Environmental Product Declaration

In accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC:2021 for:

Bar in Coil

from

DaehanSteel

Programme:	The International EPD® System, www.environdec.com
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An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com

General information

Programme information

Programme:	The International EPD® System
Address:	EPD International AB Box 210 60 SE-100 31 Stockholm Sweden
Website:	www.environdec.com
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Accountabilities for PCR, LCA and independent, third-party verification
Product Category Rules (PCR)
CEN standard EN 15804 serves as the Core Product Category Rules (PCR)
Product Category Rules (PCR): *PCR 2019:14 Construction products (version 1.3.4) and 412*
PCR review was conducted by: The Technical Committee of the International EPD System. See www.environdec.com for a list of members. Review chair: Claudia A. Peña, University of Concepción, Chile. The review panel may be contacted via the Secretariat www.environdec.com/contact.
Life Cycle Assessment (LCA)
LCA accountability: *Sungmo Yeon, H.I.Pathway Co., Ltd.*
Third-party verification
Independent third-party verification of the declaration and data, according to ISO 14025:2006, via: ☒ EPD verification by individual verifier Third-party verifier: < *Noh-hyun Lim(IGSC), Certiquality Srl* > The certification body is accredited by: Accredia
OR
Procedure for follow-up of data during EPD validity involves third party verifier: ☒ Yes ☐ No [Procedure for follow-up the validity of the EPD is at minimum required once a year with the aim of confirming whether the information in the EPD remains valid or if the EPD needs to be updated during its validity period. The follow-up can be organized entirely by the EPD owner or together with the original verifier via an agreement between the two parties. In both approaches, the EPD owner is responsible for the procedure being carried out. If a change that requires an update is identified, the EPD shall be re-verified by a verifier]

The EPD owner has the sole ownership, liability, and responsibility for the EPD.

EPDs within the same product category but registered in different EPD programmes, or not compliant with EN 15804, may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of

PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see EN 15804 and ISO 14025.

Company information

Owner of the EPD: DaehanSteel
Contact: JuKyung Lee / 031-650-0022
Description of the organisation: DaeHanSteel was established in 1954 and produced Process Rebar and Bar in Coil at Sinpyeong, Noksan and Pyeongtaek plant in Republic of Korea. Especially, the Bar in Coil has been produced at Pyeongtaek plant.
Pyeongtaek plant serves as a starting base for Business Transformation pursued by DaehanSteel. The completion of the construction of the rolling factory located in Pyeongtaek enabled the steelmaker to increase its capability of manufacturing reinforcing bars by approximately 40 percent and to have an annual capacity of 450,000 tons of steel rolling. Notably, Pyeongtaek Factory uses the VCC line from German's SMS to manufacture Bar in Coil.
Product-related or management system-related certifications: An Environmental Management System compliant with the international standard ISO 14001 has formalized its commitment, awareness of environmental issues and maintained its environmental performance over time.
Also, we certified ISO 9001 and 45001 management system for quality management and health and safety (OH&S) management.

Name and location of production site(s): Pyeongtaek plant / 39, Pyeongtaekhang-ro 268beon-gil, Poseung-eup, Pyeongtaek-si, Gyeonggi-do, Republic of Korea

Product information

Product name: Bar in Coil

Product identification The CEN standard EN 15804:2012+A2:2019 serves as the core PCR. In addition, PCR 2019:14 Construction products (version 1.3.4) and the EN 10204

Product description: DaehanSteel introduced Bar in Coil based on a long period of research and field experience. Bar in Coil, already widely used in Europe, is a new concept rebar that can provide many advantages such as maximization of production efficiency through the automated system, reduction of labor costs, reduction of processing losses and the amount of use of steel, better inventory management and efficient use of space for storage.

Bar in Coil can increase productivity and reduce losses. With the adoption of the automated system, it is effective in decreasing labor costs. Bar in Coil makes it possible to use the storage space in a more efficient way and to address problems with inventory management arising due to differences in the lengths of deformed straight bars. Rather than an individual bar, roll-type rebars can improve productivity. The reduced time for changing materials can enhance the productivity of each machine, and it is possible to charge steel bars in a constant basis, thus increasing productivity and reducing losses.

