Environmental Product Declaration

In accordance with ISO 14025 and EN 15804 for:

dassoXTR and dassoCTECH

from

Zhejiang Daocheng Bamboo Industry Co., Ltd.

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Independent third-party verification of the declaration and data, according to ISO 14025:2006: ☐ EPD process certification ☒ EPD verification	
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Company information

Owner of the EPD:
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Description of the organisation:
Founded in 1993, headquartered in Hangzhou, China, dasso has been committed for over two decades to the development and production of innovative bamboo products, including bamboo flooring, decking, siding, and furnishings.

dasso has now 8 manufacturing facilities and over 1000 employees, in addition to owning over 2,700 hectares of productive, sustainable bamboo forest in China. Besides, dasso has also established an independent R&D team with 50 people for product optimization and innovation. Up until now, 65 authorized patents, 24 innovative patents and 13 international patents have been acquired by dasso.

Figure 1 dasso factory in Jiangxi, China

Product information

Product name:
This declaration covers two products: dassoXTR and dassoCTECH.

UN CPC code:
3145 Plywood, veneer panels and similar laminated wood of bamboo

Geographical scope: Global

Product description:
Bamboo is one of the fastest-growing plants in the world. It is a renewable and versatile resource with multi-purpose usage. Bamboos are of notable economic and cultural significance in South Asia, Southeast Asia, and East Asia where the climate is best suitable for its cultivation. The material may be cut and laminated into sheets and planks, and may be curved or flattened by the application of heat and pressure. It is an ideal construction material as it is durable, sustainable, and environmentally friendly. Bamboo used for construction purposes must be harvested when the culms reach their greatest strength and when the sugar level in the sap is at its lowest (usually when the bamboo culm is 3 to 5 years old), and afterwards it should be cured and dried properly for further treatment and manufacturing purpose. Harvesting is best taking place at the end of the dry season, and a few months prior to the start of the rainy season.

Figure 2 Bamboo culms and rough processing site near plantations

dassoXTR and dassoCTECH are solid and high-density boards made from compressed bamboo fibers with a special, patented heat treatment process, creating the perfect space for outdoor entertainment and relaxation. A unique feature of dassoXTR and dassoCTECH is the tongue & grooved end-matched system: this can only be done with very stable materials and enables connection of an unlimited number of boards in the length. The special symmetrical shape of the sides offers the possibility to choose between either the grooved or the flat surface, and allows for quick installation with fasteners. Like any untreated tropical hardwood species, when exposed to outdoor conditions, the product will turn grey over time creating a very natural look.

Product Application:

dassoXTR and dassoCTECH are used for both commercial and residential outdoor applications, including decking, cladding, soffit, and so on.

dassoXTR Decking and dassoCTECH Decking are superior choices for all exterior decking applications and have been used worldwide in many commercial and residential projects. Only two decking profiles are needed for the exterior decking application. A single grooved (G1) plank used as starter and ending plank and a G2 for the deck itself. All deck planks also include an exclusive tongue & grooved end-matched system to attach the planks seamlessly together.

dassoXTR Cladding and dassoCTECH Cladding are great choices in commercial exterior siding, where it ages naturally. The unique sheathing system with FasTrak offers the most appealing looking rain screen and cladding siding solution. It reduces wastage and speeds up installation by 50%.

dassoXTR and dassoCTECH Soffit, Deck Skirting and Wainscoting are pre-primed and specifically designed for exterior use and ideal for creating an elegance lasting beauty environment.

dassoCTECH Lumbers and Panels are to be considered like unfinished lumber. The material is not pre-primed so the user can finish it as they like. Both lumbers and panels come oversized in two different thicknesses to be trimmed: 20mm and 40mm. dassoCTECH bamboo lumbers and panels are ideal for creating outdoor furnishings for years of lasting beauty.

Product identification:

Table 1 Product technical specifications

	dassoXTR	dassoCTECH
Density	1,150 kg/ m^3	1,250 kg/m^3
Thickness	12-40 mm	12-40 mm
Moisture Content	10% - 14%	8% - 12%
Hardness	106.8 N/mm^2 (DIN EN 1534)	79.2 N/mm^2 (DIN EN 1534)

