EPD™

Environmental Product Declaration

Global GreenTag^{CertTM} EPD Program

Compliant to EN 15804:2012+A1 2013

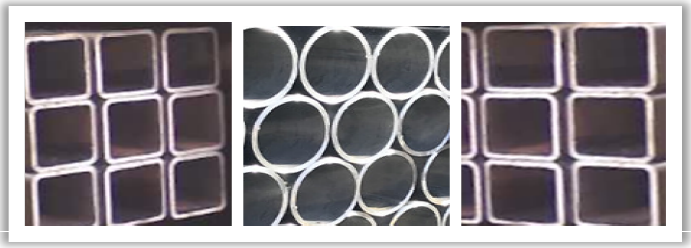
Yuantai Derun Steel Hollow Sections

Tianjin Yuantai Derun Pipe Manufacturing Group

Daqiuzhuang Industrial Zone, Jinghai, Tianjin, China

EPD Verification and LCA Details

EPD Scope	Cradle to Gate
EPD Number	TIA-001-2019
Issue Date	4th April 2019
Valid Until	4th April 2024



This EPD discloses potential environmental outcomes compliant with EN 15804:2012 + A1 2013 for business to consumer communication.

Demonstration of Verification

Standard EN 15804 serves as the core Product Category Rules (PCR)

Independent external verification of the declaration and data, according to ISO 14025:2010

☐ Internal ☒ External

Third Party Verifier [a] by Murray Jones Ecquate Pty Ltd 03-04-2019

LCA Reviewed by Omar Biaz Global GreenTag Pty Ltd 04-04-2019

EPD Reviewed by David Baggs Global GreenTag International Pty Ltd 05/04/19

a Optional for business-to-business communication; mandatory for business-to-consumer communication according to EN ISO 14025:2010, 9.4.

The EPD is property of declared manufacturer. Different program EPDs may not be comparable as e.g. Australian transport is often more than elsewhere. Comparability is further dependent on the product category rules used and the source of the data. Further explanatory information is found at info@globalgreentag.com or contact: certification1@globalgreentag.com.

EPD Program Operator	LCA and EPD Producer	Declaration Owner
Global GreenTag International Pty Ltd., PO Box 311 Cannon Hill, QLD 4170 Phone: +61 (0)7 33 999 686 http://www. globalgreentag.com	The Evah Institute PO Box 123 Thirroul NSW Phone: +61 (0)7 5545 0998 http://www.evah.com.au/	Tianjin Yuantai Derun Pipe Manufacturing Group Co., Ltd Daqiuzhuang Industrial Zone, Jinghai, Tianjin, China Phone: +86-022-58951960 http://www.ytdrintl.com/ http://www.ytdrgg.com/

Product Information

Product Name	Yuantai Derun Steel Hollow Sections
Product code	Chinese grade low carbon steels: • Q195 and • Q215A/B. Chinese grade mild steels: • Q235GJB/C/D • Q345GJC/D/E, Q345B & Q345GJB • Q390GJC/D/E and • Q460GJE/D/E. Chinese grade low alloy steels: • Q420GJC/D/E and • Q460GJE/D/E. EN-grade mild steels: • S235JRH/JOH/J2H • S275JRH/JOH/J2H,S275NH and • S355JRH/JOH/J2H, S355NH. Japanese Grade mild steels: • SS490 and SS400 American grade mild steels: • A500GA/GB, A500GC • A501GR.A and • A501 GR.B. EN-grade low alloy steels: • S420JOH and • S460NH/S460JOH.
Manufacturing Site	Tianjin Yuantai Derun Pipe Manufacturing Group Factory in Tianjin
Site Representation and Geography	Daqiuzhuang Industrial Zone, Jinghai, Tianjin, China
Manufacturer warranty	Not Applicable
Service Life	The reference service life is unspecified for cradle to gate scope
Standards	ASTMA500, ASTMA501, AS1163, EN10219, EN10210, BS1387, JISG3466, DIN2240
Product Specifications	Hollow sections 50 ±5mm thick wall exterior: • Square 1100*1100mm linear mass density 1627kg/m, • Rectangular 1000*1100mm linear mass density 1548kg/m and • Round 2032mm dia linear mass density 2440kg/m.
Functional & Technical Performance	Low carbon steel yield strengths of: • 195MPa • 215MPa. Mild steel yield strengths of: • 235MPa, • 345MPa, • 390 MPa or • 460 Mpa Low alloy steel yield strength of: • 420MPa or • 460MPa
Functional Performance in building	Hollow Structural sections can be circular (CHS), square (SHS) or rectangular (RHS). As well as welded steel frames RHS steel is commonly used for beams while SHS and CHS are more often used for columns.
No Very High Concern	Contains no substances in the “Candidate List of Substances of Very High Concern for authorisation” registration with the European Chemicals Agency

