



Investment casting parts

CPC Code:

4219 - Other structures (except prefabricated buildings) and parts of structures, of iron, steel or aluminium

Geographical scope: Global

Verified Environmental Product Declaration

Registration No.: S-P-01328, ECO EPD reference number: 00000734

Rev. 0

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Company and product description

The Company

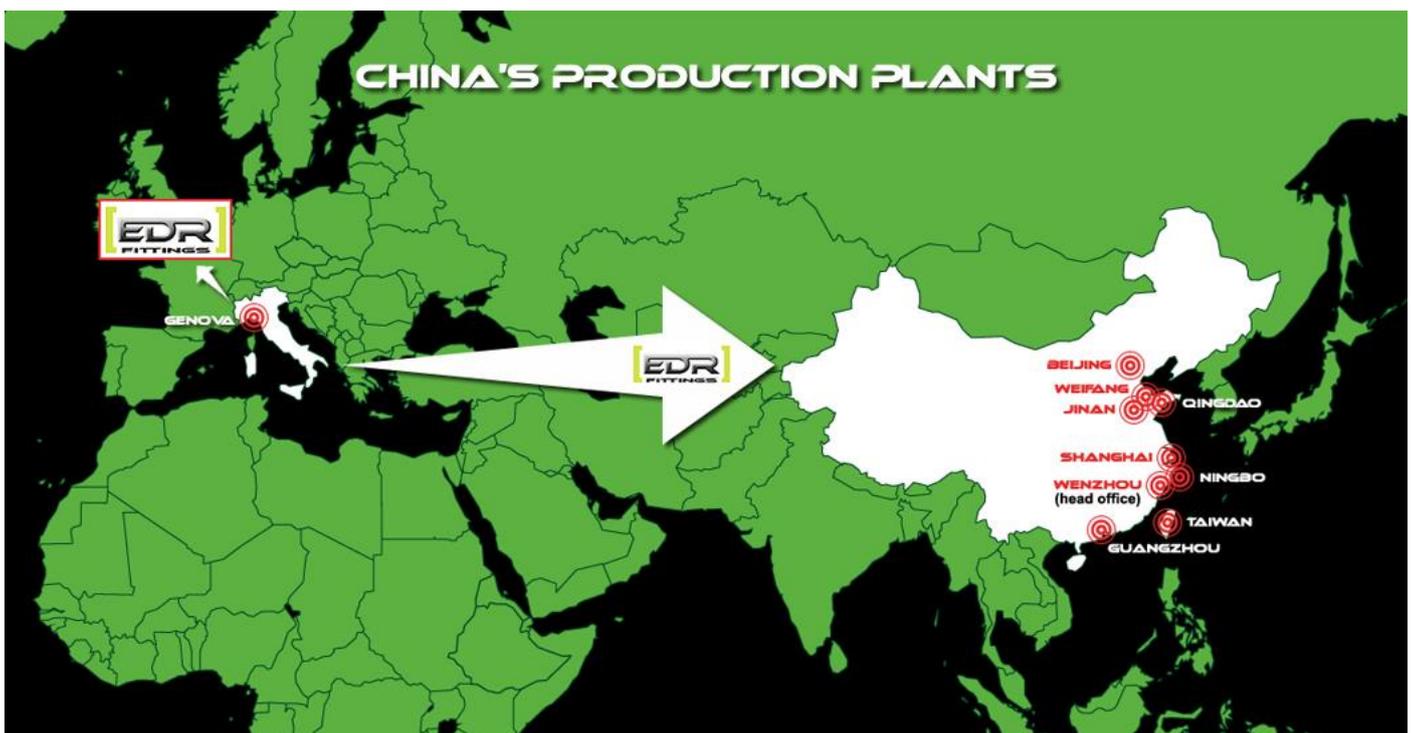
EDR Fittings was founded in 1998: with an office in Genoa (Italy) and another in Asia, the company uses precision casting and CNC (Computer Numerical Control) to manufacture mechanical components for many areas of industry.

On-going research into the widest range of technologies through the years has enabled the company to select countless businesses around the world, with a special focus on Asia, where the 80% of its partners are located.