Reaction to Fire	Bfl-s1 (DIN EN 13501-1:2010)	Bfl-s1 (DIN EN 13501-1:2010)
Static Bending Strength	74.4 N/mm² (DIN EN408)	73.8 N/mm² (DIN EN408)
Modulus of Elasticity	19,100 N/mm² (DIN EN 408)	16,700 N/mm² (DIN EN 408)
Termite Resistance Level	DC M (EN117)	DC D (EN117)
Biological Durability	Class 1 (EN350:2016)	Class 1 (EN350:2016)
Slip Resistance (flat)	23° Classification B（DIN 51097）	19° Classification B（DIN 51097）
Slip Resistance (reed)	25° Classification C（DIN 51097）	22° Classification B（DIN 51097）
Thickness of Swelling Rate	4.6 % (DIN EN 15534-1)	4 % (DIN EN 15534-1)
Width of Swelling Rate	0.6 % (DIN EN 15534-1)	0.6 % (DIN EN 15534-1)

Manufacturing Process:

dassoXTR is manufactured using dasso's patented process, which combines two stages of heat treatment to first carbonize the bamboo in order to remove the starch and sugar from the bamboo fiber, and then restructure the bamboo to reinforce its natural strength characteristics. The modified bamboo strands are then fused together using phenolic resin. The result is an extremely dense, durable exterior-use product. dassoXTR has a relatively flawless appearance and resistance to shrinkage. This consistent grain structure also allows dassoXTR to distribute weight very the product evenly, adding to its durability.

Unlike dassoXTR, during the production of dassoCTECH, the bamboo fibers are crystalized with CeramiX® particles, impregnated with phenolic resin, and then compressed to form Fused Bamboo® that is hard, dense, durable, and can prevent itself from the attack from bacteria, fungus and other microorganisms in outdoor environment.

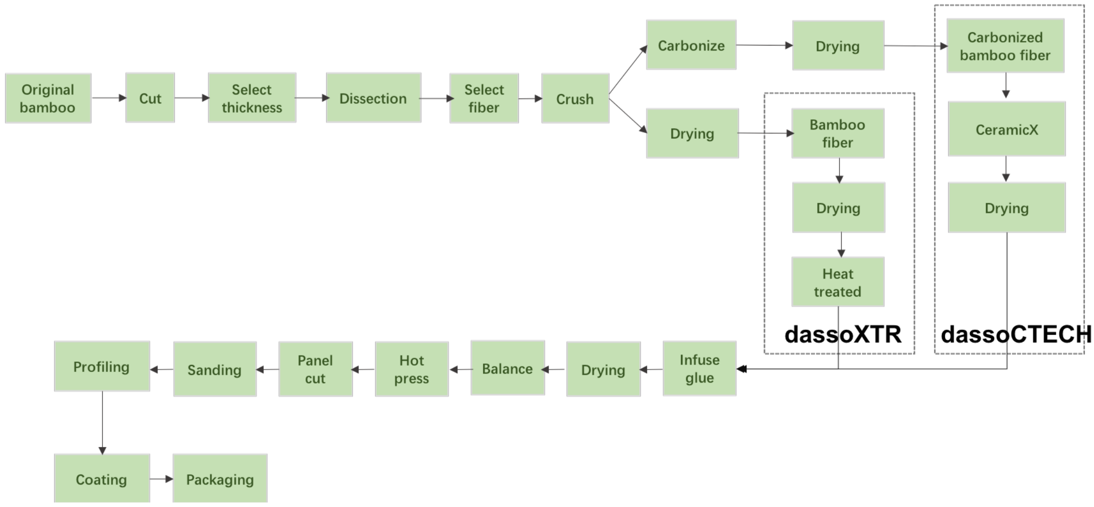

Figure 3 dassoXTR and dassoCTECH manufacturing process

Content declaration

Product

Table 2 Product content

Materials / chemical substances	Percentage	CAS Number	Environmental / hazardous properties
Bamboo	87.00%		No dangerous substances according to (EC) No. 1907/2006
Water based Phenolic Resin	12.78%	9003-35-4	GHS-H302, GHS-H313, GHS-H320, GHS-H332, GHS-H402
Vegetable Oil	0.22%		No dangerous substances according to (EC) No. 1907/2006

*For the substance “Water based Phenolic Resin”, the concentration of phenol is less than 3%, and the concentration of formaldehyde is less than 0.3%.

Packaging

After manufacturing, dassoXTR and dassoCTECH will be packaged with corrugated board, wrapping film, pallet, and packing belt. For each kg of bamboo product, the following amounts of packaging materials are consumed.

Table 3 Packaging information

Materials	dassoXTR (amount per unit)	dassoCTECH (amount per unit)
Pallet	32.2 g	29.6 g
Packing belt	0.9 g	0.8 g
Wrapping film	0.7 g	0.6 g
Corrugated board	11.3 g	10.5 g

LCA information

Functional unit:
The functional unit is 1 kg of bamboo product.

