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NSAI Standards

Irish Standard
I.S. EN 19694-6:2016

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

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National Foreword

I.S. EN 19694-6:2016 is the adopted Irish version of the European Document EN 19694-6:2016, Stationary source emissions - Determination of greenhouse gas (GHG) emissions in energy-intensive industries - Part 6: Ferroalloy industry

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 19694-6

July 2016

ICS 13.040.40

English Version

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

Émissions de sources fixes - Détermination des émissions de gaz à effet de serre (GES) dans les industries énergo-intensives - Partie 6: Industrie des ferro-alliages

Emissionen aus stationären Quellen - Bestimmung von Treibhausgasen (THG) aus energieintensiven Industrien - Teil 6: Ferrolegierungsindustrie

This European Standard was approved by CEN on 5 May 2016.

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European foreword

This document (EN 19694-6:2016) has been prepared by Technical Committee CEN/TC 264 "Air quality", the secretariat of which is held by DIN.

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of an identical text or by endorsement, at the latest by January 2017, and conflicting national standards shall be withdrawn at the latest by January 2017.

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 has been prepared under a mandate M/478 given to CEN by the European Commission and the European Free Trade Association.

EN 19694, *Stationary source emissions — Determination of greenhouse gas (GHG) emissions in energy-intensive industries* is a series of standards that consists of the following parts:

— *Part 1: General aspects*

— *Part 2: Iron and steel industry*

— *Part 3: Cement industry*

— *Part 4: Aluminium industry*

— *Part 5: Lime industry*

— *Part 6: Ferroalloy industry*

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, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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Introduction

Overview of the ferro-alloy manufacturing process

Ferroalloy production involves a metallurgical reduction process that results in significant carbon dioxide emissions. These emissions are the results of a carbothermic 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.

Submerged Electric Arc Furnaces (SEAF) with graphite electrodes, self- baking Søderberg or composite electrodes is the main process to produce ferro-alloys in Europe (see Figure 1). 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.

The reduction process is the main source of direct CO_2 emissions. Other 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.

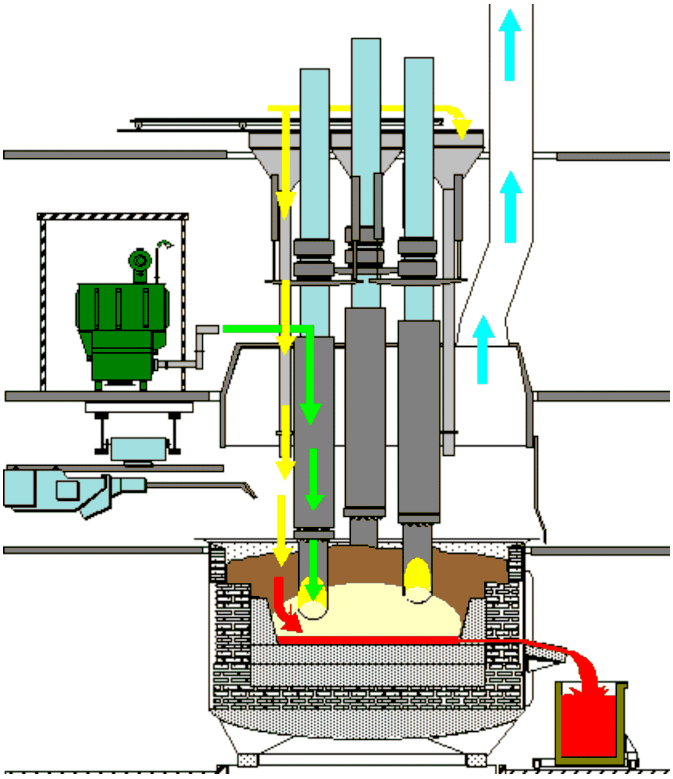

Figure 1 — Submerged Electric Arc Furnace (SEAF)

CO_2 from the smelting of raw materials

<u>CO_2 emissions from reducing agents and electrode use</u>

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 carbon based electrodes. The carbon in the reductants reacts with oxygen from the metal oxides to form CO and then CO_2 (in different

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ways depending on the process), and the ores are reduced to molten base metals. For calculation, the assumption is that 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 reducing agent, which means that volatile matter, ashes and moisture mostly leave the furnace with the off-gas and slag.

The nature of reducing agents, price 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] 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.

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1 Scope

This European Standard provides a harmonized 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;

  — 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.

This European Standard is to be used in conjunction with EN 19694-1, which contains generic, overall requirements, definitions and rules applicable to the determination of GHG emissions for all energy-intensive sectors, provides common methodological issues and defines the details for applying the rules. The application of this standard to the sector-specific standards ensures accuracy, precision and reproducibility of the results and is for this reason a normative reference standard. The requirements of these standards do not supersede legislative requirements.

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.

EN 19694-1:2016, *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 terms and definitions in EN 19694-1 and the following apply.

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

3.2
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

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[2] Based on European Commission Regulation 601/2012.

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