Studiengemeinschaft Holzleimbau e.V.

IBU
Environmental Product Declaration

Environmental Product Declaration

in accordance with ISO 14025 and EN 15804 for

Duobalken®, Triobalken®
(glued solid timber)

Valid until 9. January 2018

Environmental Product Declaration in accordance with ISO 14025 and EN 15804 for **Duobalken®, Triobalken® (glued solid timber)**

Studiengemeinschaft Holzleimbau e.V.

Studiengemeinschaft Holzleimbau e.V.
Heinz-Fangman-Str. 2
D-42287 Wuppertal
0202/769 7273-3 Fax
www.brettschichtholz.de
info@brettschichtholz.de

Überwachungsgemeinschaft KVH e.V.
Heinz-Fangman-Str. 2
D-42287 Wuppertal
0202/769 7273-5 fax
info@kvh.de
www.kvh.de

ENVIRONMENTAL PRODUCT DECLARATION

in accordance with ISO 14025 and EN 15804

Declaration holder	**Studiengemeinschaft Holzleimbau e.V. and Überwachungsgemeinschaft Konstruktionsvollholz e.V.**
Publisher	Institute Construction and Environment e.V. (IBU)
Programme holder	Institute Construction and Environment e.V. (IBU)
Declaration number	EPD-SHL-201200018-IBG1-E
Issue date	09.01.2013
Valid until	09.01.2018

Duobalken®, Triobalken® (glued solid timber)

Studiengemeinschaft Holzleimbau e.V. and Überwachungsgemeinschaft Konstruktionsvollholz e.V.

Institut Bauen und Umwelt e.V.

www.bau-umwelt.com / https://epd-online.com

1. General information

Studiengemeinschaft Holzleimbau e.V. and Überwachungsgemeinschaft Konstruktionsvollholz e.V.	**Duobalken®, Triobalken® (glued solid timber)**
Programme holder IBU – Institute Construction and Environment e.V. Rheinufer 108 D-53639 Königswinter	**Holder of the Declaration** Studiengemeinschaft Holzleimbau e.V. and Überwachungsgemeinschaft Konstruktionsvollholz e.V. Elfriede-Stremmel-Strasse 69 D-42369 Wuppertal
Declaration number EPD-SHL-201200018-IBG1-E	**Declared product/unit** 1 m³ Duobalken®, Triobalken® (glued solid timber)
This Declaration is based on the Product Category Rules: Solid wood products, 07-2012 (PCR tested and approved by the independent Committee of Experts (SVA))	**Area of applicability:** The content of this Declaration is based on information provided by approx. 60% of members, whereby the technology presented here is representative for all members. The results of the Life Cycle Assessment are therefore representative for all Duobalken® / Triobalken® manufactured in Germany. The holder of the Declaration is liable for the information and evidence on which it is based.
Issue date 09.01.2013	
Valid until 09.01.2018	**Verification** The CEN EN 15804 standard serves as the core PCR. Verification of the EPD by an independent third party in accordance with ISO 14025 ☐ internal ☒ external
Prof. Dr.-Ing. Horst J. Bossenmayer (President of Institut Bauen und Umwelt e.V.)	
Prof. Dr.-Ing. Hans-Wolf Reinhardt (Chairman of the Expert Committee (SVA))	Dr. Frank Werner, Independent auditor appointed by the SVA

2. Product

2.1 Product description

Duobalken® / Triobalken® (glued solid timber) are industrially-manufactured products for load-bearing structures. They comprise two (Duobalken®) or three (Triobalken®) coniferous wood planks or squared timbers which are glued together by their face sides with the fibres running in parallel. Duobalken® and Triobalken® are also referred to as glued solid timber. The manufacturing process corresponds with that of glued laminated timber, whereby larger individual cross-sections are glued together.
Thanks to their manufacturing process, Duobalken® / Triobalken® are very dimensionally stable and are only susceptible to minor cracking. Unlike solid wood and structural timber, Duobalken® / Triobalken® made of S10-grade laminations (complies with strength class C24) have a higher modulus of elasticity parallel to the grain. Owing to their high dimensional stability and low moisture content, Duobalken® / Triobalken® beams are particularly suitable for timber-frame buildings.

2.2 Application

Duobalken® / Triobalken® beams are used as structural components for buildings and bridges.

