# SLOVENSKI STANDARD
# oSIST prEN ISO 19694-6:2014

**01-november-2014**

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**Emisije nepremičnih virov - Določevanje emisij toplogrednih plinov (TGP) v energetsko intenzivnih industrijah - 6. del: Proizvodnja ferozlitin (ISO/DIS 19694-6:2014)**

Stationary source emissions - Determination of greenhouse gas (GHG) emissions in energy-intensive industries - Part 6: Ferroalloy industry (ISO/DIS 19694-6:2014)



Emissionen aus stationären Quellen - Bestimmung von Treibhausgasen (THG) aus energieintensiven Industrien - Teil 6: Ferrolegierungsindustrie (ISO/DIS 19694-6:2014)



Émissions de sources fixes - Détermination des émissions des gaz à effet de serre dans les industries à forte intensité énergétique - Partie 6: Industrie des ferro-alliages (ISO/DIS 19694-6:2014)

**Ta slovenski standard je istoveten z:** **prEN ISO 19694-6**

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**ICS:**

| | | |
|---|---|---|
| 13.040.40 | Emisije nepremičnih virov | Stationary source emissions |

**oSIST prEN ISO 19694-6:2014** **en,de**

DRAFT INTERNATIONAL STANDARD

# ISO/DIS 19694-6

ISO/TC **146**/SC **1** Secretariat: **NEN**

Voting begins on: **2014-08-21**

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# Stationary source emissions — Determination of greenhouse gas (GHG) emissions in energy-intensive industries —

## Part 6: Ferroalloy industry

*Émissions de sources fixes — Détermination des émissions des gaz à effet de serre dans les industries à forte intensité énergétique —*

*Partie 6: Industrie des alliages de fer*



ICS: 13.040.40



**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.

Should this draft be accepted, a final draft, established on the basis of comments received, will be submitted to a parallel two-month approval vote in ISO and formal vote in CEN.

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.



Reference number
ISO/DIS 19694-6:2014(E)

 

General information regarding the preparation of EN ISO 19694 Part 1 to 6

By end of 2010 the European Commission/EFTA gave Mandate M/478 to CEN entrusting CEN to produce and adopt Standards, in particular containing harmonized methods for:

a. Measuring, testing and quantifying greenhouse gas (GHG) emissions from sector-specific sources

b. Assessing the level of GHG emissions performance of production processes over time, at production sites;

c. Establishing and providing reliable, accurate and quality information for reporting and verification purposes.

Based on a gap analysis it was agreed to describe the assessment methodologies of the five energy-intensive industry sectors steel-, cement -, aluminum-, lime- and ferroalloy industry as well as general aspects in the six standards. As sector-specific knowhow was essential, the concerned industry sectors (companies and associations) have been engaged extensively in the development of the methodologies as well as the draft standards.
The methods of determination of green house gases (GHG) in these five energy intensive industries were subject to comprehensive verification exercises (field tests) which were financially supported by EC/EFTA and which reflect especially the uncertainties obtained.

The scope of the six standards is limited to the above described mandated frame and cannot be arbitrarily enlarged.

# Contents

# Foreword

This document (TC 264 WI 00264147) has been prepared by Technical Committee CEN/TC 264 “Air quality”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex D, which is an integral part of this document.

# Introduction

### Overview of the ferro-alloy manufacturing process

Ferroalloy production involves a m etallurgical reduction process that results in significant carbon dioxide emissions. These emissions are the results of a c arbothermic reaction which is intrinsic to the process. In ferroalloy production, ore, carbon materials and slag forming materials are mixed and heated to high temperatures for smelting.

Smelting in an electric arc furnace is accomplished by conversion of electrical energy to heat. An alternating current applied to the electrodes creates current to flow through the charge between the electrode tips. The heat is produced by the electric arcs and by the resistance in the charge materials. Emissions from the smelting process are therefore not to combustion emissions. The furnaces may be open, semi-closed or closed.

Submerged Electric Arc Furnaces (SEAF) with graphite electrodes or self- baking Søderberg electrodes are used (see Figure 1).

The reduction process is the main source of direct $CO_2$ emissions. O ther $CO_2$ sources include direct emissions from calcination of calcium, magnesium and other carbonates (e.g. limestone) in some processes and from non-smelting fuels (e.g. dryers for ladles and refractory linings), room heating,), and indirect emissions from e.g. external power production.



