Tenaris

Environmental Product Declaration

Offshore and Onshore Seamless Line Pipe Solutions

BASED ON:	CERTIFICATION N°:	REVISION DATE:	ISSUE DATE:	VALID UNTIL:
PCR ICMQ-001/15 - rev. 2. Construction products and construction services. Multiple UN CPC codes	EPDItaly 0010	2018/07/30	2017/12/01	2022/11/30
	REVISION: 1			

EPD ITALY

General information

ECO EPD REFERENCES

EPD OWNER: TENARIS SA, 29 AVENUE DE LA PORTE-NEUVE, L2227 - LUXEMBOURG

PROGRAM OPERATOR: ICMQ S.P.A. VIA GAETANO DE CASTILLIA, 1020124 MILAN - ITALY TEL. +39.02.7015081

INDEPENDENT VERIFICATION

This declaration has been developed referring to the EPDItaly, following the General Programme Instructions; further information and the document itself are available at: www.epditaly.it. EPD document valid within the following geographical area: Italy and other countries according to sales market conditions (North Africa and Europe).

CEN standard EN 15804 served as the core PCR (PCR ICMQ-001/15 - rev. 2 Construction products and Construction services, 2017-04-21)
PCR review was conducted by: Daniele Pace.
Contact via info@epditaly.it

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

Third party verifier: ICMQ SpA, via De Castillia, 10 20124 Milano (www.icmq.it) ☐ EPD process certification (Internal) ☑ EPD verification (External)

Accredited by: Accredia

Environmental declarations published within the same product category, though originating from different programs, may not be comparable. In particular, EPDs of construction products may not be comparable if they do not comply with EN 15804.

CONTACTS

TenarisDalmine is available to release an Environmental Product Declaration for one specific product at the customer's request. To get more information about this environmental declaration or about TenarisDalmine activities please contact:

Fabio Praolini (fpraolini@tenaris.com) Silvia Tosato (silviatosato@tenaris.com)
Tel. +39 035.5603898

Technical support to TenarisDalmine was provided by Life Cycle Engineering, Italy. (info@studiolce.it, www.lcengineering.eu).