Chemical Composition and material components (% by mass) for Bar in Coil

Chemical composition	%
Fe	98
Si, Mn, C	2
Material Components	**%**
Pre-consumer scrap/Post-consumer scrap	100
Renewable material	0
Biogenic carbon	0
Packaging materials	**%**
Steel strap – packaging (versus product)	0.09

Product characteristics for Bar in Coil

Characteristic	500N	B500B	SD295	SD345
Diameter (mm)	10-20	10-20	10-16	10-16
Weight (kg)	3,500	3,500	3,500	3,500
Yield strength (N/mm^2)	500-600	500-600	≥ 295	345-440
Elongation (%)	≥ Agt 5	≥ Agt 5	≥ EL 16	≥ EL 18

Product-related certifications for Bar in Coil

Country	Standard	Product	Quality	Diameter
Australia	AS/NZS 4671:2019	Coil	500N	10-20mm
Singapore	SS 560:2016	Coil	B500B	10-16mm
UK	BS 4449:2005	Coil	B500B	10-16mm
Malaysia	MS 146:2014	Coil	B500B	10mm, 20mm
Japan	JIS G 312	Coil/Bar	SD295, SD345	10-16mm

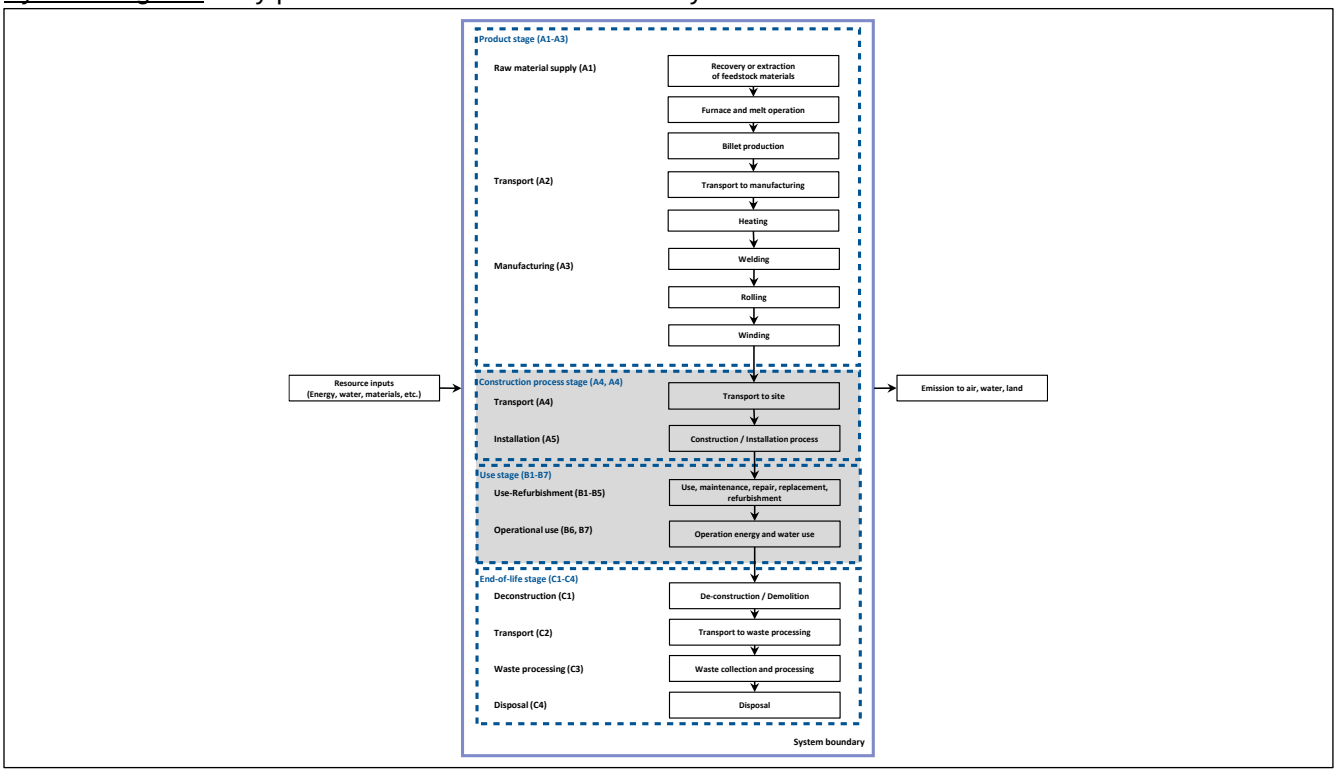
UN CPC code: 4124

Geographical scope: The production site of DaehanSteel is located at Pyeongtaek city (154, 39, Pyeongtaekhang-ro 268beon-gil, Poseung-eup, Pyeongtaek-si, Gyeonggi-do, Republic of Korea). Product use was excluded from the scope of environmental impact calculations in this study. For the end-of-life stage, the environmental impact was calculated based on product disposal statistics from the World Steel Association, 2020.