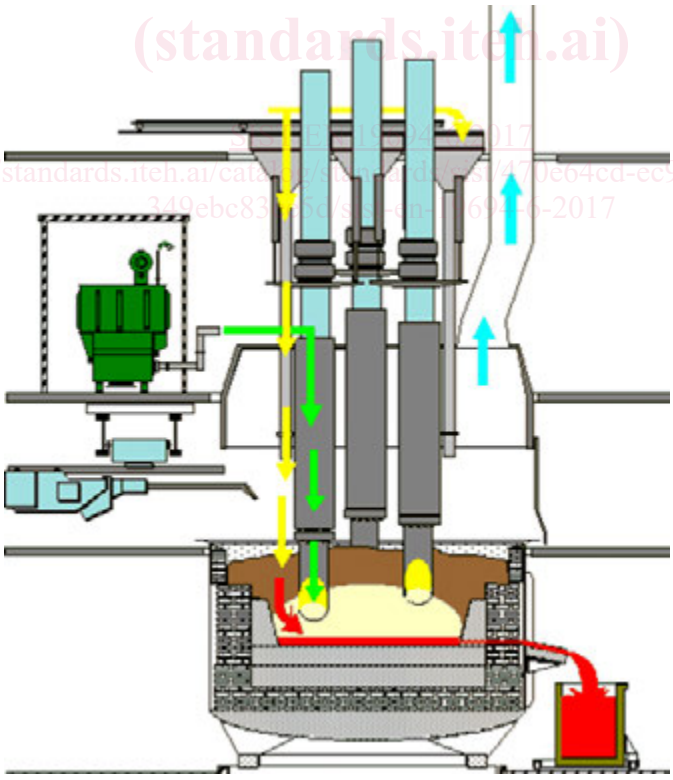

**Figure 1 — Submerged Electric Arc Furnace (SEAF)**

### $CO_2$ from the smelting of raw materials

$CO_2$ emissions from reducing agents and electrode use

In the smelting process, $CO_2$ is released due to the carbothermic reduction of the metallic oxides occurring with the consumption of both carbonaceous reductants and c arbon based electrodes. The carbon in the reductants reacts with oxygen from the metal oxides to form CO and then $CO_2$ (in different ways depending on the process), and the ores are reduced to molten base metals. All CO is assumed to be converted in the furnace to $CO_2$.

The reductant carbon is used in the form of coke, coal, pet coke, anthracite, charcoal and wood-chips. The first four are fossil based and the charcoal and wood-chips are bio-carbon.

In the carbothermic process, only the fixed carbon content is used as a r educing agent, which means that volatile matter, ashes and moisture mostly leave the furnace with the off-gas and slag.

The nature of reducing agents and electrodes is depending of the localization of the plant, the raw material availability and it is presented in Table 1. It is variable from one site to another and from one year to another and also from one ferro-alloy to another.

**Table 1 — Type of reducing agents and electrodes used in the electrometallurgy Sector**

| Reducing agents | Electrodes |
|---|---|
| Crude petroleum coke | Graphite electrode |
| Calcinated petroleum coke | Prebaked electrodes |
| Coal coke | Södeberg paste |
| Coke from coal | Composite electrode |
| Wood | |
| Calcinated wood | |
| Charcoal | |
| Graphite powder | |
| Anthracite | |



$CO_2$ emissions are estimated with/calculated from the consumption of the reducing agents and electrodes, their carbon content and the carbon content of the final products[1].



ores + reducing agent → ferro-alloys/metal* + $CO_2$ + dust/by-product (i.e. slags)*

* amount of carbon can be found in the products

Default emission factors suggested in these documents are used, except where more recent, industry-specific data has become available.

## 1 Scope

This standard provides a harmonised methodology for calculating GHG emissions from the ferro-alloys industry based on the mass balance approach[2]. It also provides key performance indicators over time of ferro-alloys plants. It addresses the following direct and indirect sources of GHG:

— Scope 1 – Direct GHG emissions from sources that are owned or controlled by the company, such as emissions result from the following sources:

  — Smelting (reduction) process:

  — Decomposition of carbonates inside the furnace

[1] The basic calculation methods used in this standard are compatible with the 2006 IPCC Guidelines for National Greenhouse Gas Inventories issued by the Intergovernmental Panel on Climate Change (IPCC), and with the Regulation 601/2012 but the objectives of this standards are of different nature implying that the data gathered can cover a broader (or reduced) boundaries as compared to the objectives of the Regulation.

[2] based on European Commission Regulation 601/2012

- auxiliaries operation related to the smelting operation (i.e. aggregates, drying processes, heating of ladles, etc.).

- Scope 2 – Indirect GHG emissions from:

  - the generation of purchased electricity consumed in the company's owned or controlled equipment

## 2 Normative references

The following referenced document is indispensable for the application 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/DIS 19694-1:2014, *Stationary source emissions – Determination of Greenhouse Gas (GHG) emissions in energy intensive industries – Part 1: General aspects*

## 3 Terms and definitions

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

**3.1.**
**Auxiliaries**
equipment consuming electricity/power related to the smelting process: fans, pumps, gas abatement systems (filter bags, venture scrubbers …)



**3.2**
**biomass emissions**
$CO_2$ emissions originating from biomass fuels plus the ones originating from biomass fraction of mixed fuels



**3.3**
**Silica Fume:** Amorphous silicon dioxide particles from the volatilization and vaporization of furnace feed materials in the manufacture of ferrosilicon and silicon, the process off-gas that contains silica fumes beings cleaned in a baghouse using fabric filters of the open or semi-closed SEAF

**3.4**
**Ferro-alloy:**
Ferroalloy is the term used to describe concentrated alloys of iron and one or more metals such as silicon,manganese, chromium, molybdenum, vanadium and tungsten.