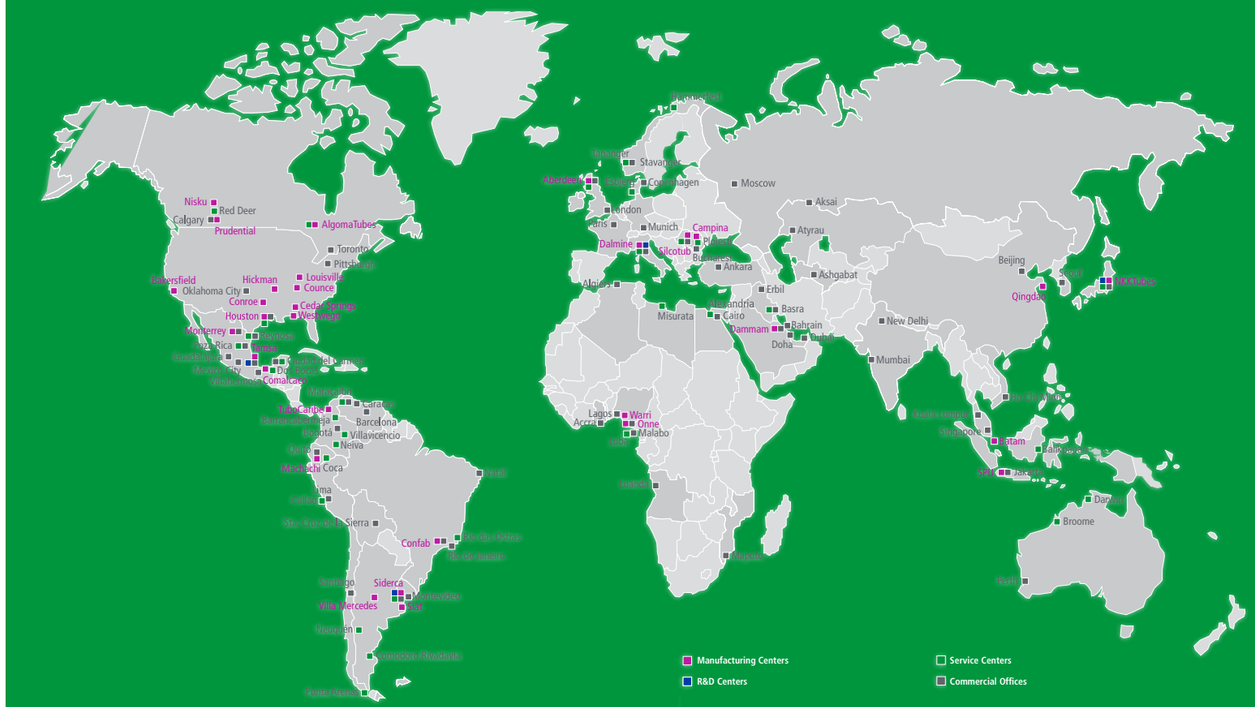
Tenaris

Tenaris is the leading global manufacturer and supplier of tubular products and services used in the drilling, completion and production of oil and gas and a leading supplier of tubular products and services used in process and power plants and in specialized industrial and automotive applications.
Tenaris prioritizes the health and safety of its personnel, collaborators and visitors, the satisfaction of its customers, the protection of the environment and the development of the communities with which it interacts as an absolute and integrated priority; the entire organization is oriented toward achieving these goals openly and transparently.

Tenaris is committed to developing long-term sustainable business, preventing pollution and minimizing the environmental impact of its operations, making the most efficient use of natural resources and energy.

TenarisDalmine

TenarisDalmine - the steel pipe operations of Tenaris in Italy - is the top Italian producer of seamless steel tubes for the energy, automotive and mechanical industries, with an annual production capacity of 950,000 tons of finished products, , 5 plants, a steel shop and a 120 MW self-production power plant which, as well as all TenarisDalmine production sites, received both the ISO EN 14001 and OHSAS 18001 certifications.
As far as energy efficiency, TenarisDalmine mills and its power plant received the ISO EN 50001 certification, the international standard guaranteeing the use of procedures developed for a continuous improvement and an efficient energy management.



Tenaris Offshore and Onshore Seamless Line Pipe

Continuing global oil and gas demand is driving operators to extend their exploration efforts into deeper offshore waters and tap difficult-to produce land reservoirs.

To satisfy this demand, offshore operators need advanced technology solutions to challenges such as sour service, high-temperature/high-pressure (HT/HP) environments, and long-distance tiebacks in deep and ultra-deep water. Similar trends are also present in the onshore business for long pipelines, sour service requirements, artic and artic alike environment as well as HP/HT.

With more than 200 line pipe projects successfully delivered with ancillary services, Tenaris is able to offer a wide range of solutions, including:

- Complete LP and Riser Package
- Premium Connections
- Coating (including corrosion resistance, flow assurance, concrete weight, and thermal insulation)
- Ancillary (Anode Pad, Taper Joint, Buckling Arrestor,…)
- Hot Induction Bends
- Welding & Multiple Jointing
- Laser End Information Services
- End Conditioning
- Corrosion Resistant Alloys (clad, lined and solid)

Scope and type of EPD®

The approach used in this EPD is “Cradle to gate with options” one

TABLE OF MODULES

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De- construction demolition	Transport	Waste processing	Disposal	Reuse - Recovery - Recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

SOFTWARE: SimaPro ver. 8.5.2.0 (www.pre.nl)
MAIN DATABASE: Ecoinvent 2.2
REPORT LCA: Life Cycle Assessment (LCA) for manufacturing of seamless line pipe with the EAF process - SURVEILLANCE report.
GEOGRAPHICAL SCOPE OF THE EPD: World according to sales market conditions.
Environmental declarations published within the same product category, though originating from different programs, may not be comparable.

Detailed product description

Detailed product description

Tenaris provides complete tubular and services solutions packages for the most demanding operator challenges in oil & gas application. Solutions include:

- Steel catenary, hybrid risers and top tension risers
- Export lines and flowlines
- Tubular components for subsea applications
- Tubular components for structural applications
- Premium connections
- Pipe End Conditioning
- Laser Ends Measurement Services
- Coating

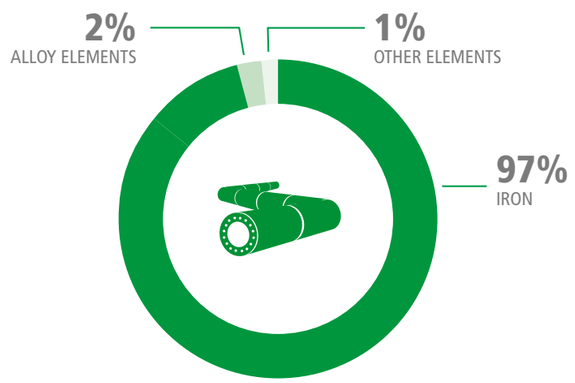
INFORMATION	DESCRIPTION
PRODUCT IDENTIFICATION	C-Mn steel seamless pipe for on-shore and offshore LP applications
PRODUCT FEATURES	OD from 159 mm to 711 mm, WT up to 60 mm
PRODUCT PROPERTIES	Steel grades and pipe properties according to main international standards (DNV OS F101, API 5L, ISO 3183) and customer requirements.
COATING*	FBE + 3 LPP
MANUFACTURING PLANT	Dalmine

* The coating may vary in material and geometric characteristics as well as in its environmental burden.
In this document a coating system composed of one internal layer of epoxy powder and three external layers of polypropylene is analysed as it is one of the most utilized to protect pipes in aggressive environment.
This solution is contributing 10% on total green house gases emission, other systems may lead to partial increase or reduction of this contribution.

CONTENT DECLARATION

The product here considered has the following composition.

THE MINIMUM CONTENT OF RECYCLED MATERIAL IS 88.4%, ACCORDING TO UNI EN ISO 14021



Manufacturing Specification

Dalmine plant

STEEL SHOP

The furnace at the steel shop is loaded mostly by pre-selected scrap and pig iron (approx. 100 ton in 2 steps), which is melted with the heat generated by an electric arc created between the electrode and the scrap and by the use of chemical energy coming from combustion processes (natural gas and coal).

Once the slag has been removed around 95 tons of liquid steel at a temperature of around 1,650°C are poured into the ladle furnace, where secondary metallurgy is carried out. Vacuum degassing for special steels is performed.

Continuous casting transforms liquid steel into round section solid bars with diameters between 148 and 395 mm for subsequent rolling.

All processes are controlled by an integrated system including the furnace power management, the furnace fumes emission, the addition of ferro-alloys to reach the required chemical composition and the control of the casting parameters until the cut-to-length of the bars.

MANDREL ROLLING

After passing through a rotary hearth furnace, the bars are transferred to the hot rolling mill in order to carry out the piercing process, thickness rolling and diameter sizing. The piercing process transforms the hot bar into a hollow: the bar turns due to the movement of two skewed opposing rollers.

As a result of the internal tension generated, a hollow is created in the center of the bar, into which the piercing plug is introduced.

A “hollow” with very thick walls is thereby produced. To transform the hollow into a tube with the specified dimensions, the wall thickness must be reduced. The mandrel is inserted into the hollow and lamination takes place between the rolls and the mandrel with a gradual reduction in thickness. The tube is then sent to the sizing, to set the final diameter and wall thickness according to customer’s requests.