LCA information

Functional unit / declared unit: 1 metric ton (1,000 kg)
Reference service life: Not applicable
Time representativeness: The production data are from 2023, and the database data are from 2022 i.e., no data is older than 10 years.
Database(s) and LCA software used: Database used is mainly Ecoinvent 3.9.1. The LCA software used is SimaPro 9.5.0.1
Description of system boundaries:
According to the PCR, the included life cycle stages are product stage (modules A1-A3), construction stage (modules A4-A5), use stage (B1-B7), end of life stage (modules C1-C4) and benefits and loads beyond the system boundary (D). All major materials, production energy use and waste are included for product stages A1, A2 and A3. The product is a Bar in Coil. After the customer purchases the product, it is manufactured as a construction product and then applied to the construction site, so, DaehanSteel does not have control over subsequent processes, and the usage data for each sector to which certified products are applied is not managed. Therefore, the installation (A4-A5) and use(B1-B7) are not the responsibility of DaehanSteel. All life cycle impacts are included, see flowchart below. The following information describes the scenarios in the different modules of the EPD. All major raw materials and all the essential energy are included. All raw material and energy flows were included in the environmental impact assessment.

System diagram: Gray phases are excluded from this study.



More information: Electricity, waste and ancillary materials in production are calculated as an average weight per produced tonne of all products using yearly production data and the rate for 2023. For manufacturing processes, the specific country mix of electricity is considered. For secondary data on materials' flow information has been gathered from the Ecoinvent 3.9.1. database. In addition, the allocation is made following the provisions of PCR 2019: 14 Construction products (EN 15804: 2012+A2:2019) (1.11). According to PCR, a minimum of 95% of total environmental impact per module has been in the life cycle modelling. The transportation of the material is considered in this

analysis. The polluter pays and modularity principles are followed. The processes excluded from analysis are infrastructure, maintenance efforts for infrastructure, personnel lodging and transport, employee commute, administration.

Modules declared, geographical scope, share of specific data (in GWP-GHG results) and data variation (in GWP-GHG results):

	Product stage			Construction process stage		Use stage							End of life stage				Resource recovery stage
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
Module	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Modules declared	X	X	X	ND	ND	ND	ND	ND	ND	ND	ND	ND	X	X	X	X	X
Geography	RoW	RoW	KR	ND	ND	ND	ND	ND	ND	ND	ND	ND	EU	EU	EU	EU	RoW
Specific data used	> 95%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	0%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	0%			-	-	-	-	-	-	-	-	-	-	-	-	-	-

X = declared stage, ND = Not Declared

- Raw material supply (A1)

The main raw materials used to produce the PCM are as follows.

A. Pre-consumer scrap/post-consumer scrap

B. Anthracite

C. Dolomite

D. Quicklime- Transport (A2)

The transport of raw materials and packaging is carried out by suppliers to the Bar in Coil production site by various transport modes. Transportation distance information is listed in below table.

Inputs	Amount per functional unit			
	Transport mode		Distance (km)	Load (ton·km)
Pre-consumer scrap/post-consumer scrap	National supply chain	Truck	42.14	4.716E-02
Anthracite	National supply chain	Truck	379.5	6.461E-03
Fe-Si Briq	National supply chain	Truck	122.6	3.595E-04
Fe-Si	National supply chain	Truck	52.6	6.781E-05
Si-Mn	National supply chain	Truck	123.14	7.667E-04
Electrode	National supply chain	Truck	9.70	9.880E-06
Quicklime	National supply chain	Truck	309.0	2.680E-03
Dolomite	National supply chain	Truck	290.24	4.532E-03
Fe-V	National supply chain	Truck	419.5	1.497E-05

- Manufacturing (A3)

All energy, industrial water, gas and environmental emission data are collected and calculated based on 2023 production year.

