 European Standards available for the determination of the chemical composition of steel and iron**3.1 Mono-elemental methods****— Aluminium, Al**

EN 29658:1991, *Steel — Determination of aluminium content — Flame atomic absorption spectrometric method (ISO 9658:1990)*

— Arsenic, As

EN 10212:1995, *Chemical analysis of ferrous materials — Determination of arsenic in steel and iron — Spectrophotometric method*

— **Boron, B**

EN 10200:2012, *Chemical analysis of ferrous materials — Determination of boron in steels — Spectrophotometric method*

EN ISO 13900:2002, *Steel — Determination of boron content — Curcumin spectrophotometric method after distillation (ISO 13900:1997)*

— **Calcium, Ca**

EN 10177:1989, *Chemical analysis of ferrous materials — Determination of calcium in steels — Flame atomic absorption spectrometric method*

— **Carbon, C**

EN 10036:1989, *Chemical analysis of ferrous materials — Determination of total carbon in steels and irons — Gravimetric method after combustion in a stream of oxygen*

EN ISO 15349-2:2003, *Unalloyed steel — Determination of low carbon content — Part 2: Infrared absorption method after combustion in an induction furnace (with preheating) (ISO 15349-2:1999)*

EN ISO 9556:2001, *Steel and iron — Determination of total carbon content — Infrared absorption method after combustion in an induction furnace (ISO 9556:1989)*

— **Chromium, Cr**

EN 10188:1989, *Chemical analysis of ferrous materials — Determination of chromium in steels and irons — Flame atomic absorption spectrometric method*

EN 24937:1990, *Steel and iron — Determination of chromium content — Potentiometric or visual method (ISO 4937:1986)*

EN 24937:1990/AC:1991 (Editorial correction), *Steel and iron — Determination of chromium content — Potentiometric or visual method (ISO 4937:1986)*

— **Copper, Cu**

EN 24943:1990, *Chemical analysis of ferrous metal — Determination of copper content — Flame atomic absorption spectrometric method (ISO 4943:1985)*

EN 24943:1990/AC:1991 (Editorial correction), *Steel and cast iron — Determination of copper content — Flame atomic absorption spectrometric method (ISO 4943:1985)*

EN 24946:1990, *Steel and cast iron — Determination of copper content — 2,2'diquinolyl spectrophotometric method (ISO 4946:1984)*

EN 24946:1990/AC:1991 (Editorial correction), *Steel and cast iron — Determination of copper content — 2,2'diquinolyl spectrophotometric method (ISO 4946:1984)*

— **Lead, Pb**

EN 10181:1989, *Chemical analysis of ferrous materials — Determination of lead in steels — Flame atomic absorption spectrometric method*

— **Manganese, Mn**

EN 10071:2012, *Chemical analysis of ferrous materials — Determination of manganese in steels and irons — Electrometric titration method*

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EN 24159:1989, *Ferromanganese and ferrosilicomanganese — Determination of manganese content — Potentiometric method (ISO 4159:1978, ed. 1)*

EN 24159:1989/AC1:1989 (Editorial correction), *Ferromanganese and ferrosilicomanganese — Determination of manganese content — Potentiometric method (ISO 4159:1978, ed. 1)*

EN ISO 10700:1995, *Steel and iron — Determination of manganese content — Flame atomic spectrometric method (ISO 10700:1994)*

— **Nickel, Ni**

EN 10136:1989, *Chemical analysis of ferrous materials — Determination of nickel in steels and irons — Flame atomic absorption spectrometric method*

EN 24938:1990, *Steel and iron — Determination of nickel content — Gravimetric or titrimetric method (ISO 4938:1988)*

EN 24938:1990/AC:1991 (Editorial correction), *Steel and iron — Determination of nickel content — Gravimetric or titrimetric method (ISO 4938:1988)*

— **Niobium, Nb**

EN 10178:1989, *Chemical analysis of ferrous materials — Determination of niobium in steels — Spectrophotometric method*

— **Nitrogen, N**

EN 10179:1989, *Chemical analysis of ferrous materials — Determination of nitrogen (trace amounts) in steels — Spectrophotometric method*

EN ISO 10720:2007, *Steel and iron — Determination of nitrogen content — Thermal conductimetric method after fusion in a current of inert gas (ISO 10720:1997)*

EN ISO 15351:2010, *Steel and iron — Determination of nitrogen content — Thermal conductimetric method after fusion in a current of inert gas (Routine method) (ISO 15351:1999)*

EN ISO 4945:2009, *Steel — Determination of nitrogen content — Spectrophotometric method (ISO 4945:1977)*

— **Oxygen, O**

EN 10276-1:2000, *Chemical analysis of ferrous materials — Determination of oxygen in steel and iron — Part 1: Sampling and preparation of steel samples for oxygen determination*

EN 10276-2:2003, *Chemical analysis of ferrous materials — Determination of oxygen content in steel and iron — Part 2: Infrared method after fusion under inert gas*

— **Phosphorus, P**

EN 10184:2006, *Chemical analysis of ferrous materials — Determination of phosphorus in non-alloyed steels and irons — Molybdenum blue spectrophotometric method*

EN ISO 10714:2002, *Steel and iron — Determination of phosphorus content — Phosphovanadomolybdate spectrophotometric method (ISO 10714:1992)*

— **Silicon, Si**

EN 24829-1:1990, *Steel and cast iron — Determination of total silicon content — Reduced molybdsilicate spectrophotometric method — Part 1: Silicon content between 0,05 and 1 % (ISO 4829-1:1986)*

EN 24829-1:1990/AC:1991 (Editorial correction), *Steel and cast iron — Determination of total silicon content — Reduced molybdsilicate spectrophotometric method — Part 1: Silicon content between 0,05 and 1 % (ISO 4829-1:1986)*

EN 24829-2:1990, *Steel and cast iron — Determination of total silicon content — Reduced molybdsilicate spectrophotometric method — Part 2: Silicon content between 0,01 and 0,05 % (ISO 4829-2:1988)*

EN 24829-2:1990/AC:1991 (Editorial correction), *Steel and cast iron — Determination of total silicon content — Reduced molybdsilicate spectrophotometric method — Part 2: Silicon content between 0,01 and 0,05 % (ISO 4829-2:1988)*

EN ISO 439:2010, *Steel and iron — Determination of total silicon content — Gravimetric method (ISO 439:1994)*

— **Sulphur, S**

EN 24935:1991, *Steel and iron — Determination of sulphur content — Infrared absorption method after combustion in an induction furnace (ISO 4935:1989)*

EN ISO 4934:2003, *Steel and iron — Determination of sulfur content — Gravimetric method (ISO 4934:2003)*

— **Titanium, Ti**

EN 10211:1995, *Chemical analysis of ferrous materials — Determination of titanium in steel and iron — Flame atomic absorption spectrometric method*

EN ISO 10280:1995, *Steel and iron — Determination of titanium content — Diantipyrylmethane spectrophotometric method (ISO 10280:1991)*

— **Vanadium, V**

EN 24947:1991, *Steel and cast iron — Determination of vanadium content — Potentiometric titration method (ISO 4947:1986)*

3.2 Multi-elemental methods— **Aluminium, Al; Chromium, Cr; Cobalt, Co; Copper, Cu; Manganese, Mn; Molybdenum, Mo; Nickel, Ni; Phosphorus, P; Tin, Sn and Vanadium, V**

EN 10351:2011, *Chemical analysis of ferrous materials — Inductively coupled plasma optical emission spectrometric analysis of unalloyed and low alloyed steels — Determination of Mn, P, Cu, Ni, Cr, Mo, V, Co, Al (total) and Sn [Routine method]*

— **Aluminium, Al; Lead, Pb; Nickel, Ni; Silicon, Si and Zinc, Zn**

EN 10318:2005, *Determination of thickness and chemical composition of zinc- and aluminium-based metallic coatings — Routine method*

— **Carbon, C; Chromium, Cr; Copper, Cu; Manganese, Mn; Nickel, Ni; Phosphorus, P; Silicon, Si and Sulphur, S**

CR 10320:2004, *Optical emission analysis of low alloy steels (routine method) — Method for determination of C, Si, S, P, Mn, Cr, Ni and Cu*

CEN/TR 10261:2013 (E)— **Carbon, C and Sulphur, S**

EN ISO 15350:2010, *Steel and iron — Determination of total carbon and sulfur content — Infrared absorption method after combustion in an induction furnace (routine method) (ISO 15350:2000)*

— **Chromium, Cr; Cobalt, Co; Copper, Cu; Manganese, Mn; Molybdenum, Mo; Nickel, Ni; Niobium, Nb; Phosphorus, P; Silicon, Si; Titanium, Ti and Vanadium, V**

EN 10315:2006, *Routine method for analysis of high alloy steel by X-ray Fluorescence Spectrometry (XRF) by using a near by technique*

4 Range of application and principle of the methods**4.1 Mono-elemental methods****4.1.1 Aluminium, Al****4.1.1.1 EN 29658:1991, Steel — Determination of aluminium content — Flame atomic absorption spectrometric method (ISO 9658:1990).**

Range of application:

- Determination of aluminium contents from 0,005 % to 0,20 % (m/m) in non-alloyed steel.

Principle of the method:

- a) Dissolution of a test portion in dilute hydrochloric and nitric acids;
- b) Fusion of the acid-insoluble material with a mixture of orthoboric acid and potassium carbonate;
- c) Spraying of the solution into a dinitrogen monoxide-acetylene flame;
- d) Spectrometric measurement of the atomic absorption of the 309,3 nm spectral line emitted by an aluminium hollow cathode lamp.

4.1.2 Arsenic, As**4.1.2.1 EN 10212:1995, Chemical analysis of ferrous materials — Determination of arsenic in steel and iron — Spectrophotometric method.**

Range of application:

- Determination of arsenic contents from 0,001 % to 0,08 % (m/m) in all types of steel and iron.