EXPANDER MILL

Mother pipes with an external diameter of 360 and 406 mm produced by the continuous rolling mill are used for the production of big diameter pipes.

After heating, the mother pipes are expanded through a cross rolling mill on a taper plug. The reduction in thickness is compensated by the increase in the diameter. It can produce tubes with an external diameter between 406 and 711 mm.

HEAT TREATMENTS

In order to obtain the required mechanical properties, heat treatments of normalizing or quenching & tempering are performed in different facilities depending on tube dimension.

Quench and tempering is the most commonly used heat treatment for medium-high steel grades and for demanding LP applications; the cooling phase from austenitizing temperature can be performed with quenching head for thinner wall thickness or with more effective water tank in case of thicker wall.

FINISHING & NON-DESTRUCTIVE TESTS

To guarantee the high quality of its material, Tenaris performs a combination of non-destructive tests (ultrasound, flux leakage, Eddy current, magnetic particle inspections).

TENARISDALMINE POWER PLANT

TenarisDalmine Thermal Power Plant is based on a combined cycle technology (energy and heat), counting on two 43MW natural gas turbines and one 41MW steam turbine.

The Thermal Power Plant is able to produce almost 900 GW per year, 70% is used to serve the TenarisDalmine energy need and 30% is sold in the free energy market, with a cycle performance of 51% vs an Italian energy park average of 40% and with the highest environmental performance among Italian thermal power plant of such dimension. The remote heating network uses a part of the steam that, instead of producing energy, is sent to heat exchangers which produce 90°C hot water.

A special pipeline system provides hot water to the buildings in the remote heating network, where an exchanger gives heat to the building heating system. Cooled water goes back to the Thermal Power Plant, where it is re-heated to the maximum temperature before starting again the cycle.

Environmental Performance

The detailed environmental performance (in terms of potential environmental impacts, use of resources and waste generation) is presented for the three phases Upstream, Core and Downstream and related sub-phases (A1-A2-A3-A4). Construction installation (A5), use phase (B1 - B7) and end of life (C1 - C4) are modules not declared (MND).

DECLARED UNIT (D.U.) The declared unit is 1 tonne (1000 kg) of fabricated steel product.

ENVIRONMENTAL IMPACTS

POTENTIAL ENVIRONMENTAL IMPACTS	UNITS / D.U.	UPSTREAM PROCESS	CORE PROCESS		DOWNSTREAM PROCESS	TOTAL
		A1	A2	A3	A4	
GWP	kg CO_2 eq	631	58	866	88	**1 644**
ODP	g CFC 11eq	< 1	< 1	< 1	< 1	**< 1**
AP	g SO_2 eq	2 759	331	762	1 949	**5 801**
EP	g PO_4^{3-} eq	294	65	154	177	**689**
POCP	g C_2H_4 eq	231	9	68	60	**368**
ADPE	g Sb eq	36	< 1	< 1	< 1	**36**
ADPF	MJ	24 811	780	1 714	1 186	**28 492**

GWP Global warming potential
ODP Depletion potential of the stratospheric ozone layer
AP Acidification potential of land and water
EP Eutrophication potential
POCP Formation potential of tropospheric ozone photochemical oxidants
ADPE Abiotic depletion potential for non-fossil resources
ADPF Abiotic depletion potential for fossil resources

RESOURCE USE PER DECLARED UNIT

USE OF RENEWABLE MATERIAL RESOURCES	UNITS / D.U.	UPSTREAM PROCESS	CORE PROCESS		DOWNSTREAM PROCESS	TOTAL
		A1	A2	A3	A4	
PERE	MJ	502	11	76	2	**591**
PERM	MJ	<1	<1	<1	<1	**<1**
PERT	MJ	502	11	76	2	**591**
PENRE	MJ	30 787	846	1 937	1 197	**34 767**
PENRM	MJ	37	<1	91	<1	**127**
PENRT	MJ	30 824	846	2 028	1 197	**34 894**
SM	kg	1 184	<1	<1	<1	**1 184**
RSF	MJ	<1	<1	<1	<1	**<1**
NRSF	MJ	<1	<1	<1	<1	**<1**
FW	m^3	4	<1	9	<1	**14**