The manufacturing process of module A3 is Rep of Korea, and the environmental impact was calculated using the "Electricity, medium voltage {KR} | electricity voltage transformation from high to medium voltage | Cut-off" (GWP_{fossil} = 6.94E-01 $kgCO_2$-eq./kWh, $GWP_{biogenic}$ = 6.77E-04 $kgCO_2$-eq./kWh, GWP_{luluc} = 3.67E-04 $kgCO_2$-eq./kWh)., "natural gas, liquefied {RoW} | natural gas, liquefied, import from QA | Cut-off" (GWP_{fossil} = 5.50E-01 $kgCO_2$-eq./m^3, $GWP_{biogenic}$ = 2.08E-04 $kgCO_2$-eq./ m^3, GWP_{luluc} = 2.26E-04 $kgCO_2$-eq./ m^3).

In this study, wastes sent to landfill and incineration were modeled. For wastes sent to recycling facility, only transport from Bar in Coil site to treatment facility was considered.

- De-construction demolition (C1)

Energy consumption of a demolition process is on average 10kWh/m^2 (Bozdag, Ö & Seçer, M. 2007). The average mass of a reinforced concrete building is about 1000 kg/m^2. Therefore, energy consumption during demolition is 0,01 kWh/kg. A conservative assumption has been made that the energy consumed during demolition of a steel building is the same as that of a concrete building. The source of energy is diesel fuel used by work machines. It is assumed that 100% of the waste is collected and transported to the waste treatment.

- Transport (C2)

Transportation distance and truck type from the construction site to the recycling site / final disposal(landfill) is assumed as 300 km and the Lorry, 7.5-16 metric ton, Euro VI.

- Waste processing (C3)

Approximately 85% of steel is assumed to be recycled based on World Steel Association, 2020.

- Disposal (C4)

It is assumed that the remaining 15 % of Bar in Coil is taken to landfill for final disposal.

- Benefits and loads beyond the system boundary (D)

Steel collected and recycled is assumed to replace a value of scrap (GLO).

Content information

Product components	Weight, kg	Post-consumer material, weight-%	Biogenic material, weight-% and kg C/kg
Pre-consumer scrap/post-consumer scrap	1.119E+00	-	-
Anthracite	1.703E-02	-	-
Dolomite	1.562E-02	-	-
Quicklime	8.674E-03	-	-
Si-Mn	6.226E-03	-	-
Fe-Si Briq	2.933E-03	-	-
Fe-Si	1.289E-03	-	-
Electrode	1.019E-03	-	-
Oil	2.174E-04	-	-
Fe-V	3.569E-05	-	-
TOTAL	1.172E+00		
Packaging materials	**Weight, kg**	**Weight-% (versus the product)**	**Weight biogenic carbon, kg C/kg**
Band	8.181E-04	-	-

Results of the environmental performance indicators

The environmental performance of the functional unit of 1 metric tonne of Bar in Coil are reported below using the parameters and units as specified in PCR 2019:14.

Mandatory impact category indicators according to EN 15804+A2 (EF3.1)

Results per functional or declared unit							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-fossil	kg CO_2 eq.	5.99E+02	3.48E+00	7.01E+01	6.49E+01	1.02E+00	-1.59E+03
GWP-biogenic	kg CO_2 eq.	1.11E+00	1.28E-01	5.42E-02	2.80E-02	5.84E-04	6.90E-01
GWP-luluc	kg CO_2 eq.	5.36E-01	8.70E-03	3.22E-02	1.27E-02	6.16E-04	-3.40E-02
GWP-total	kg CO_2 eq.	6.01E+02	3.62E+00	7.01E+01	6.50E+01	1.02E+00	-1.58E+03
ODP	kg CFC 11 eq.	1.15E-05	6.25E-08	1.53E-06	1.01E-06	2.96E-08	-3.60E-12
AP	mol H+ eq.	3.49E+00	1.75E-02	1.45E-01	5.91E-01	7.69E-03	-3.53E+00
EP-freshwater	kg P eq.	4.63E-01	3.17E-03	4.85E-03	3.21E-03	8.50E-05	-2.99E-04
EP-marine	kg N eq.	9.28E-01	3.10E-03	3.60E-02	2.70E-01	2.95E-03	-6.22E-01
EP-terrestrial	mol N eq.	1.21E+01	2.74E-02	3.64E-01	2.93E+00	3.16E-02	-5.46E+00
POCP	kg NMVOC eq.	2.76E+00	8.83E-03	2.26E-01	8.68E-01	1.10E-02	-2.52E+00
ADP-minerals&metals*	kg Sb eq.	9.31E-03	6.92E-06	2.24E-04	3.74E-05	1.42E-06	-4.10E-03
ADP-fossil*	MJ	1.03E+04	8.01E+01	9.88E+02	8.50E+02	2.54E+01	-1.51E+04
WDP	m^3	8.82E+01	8.27E-01	3.75E+00	2.23E+00	1.12E+00	-1.97E+04
Acronyms	GWP-fossil = Global Warming Potential fossil fuels; GWP-biogenic = Global Warming Potential biogenic; GWP-luluc = Global Warming Potential land use and land use change; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption						

