



**Environmental Product
Declaration No. S-EP-00958
on TAMINI Green Power
Autotransformer
250 MVA 400/135 kV**

This Environmental Product Declaration (EPD) is part of the International EPD System Programme according to the ISO 14025.

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Who We Are

Tamini is the leading globally established Italian company for the design and manufacture of industrial, power and special transformers.

Founded in 1916 in Milan, Tamini supplies its products to most important industrial sectors – steel, aluminum, mining, oil & gas, chemical and transportation – and the most advanced operators engaged in the generation, distribution and transmission of electrical energy.

In 2014, Tamini became part of Terna Group, the Italian Electricity Transmission Grid Operator, which maintained the business partnership of Tamini and TES – Transformer Electro Service, creating one of the most advanced and qualified players in the market of industrial high voltage transformers. With this business partnership, Tamini became a leading market player and is now even stronger to effectively cope with all future challenges.

Tamini operates six production plants in Italy and has branches in USA, North Africa and India. Approximately 80% of the company's turnover comes from exports, particularly to emerging countries.

With 100 years of experience, Tamini combines the quality of its products with the unmatched expertise of Made-in-Italy design and manufacture. More than 9,000 Tamini transformers have been manufactured and installed for customers in over 90 countries around the world.

A large share of our resources is devoted to the development of special transformers for any industrial application, such as furnace transformers, reactors, power transformers for industrial distribution and rectifier transformers.

In the power sector, Tamini has manufactured 400 kV transformers, auto-transformers and reactors for some of the main European utilities and works with the main players in the renewable energy market.

Tamini guarantees its customers high-quality technical assistance in each phase of the transformer life cycle thanks to the team of experienced specialists and a complete service portfolio.

For more information about the company, visit the official website: <http://www.tamini.it>.



Our Mission

Tamini designs power transformers for application in the distribution, transmission and generation of electricity from both conventional and renewable sources. Our products are designed to provide custom solutions for specific customer needs, effectively responding to ongoing technological progress in electricity generation and transmission systems, meeting the increasing demand for the interconnection of different national networks.

In particular, Tamini Transformers S.r.l. production site in Legnano, Italy is dedicated to the production of large power transformers up to 550 kV and 700 MVA (up to 1800 MVA in the case of phase shifting transformers), their validation and placing on the market.

The materials, components and commercial products are purchased and transported to the production plant, where the components are assembled according to the specifications provided by the technical office. The transformers are assembled, closed and filled with an insulating liquid (such as mineral oil, natural or synthetic ester). The complete and ready to use equipment is then subject to specific tests in accordance with the required international reference standards.



Tamini Green Transformer – EPD Certified

The green transformer is an innovative, environmentally sustainable and eco-efficient product, filled with natural ester instead of mineral oil. Committed to preserving the environment, the product provides benefits to health and environment, including:

- extended transformer life due to a longer life of the cellulose-based insulation;
- reduced risk of pollution (in case of spillage or loss) since natural ester is bio-degradable and less toxic thus reducing the risk of pollution during operation, installation and end of service life;
- greater safety (toxic and fire safety) as natural ester has a higher flash point – more than double that of mineral oil. This makes it possible to practically reduce the possibility of fire ignition to zero as a result of a fault;
- space saving – reduced impact on the construction site due to smaller distances between transformers, and because collection tank is no longer indispensable although still required by regulations in some countries;
- improved efficiency and environmental performance with the same nominal power.

In 2017, Tamini Trasformatori S.r.l. put the innovative 250 MVA autotransformer filled with natural ester on the national and international markets. This was the first green autotransformer of this high capacity on the market with the **Environmental Product Declaration (EPD)**.

The EPD Certification is a further step towards recognition of the primacy and qualities of innovation, efficiency and sustainability of this product.

To anticipate market demands, improve the environmental performance of the energy transformation process, offer significant environmental benefits and meet the major energy challenges of today and tomorrow (such as energy efficiency, market efficiency, grid reliability and environmental issues), eco-friendly energy-efficient solutions are also under development to advance the process of transformer production.

In particular, the aim is to improve product performance in three phases of the transformer life cycle:

- **Production:** reducing the consumption of natural resources;
- **Operation:** lower emissions, limitation of environmental risk, noise reduction, space saving, increased energy efficiency;
- **End of Life:** possibility to recycle the products or their components.

