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## Calculation method of carbon dioxide emission intensity from iron and steel production — ~~1~~ 2

Part ~~3~~:  
Steel plant with electric arc furnace (EAF) and coal-based or gas-based direct reduction iron (DRI) facility

ISO/FDIS 14404-3

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Méthode de calcul de l'intensité de l'émission de dioxyde de carbone de la production de la fonte et de l'acier —

Partie 3: Usine sidérurgique avec four électrique à arc (FEA) et installation de réduction directe de la fonte (DRI) à base de charbon ou de gaz

# FDIS stage

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CP 401 • Ch. de Blandonnet 8  
CH-1214 Vernier, Geneva  
Phone: +41 22 749 01 11

~~Fax: +41 22 749 09 47~~

~~Email~~E-mail: [copyright@iso.org](mailto:copyright@iso.org)  
Website: ~~www.iso.org~~[www.iso.org](http://www.iso.org)

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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 document 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](http://www.iso.org/directives)).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at [www.iso.org/patents](http://www.iso.org/patents). ISO shall not be held responsible for identifying any or all such patent rights.

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](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 21, *Environment related to climate change in the iron and steel industry*.

This second edition cancels and replaces the first edition (ISO 14404-3:2017), which has been technically revised.

The main changes are as follows:

- revision of Introduction, Terms and Definitions, and default emission factors;
- adding addition and revising revision of some emissions sources;
- clarifying clarification of the difference between "Boundary" and "Site boundary";
- adding addition a new informative annex, *Annex D* on "Decarbonization strategies and its impact in CO<sub>2</sub> Calculation Method" to give guidance on future relevant emission source categories as new materials and processes become widely applicable at industrial level.

A list of all the parts in the ISO 14404 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](http://www.iso.org/members.html)~~www.iso.org/members.html~~.

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## Introduction

The steel industry recognizes the urgent need to take actions concerning climate change. Slowing and halting global warming requires reductions in GHG emissions on a global scale. To play a part in achieving these reductions, it is necessary for steel plants to identify the amount of CO<sub>2</sub> emitted during the production of steel products, in order to identify next opportunities for reduction of CO<sub>2</sub> on their pathway to decarbonization.

The production process of steel involves complex chemical reactions, various heating cycles, and the recycling of various by-products. This variety of imports, including raw materials, reactive agents, fuel and heat sources are transformed into wide range of steel products, by-products, waste materials and waste heat.

Steel plants manufacture a vast range of products with various shapes and specifications including: flat items, long items, pipes, tubes and many others. In addition, they produce unique specialty-grade steel products with high-performance. These are achieved using a number of sub-processes including micro-alloying and applying surface treatments like galvanizing and coating, which require additional heat treatments. The variety of products manufactured, and processes used means there are not two identical steel plants in the world.

Additionally, there are other aspects related to the heterogeneity nature of steel industry around the globe other than assets characteristics, that should be taken into account (inputs availability; market and business environment, innovation), when looking for commonalities in calculation methodologies to ensure consistency and comprehensiveness.

Climate regulations in each country require steel companies to devise methods to lower CO<sub>2</sub> emissions from steel plants while continuing to produce steel products by these diverse and complex steelmaking processes. To accomplish this, it is desirable to have universally common indicators for determining steel plant CO<sub>2</sub> emissions.

There are many methods for calculating CO<sub>2</sub> emission intensity from steel plants and specific processes. Each method was created to meet the objectives of a particular country or region. In some cases, a single country can have several calculation methods in order to fulfil different objectives. Each one of these methods reflects the unique local characteristics of a particular country or region. Therefore, these methods cannot be used for comparisons of CO<sub>2</sub> emission intensity from steel plants located in different countries and regions.

To overcome this methodological fragmentation, the World Steel Association (worldsteel), -has developed a calculation method for CO<sub>2</sub> emission intensity of steel plants. This calculation method was developed to facilitate the improvement of steel plant CO<sub>2</sub> emissions. ~~The calculation method~~It helps members keep track of their CO<sub>2</sub> emissions intensity relative to the other member steel companies located in different places in the world. An agreement was reached among members, and worldsteel has issued the method as a guideline called "CO<sub>2</sub> Emissions Data Collection User Guide." Actual data collection among worldsteel members based upon the guide started in 2007. Furthermore, worldsteel is encouraging even non-member steel companies to begin using the guide to calculate CO<sub>2</sub> emission intensity of their steel plants.

The present ISO 14404-3 revision is based on worldsteel's CO<sub>2</sub> Data Collection Users Guide, version 11,<sup>[4]</sup> reviewed in 2022, and follows ISO14404-4<sup>[2]</sup>.