** Disclaimer: The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.*

Additional mandatory and voluntary impact category indicators

Results per functional or declared unit							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-GHG[1]	kg CO_2 eq.	6.00E+02	3.49E+00	7.01E+01	6.49E+01	1.02E+00	-1.59E+03
Additional voluntary indicators e.g., the voluntary indicators from EN 15804 or the global indicators according to ISO 21930:2017							

Resource use indicators

Results per functional or declared unit							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	MJ	1.69E+02	1.30E+01	1.31E+01	7.97E+00	1.56E-01	4.86E+01
PERM	MJ	1.77E+02	2.34E+00	4.15E+00	1.53E+00	6.13E-02	-5.08E-01
PERT	MJ	3.46E+02	1.54E+01	1.73E+01	9.50E+00	2.18E-01	4.80E+01
PENRE	MJ	2.22E+03	3.98E+01	2.65E+01	1.19E+01	2.68E-01	5.86E+02
PENRM	MJ	8.05E+03	4.02E+01	9.61E+02	8.38E+02	2.52E+01	-1.57E+04
PENRT	MJ	1.03E+04	8.00E+01	9.88E+02	8.50E+02	2.54E+01	-1.51E+04
SM	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m^3	2.92E+00	6.26E-02	1.43E-01	8.34E-02	2.70E-02	-6.90E+00
Acronyms	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; RE = Recovered energy; FW = Use of net fresh water						

[1] This indicator accounts for all greenhouse gases except biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. As such, the indicator is identical to GWP-total except that the CF for biogenic CO_2 is set to zero.

Waste indicators

Results per functional or declared unit							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	8.59E-01	2.51E-03	2.27E-02	8.69E-03	3.13E-04	0.00E+00
Non-hazardous waste disposed	kg	7.43E+01	2.20E-01	4.08E+01	1.37E+00	1.68E+02	0.00E+00
Radioactive waste disposed	kg	3.43E-02	5.83E-04	3.92E-04	1.84E-04	3.76E-06	0.00E+00

Output flow indicators

Results per functional or declared unit							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Material for recycling	kg	0.00E+00	0.00E+00	0.00E+00	8.50E+02	0.00E+00	0.00E+00
Materials for energy recovery	kg	1.51E+02	0.00E+00	0.00E+00	0.00E+00	9.51E+02	0.00E+00
Exported energy, electricity	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy, thermal	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Additional environmental information

Regulated Hazardous Substance

- The base material of the Bar in Coil is iron. No substances required to be reported as hazardous are associated with the production of this product.

Dangerous Substance

- All chemicals used in the Pyeongtaek factory are managed in accordance with the Korean Toxic Chemicals Control Act. Substances listed on the Candidate List of Substances of Very High Concern (SVHC) for authorization published by European Chemicals Agency (ECHA) are not contained in the steel in declarable quantities.

Information related to Sector EPD

This EPD® is individual.

References

General Programme Instructions of the International EPD® System. Version 4.0.
PCR 2019:14. Construction products (EN15804:A2). 1.3.4
EN 15804:2012+A2:2019. Sustainability of construction works – Environmental product declarations –
ISO 14025:2006. Environmental labels and declarations — Type III environmental declarations — Principles and procedures
ISO 14040:2006. Environmental management – Life cycle assessment – Principles and framework
ISO 14044:2006. Environmental management – Life cycle assessment – Requirements and guidelines
LCA software SimaPro 9.5.0.1

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