Its presence throughout Asia allows the company to offer an optimal service for every need related to castings, machining, assemblies, pneumatic and stainless-steel fittings.

The product is manufactured in the production plant of Dongying Highyond Investment Casting Co. ("Highyond" for short), located in Dongying, Shandong, China with 180 employees and monthly production capacity of 80 tons, more than 13,000 produced parts types with more than 300 alloy grades.

Founded in 2004, Highyond integrates making, casting, processing and surface treatment, providing one-stop service for customers. The colloidal silica shell precision casting process ensures product quality to the greatest extent. At present, Highyond can produce various products made of stainless steel, heat resistant steel, carbon steel, low alloy steel, high-temperature alloy, non-ferrous alloy, etc for different purposes.



The Product

The product object of the study belongs to investment casting steel parts. In particular, it is a **Tieback bracket cast fitting for trellis superstructure HPC-01 made by G24Mn6 steel to be used for Expo 2020 Dubai pavilions.**

Investment casting is one of the most used processes in the production of castings with a high quality and finishing both in small and large production batches. It is the modern derivation of the ancient lost wax process. Wax models are made through the use of aluminium moulds for machining or electro-discharge machining. They will later be placed in special tanks containing thermo setting resins and micro ceramic granules. These two polymerize together, giving rise to an external coating which is able to withstand the very high temperatures associated with molten metals. In order to minimize the creation of micro porosity in castings, the so-called "shell making" or "Shell" is introduced into a high-temperature autoclave for the

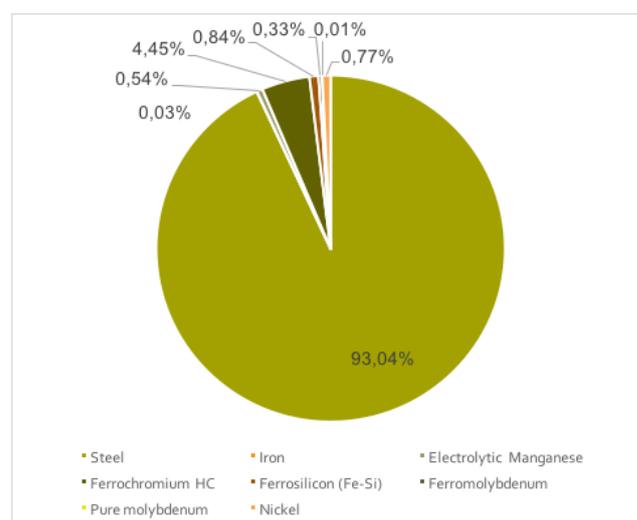
complete evacuation of residual wax, thereby obtaining a negative mould ready for the next operation. At this point, after suitably preheating the "Shell" or "Shell making", molten metals poured into it and leaved to cooling in an environment with a controlled temperature in order to avoid any metal hardenings. The external coating will be destroyed and risers will be individually removed before moving on to subsequent machining or surface finishes.

Product	Tieback bracket cast
Grade :	G24Mn6
Number:	1.1118
Classification:	Cast steel (carbon steel)
Standard:	EN 10340: 2007 Steel castings for structural uses
General dimension	from <25 to >150 mm

Declaration of Content

The product is obtained starting from the following percentages of raw materials.

Material	Percentage
Steel scrap	93,04%
Iron	0,03%
Electrolytic Manganese	0,54%
Ferchromium HC	4,45%
Ferrosilicon (Fe-Si)	0,84%
Ferromolybdenum	0,33%
Pure molybdenum	0,01%
Nickel	0,77%



Declaration of the environmental performance

Methodology

The environmental performance of the products has been calculated according to the requirements of the International EPD® System and the PCR 2012:01 Version 2.2 Construction Products and CPC 54 Construction Services (Cradle to gate).

The methodology used to quantify the environmental performance is Life Cycle Assessment (LCA), regulated by the standards ISO 14040-14044. The goal of the LCA study is to evaluate the environmental load related to the production of investment casting parts.

Specific data have been collected on the plant involved in the process with reference to the year **2017**.

The functional unit is **1 ton of investment casting parts** in steel.

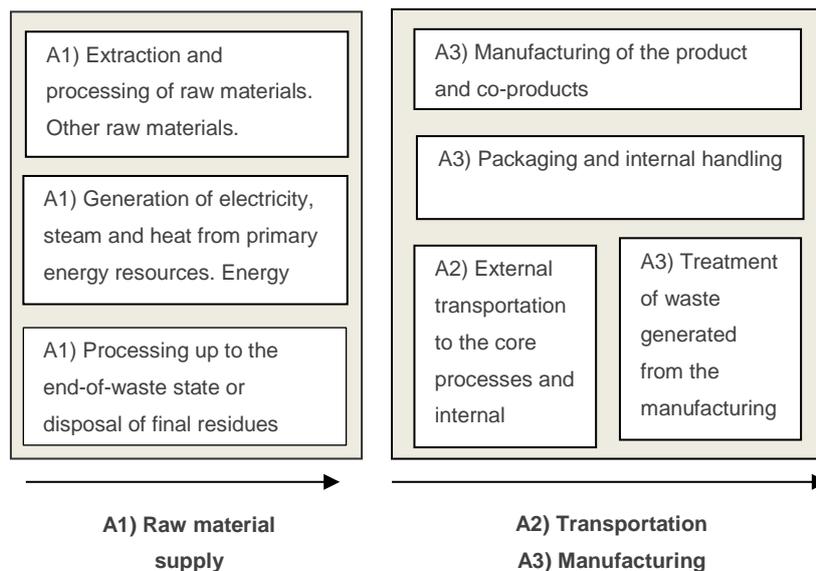
System boundaries

In agreement with the reference PCR and the standard EN 15804, the system boundaries are divided into the following two phases of the life cycle:

- Upstream processes (A1 - Raw Materials Supply)
- Core processes (A2 – Transportation; A3 – Manufacturing)

The study conducted is of the "cradle-to-gate" EPD type (declared unit): the modules from A1 to A3 are included.

The life cycle phases included are shown in the following figure.



Use of resources

The data are referred to the functional unit.

Use of resources	U.M.	A1	A2	A3	TOTAL
Use of renewable primary energy (excluding renewable primary energy resources used as raw materials)	MJ	546,44	0,34	3,94	550,72
Use of renewable primary energy resources used as raw materials	MJ	-	-	-	-
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	546,44	0,34	3,94	550,72
Use of non- renewable primary energy (excluding non- renewable primary energy resources used as raw materials)	MJ	60.975,04	438,47	4.572,44	65.985,95
Use of non- renewable primary energy resources used as raw materials	MJ	3.277,88	0,01	0,48	3.278,37
Total use of non- renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	64.252,92	438,48	4.572,92	69.264,32
Use of secondary material	kg	1.218,90	-	-	1.218,90
Use of renewable secondary fuels	MJ	-	-	-	-
Use of non-renewable secondary fuels	MJ	-	-	-	-
Use of net fresh water	m ³	27,83	0,05	0,50	28,38

Environmental impacts

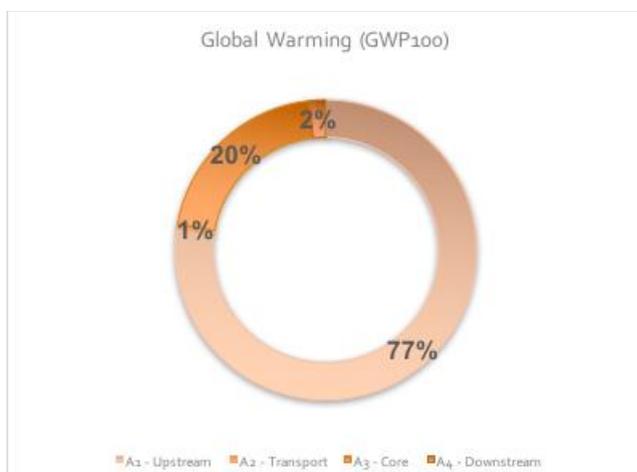
The data are referred to the functional unit.

Environmental impacts	U.M.	A1	A2	A3	TOTAL
Global warming (GWP100)	kg CO ₂ eq	4.265,42	28,37	1.130,82	5.424,61
Ozone depletion (ODP)	kg CFC-11 eq	0,00014	0,00001	0,00006	0,00020
Acidification (AP)	kg SO ₂ eq	49,94	0,73	1,92	52,59
Eutrophication (EP)	kg PO ₄ ⁻⁻⁻ eq	2,79	0,06	0,34	3,19
Photochemical ozone creation (POCP)	kg C ₂ H ₄ eq	2,28	0,02	0,07	2,37
Depletion of abiotic resources (elements)	kg Sb equivalents	0,08	0,00	0,00	0,08
Depletion of abiotic resources (fossil)	MJ net calorific value	56.832,07	437,06	4.556,92	61.826,05

Waste production and other indicators

The data are referred to the functional unit.

Waste	U.M.	A1	A2	A3	TOTAL
Hazardous waste disposed	kg	-	-	-	-
Non-hazardous waste disposed	kg	-	-	1.579,18	1.579,18
Radioactive waste disposed	kg	-	-	-	-



As an example, the contribution of the various life cycle phases to the Global Warming Potential is shown in the figure.

Programme-related information and verification

Certification Body

This EPD has been approved by the Individual Verifier Michela Gallo for the validation in agreement with the reference standard published by The International EPD® System (General Programme instructions for the International EPD® System) and the PCR 2012:01 Version 2.2 Construction Products and CPC 54 Construction Services (Cradle to gate with options).

Standard EN 15804 serves as the core for the PCR	
PCR	PCR 2012:01 Construction products and construction services, Version 2.2
PCR review conducted by:	The Technical Committee of the International EPD® System Contact via: info@environdec.com
Independent verification of the declaration, according to EN ISO 14025:	<input type="checkbox"/> EPD process certification (Internal) <input checked="" type="checkbox"/> EPD verification (External)
Third party verifier:	Michela Gallo – Recognised Individual Verifier michela.gallo@unige.it
Accredited or approved by:	Technical Committee of “The International EPD® System”

Valid until: June, 13th 2023

Note: EPDs developed under different programs may not be comparable

EPD of construction products may not be comparable if they do not comply with EN 15804

All the life cycle phases have been analysed and accounted in the study

This EPD and further information are available online on the website of the International EPD® System: www.environdec.com

References

General Programme instructions for the International EPD® System, v.2.5

PCR 2012:01 Version 2.2 Construction Products e CPC 54 Construction Services (Cradle to gate with options).

EN 15804:2012+A1:2013 (Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products)

ISO 21930 Environmental declaration of building products

Database Ecoinvent v.3 (www.ecoinvent.org)

LCA study “A life cycle assessment of investment casting parts” Rev.01 - TETIS Institute Srl – Spin off of the University of Genoa, Italy (www.tetisinstitute.org)

Glossary

LIFE CYCLE ASSESSMENT (LCA): is a methodology regulated by the ISO 14040-44 standards that aims to quantify the energy and environmental load of a product or an activity's life cycle, by quantifying the energy and materials used and emissions (solid, liquid and gaseous) released into the environment, from the extraction of raw materials to the disposal of final waste

GLOBAL WARMING (GWP₁₀₀): global warming phenomenon, calculated for the next 100 years, due to the emission of greenhouse gases into the atmosphere such as carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), etc.

OZONE DEPLETION POTENTIAL (ODP): degradation and depletion of the ozone layer in the stratosphere, which has the property of blocking the ultraviolet components of sunlight thanks to its particularly reactive compounds, originated by chlorofluorocarbons (CFC) or by chlorofluoromethanes (CFM)

ACIDIFICATION (AP): lowering of the pH of soils, lakes, forests, due to the introduction into the atmosphere of acid substances, with harmful consequences on living organisms (e.g. "acid rain")

EUTROPHICATION (EP): reduction of oxygen present in water bodies and necessary for ecosystems due to the excessive intake of nutrients such as nitrogen and phosphorus

PHOTOCHEMICAL OZONE CREATION (POCP): ozone formation at the Earth's surface level due to the introduction into the atmosphere of unburnt hydrocarbons and nitrogen oxides in the presence of solar radiation. This phenomenon is harmful to living organisms, and is often present in large urban centres

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