This calculation method establishes clear boundaries for collection of CO<sub>2</sub> emissions data. The net CO<sub>2</sub> emissions and production from a steel plant are calculated using all parameters within the boundaries. The CO<sub>2</sub> emission intensity of the steel plant is calculated by the net CO<sub>2</sub> emission from the plant using the boundaries divided by the amount of crude steel production of the plant. With this methodology, the CO<sub>2</sub> emission intensity of steel plants is calculated irrespective of the variance in the type of process used, products manufactured and geographic characteristics.

This calculation method only uses basic imports and exports that are commonly measured and recorded by the plants; thus, the method requires neither the measurement of the specific efficiency of individual equipment or processes nor dedicated measurements of the complex flow and recycling of materials and waste heat. In this way, the calculation method ensures its simplicity and universal applicability without requiring steel plants to install additional dedicated measuring devices or to collect additional dedicated data other than those commonly used data in the management. Even though, the use of measured carbon content and net calorific values are highly recommended to obtain more accurate emissions accounting for each material considered. Any home metrics needs to be referenced with link to a transparent and accessible source, including indirect emission factors. To ensure transparency in communicating results to interested parties, these distinctions should be clearly stated.

With this method, a steel company can calculate a single figure for the CO<sub>2</sub> emissions intensity of a -steel plant as a whole. By observing changes in CO<sub>2</sub> emissions intensity over time using this methodology, steel companies can evaluate whether their efforts to reduce CO<sub>2</sub> emissions are being properly implemented. As was explained earlier, most steel plants manufacture vast range of products with various shapes and specifications. This calculation method is simple and universally applicable because it is not affected by the differences in the production processes of such diverse products, and treats a whole steel plant as one unit with one CO<sub>2</sub> emission intensity. Therefore, this calculation method is not applicable for calculating and determining the carbon footprint of any specific steel product.

When comparing CO<sub>2</sub> emission intensity between different steel plants, it should be kept in mind that each steel plant has a different composition of manufacturing products and that the energy sources and raw materials available varies among countries and regions. In addition, since the ISO 14404 series strictly defines the boundary of the target process route for each part, only steel plants using the same part of the ISO 14404 series (i.e., ISO 14404-1, ISO 14404-2, ISO 14404-3) can be compared with each other. Note that the default emission factors provided in the ISO 14404 series are global averages and is not adjusted to reflect regional differences in energy sources and raw materials. When calculating total CO<sub>2</sub> emissions or CO<sub>2</sub> emission intensity for inventory or benchmarking purposes, the emission factors applicable to the conditions of the target country or region should be selected.

In order to give guidance to users on which areas of interest will be dealt with as future sources for direct and indirect CO<sub>2</sub> emission factors in programmed revisions of this document, tentative list is provided in ~~Annex~~ Annex D.

# Calculation method of carbon dioxide emission intensity from iron and steel production—2

## Part 3: Steel plant with electric arc furnace (EAF) and coal-based or gas-based direct reduction iron (DRI) facility

### 1 Scope

This document specifies calculation methods applicable to manufacturers using an electric arc furnace (EAF) to produce steel and having direct reduced iron (DRI) facilities within their premises. ~~The~~

~~This~~ document allows the user to cover those particular cases of agglomeration of iron ore on site. It can be used to evaluate the total annual carbon dioxide (CO<sub>2</sub>) emissions and the emission factor of CO<sub>2</sub> intensity of the entire steel production process. This document is applicable to plants producing mainly carbon steel.

It includes boundary definition, material and energy flow definition and emission factor of CO<sub>2</sub>. Besides direct source import to the boundary, upstream and credit concept is applied to exhibit the plant CO<sub>2</sub> intensity.

This document supports the steel producer to establish CO<sub>2</sub> emissions attributable to a site.

Conversion to energy consumption and to consumption efficiency can be obtained using ~~Annex A~~ Annex A.

### 2 Normative references

There are no normative references in this document.

### 3 Terms and definitions

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

ISO and IEC maintain ~~terminological~~ terminology databases for use in standardization at the following addresses:

- ~~ISO Online browsing platform: available at [www.iso.org/obp](http://www.iso.org/obp)~~ <https://www.iso.org/obp>
- ~~IEC Electropedia: available at [www.electropedia.org](http://www.electropedia.org)~~ <https://www.electropedia.org/>

#### 3.1 Emissions

##### 3.1.1

##### emission source

process emitting CO<sub>2</sub> during the production of steel products

Note 1-~~to entry~~:- There are three categories of CO<sub>2</sub> emission sources: direct, upstream and credit. Examples of emission sources that are subject to this document are given in ~~3.1.2, 3.1.3 and 3.1.4~~ 3.1.2, 3.1.3 and 3.1.4.