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 resources
SM Use of secondary raw materials
RSF Use of renewable secondary fuels
NRSF Use of non-renewable secondary fuels
FW Use of net fresh water

OUTPUT FLOWS AND WASTE CATEGORIES PER DECLARED UNIT

WASTE GENERATION AND TREATMENT	UNITS / D.U.	UPSTREAM PROCESS	CORE PROCESS		DOWNSTREAM PROCESS	TOTAL
		A1	A2	A3	A4	
HWD	kg	<1	<1	6	<1	**6**
NHWD	kg	966	<1	<1	<1	**966**
RWD	kg	<1	<1	<1	<1	**<1**
CRU	kg	<1	<1	<1	<1	**<1**
MFR	kg	1	<1	176	<1	**177**
MER	kg	<1	<1	1	<1	**1**
EEE	kg	-8	<1	<1	<1	**-8**
EET	kg	-17	<1	<1	<1	**-17**

HWD Hazardous waste disposed
NHWD Non-hazardous waste disposed
RWD Radioactive waste disposed
CRU Components for re-use
MFR Materials for recycling
MER Materials for energy recovery
EEE Exported electrical energy
EET Exported thermal energy

The environmental impacts associated with waste disposal to landfill and incineration are accounted in the indicators related to the potential environmental impact (page 12).

Calculation Rules

According to the PCR ICMQ-001/15 - rev.2 the main activities are listed and divided n three subsystems:
UPSTREAM Process, CORE Module, Downstream Process

LCA METHODOLOGY

The environmental burden of the product has been processed according to the general rules of the EPDItaly general rules and the PCR ICMQ-001/15 - rev. 2, construction products and construction services - Multiple UN CPC codes (Cradle to gate with options).

This declaration is based on the application of Life Cycle Assessment (LCA) methodology to the whole life-cycle system. Seamless pipe product at plant level, was described by using specific data from Dalmine manufacturing facility for year 2017.

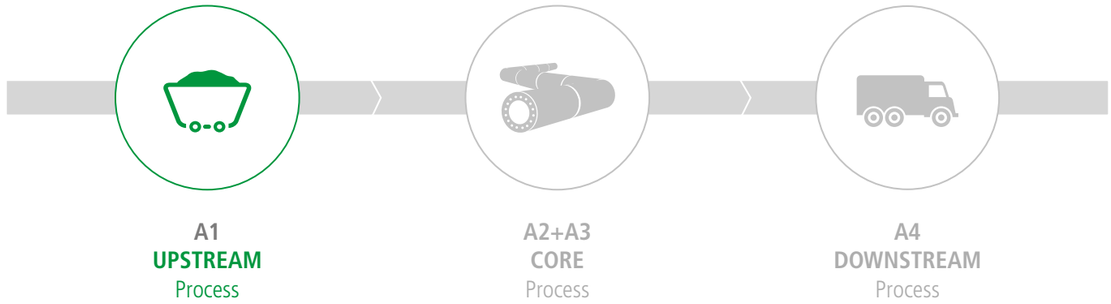
Packaging used for product delivery and pollutant concentration in wastewater is considered negligible in accordance with the cut-off criteria established in PCR ICMQ-001/15 - rev. 2.

Customized LCA questionnaires were used to gather in-depth information about all aspects of the production system (for example, raw materials specifications, pre-treatments, process efficiencies, air emissions, waste management), ultimately providing a complete picture of the environmental burden of the system:

Raw materials supply (A1), Transport (A2), Manufacturing (A3) and transport to final destination was considered (A4).