**3.5**
**Silicon:**
Silicon is a metalloid produced by carbo-thermic reduction of quartz in an electric submerged arc furnace.

**3.6**
**Smelting:**
Industrial process where one or more ores or ore concentrates are heated and reduced (i.e. chemically modified) by e.g. aluminino-carbo-silico thermic reduction –to manufacture and mix the metals in one step. Examples of smelted alloys are ferro-alloys.

**3.7**
**Gross GHG emissions**
Absolute gross GHG emissions excluding GHG emissions from on-site power production

**3.8**
**Absolute gross GHG emissions**
Total direct emissions of GHGs within the boundaries excluding GHG emissions from biomass or biogenic emissions (i.e. woodchips and charcoal)

**3.9**
**Submerged Electric Arc Furnace (SEAF)**
An electric arc-heating furnace in which the arcs are completely submerged under the charge. The arc forms between the electrode (graphite electrodes or self- baking Søderberg electrodes) and metal surface or bottom lining. The heat being produced by the electric arcs and by the resistance in the charge materials *initiates* the reduction process. The furnaces may be open, semi-closed or closed. A commonly used technology is the submerged-arc (electric) furnace (SEAF).

**3.10**
**Fossil fuels**
All fossil fuels listed by IPCC or any fuel which contains organic and inorganic carbon that is not biomass.

**3.11**
**Biomass Fuels**
Fuels with only biogenic carbon

**3.12**
**Petcoke**
Petroleum coke, a carbon-based solid fuel derived from oil refineries

**3.13**
**Sintering/Sinter**
Process to form a coherent mass by heating without melting.

**3.14**
**Søderberg Electrodes**
A continuously self-baking carbon electrode used in electro-metallurgical furnaces for production of ferroalloys and silicon (the “Søderberg paste” is a preparation of coal tar pitch and carbonaceous dry aggregate).



**3.15**
**Composite electrodes**
In composite electrodes the core is composed of graphite while the exterior is a self baking carbon paste ( which is a “Søderberg paste”).



**3.16**
**Pre-baked electrodes**
The carbonaceous paste (a mixing of coal tar pitch with a dry carbonaceous aggregate) is baked so as to carbonize coal tar pitch in order to form a solid pitch coke binder phase.

## 4 Symbols and abbreviations

For the purposes of this document, the following symbols and abbreviations apply

| | |
|---|---|
| AF | Alternative fuels |
| EF | Emission Factor |
| EU ETS | The $CO_2$ Emissions Trading Scheme of the European Union |
| GHG | Greenhouse gases |
| FA | Ferro-alloys |
| FABP | Ferro-alloys and related by-products |
| IPCC | Intergovernmental Panel on Climate Change |

| | |
|---|---|
| KPI | Key Performance Indicator. |
| LHV | Lower heat value (synonym for net calorific value) |
| MIC | Mineral components |
| TC | Total Carbon (the sum of TOC and TIC) |
| TIC | Total Inorganic Carbon |
| TOC | Total Organic Carbon |
| t | ton ( 1,000 kg) |
| $m_n^3$ | normal $m^3$ (at 0 ºC and at a pressure of 1 atmosphere) |
| GJ | Giga Joule |
| CO | carbon monoxide |
| $CO_2$ | carbon dioxide |

# 5 Determination of GHGs - Principles



GHG emissions are determined by the mass balance method (section 5.1).

## 5.1 Major GHG in ferro-alloys

$CO_2$ is the only GHG relevant for the ferro-alloys industry.



## 5.2 Determination based on mass balance

In installations where carbon stemming from input materials used remains in the products or other outputs of the production, e.g. for the reduction of metal ores, a mass balance approach is applied. In installations where this is not the case combustion emissions and process emissions are calculated separately.

Emissions from source streams are calculated from input or production data, obtained by means of measurement systems, and additional parameters from laboratory analyses including calorific factor, carbon content and biomass content. Standard factors may also be used; these are provided in the General Aspects Standard (see normative references).

## 5.3 Use of waste gas/heat recovery

Direct GHG emissions related to waste gas and heat recovery will be reported as scope 1 emissions. Waste gas including CO and $CO_2$ can be subtracted from the direct emission, when exported outside the boundaries of the location, as a negative carbon flow in the mass balance (for example when exporting waste gas to another installation).

# 6 Boundaries

Drawing appropriate boundaries is one of the key tasks in an emissions inventory process.

## 6.1 Operational boundaries

Operational boundaries refer to the types of sources covered by an inventory. A key distinction is between direct and indirect emissions: