Life Effige
Environmental Footprint For Improving and Growing Eco-efficiency

PRODUCT ENVIRONMENTAL FOOTPRINT CATEGORY RULES

Raw Castings

Draft version 1.0
July 2018

Il presente documento include indicazioni metodologiche per la conduzione di uno studio LCA secondo quanto previsto dalla metodologia PEF (Product Environmental Footprint) per la valutazione dell'impronta ambientale di prodotto così come definita nella Raccomandazione 2013/179/UE della Commissione e, ove possibile, dalle Product Environmental Footprint Category Rules Guidance, Version 6.3, May 2018.

Il documento, sviluppato nell'ambito del progetto LIFE EFFIGE, è riferito al solo mercato italiano ed è stato redatto in collaborazione con il partner FLA.

I suoi contenuti sono un contributo agli studi di settore, ma non sono vincolanti rispetto ad altre iniziative in corso o a venire.

Summary

1. Introduction

The present Product Environmental Footprint Category Rules (PEFCR) is developed within the Life EFFIGE Project, aimed to develop new tools for the implementation of PEF in small and medium-sized businesses, helping them to experiment innovative approaches and methods reduce their environmental footprint and making them more competitive on the current market.

The Product Environmental Footprint (PEF) Guide provides detailed and comprehensive technical guidance on how to conduct a PEF study. PEF studies may be used for a variety of purposes, including in-house management and participation in voluntary or mandatory programmes.

The compliance with the present PEFCR is optional for PEF in-house applications, whilst it is mandatory whenever the results of a PEF study or any of its content is intended to be communicated.

Terminology: shall, should and may

This PEFCR uses precise terminology to indicate the requirements, the recommendations and options that could be chosen when a PEF study is conducted.

- The term “shall” is used to indicate what is required in order for a PEF study to be in conformance with this PEFCR.
- The term “should” is used to indicate a recommendation rather than a requirement. Any deviation from a “should” requirement has to be justified when developing the PEF study and made transparent.
- The term “may” is used to indicate an option that is permissible. Whenever options are available, the PEF study shall include adequate argumentation to justify 2. General information about the PEFCR

This PEFCR is valid for products in scope sold in Italy.

The PEFCR is written in English.

This PEFCR has been prepared in conformance with the following documents:

- Product Environmental Footprint (PEF) Guide; Annex II to the Recommendation 2013/179/EU, 9 April 2013. Published in the official journal of the European Union Volume 56, 4 May 2013;

- "PEFCR Guidance version 6.3", excluding all that parts applicable only from products already covered by existing PEFCR. Deviations from the requirements of Guidance v.6.3 have been made based on older versions of the Guidance and expert judgment.

The organisations listed in Table 1 were the Sectorial Technical Group (STG), which is responsible for the development of the PEFCRs for the foundry sector.

Table 1 List of the organizations in the STG

Name of the organization	Type of organization	Name of the members
ASSOFOND	Industrial association	Dott. Silvano Squaratti
Fonderie Ariotti	Industry	Dott. Roberto Ariotti
Fonderia Boccacci	Industry	Dott. Andrea Boccacci
VDP Fonderia	Industry	Ing. Fabio Peruzzo

2. PEFCR scope

2.1 Product classification

Raw casting is the result of activities that are classified *Nomenclature Générale des Activités Économiques dans les Communautés Européennes*/Statistical classification of products by activity (NACE/CPA) Rev.2 under code 24.5 - Casting of metals and, in particular:

24.5.1 - Casting of iron
24.5.2 - Casting of steel

2.2 Representative product(s)

The RPs are virtual products defined on the basis on Italian market share of the different kind of raw casing production technologies.

The following two RPs have been identified:

Representative Products		Casting Technique		Melting Technique	
RP1	**Cast-iron raw casting**	Green sand casting	84%	Cupola furnace	*20%*
				Electric furnace	*50%*
				Rotary furnace	*30%*
		Sand casting	14%	Electric furnace	*90%*
				Rotary furnace	*10%*
		Permanent mold casting	2%	Electric furnace	*100%*
RP2	**Steel raw casting**	Green sand casting	70%	Electric furnace	100%
		Sand casting	30%		

2.3 Functional unit and reference flow

The functional unit, as approved by the STG, is **1 ton of raw casting at foundry gates**.

Table 3.1 defines the key aspects used to define the FU.

Table 3.1 ***Key aspects of the FU***

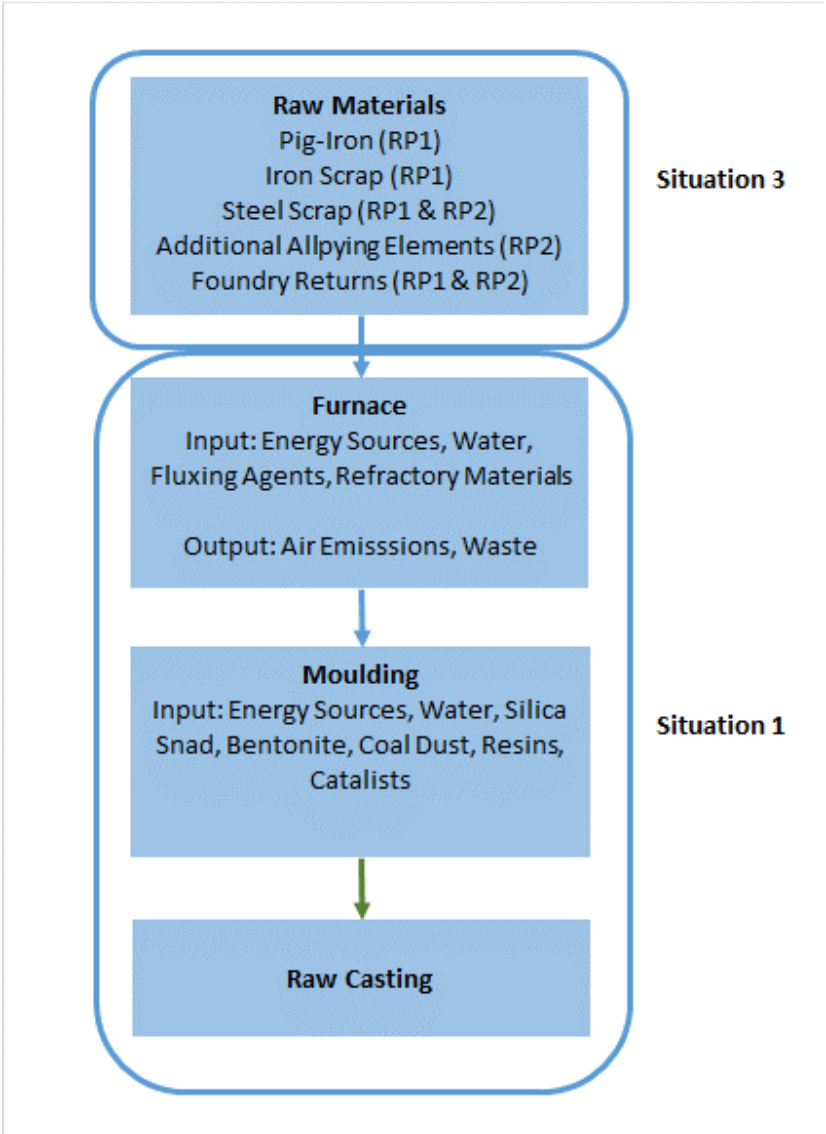
What?	Cast Iron or steel raw casting
How much?	1 ton of raw casting
How long?	Raw casting is an intermediate product and has no expiry date. Its life span depends from its final use but considering that use phase is beyond the system boundaries of these PEFCR, "how long?" specification cannot be defined.

2.4 System boundary

The flow diagram of the entire process includes the following activities:

Table 3.2 Life cycle stages

Life cycle stage	*Short description of the processes included*
Raw Material	Production and supply of raw materials, including: - Pig-Iron (for RP1); - Iron scrap (for RP1); - Steel scrap (for RP1 and RP2); - Additional alloying elements (for RP2); - Foundry Returns (for RP1 and RP2).
Production - Furnace	Melting of raw materials in electric, cupola or rotary furnace. From the input side: - Energy sources (electricity, natural gas and/or coke) - Water; - Fluxing agents; - Refractory materials From the output side; - Air emissions - Waste
Production - Moulding	Casting of molten cast-iron /steel into the mould and mould preparation. From the input side: - Electricity; - Water; - Silica sand; - Bentonite; - Coal dust; - Resins; - Catalysts From the output side; - Air emissions; - Waste-
Production – Compressors, Aspiration and Other operations	Energy and water consumption for compressors, aspirations and other foundry operations.



Processes in Situation 1 are the processes run by the company applying the PEFCR. Processes in Situation are the ones not run by the company applying the PEFCR and this company does not have access to (company-) specific information.

According to this PEFCR, the following processes may be excluded based on the cut-off rule:

- The production of buildings and equipment. *Relevance of buildings and equipment will be tested during supporting studies.*
- Production of permanent mould.

2.5 EF impact assessment

Each PEF study carried out in compliance with this PEFCR shall calculate the PEF-profile including all PEF impact categories listed in the table below (ILCD Method 2011 for characterisation, normalisation and weighting factors)

Impact category	*Indicator*	*Unit*	*Recommended default LCIA method*
Climate change	*Radiative forcing as Global Warming Potential (GWP100)*	*kg $CO_{2\ eq}$*	*Baseline model of 100 years of the IPCC (based on IPCC 2013)*
- Climate change-biogenic			
- Climate change – land use and land transformation			
Ozone depletion	*Ozone Depletion Potential (ODP)*	*kg CFC-11 $_{eq}$*	*Steady-state ODPs 1999 as in WMO assessment*
Human toxicity, cancer*	*Comparative Toxic Unit for humans (CTU_h)*	*CTUh*	*USEtox model (Rosenbaum et al, 2008)*
Human toxicity, non-cancer*	*Comparative Toxic Unit for humans (CTU_h)*	*CTUh*	*USEtox model (Rosenbaum et al, 2008)*
Particulate matter	*Impact on human health*	*kg PM2,5 equivalent*	*UNEP recommended model (Fantke et al 2016)*
Ionising radiation, human health	*Human exposure efficiency relative to U^{235}*	*kBq U^{235} $_{eq}$*	*Human health effect model as developed by Dreicer et al. 1995 (Frischknecht et al, 2000)*
Photochemical ozone formation, human health	*Tropospheric ozone concentration increase*	*kg NMVOC $_{eq}$*	*LOTOS-EUROS model (Van Zelm et al, 2008) as implemented in ReCiPe*
Acidification	*Accumulated Exceedance (AE)*	*mol H+ $_{eq}$*	*Accumulated Exceedance (Seppälä et al. 2006, Posch et al, 2008)*
Eutrophication, terrestrial	*Accumulated Exceedance (AE)*	*mol N $_{eq}$*	*Accumulated Exceedance (Seppälä et al. 2006, Posch et al, 2008)*
Eutrophication, freshwater	*Fraction of nutrients reaching freshwater end compartment (P)*	*kg P $_{eq}$*	*EUTREND model (Struijs et al, 2009b) as implemented in ReCiPe*
Eutrophication, marine	*Fraction of nutrients reaching marine end compartment (N)*	*kg N $_{eq}$*	*EUTREND model (Struijs et al, 2009b) as implemented in ReCiPe*
Ecotoxicity, freshwater[1]	*Comparative Toxic Unit for ecosystems (CTU_e)*	*CTUe*	*USEtox model, (Rosenbaum et al, 2008)*
Land Use	*Soil Organic Matter (SOM)*	*Kg C deficit*	*Mila i Canals et al. 2007*
Water resource depletion	*Freshwater scarcity*	*m^3 water $_{eq}$*	*Swiss Ecoscarcity 2006*

[1] Long-term emissions (occurring beyond 100 years) shall be excluded from the toxic impact categories. Toxicity emissions to this sub-compartment have a characterisation factor set to 0 in the EF LCIA (to ensure consistency). If included by the applicant in the LCI modelling, the sub-compartment 'unspecified (long-term)' shall be used

Impact category	*Indicator*	*Unit*	*Recommended default LCIA method*
Mineral, fossil & renewable resource depletion	***Scarcity of mineral resource***	***kg Sb $_{eq}$***	*van Oers et al. 2002.*

2.6 Limitations

The main limitation are:

- The lack of data on the production of buildings and equipment
- The lack of data on the production of permanent mould.

4. Most relevant impact categories, life cycle stages, processes and elementary flows

The most relevant impact categories for the product RP1 – Cast-Iron Raw Casting and RP2 – Steel Raw Casting, in scope of this PEFCR, are the following:

- Climate change, fossil;
- Particular matter;
- Ionizing radiation;
- Photochemical ozone formation;
- Acidification;
- Freshwater eutrophication;
- Mineral, fossil & renewable resource depletion.

For all relevant impact categories, the most relevant life cycle stages for product RP1 – Cast-Iron Raw Casting and RP2 – Steel Raw Casting, in scope of this PEFCR, are the following:

- Raw materials;
- Production.

The most relevant processes for product RP1 – Cast-Iron Raw Casting in scope of this PEFCR are the following:

Table 3. 1. List of the most relevant processes

Impact category	*Processes*
Climate change, fossil;	Pig Iron (from Raw Material life cycle stage)
	Iron & Steel Scrap (from Raw Material life cycle stage)
	Energy – Furnace (from Production life cycle stage)
	Emissions – Furnace (from Production life cycle stage)
	Energy - Other Plant Operations (from Production life cycle stage)
Particular matter	Pig Iron (from Raw Material life cycle stage)
	Iron & Steel Scrap (from Raw Material life cycle stage)
	Energy – Furnace (from Production life cycle stage)
	Energy - Other Plant Operations (from Production life cycle stage)
Ionizing radiation	Pig Iron (from Raw Material life cycle stage)
	Energy – Furnace (from Production life cycle stage)
	Energy – Moulding (from Production life cycle stage)
	Energy – Aspiration (from Production life cycle stage)
	Energy - Other Plant Operations (from Production life cycle stage)
Photochemical ozone formation	Pig Iron (from Raw Material life cycle stage)
	Iron & Steel Scrap (from Raw Material life cycle stage)
	Raw Materials Supply (from Raw Material life cycle stage)
	Energy – Furnace (from Production life cycle stage)
	Consumables - Furnace (from Production life cycle stage)
	Energy - Other Plant Operations (from Production life cycle stage)
Acidification	Pig Iron (from Raw Material life cycle stage)
	Iron & Steel Scrap (from Raw Material life cycle stage)

Impact category	*Processes*
	Raw Materials Supply (from Raw Material life cycle stage)
	Energy – Furnace (from Production life cycle stage)
	Energy - Other Plant Operations (from Production life cycle stage)
Freshwater eutrophication	Pig Iron (from Raw Material life cycle stage)
	Iron & Steel Scrap (from Raw Material life cycle stage)
	Energy – Furnace (from Production life cycle stage)
	Energy - Other Plant Operations (from Production life cycle stage)
Mineral, fossil & renewable	Pig Iron (from Raw Material life cycle stage)
resource depletion	Iron & Steel Scrap (from Raw Material life cycle stage)
	Raw Materials Supply (from Raw Material life cycle stage)
	Energy – Furnace (from Production life cycle stage)
	Consumables - Furnace (from Production life cycle stage)
	Energy - Other Plant Operations (from Production life cycle stage)

The most relevant processes for product RP2 – Steel Raw Casting, in scope of this PEFCR, are the following

Table 3. 2. List of the most relevant processes

Impact category	*Processes*
Climate change, fossil;	Additional Alloying Elements (from Raw Material life cycle stage)
	Energy – Furnace (from Production life cycle stage)
	Energy - Other Plant Operations (from Production life cycle stage)
Particular matter	Additional Alloying Elements (from Raw Material life cycle stage)
Ionizing radiation	Additional Alloying Elements (from Raw Material life cycle stage)
	Energy – Furnace (from Production life cycle stage)

Impact category	*Processes*
	Energy - Other Plant Operations (from Production life cycle stage)
Photochemical ozone formation	Additional Alloying Elements (from Raw Material life cycle stage)
	Energy – Furnace (from Production life cycle stage)
	Energy - Other Plant Operations (from Production life cycle stage)
Acidification	Additional Alloying Elements (from Raw Material life cycle stage)
Freshwater eutrophication	Additional Alloying Elements (from Raw Material life cycle stage)
Mineral, fossil & renewable resource depletion	Additional Alloying Elements (from Raw Material life cycle stage)

5. Life cycle inventory

5.1 List of mandatory company-specific data

The following processes shall be modelled using company specific data:

- Consumption and supply of raw materials;
- Furnace;
- Moulding;
- Aspirations, compressors and other foundry operations

Data collection requirements for mandatory process of Raw Material life cycle stage

Requirements for data collection purposes			Requirements for modelling purposes							Remarks
Activity data to be collected	*Specific requirements (e.g. frequency, measurement standard, etc)*	*Unit of measure*	*Default dataset to be used*	*Dataset source (i.e. node)*	*UUID*	*TiR*	*TeR*	*GR*	*P*	*DQR*	
Inputs:											
Yearly pig-iron consumption	1 year average	ton/year	Pig iron {GLO}| production | APOS, U	Ecoinvent	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly amount of transported pig-iron per km travelled on lorry	1 year average	tonkm / year	Transport, freight, lorry 16-32 metric ton, EURO4 {GLO}| market for | APOS, U	Ecoinvent	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly amount of transported pig-iron per km travelled on ship	1 year average	tonkm / year	Transport, freight, sea, transoceanic ship {GLO}| market for | APOS, U	Ecoinvent	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly steel scrap consumption	1 year average	ton	Erec: Iron scrap, unsorted {RoW}| steel production, electric, low-alloyed | APOS, U Ev: Iron pellet {RoW}| production | APOS, U	Ecoinvent	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly amount of transported steel scrap per km travelled	1 year average	tonkm / year	Transport, freight, lorry 16-32 metric ton, EURO4 {GLO}| market for | APOS, U	Ecoinvent	n/a	n/a	n/a	n/a	n/a	n/a	

on lorry											
Yearly iron scrap consumption	1 year average	ton	Erec: Iron scrap, sorted, pressed {GLO}| market for | APOS, U Ev: Pig iron {GLO}| production | APOS, U	Ecoinvent	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly amount of transported iron scrap per km travelled on lorry	1 year average	tonkm / year	Transport, freight, lorry 16-32 metric ton, EURO4 {GLO}| market for | APOS, U	Ecoinvent	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly additional alloying elements consumption - Chromium	1 year average	ton	Ferrochromium, high-carbon, 68% Cr {GLO}| market for | APOS, U	Ecoinvent	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly additional alloying elements consumption - Manganese	1 year average	ton	Ferromanganese, high-coal, 74.5% Mn {GLO}| market for | APOS, U	Ecoinvent	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly additional alloying elements consumption - Molybdenum	1 year average	ton	…	…	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly additional alloying elements consumption -	1 year average	ton	Nickel, 99.5% {GLO}| market for | APOS, U	Ecoinvent	n/a	n/a	n/a	n/a	n/a	n/a	

Nickel											
Yearly additional alloying elements consumption – *OTHER METALS*	1 year average	ton	No other addition alloying elements have been considered in Screening Study. Select a dataset following the approach define in cap. 5.6.		n/a	n/a	n/a	n/a	n/a	n/a	

Data collection requirements for mandatory process of Production life cycle stage

Requirements for data collection purposes			Requirements for modelling purposes							Remarks
Activity data to be collected	***Specific requirements (e.g. frequency, measurement standard, etc)***	***Unit of measure***	***Default dataset to be used***	***Dataset source (i.e. node)***	***UUID***	***TiR***	***TeR***	***GR***	***P***	***DQR***	
Inputs:											
Yearly electricity consumption for furnace	1 year average	kWh / year	Electricity, medium voltage {*COUNTRY*}| market for | APOS, U	Ecoinvent	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly natural gas consumption for furnace	1 year average	m^3 / year	Heat, district or industrial, natural gas {RER}| market group for | APOS, U	Ecoinvent	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly coke consumption for furnace	1 year average	ton / year	Petroleum coke {Europe without Switzerland}| petroleum refinery	Ecoinvent	n/a	n/a	n/a	n/a	n/a	n/a	

Requirements for data collection purposes			Requirements for modelling purposes								Remarks
Activity data to be collected	*Specific requirements (e.g. frequency, measurement standard, etc)*	*Unit of measure*	*Default dataset to be used*	*Dataset source (i.e. node)*	*UUID*	*TiR*	*TeR*	*GR*	*P*	*DQR*	
			operation | APOS, U								
Yearly water consumption for furnace	1 year average	m^3 / year	Tap water {Europe without Switzerland}| tap water production, conventional treatment | APOS, U	Ecoinvent	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly electricity consumption for moulding	1 year average	kWh / year	Electricity, medium voltage {*COUNTRY*}| market for | APOS, U	Ecoinvent	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly water consumption for moulding	1 year average	m^3 / year	Tap water {Europe without Switzerland}| tap water production, conventional treatment | APOS, U	Ecoinvent	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly electricity consumption for compressors	1 year average	kWh / year	Electricity, medium voltage {*COUNTRY*}| market for | APOS, U	Ecoinvent	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly electricity consumption	1 year average	kWh / year	Electricity, medium voltage {*COUNTRY*}| market for | APOS, U	Ecoinvent	n/a	n/a	n/a	n/a	n/a	n/a	

Requirements for data collection purposes			Requirements for modelling purposes								Remarks
Activity data to be collected	*Specific requirements (e.g. frequency, measurement standard, etc)*	*Unit of measure*	*Default dataset to be used*	*Dataset source (i.e. node)*	*UUID*	*TiR*	*TeR*	*GR*	*P*	*DQR*	
for aspiration											
Yearly electricity consumption for other plant operations	1 year average	kWh / year	Electricity, medium voltage {*COUNTRY*}| market for | APOS, U	Ecoinvent	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly natural gas consumption for other plant operations	1 year average	m^3 / year	Heat, district or industrial, natural gas {RER}| market group for | APOS, U	Ecoinvent	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly Fluxing agents (CaCO3) consumption - Furnace	1 year average	ton / year	Calcium carbonate, precipitated {GLO}| market for calcium carbonate, precipitated | APOS, U	Ecoinvent	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly Refractory materials consumption - Furnace	1 year average	ton / year	Refractory, fireclay, packed {GLO}| market for | APOS, U	Ecoinvent	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly Silica sand	1 year average	ton / year	Silica sand {GLO}| market for | APOS, U	Ecoinvent	n/a	n/a	n/a	n/a	n/a	n/a	

Requirements for data collection purposes			Requirements for modelling purposes								Remarks
Activity data to be collected	*Specific requirements (e.g. frequency, measurement standard, etc)*	*Unit of measure*	*Default dataset to be used*	*Dataset source (i.e. node)*	*UUID*	*TiR*	*TeR*	*GR*	*P*	*DQR*	
consumption - Moulding											
Yearly Bentonite consumption - Moulding	1 year average	ton / year	Bentonite {GLO}| market for | APOS, U	Ecoinvent	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly Coal dust consumption - Moulding	1 year average	ton / year	Hard coal {RoW}| market for | APOS, U	Ecoinvent	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly Resins consumption – Moulding - Phenolic	1 year average	ton / year	Phenolic resin {GLO}| market for | APOS, U	Ecoinvent	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly Resins consumption – Moulding - Furan	1 year average	ton / year	50% Tetrahydrofuran {GLO}| market for | APOS, U 50% Urea formaldehyde resin {GLO}| market for | APOS, U	Ecoinvent	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly Resins consumption – Moulding -	1 year average	ton / year	Polyurethane, flexible foam {GLO}| market for | APOS, U	Ecoinvent	n/a	n/a	n/a	n/a	n/a	n/a	

Requirements for data collection purposes			Requirements for modelling purposes								Remarks
Activity data to be collected	*Specific requirements (e.g. frequency, measurement standard, etc)*	*Unit of measure*	*Default dataset to be used*	*Dataset source (i.e. node)*	*UUID*	*TiR*	*TeR*	*GR*	*P*	*DQR*	
Polyurethane											
Yearly Resins consumption – Moulding - Ester	1 year average	ton / year	Bisphenol A epoxy based vinyl ester resin {RER}| production | APOS, U	Ecoinvent	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly Resins consumption – Moulding - Silicate	1 year average	ton / year	50% Polyester resin, unsaturated {GLO}| market for | APOS, U 50% Silica sand {GLO}| market for | APOS, U	Ecoinvent	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly Catalyst consumption – Moulding - Triethylamine	1 year average	ton / year	Triethyl amine {GLO}| market for | APOS, U	Ecoinvent	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly Catalyst consumption – Moulding - sulfonic acid	1 year average	ton / year	Methane sulfonic acid {GLO}| market for | APOS, U	Ecoinvent	n/a	n/a	n/a	n/a	n/a	n/a	
Outputs:											
Year slag generation, going to material	1 year average	ton / year	Erec EoL: Blast furnace slag {GLO}| market for | Alloc Def, U_Assofond E*V: Silica sand {GLO}|	Ecoinvent	n/a	n/a	n/a	n/a	n/a	n/a	

Requirements for data collection purposes			Requirements for modelling purposes								Remarks
Activity data to be collected	*Specific requirements (e.g. frequency, measurement standard, etc)*	*Unit of measure*	*Default dataset to be used*	*Dataset source (i.e. node)*	*UUID*	*TiR*	*TeR*	*GR*	*P*	*DQR*	
recovery (EWC 10.09.03)			market for | APOS, U Eer: Waste glass {Europe without Switzerland}| treatment of waste glass, municipal incineration | APOS, U Ed: Inert waste {CH}| treatment of, sanitary landfill | APOS, U								
Year slaggeneration, going to disposal (EWC 10.09.03)	1 year average	ton / year	Inert waste {CH}| treatment of, sanitary landfill | APOS, U		n/a	n/a	n/a	n/a	n/a	n/a	
Yearly dust generation, going to material recovery (EWC 10.09.09 - 10.09.10)	1 year average	ton / year	Erec EoL: Blast furnace slag {GLO}| market for | Alloc Def, U_Assofond E*V: Silica sand {GLO}| market for | APOS, U Eer: Waste glass {Europe without Switzerland}| treatment of waste glass, municipal incineration | APOS, U	Ecoinvent	n/a	n/a	n/a	n/a	n/a	n/a	

Requirements for data collection purposes			Requirements for modelling purposes								Remarks
Activity data to be collected	*Specific requirements (e.g. frequency, measurement standard, etc)*	*Unit of measure*	*Default dataset to be used*	*Dataset source (i.e. node)*	*UUID*	*TiR*	*TeR*	*GR*	*P*	*DQR*	
			Ed: Inert waste {CH}| treatment of, sanitary landfill | APOS, U								
Yearly dust generation, going to disposal (EWC 10.09.09 - 10.09.10)	1 year average	ton / year	Dust, unalloyed electric arc furnace steel {CH}| treatment of, residual material landfill | Cut-off, U	Ecoinvent	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly used foundry sand generation, going to material recovery (EWC 10.09.08)	1 year average	ton / year	Erec EoL: Blast furnace slag {GLO}| market for | Alloc Def, U_Assofond E*V: Silica sand {GLO}| market for | APOS, U Eer: Waste glass {Europe without Switzerland}| treatment of waste glass, municipal incineration | APOS, U Ed: Inert waste {CH}| treatment of, sanitary landfill | APOS, U	Ecoinvent	n/a	n/a	n/a	n/a	n/a	n/a	

Direct elementary flow collection requirements

Emissions/resources	Elementary flow	Frequency of measurement
Water from well	Water, well, in ground, *COUNTRY*	Yearly consumption
CO_2 to Air, from furnace	Carbon dioxide	Yearly emission
CO_2 to Air, from moulding	Carbon dioxide	Yearly emission
COV to air, from moulding	VOC, volatile organic compounds	Yearly emission
Dust to air, from furnace	Particulates	Yearly emission
Dust to air, from moulding	Particulates	Yearly emission
Nitrogen oxides to air, from furnace	Nitrogen oxides	Yearly emission
Sulphur oxides to air, from furnace	Sulphur oxides	Yearly emission

5.2 List of processes expected to run by the company

All processes expected to be run by the company, for which company-specific data are mandatory, are reported in chapter 5.1 List of mandatory company-specific data.

5.3 Data gaps

Unless primary data on raw materials and consumables production of appropriate quality (as defined in the PEF Recommendation) are made available from producers, to assure an appropriate overall quality of the PEF study and the comparability of the results, default proxies reported in cap. 5.1. have to be used.

5.4 Data quality requirements

This PEFCR does not specify more stringent data quality requirements and additional criteria for the assessment of data quality compared to the ones reported in PEFCR Guidance 6.3.

For data quality requirements, assessment and reporting, see. PEFCR Guidance 6.3, Section B.5.4

5.5 Data needs matrix (DNM)

For the evaluation of all processes required to model the product using the Data Needs Matrix, see PEFCR Guidance 6.3. Section B.5.5.

5.6. Allocation rules

No allocation shall be applied within the system boundaries of raw casting life cycle.

5.7 Which datasets to use?

The secondary datasets to be used by the applicant are those listed in this PEFCR. Whenever a dataset needed to calculate the PEF-profile is not among those listed in this PEFCR, then the applicant shall choose between the following options (in hierarchical order):

- Use an EF-compliant dataset available on one of the EU nodes or available in a free or commercial source;
- Use another EF-compliant dataset considered to be a good proxy. In such case this information shall be included in the "limitation" section of the PEF report;

- Use an ILCD-entry level-compliant dataset. In such case this information shall be included in the "data gap" section of the PEF report.

5.8 Modelling of wastes and recycled content

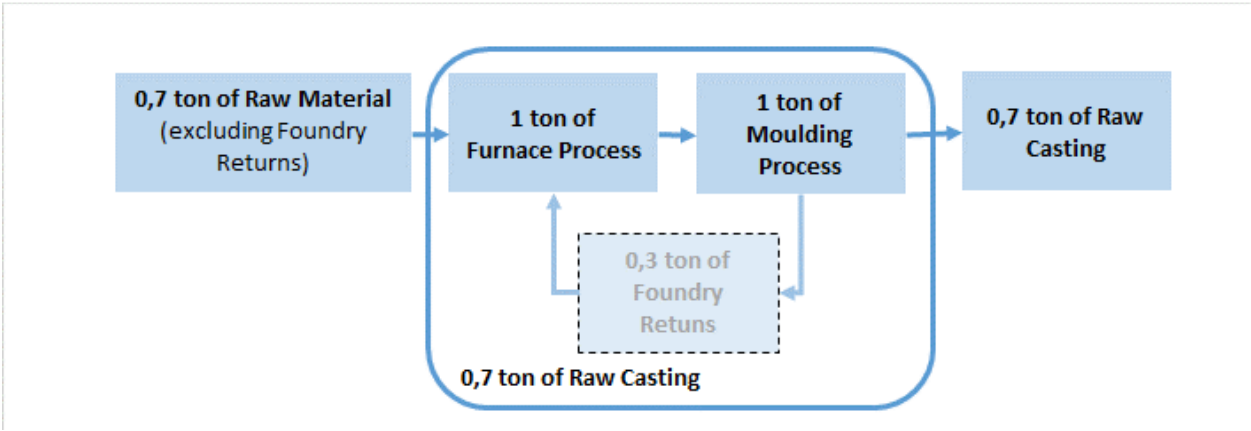
For modelling of waste and recycled content the Circular Footprint Formula, as described in PEFCR Guidance 6.3, Section B.5.11, shall be applied.

5.8.1. Modelling of foundry returns.

Foundry returns are a pre-consumer scrap that circulates within the process chain.

When dealing with foundry returns modelling, they shall be excluded from being defined as recycled content and they should not be included in R1. Foundry returns are not claimed as pre-onsumer recycled content.

Process boundaries and modelling requirements applying the Circular Footprint Formula are shown in figure below:



6. Life cycle stages

6.1 Raw Materials

Processes related to raw material acquisition, for which company-specific data are mandatory, are reported in chapter 5.1 List of mandatory company-specific data.

6.2 Manufacturing

Processes expected to be run by the company at manufacturing stage, for which company-specific data are mandatory, are reported in chapter 5.1 List of mandatory company-specific data.

7. PEF results

7.1 Benchmark values

Benchmark is not applicable for leather raw casting it is an intermediate product.

7.2 PEF profile

The applicant shall calculate the PEF profile of its product in compliance with all requirements included in this PEFCR. The following information shall be included in the PEF report:

- full life cycle inventory;
- characterised results in absolute values, for all impact categories (including toxicity; as a table);
- normalised and weighted result in absolute values, for all impact categories (including toxicity; as a table);
- the aggregated single score in absolute values