The product that was born out of this initiative is Tamini's "green transformer" – the 250 MVA autotransformer (ATR) immersed in natural ester fluid instead of mineral oil.



Table 1. Tamini 250 MVA autotransformer characteristics

Power	250 MVA
Voltage	400/135 ± 5x2% kV
Frequency	50 Hz
Vector group	YNa0
Type of cooling	KDAF

EPD Certification

This EPD was drafted in compliance with the **International EPD® System** General Programme Instruction of the International EPD® System, version 3.0 dated 2017-12-11, on the basis of PCR 2019:12 "LIQUID IMMERSED POWER TRANSFORMERS (>25 MVA)". The product category corresponds to a subset of UN CPC 46121 "Electrical Transformers".

EPD is a worldwide certification that was developed applying the standard UNI EN ISO 14025:2010, which defines Type III environmental declarations, a tool for communicating objective, comparable, verifiable and credible information on the environmental performance of products, processes and services. These performances must be based on the life cycle analysis, the methodology which is laid down in Standards UNI EN ISO 14040:2006 and UNI EN ISO 14044:2018.

Life Cycle Assessment

The Life Cycle Assessment (LCA) is a cradle-to-grave study which looks at the impacts of all life cycle stages – from raw materials, through the components production, transport and assembly, to the use of the product for an average lifetime at a certain load with the necessary routine and non-routine maintenance, to dismantling and disposal of the transformer at the end of life.

The LCA study was based on:

1. The functional unit
2. Allocation method
3. System boundaries
4. Cut-off rules
5. Software, database, evaluation method

Table 2 outlines the impact categories and the related methods.

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Method	Impact category	MU
Greenhouse gas protocol	Fossil CO2 eq	kg CO2 eq
	Biogenic CO2 eq	kg CO2 eq
	CO2 eq from land transformation	kg CO2 eq
	Total CO2 eq	kg CO2 eq
CML-IA baseline V3.05 / EU25	Acidification	kg PO4 eq
	Eutrophication	kg CO2 eq
	Photochemical oxidation	kg C2H4 eq
	Ozone layer depletion (ODP)	kg CFC-11 eq
EPD (2018) V1.00	Abiotic depletion, elements	kg Sb eq
	Abiotic depletion, fossil fuels	MJ
	Water scarcity	m³ eq
ILCD 2011 Midpoint+ V1.10 / ECJRC Global, equal weighting	Land use	kg C deficit



Life Cycle Stages

As the cradle-to-grave analysis, the study considers upstream, core and downstream stages. The upstream stage includes components supply – their production, manufacturing treatments and their transport to the assembly site. The core phase includes the following processes: transformer assembly at the factory, consumption and waste at the assembly factory, tests during the assembly process and partial disassembly in order to be sent to the operation site. The downstream phase includes distribution, the use phase and the end of life. Distribution process considers the transport of the transformer with its packaging to the site and its installation. The use phase consists of operation losses during the product average life, routine and non-routine maintenance. The end of life includes transformer dismantling and its subsequent disposal.