2.3 Technical data

Duobalken® / Triobalken® beams are manufactured from spruce, fir, pine, larch or Douglas fir. Other coniferous species are permissible but not typical. Adhesives in accordance as per 2.6 are used for gluing.
Duobalken® / Triobalken® beams are manufactured with a maximum moisture content of 15%.
Duobalken® / Triobalken® beams are supplied in formats as per 2.5 and dimensional tolerances in accordance with dimensional tolerance class 2 to DIN EN 336:2003.
The typical strength class to DIN 1052: 2008 is C24.
In accordance with the Duo-/Trio-beam agreement of Überwachungsgemeinschaft Konstruktionsvollholz e.V., the products can be manufactured in Si or NSi qualities or as per the Glued Laminated Timber Data Sheet in supreme quality, visual quality or industrial quality.
Use of wood preservatives in accordance with DIN 68800-3: 2012 is not typical and only permissible if other preservative means as per DIN 68800-2*:* 2012 are not sufficient on their own.
Where wood preservatives are used in exceptional cases, they must be regulated in the form of a national technical approval.

KVH® BS Holz

Constructional data

Description	Value	Unit
Moisture content to DIN 1052 2008	≤ 15	%
Use of wood preservatives to DIN 68800-3	Where other preservative means are insufficient	-
Typical species by trade name	Spruce, fir, pine, larch, Douglas fir	

2.4 Placing on the market / Application rules

The products are subject to a national technical approval Z 9.1-440 of the German Institute for Structural Engineering (DIBt).
Dimensioning is in accordance with DIN 1052: 2008 or DIN EN 1995-1-1: 2010-12 with the corresponding National Annex DIN EN 1995-1-1 NA.

2.5 Delivery status

The products are manufactured in the following preferred dimensions:
Max. height: 360 mm
Max. width: 280 mm
Max. lengths: >14 m (depending on the cross-section)

2.6 Base materials / Auxiliaries

Duobalken® / Triobalken® beams comprise two/three coniferous wood planks or squared timbers which are glued together by their face sides with the fibres running in parallel. Melamine-urea-formaldehyde adhesives (MUF) or polyurethane adhesives (PUR) as well as smaller volumes of phenol-resorcin-formaldehyde adhesives (PRF) or emulsion-polymer-isocyanate adhesives (EPI) are used for basic duroplastic gluing. Average percentages of ingredients per m³ Duobalken® / Triobalken® for the Environmental Product Declaration:

- Coniferous wood, primarily spruce: approx. 88.4%
- Water: approx. 10.61%
- PUR adhesives: approx. 0.31%
- MUF adhesives: approx. 0.66%
- PRF adhesive: approx. 0.03%
- EPI adhesive: approx. 0.01%

The product has an average bulk density of 500.33 kg/m³.

2.7 Production

The manufacture of Duobalken® / Triobalken® beams involves kiln drying conventional sawn timber to less than 15% moisture content, rough-planed and visually or automatically strength-graded. Depending on the requisite strength class, any board sections of lower strength are lopped out and the remaining board sections bonded via finger joints to form laminations of infinite length. The subsequent rough-planing process involves planing the laminations to thicknesses of 45 to 80 mm (120 mm for lamination end widths smaller than 100 mm) for pressing as 2- or 3-layer blanks after glueing the wide face in a press bed. After hardening, the blanks are planed, bevelled, bound and packed. If necessary, they can be treated with wood preservative.

2.8 Environment and health during manufacturing

Waste air incurred is cleaned in accordance with statutory specifications. There are no risks for water or soil. The process waste water incurred is fed into the local waste water system. Noise-intensive machinery is encapsulated appropriately.

2.9 Product processing/installation

Duobalken® / Triobalken® beams can be processed using conventional tools suitable for processing solid wood. The health and safety guidelines must also be observed during processing and/or assembly.

2.10 Packaging

Polyethylene, metal, solid wood, paper and cardboard are used as well as small percentages of other plastics (AVV 15 01 02).

2.11 Condition of use

The composition for the period of use complies with the composition of base materials in accordance with section 2.6 "Base materials".
Approx. 221.3 kg carbon are bound in the product during use. This complies with approx 811 kg carbon dioxide at full oxidation.