Upstream Process

(A1 Raw material supply)



Core Process

(A2 Transportation + A3 Manufacturing)

NATURAL GAS COMBUSTION FOR ENERGY PRODUCTION

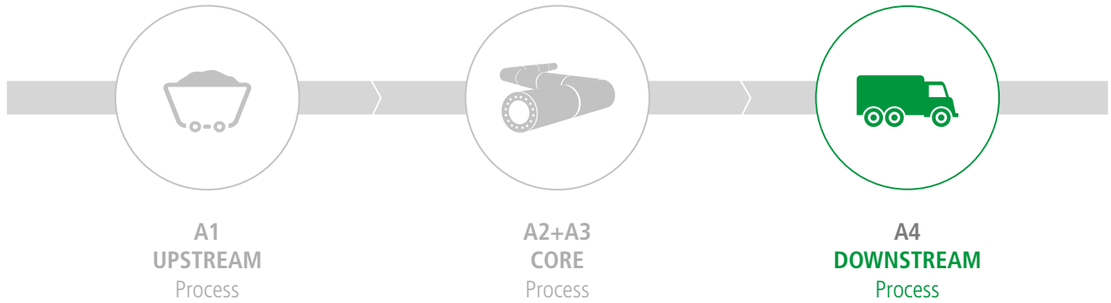
MANUFACTURING PROCESS INCLUDING STEEL MILL, ROLLING MILL, FAS EXPANDER, THERMAL TREATMENT AND FINISHING PROCESS

TREATMENT PROCESS OF WASTE GENERATED BY THE MANUFACTURING PROCESS

ANCILLARY PRODUCTION

Downstream Process

(A4 Transport to final destination)



TRANSPORT TO CUSTOMERS (general market average) :

WORLD (87%):
DISTANCE RANGE ~ 10 000 km

ITALY (11%):
DISTANCE RANGE ~ 600 km

EUROPE (2%):
DISTANCE RANGE ~ 1 200 km

Additional Information

Other environmental characteristics of Dalmine plant are:

1. TenarisDalmine has a steel scrap yard for scraps feeding the EAF[1]. The area is completely paved and has a water collection system connected to the internal water treatment plant. Steel scraps are here separated in different classes to allow the most efficient charge bucket preparation.

2. TenarisDalmine has a slag milling and separation system: the whole system allows to consider slags as standard construction materials (EC marking available for applications as, cement products, bituminous conglomerates, road embankments).

3. TenarisDalmine has finalized the EAF air emission catchment and treatment system revamping that will double the aspiration capacity over the EAF achieving the upper limits provided by BREF[2].

4. TenarisDalmine has installed a new dust collector system at rolling mill in 2017. This is able to reduce up to 5 times the dust air emissions.

5. TenarisDalmine has a prevention and reduction system for PCDD/F[3] emission in atmosphere: the equipment has been running since 2010 with concentrations at stack lower than limits imposed by EU for 2016 (< 0,1 ngI-TEQ[4]/Nm^3 on all existing stacks)

6. TenarisDalmine in 2010 installed low-NOX regenerative burners in its main rotary heating furnace (RHF FTM[5]); this allowed the plant to increase the production capacity without increasing gas consumption and NOx emissions. An HRSG[6] boiler was recently installed in order to use the RHF FTM fumes to generate steam for industrial use.

7. TenarisDalmine has a closed loop recirculating system for industrial water. Filtering and oil separation allow water reuse, water consumption is therefore limited to evaporation.

8. TenarisDalmine is continuously aiming to improve its process and product environmental performance. The ISO 14001 compliant Environmental Management System main goals are: periodic renovation of air and water emission systems, continuous improvement of installed monitoring systems, periodic training and communication for the operators on environmental management.

1 EAF Electric Arc Furnace
2 BREF Best available techniques REFerence document
3 PCDD/F Poly Chlorinated Di-benzo Dioxins/Furans
4 TEQ Toxic Equivalency Factor
5 RHF FTM Rotary Hearth Furnace - Medium Pipe Mill
6 HRSG Heat Recovery Steam Generator

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