Principle of the method:

- a) Dissolution of a test portion in a mixture of nitric and hydrochloric acids followed by evaporation to dryness and prolonged heating of the dried residue;
- b) Extraction of the residue with acid, reduction of the arsenic (As V to As III) by addition of potassium iodine, ascorbic acid and tin (II) chloride. Conversion of the arsenic to arsenic hydride (arsine) with zinc;
- c) Absorption of the evolved arsine in a solution of silver diethyldithiocarbamate and l-ephedrin in trichloromethane;

- d) Spectrophotometric measurement of the reddish-violet coloured colloid at a wavelength between 500 nm and 520 nm.

4.1.3 Boron, B

4.1.3.1 EN 10200:2012, *Chemical analysis of ferrous materials — Determination of boron in steels — Spectrophotometric method.*

Range of application:

- Determination of boron content from 0,000 4 % to 0,012 0 % (m/m) in non-alloyed and alloyed steels.

Principle of the method:

- a) Dissolution of a test portion with hydrochloric and nitric acids;
- b) Decomposition of boron compounds (nitrides etc.) with orthophosphoric and sulphuric acids at 290 °C. Spectrophotometric measurement at a wavelength of 543 nm of the complex formed between boric acid and curcumin in buffered acetic medium.

4.1.3.2 EN ISO 13900:2002, *Steel — Determination of boron content — Curcumin spectrophotometric method after distillation (ISO 13900:1997).*

Range of application:

- Determination of boron content from 0,000 05 % to 0,001 0 % (m/m) in steel.

Principle of the method:

- a) Dissolution of a test portion in hydrochloric and nitric acids. Decomposition of boron compounds (nitrides, etc.) with orthophosphoric and sulphuric acids at a temperature of 290 °C;
- b) Distillation of the solution after the addition of methanol and collection of methylborate in a receiver containing sodium hydroxide solution;
- c) Evaporation of the solution to dryness. Formation of a coloured complex between orthoboric acid and curcumin in a methanol medium;
- d) Spectrophotometric measurements at a wavelength of about 550 nm.

4.1.4 Calcium, Ca

4.1.4.1 EN 10177:1989, *Chemical analysis of ferrous materials — Determination of calcium in steels — Flame atomic absorption spectrometric method.*

Range of application:

- Determination of calcium contents greater than 0,000 2 % (m/m) in non-alloyed and low-alloy steels.

Principle of the method:

- a) Dissolution of a test portion with hydrochloric acid followed by oxidation with nitric acid;
- b) Addition of potassium chloride solution and spraying of the solution into an acetylene-nitrous oxide flame; determination of the calcium by means of the spectrometric measurement of the atomic absorption of the 422,67 nm line emitted by a calcium hollow cathode lamp.

CEN/TR 10261:2013 (E)**4.1.5 Carbon, C****4.1.5.1 EN 10036:1989, *Chemical analysis of ferrous materials — Determination of total carbon in steels and irons — Gravimetric method after combustion in a stream of oxygen.***

Range of application:

— Determination of carbon content equal to or greater than 0,1 % (m/m) in steels and irons.

Principle of the method:

- a) Combustion of a test portion in a stream of oxygen in a high temperature furnace (1 200 °C – 1 400 °C), with the addition of a fluxing agent to assist combustion;
- b) Absorption of the evolved carbon dioxide in soda asbestos contained in a weighed absorption bulb;
- c) Calculation of the carbon content from the increase in mass of the absorption bulb.

4.1.5.2 EN ISO 15349-2:2003, *Unalloyed steel — Determination of low carbon content — Part 2: Infrared absorption method after combustion in an induction furnace (with preheating) (ISO 15349-2:1999).*

Range of application:

— Carbon contents from 0,000 3 % to 0,010 % (m/m) in unalloyed steel.

Principle of the method:

- a) Preheating of a test portion at low temperature and combustion of a test portion with accelerator at a high temperature in an induction furnace in a current of pure oxygen;
- b) Transformation of carbon into carbon dioxide and/or carbon monoxide;
- c) Measurement of infrared absorption of the carbon dioxide or carbon dioxide/carbon monoxide evolved from steel and carried by a current of pure oxygen;
- d) Calibration graph is established using sucrose or calcium carbonate.

4.1.5.3 EN ISO 9556:2001, *Steel and iron — Determination of total carbon content — Infrared absorption method after combustion in an induction furnace (ISO 9556:1989).*

Range of application:

— Determination of carbon contents from 0,003 % to 4,5 % (m/m) in steel and iron.

Principle of the method:

- a) Combustion of a test portion with accelerator at a high temperature in a high-frequency induction furnace in a current of pure oxygen; transformation of carbon into carbon dioxide and/or carbon monoxide;
- b) Measurement by infrared absorption of the carbon dioxide and/or carbon monoxide carried by a current of oxygen.