Program Description

PCR	This declaration is based on Structural Steel Products PCR SS: 2019 V1
PCR Review Chair	Murray Jones of Ecquate Pty Ltd
EPD type	Cradle to gate (A1 to A3) as defined by EN 15804 and depicted in Figure 1
Declared Unit	Each declared product per kilogram
Comparability	Construction product EPDs may not be comparable if not EN15804 compliant
Range and variability	Significant differences of average LCIA results are declared
Cut-off criteria and Data quality	Complies with the EN 15804 + A1 2013
Primary Data	Data was collected in accordance with EN ISO 14044:2006, 4.3.2, from primary sources including the manufacturer, suppliers and their publications on standards locations, logistics, technology, market share, management system, and commitment to improved environmental performance.
System boundary	The system boundary with nature includes material and energy system input processing plus manufacture and transport to factory gate plus waste arising.
Product stages included	A1, A2, A3 as depicted and denoted by x in Figure 1 Stages are included from • A1 raw material acquisition, extraction, refining and processing plus reuse of scrap or material from previous systems; electricity generated from all sources with extraction, refining & transport; plus secondary fuel energy and recovery processes, and • A2 transport internal and to the factory gate as well as • A3 manufacture of product packaging, inputs and ancillary material and system flows leaving at end-of-waste boundary allocated as coproducts.
Stages excluded	A4-5, B1-7, C1-1& D as depicted and denoted by MND in Figure 1

Information Modules

As Figure 1 shows an x marking LCA and EPD results to be shown summed for modules A1-3. Modules A4 to C4 and D are not declared marked MND which does not indicate zero inventory or impact.

Model	Actual					Scenarios										Potential		
Phase	Produce			Construct		Building Fabric					Building Use		End of life				Beyond Boundary	
Module	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D1, D2	D3
Unit Operations	Resource supply	Transport	Manufacturing	Transport	Construction	Use	Maintain	Repair	Replace	Refurbish	Operating Energy	Operating Water	Demolish	Transport	Process Waste	Disposal	Reuse	Recovery	Recycling
Cradle to Gate	x	x	x	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

Figure 1 EPD Life Cycle Phases and Stages Cradle to Gate or Grave

Base Material Origin and Detail

Table 1 lists the low carbon, mild and low alloy steel hollow section product components, function, source and amount in mass percent.