Time representativeness:
The study used primary data collected from November 2018 to November 2019.

Database(s) and LCA software used:
SimaPro9 was used for the LCA modelling. In the study, the key parameters for producer-specific foreground data were based on one year (November 2018 to November 2019) of averaged data from dasso. Generic data for certain processes were sourced from Ecoinvent database in SimaPro 9. Modification of the global background database was done by replacing all the energy data, especially electricity production data, by localized Chinese energy data.

The data quality requirements for this study were as follows:

- Existing LCI data were, at most, 10 years old. Newly collected LCI data were current or up to 3 years old;
- The LCI data related to the geographical locations where the processes took place, e.g. electricity and transportation data from China, disposal data from China and Europe were utilized;
- The scenarios represented the average technologies at the time of data collection.

System diagram:

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)																
Product Stage			Construction process stage		Use Stage							End of life stage				Resource recovery stage
Raw Material	Transport	Manufacturing	Transport	Assembly / Install	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction and 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	X	X	X	X	X

Description of system boundaries:
The is a "cradle-to-gate with options" EPD. The LCA study traced all energy and material inputs back to the extraction of resources for each life-cycle stage of the products. In addition, the study quantified emissions from the whole system, and included various waste management scenarios.

The life cycle stages below have been covered:

- A1-A3: Product stage (raw material acquisition, transport to manufacturing site and manufacturing)
- A4: Construction stage (transport to user site)
- C1-C4: End-of-life stage (deconstruction, transport, waste processing and disposal)
- D: Resource recovery stage (reuse, recovery, recycling)

Excluded lifecycle stages:
The installation stage on the construction site and the usage stage of the product are excluded from this study.

Assumption and limitations:
In order to carry out the LCA study, the following main assumptions were made:

- Assumptions on transportation were made where it was not possible to obtain the specific data, such as the distance from distribution centre to outlet and from outlet to consumer. When this occurred, it was clearly stated in the report;
- Electricity consumption data was not obtained for certain processes, so assumptions were made for these. When this occurred, it was clearly stated in the report;
- Modification of the global background database was done by replacing all the energy data, especially electricity production data, by Chinese energy data, and the study used the modified background data to get better indication of the potential environmental impact results by using more localized dataset of energy supply;
- In this study, the environmental benefit from incineration of waste bamboo product was considered. It was assumed that there is no recovery, reuse, and recycling of bamboo product. During the end-of-life stage, bamboo flooring is burned to generate calorific values. The heat value of bamboo is 18.87MJ/kg. Calorific value recovery replaces coal-fired power generation. The efficiency of thermal power was assumed to be 42%. Therefore, 2.2 kWh electricity can be generated by burning 1kg waste bamboo flooring.

Allocation:
During the production process of dassoXTR and dassoCTECH, the use of raw materials and resource were calculated according to the relationship between output and energy consumption, water consumption, and related resources, avoiding the use of mass, energy, and economic distribution method.

During manufacturing process, there is no generation of by-products that need to be allocated in this situation.

Cut-off rules:
Raw materials that account for less than 1% of the mass of the product were allowed not to be considered in the study, including the transportation of the associated materials. The infrastructure for manufacturing was not included in the LCA, including the machine, either.

Electricity source:
As required in PCR Section 10, "If the electricity in A3 accounts for more than 30% of the total energy in stage A1 to A3, the energy sources behind the electricity grid in module A3 shall be documented in the EPD and given in g CO_2 e/kWh".

In this LCA, the grid mix data on electricity for the site in Fujian and Jiangxi Province was based on grid mixes of China. The electricity inventory is based on the year of 2015 for Chinese electricity generation (China Energy Statistics).

In Chinese map of electricity generation, thermal power is the principal part of total national installed capacity and electricity generation. Development of hydropower is slower than that of thermal power, and nuclear power is still in its initial step. Power generation from renewable energy resources, such as wind, solar energy, and tide, are usually not included due to the small share in electricity generation in China. However, the renewable energy was also considered in this study by taking a small ratio of wind, solar, and other renewable energy generation in China into account.

In 2015, the source of power supply is 73.3% thermal power, 19.4% hydropower and 2.9% nuclear power. The transmission of electricity in all cases is taken from the power station via a high voltage electricity grid to low voltage electricity suitable for domestic use, with a loss factor of 7.52% of the electricity produced at the power station, and a loss of 6.15% by the electricity consumption at the power plants.

The applied electricity data set used in the manufacturing phase is 654 g CO_2 e/kWh.

Life cycle assessment scenarios

According to dasso, products are consumed in China and oversea, and transportation distance for product delivery was estimated with reference to external resources. The table below demonstrates the data used for stage A4 in the LCA modelling.

Table 4 Transport to the construction Site (A4)

Additional technical information life cycle stage A4					
Scenario title	**Parameter**	**Units (expressed per declared unit)**		**Value**	
A4 Transport to Site	Vehicle type used for transport	Lorry	Transoceanic Ship	Lorry	Transoceanic Ship
	Vehicle load capacity	Metric ton	dwt	32	50,000
	Fuel type and consumption	Diesel, L/100km	Heavy oil, t/100km	31.11	12.483
	Distance to central warehouse or storage, if relevant	dassoXTR (km)		1,073	14,405
		dassoCTECH (km)		1,091	13,510
	Distance to construction site	km		-	-
	Capacity utilization (including empty returns)	%		50	100
	Bulk density of transported products	kg/m^3		unknown	
	Volume capacity utilization factor (factor: =1or <1 or >=1 for compressed or nested packaged products)	Not applicable			

Demounting and demolition of the product were assumed to be conducted manually, so there was no energy and material input involved in the LCA modelling. For waste processing, three sets of background data were used. The first set is electricity generation from waste incineration; the second is the electricity generation in China/EU; the last one is the landfill of waste bamboo product. The table below demonstrates the data used for stage C in the LCA modelling.

Table 5 End of Life (C1-C4)

Additional technical information for end-of-life C stage			
Module	**Parameter**	**Units (expressed per declared unit)**	**Value**
C1 Deconstruction	Collection process specified by type	kg collected separately	1
		kg collected with mixed construction waste	-
C2 Transport	Assumptions for scenario development	km	100
C3 Waste processing	Recovery system specified by type	kg for re-use	-
		kg for recycling	-
		kg for Incineration	0.95
		kg for landfill	0.05
C4 Disposal	Disposal specified by type	kg product or material for final deposition	-

Environmental performance

To analyse the environmental impact of each process, a LCIA was conducted using the CML-IA baseline method. The result was allocated by stages, as shown in tables below.

Potential environmental impact for dassoXTR

PARAMETER	UNIT	A1	A2	A3	A4	C2	C3-CN	C3-EU
Global warming potential (GWP)	kg CO_2 eq.	8.10E-01	4.90E-02	1.90E-01	2.10E-01	2.29E-02	-2.22E+00	-7.44E-01
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC 11 eq.	1.60E-08	5.80E-09	8.00E-09	3.60E-08	3.78E-09	4.82E-07	3.84E-07
Acidification potential (AP)	kg SO_2 eq.	5.50E-03	2.00E-04	7.60E-04	2.20E-03	8.84E-05	-1.78E-02	9.04E-04
Eutrophication potential (EP)	kg PO_4^{3-} eq.	8.60E-04	5.90E-05	1.90E-04	3.20E-04	3.39E-05	4.89E-04	-8.90E-04
Formation potential of tropospheric ozone (POCP)	kg C_2H_4 eq.	3.60E-04	8.10E-06	3.00E-05	7.70E-05	4.02E-06	-5.60E-04	1.48E-04
Abiotic depletion potential – Elements	kg Sb eq.	1.30E-06	7.00E-08	8.50E-08	3.80E-07	1.59E-08	2.47E-05	2.45E-05
Abiotic depletion potential – Fossil resources	MJ, net calorific value	1.80E+01	7.50E-01	2.00E+00	3.30E+00	3.62E-01	-8.53E+00	4.25E-01

*It was assumed that there is no recovery, no reuse, and no recycling of bamboo products. The avoided energy use as a result from the incineration was not considered as benefit beyond the system boundary, but was calculated in the C3 stage. Zero input and output were assumed for deconstruction of the product (C1), disposal (C4) and D stage. Therefore, values for these three modules are zero and not presented in the tables. C3-EN and C3-EU represent respectively the scenario in Europe and China.