Figure 1. System boundaries

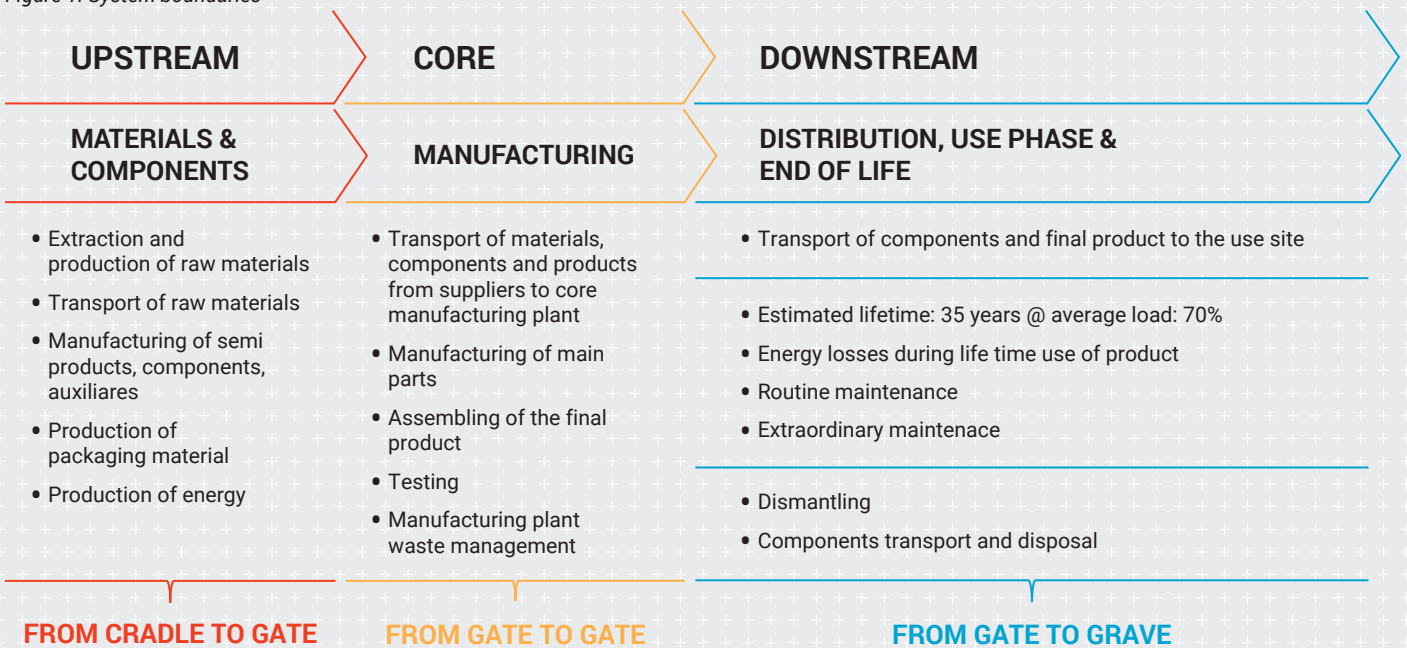
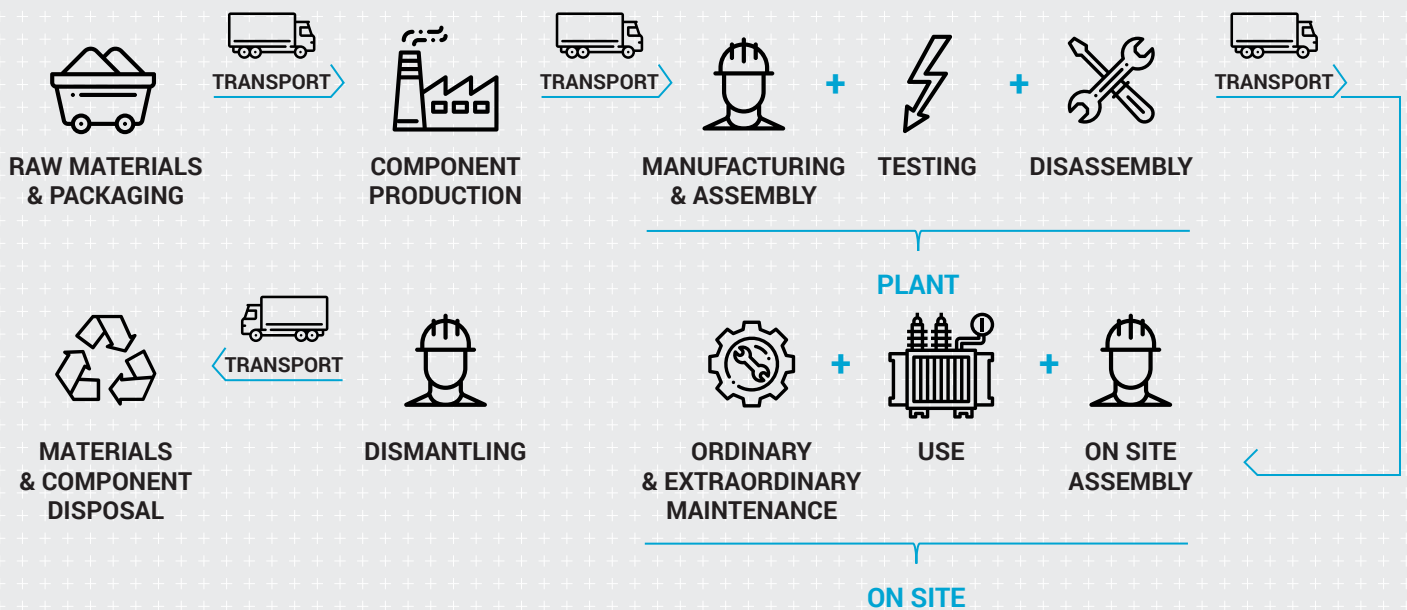