Table 1 Base Material Chemical Analysis

Function	Component	Source of Input Flow	Low Carbon Steel % w/w		Mild steel % w/w	Low Alloy Steel % w/w
Steel Substrate	Iron	Australian and Brazilian iron ore charge for iron making	>98.00	>98.00	>97.00	>97.00
Strength & Hardness	Carbon	Australian and Chinese coking coal charge for iron making	≤0.12	≤0.15	≤0.20	≤0.20
Deoxidiser & Strength	Manganese	Chinese pyrolusite ore to make ferromanganese alloy for steel making	≤0.50	≤1.20	≤1.40	≤1.70
Deoxidiser & Strength	Silicon	Iron making charge and Chinese quartzite ore to make ferrosilicon steel making alloy	≤0.30	≤0.35	≤0.35	≤0.55
Hardenability	Chromium	South African chromite ore to make ferrochrome alloy for steel making				≤0.40
Ductility	Nickel	New Caledonian goethite ore to make ferronickel alloy for steel making				≤0.40
Machinability	Sulphur	Australian and Chinese iron ore & coal charge for iron making	≤0.04	≤0.05	≤0.035	≤0.035
Machinability & Durability	Phosphor-us	Australian and Brazilian iron ore charge for iron making	≤0.035	≤0.045	≤0.030	≤0.035
Deoxidiser	Aluminium	Chinese post industrial scrap to Aluminium for steel making	≥0.015	≥0.015	≥0.015	≥0.015
Hardness	Nitrogen	Australian and Chinese coke and gas charge for iron & steel making	≤0.009	≤0.009	≤0.009	≤0.009
Toughness	Titanium	Chinese scrap for ferrotitanium alloy for steel making				0.02-0.2
Toughness	Vanadium	Chinese magnetite ore to make ferrovanadium alloy for steel making				0.02-0.2
Toughness	Niobium	Brazilian & Canadian pyrochlore ore to make ferroniobium alloy for steel				0.015-0.06

Figure 2 shows included processes for making steel products in a lilac cradle to gate system boundary. Such processes require input flows from and generate output flows to air, land, water and communities.

Alongside, within the dashed lines, are depicted many excluded scenarios outside the EPD scope. These processes are from the factory gate to end of life grave.

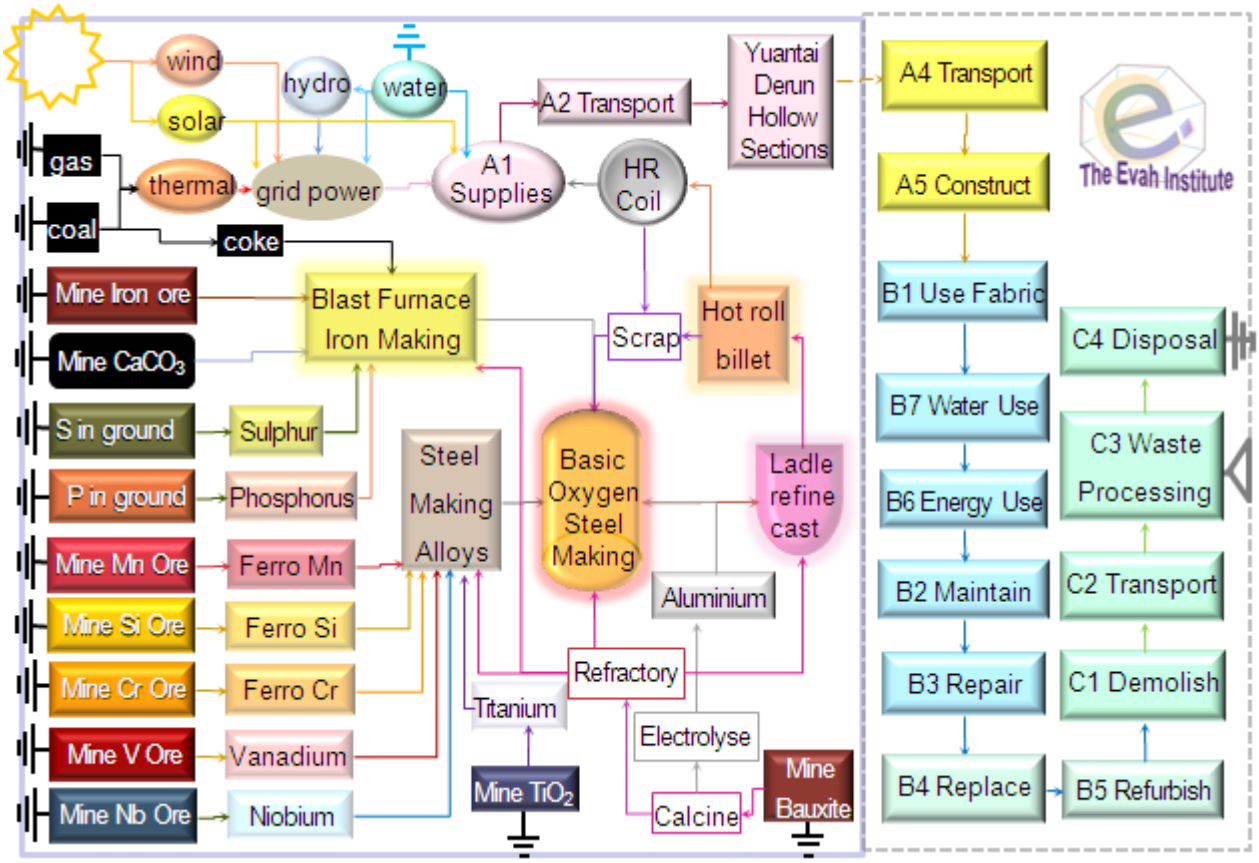


Figure 2 Steel Hollow Section Process Flow Chart Cradle to Gate

Processes include those of:

- Mining, extracting and refining resources to make commodities and packaging;
- Acquiring, cultivating, harvesting, extracting, refining produce and biomass;
- Fuel production to supply power and process energy and freight;
- Chemicals use in processing resources, intermediates and ancillaries;
- Process energy, fuel and freight of resources, intermediates and ancillaries;
- Infrastructure process energy transformed and material wear loss e.g. tyres.

Cradle to Gate Inventory and Potential Impact Results

Table 2 shows the low carbon steel product resource inputs plus waste and output flows per declared unit.

Table 2 Resource Inputs and Outputs A1-A3/kg

INPUTS	Unit	Q195	Q215A/B
Net Fresh Water	m^3	0.014	0.014
Secondary Water	m^3	0.008	0.008
Secondary Material	kg	0.004	0.004
Primary Renewable Energy Not Feedstock	MJ	0.327	0.322
Renewable Secondary Fuels	MJ	0.021	0.021
Primary Energy Renewable Feedstock Material	MJ	0.034	0.034
Total Primary Renewable Energy Resources	MJ	0.361	0.356
Non-Renewable Secondary Fuels	MJ	0.005	0.005
Primary Energy Non-Renewable Not Feedstock	MJ	29.67	29.57
Non-Renewable Primary Energy Feedstock	MJ	5.433	5.418
Total Non-Renewable Primary Energy Resources	MJ	35.10	34.99
OUTPUTS	**Unit**	**Q195**	**Q215A/B**
Hazardous waste disposed	kg	3.18E-05	3.18E-05
Non- Hazardous waste disposed	kg	8.44E-06	8.44E-06
Radio Active Waste disposed	kg	3.40E-12	3.40E-06
Components for reuse	kg	0.047	0.045
Material for recycling	kg	0.108	0.105
Material for Energy recovery	kg	<0.01	<0.01
Exported electrical energy	MJ	<0.01	<0.01
Exported Thermal Energy	MJ	<0.01	<0.01

Table 3 lists potential impact results per kg declared unit cradle to gate.

Table 3 Potential Impacts/kg

CATEGORIES	Factor	Q195	Q215A/B
Global Warming Potential	kg CO_{2e}	2.408	2.400
Stratospheric Ozone Depletion Potential	kg $R11_e$	3.25E-08	3.19E-08
Acidification of Land and Water Potential	kg SO_{2e}	8.00E-03	8.00E-03
Eutrophication Potential	kg PO_{4e}^3	1.50E-03	1.40E-03
Photochemical Ozone Creation Potential	kg C_2H_{4e}	1.37E-04	1.36E-04
Elements Abiotic Depletion Potential	kg Sb_e	2.28E-07	2.28E-07
Fossil Fuel Abiotic Depletion Potential	MJ_{ncv}	31.40	31.3

Table 4 shows the mild steel product inputs plus waste and output flows per kilogram declared unit.

Table 4 Resource Inputs and Outputs A1-A3/kg

INPUTS	Unit	Q235	Q345	Q390	Q460
Net Fresh Water	m^3	0.014	0.014	0.014	0.014
Secondary Water	m^3	0.008	0.008	0.008	0.008
Secondary Material	kg	0.004	0.004	0.004	0.004
Primary Renewable Energy Not Feedstock	MJ	0.313	0.312	0.331	0.313
Renewable Secondary Fuels	MJ	0.020	0.020	0.022	0.020
Primary Energy Renewable Feedstock Material	MJ	0.029	0.029	0.041	0.029
Total Primary Renewable Energy Resources	MJ	0.342	0.341	0.372	0.341
Non-Renewable Secondary Fuels	MJ	0.004	0.004	0.007	0.004
Primary Energy Non-Renewable Not Feedstock	MJ	28.38	28.46	30.29	28.29
Non-Renewable Primary Energy Feedstock	MJ	5.132	5.191	5.714	5.391
Total Non-Renewable Primary Energy Resources	MJ	33.51	33.625	35.959	33.681
OUTPUTS	**Unit**	**Q235**	**Q345**	**Q390**	**Q460**
Hazardous waste disposed	kg	3.18E-05	3.18E-05	3.18E-05	3.18E-05
Non- Hazardous waste disposed	kg	8.44E-06	8.44E-06	8.44E-06	8.44E-06
Radio Active Waste disposed	kg	3.47E-06	2.93E-04	3.46E-06	3.46E-06
Components for reuse	kg	0.047	0.047	0.058	0.044
Material for recycling	kg	0.135	0.133	0.120	0.131
Material for Energy recovery	kg	<0.01	<0.01	<0.01	<0.01
Exported electrical energy	MJ	<0.01	<0.01	<0.01	<0.01
Exported Thermal Energy	MJ	<0.01	<0.01	<0.01	<0.01

Table 5 lists potential impact results per kg declared unit cradle to gate.

Table 5 Potential Impacts/kg

CATEGORIES	Factor	Q235	Q345	Q390	Q460
Global Warming Potential	kg CO_{2e}	2.037	2.284	2.463	2.269
Stratospheric Ozone Depletion Potential	kg $R11_e$	3.11E-08	3.09E-08	3.27E-08	3.11E-08
Acidification of Land and Water Potential	kg SO_{2e}	7.00E-03	7.00E-03	8.00E-03	7.00E-03
Eutrophication Potential	kg PO_{4e}^3	1.40E-03	1.40E-03	1.50E-03	1.40E-03
Photochemical Ozone Creation Potential	kg C_2H_{4e}	1.28E-04	1.29E-04	1.40E-04	1.30E-04
Elements Abiotic Depletion Potential	kg Sb_e	2.17E-07	2.17E-07	2.35E-07	2.16E-07
Fossil Fuel Abiotic Depletion Potential	MJ_{ncv}	29.9	30.0	32.2	29.8

Table 6 shows low alloy steel products resource inputs plus waste and output flows per declared unit.

Table 6 Resource Inputs and Outputs A1-A3/kg

INPUTS	Units	Q420	Q460
Net Fresh Water	m^3	0.014	0.014
Secondary Water	m^3	0.008	0.008
Secondary Material	kg	0.002	0.002
Primary Renewable Energy Not Feedstock	MJ	0.320	0.320
Renewable Secondary Fuels	MJ	0.021	0.021
Primary Energy Renewable Feedstock Material	MJ	0.025	0.025
Total Primary Renewable Energy Resources	MJ	0.348	0.345
Non-Renewable Secondary Fuels	MJ	0.004	0.004
Primary Energy Non-Renewable Not Feedstock	MJ	30.01	30.01
Non-Renewable Primary Energy Feedstock	MJ	5.336	5.337
Total Non-Renewable Primary Energy Resources	MJ	35.348	35.348
OUTPUTS	**Units**	**Q420**	**Q460**
Hazardous waste disposed	kg	3.18E-05	3.18E-05
Non- Hazardous waste disposed	kg	8.44E-06	8.44E-06
Radio Active Waste disposed	kg	3.51E-06	3.51E-06
Components for reuse	kg	0.047	0.050
Material for recycling	kg	0.122	0.122
Material for Energy recovery	kg	<0.01	<0.01
Exported electrical energy	MJ	<0.01	<0.01
Exported Thermal Energy	MJ	<0.01	<0.01

Table 7 lists potential impact results per kg declared unit cradle to gate.

Table 7 Potential Impacts/kg

CATEGORIES	Factors	Q420	Q460
Global Warming Potential	kg CO_{2e}	2.417	2.417
Stratospheric Ozone Depletion Potential	kg $R11_e$	3.15E-08	3.15E-08
Acidification of Land and Water Potential	kg SO_{2e}	8.00E-03	8.00E-03
Eutrophication Potential	kg PO_{4e}^3	1.50E-03	1.50E-03
Photochemical Ozone Creation Potential	kg C_2H_{4e}	1.40E-04	1.40E-04
Elements Abiotic Depletion Potential	kg Sb_e	5.95E-7	5.95E-7
Fossil Fuel Abiotic Depletion Potential	MJ	31.6	31.6

References

ASTM A36 / A36M - 03 Standard Specifications for Carbon Structural Steel

BRE Global, BRE Environmental Profiles 2013: Product Category Rules for Type III EPD of construction products to EN 15804:2012+A1:2013, PN 514. Watford, BRE, 2014

CML LCA methodology, Institute of Environmental Sciences (CML), Faculty of Science, University of Leiden, Netherlands

EN 10025-2:2004 - Hot rolled products of structural steels - Part 2: Technical delivery conditions for non-alloy structural steels.

EN 10219:2006, Cold formed welded structural hollow sections of non-alloy and fine grain steels. Part 1: Technical delivery requirements, part 2: Tolerances, dimensions and sectional properties

EN 10210:2006, hot finished structural hollow sections of non-alloy and fine grain steels, part 1: Technical delivery requirements, part 2: Tolerances, dimensions and sectional properties

GreenTag™ 2019 http://www2.ecospecifier.org/services_offered/greentag_certification

GreenTag™ 2019 Product Category Rules http://www.globalgreentag.com/greentag-epd-program

International Energy Agency, Energy Statistics 2018 http://www.iea.org

ISO 14015:2001 EMS: Environmental assessment of sites & organizations (EASO)

ISO 14020:2000 Environmental labels & declarations — General principles

ISO 14025:2006 Environmental labelling & declarations Type III EPDs Principles & procedures

ISO 14031:1999 EM: Environmental performance evaluation: Guidelines

ISO 14040:2006 EM: Life cycle assessment (LCA): Principles & framework, London, BSI, 2006.

ISO 14044:2006 EM: LCA: Requirement & guideline LCI; LCIA Interpretation, London, BSI, 2006.

ISO 15392:2008 Sustainability in building construction General principles

ISO 15686-1:2011 Buildings & constructed assets Service life planning Part 1: General principles

ISO 15686-2:2012 Buildings & constructed assets Service life (SL) planning Part 2: prediction

ISO 15686-8:2008 Buildings & constructed assets SL planning Part 8: Reference & estimation

ISO 21929-1:2011 Sustainability in building construction Sustainability indicators Part 1 Framework

ISO 21930:2007 Building construction: Sustainability, Environmental declaration of building products

ISO/TS 21931-1:2010 Sustainability in building construction: Framework for assessment, Part 1:

ISO 21932:2013 Sustainability in buildings and civil engineering works -- A review of terminology

U.S. Geological Survey, Mineral Commodity Summaries, Iron and Steel Slag, January 2016

World Steel Association: Life cycle assessment methodology report, 2017