Potential environmental impact for dassoCTECH

PARAMETER	UNIT	A1	A2	A3	A4	C2	C3-CN	C3-EU
Global warming potential (GWP)	kg CO_2 eq.	7.80E-01	4.90E-02	1.90E-01	2.20E-01	2.29E-02	-2.22E+00	-7.44E-01
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC 11 eq.	1.50E-08	5.80E-09	7.90E-09	3.90E-08	3.78E-09	4.82E-07	3.84E-07
Acidification potential (AP)	kg SO_2 eq.	5.20E-03	2.00E-04	7.50E-04	1.90E-03	8.84E-05	-1.78E-02	9.04E-04
Eutrophication potential (EP)	kg PO_4^{3-} eq.	8.10E-04	5.90E-05	1.90E-04	2.90E-04	3.39E-05	4.89E-04	-8.90E-04
Formation potential of tropospheric ozone (POCP)	kg C_2H_4 eq.	3.40E-04	8.10E-06	3.00E-05	6.70E-05	4.02E-06	-5.60E-04	1.48E-04
Abiotic depletion potential – Elements	kg Sb eq.	1.20E-06	7.00E-08	8.40E-08	4.70E-07	1.59E-08	2.47E-05	2.45E-05
Abiotic depletion potential – Fossil resources	MJ, net calorific value	1.70E+01	7.50E-01	1.90E+00	3.50E+00	3.62E-01	-8.53E+00	4.25E-01

Use of resources for dassoXTR

PARAMETER		UNIT	A1	A2	A3	A4	C2	C3-CN	C3-EU
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	9.40E-02	2.40E-02	3.60E-01	1.00E-01	1.90E-02	3.60E+00	1.70E+00
	Used as raw materials	MJ, net calorific value	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	TOTAL	MJ, net calorific value	9.40E-02	2.40E-02	3.60E-01	1.00E-01	1.90E-02	3.60E+00	1.70E+00
Primary energy resources – Non-renewable	Use as energy carrier	MJ, net calorific value	4.90E-02	1.60E-03	3.40E-02	3.90E-03	8.20E-04	-1.50E-01	1.80E-01
	Used as raw materials	MJ, net calorific value	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	TOTAL	MJ, net calorific value	4.90E-02	1.60E-03	3.40E-02	3.90E-03	8.20E-04	-1.50E-01	1.80E-01
Secondary material		kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Renewable secondary fuels		MJ, net calorific value	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Non-renewable secondary fuels		MJ, net calorific value	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water		m^3	1.70E-04	0.00E+00	1.01E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Use of resources for dassoCTECH

PARAMETER		UNIT	A1	A2	A3	A4	C2	C3-CN	C3-EU
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	8.60E-02	2.40E-02	3.50E-01	8.50E-02	1.90E-02	3.60E+00	1.70E+00
	Used as raw materials	MJ, net calorific value	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	TOTAL	MJ, net calorific value	8.60E-02	2.40E-02	3.50E-01	8.50E-02	1.90E-02	3.60E+00	1.70E+00
Primary energy resources – Non-renewable	Use as energy carrier	MJ, net calorific value	4.50E-02	1.60E-03	3.30E-02	3.80E-03	8.20E-04	-1.50E-01	1.80E-01
	Used as raw materials	MJ, net calorific value	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	TOTAL	MJ, net calorific value	4.50E-02	1.60E-03	3.30E-02	3.80E-03	8.20E-04	-1.50E-01	1.80E-01
Secondary material		kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Renewable secondary fuels		MJ, net calorific value	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Non-renewable secondary fuels		MJ, net calorific value	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water		m^3	1.50E-04	0.00E+00	0.93E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Waste production and output flows for dassoXTR and dassoCTECH

Waste production

PARAMETER	UNIT	A1	A2	A3	A4	C2	C3-CN	C3-EU
Hazardous waste disposed	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Non-hazardous waste disposed	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Radioactive waste disposed	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Output flows

PARAMETER	UNIT	A1	A2	A3	A4	C2	C3-CN	C3-EU
Components for reuse	kg	-	-	-	-	-	-	-
Material for recycling	kg	-	-	-	-	-	-	-
Materials for energy recovery	kg	-	-	-	-	-	-	-
Exported energy, electricity	MJ	-	-	-	-	-	-	-
Exported energy, thermal	MJ	-	-	-	-	-	-	-

Additional environmental information

The formaldehyde emission of dassoXTR and dassoCTECH is no more than 0.1 mg/m^2h and the products reach therefore the emission class E1 according to GB/T 17657-2013 (Test methods of evaluating the properties of wood-based panels and surface decorated wood-based panels).

References

General Programme Instructions of the International EPD® System. Version 3.0.

PCR 2012:01 Construction Products and Construction Services, Version 2.31 (2019-12-20)

EN 15804:2012+A2:2019 Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products

ISO 21930:2017 Environmental declaration of building products

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