Figure 2. Product phases



Environmental performances

Tables 3 and 4 outline the environmental impacts of the twelve shown categories. Overall, the core processes, which include activities carried out at the Legnano plant (ATR assembly, testing and partial disassembly before shipment), have a low influence on the overall impacts of the product.

Table 3. Results of the environmental impact analysis of a functional unit

Impact category		MU	Total	Upstream	Core	Downstream
Greenhouse Warning Potential (GWP)	Fossil CO2 eq	kg CO2 eq %	5.03E+03	1.05E+02 2.1%	1.00E+01 0.2%	4.92E+03 97.7%
	Biogenic CO2 eq	kg CO2 eq %	7.46E+02	5.94E+00 0.8%	8.38E-01 0.1%	7.39E+02 99.1%
	CO2 eq from land transformation	kg CO2 eq %	3.57E+01	3.51E+01 98.2%	1.51E-03 0.0%	6.51E-01 1.8%
	Total CO2 eq	kg CO2 eq %	5.49E+03	1.19E+02 2.2%	1.06E+01 0.2%	5.36E+03 97.6%
Acidification		kg PO4 eq %	3.79E+01	3.90E-01 1.0%	5.97E-02 0.2%	3.75E+01 98.8%
Eutrophication		kg CO2 eq %	9.91E+00	9.97E-01 4.0%	1.45E-02 0.1%	9.50E+00 95.8%
Photochemical oxidation		kg C2H4 eq %	1.07E+00	5.72E-02 5.3%	1.89E-03 0.2%	1.01E+00 94.5%
Ozone layer depletion (ODP)		kg CFC-11 eq %	5.90E-04	5.49E-06 0.9%	1.27E-06 0.2%	5.83E-04 98.9%
Abiotic depletion, elements		kg Sb eq %	3.33E-03	2.05E-03 61.5%	5.37E-06 0.2%	1.28E-03 38.3%
Abiotic depletion, fossil fuels		MJ %	6.07E+04	7.47E+02 1.2%	1.32E+02 0.2%	5.99E+04 98.6%
Water scarcity		m ³ eq %	3.73E+03	1.65E+01 0.4%	4.29E+00 0.1%	3.71E+03 99.4%
Land use		kg C deficit %	5.36E+03	7.63E+02 14.2%	1.21E+01 0.2%	4.58E+03 85.5%

Table 4. Use phase impacts compared to total impacts, for each impact category

Impact category		MU	Total	Use phase	% Use phase on Total impacts
Greenhouse Warning Potential (GWP)	Fossil CO2 eq	kg CO2 eq	5.03E+03	4.92E+03	97.7%
	Biogenic CO2 eq	kg CO2 eq	7.46E+02	7.37E+02	98.8%
	CO2 eq from land transformation	kg CO2 eq	3.57E+01	6.48E-01	1.8%
	Total CO2 eq	kg CO2 eq	5.49E+03	5.36E+03	97.6%
Acidification		kg PO4 eq	3.79E+01	3.75E+01	98.8%
Eutrophication		kg CO2 eq	9.91E+00	9.50E+00	95.8%
Photochemical oxidation		kg C2H4 eq	1.07E+00	1.01E+00	94.5%
Ozone layer depletion (ODP)		kg CFC-11 eq	5.90E-04	5.83E-04	98.8%
Abiotic depletion, elements		kg Sb eq	3.33E-03	1.27E-03	38.3%
Abiotic depletion, fossil fuels		MJ	6.07E+04	5.99E+04	98.5%
Water scarcity		m ³ eq	3.73E+03	3.71E+03	99.4%
Land use		kg C deficit	5.36E+03	4.58E+03	85.4%

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