2.12 Environment and health during use

Environmental protection: According to current knowledge, there are no risks for water, air and soil when the products are used as designated.
Health protection: According to current knowledge, no health risks are to be anticipated.
With regard to formaldehyde, glued solid timber is low-emission thanks to its adhesive content, structure and particular use.
Glued solid timber glued with PUR or EPI adhesives displays formaldehyde emission values in the range of natural wood (approx. 0.004 ml/m³). MDI emissions can not be measured within the detection limit of 0.05 µg/m³ for glued solid timber glued with PUR or EPI adhesives. On account of the high reactivity displayed by MDI with water (humidity and wood moisture), it can be assumed that glued solid timber thus glued displays MDI emissions close to zero shortly after manufacturing.
Solid timber glued with MUF adhesives emanates formaldehyde subsequently. Measured using the limit value of 0.1 ml/m³ specified by the Ordinance on Chemicals, the values after testing (DIN EN 717-1: 2005) can be classified as low. Average emissions amount to approx. 0.04 ml/m³. In individual cases, they can account for up to approx. 0.06 ml/m³.

2.13 Reference Service Life (RSL)

In terms of components and production, Duobalken® / Triobalken® beams comply with glued laminated timber which has been used for more than 100 years. When used as designated, infinite durability can be anticipated. When used as designated, the service life of Duobalken® / Triobalken® beams is therefore the same as the service life of the respective building.

2.14 Extraordinary effects

Fire

Fire class D in accordance with DIN EN 13501-1; the toxicity of fire gases complies that of natural wood.

Description	Value
Building material class	D
Burning drips	d0
Smoke gas development	s2

Water

No ingredients are washed out which could be hazardous to water.

Mechanical destruction
The Duobalken® / Triobalken® fracture surface displays an appearance typical for solid wood.

2.15 Re-use phase
In the event of selective de-construction, Duobalken® / Triobalken® beams can easily be re-used after the use phase has ended.
If Duobalken® / Triobalken® beams can not be re-used, they are directed towards thermal recycling for generating process heat and electricity on account of their high calorific value of approx. 16 MJ/kg (with moisture of u=12%).
During energetic recycling, the requirements outlined in the Federal Immission Control Act must be observed: Untreated glued laminated timber is allocated to waste code 17 02 01 in accordance with Annex III of the Regulation governing requirements on the recycling and disposing of waste wood (AltholzV) dated 15.02.2002 (depending on the type of wood preservative, treated glued laminated timber is allocated to waste code 17 02 04).

2.16 Disposal
Waste wood may not be landfilled in accordance with §9 AltholzV.

2.17 Further information
More information is available at www.kvh.de or www.balkenschichtholz.org.

3. LCA: Calculation rules

3.1 Declared unit
The declared unit in the LCA is the provision of 1 m³ Duobalken® / Triobalken® beams with a mass of 500.33 kg/m³, 12% wood moisture, 10.61% water content and 1% adhesive content.

Declared unit

Description	Value	Unit
Declared unit	1	m^2
Bulk density	500.33	kg/m^3
Moisture content on delivery	12	%
Adhesive content in relation to overall mass	1	%
Water content in relation to overall mass	10.61	%

3.2 System boundary
The Declaration type corresponds with an EPD "from cradle to plant gate, with options". Contents include the production stage, i.e. from the provision of raw materials to the production plant gate (cradle to gate, Modules A1 to A3) as well as elements of the End of Life (Modules C2 to C4). The benefits and loads beyond the product life cycle are also analysed (Module D).
Module A1 analyses the provision of wood from forestry resources, the provision of other pre-treated wood products and the provision of adhesives. Transport of these substances is considered in Module A2. Module A3 handles the provision of fuels, consumables and electricity as well as the manufacturing processes on site. These essentially involve debarking, cutting, drying, planing and profiling processes as well as glueing and packing the products.
Module C2 takes consideration of transport to disposal; Module C3 handles preparation and sorting of waste wood; Module D analyses thermal recycling as well as the ensuing benefits in the form of a system extension.

3.3 Estimates and assumptions
As a general rule, all material and energy flows for the products required for production are established specifically on site. It was only possible however to estimate the emissions from incineration and other processes incurred on site on the basis of literary references. All other data is based on average values. More detailed information on all estimates and assumptions made is documented in (S. Rüter, S. Diederichs: 2012).

3.4 Cut-off criteria
The choice of material and energy flows analysed is aligned towards their involvement in renewable and non-renewable primary energy for each unit process. A decision on the flows to be analysed was based on studies already available on analysing wood products. At least those material and energy flows were analysed which account of 1% of the renewable or non-renewable primary energy used, whereby the total of flows not considered does not exceed 5% of the indicators outlined. No known material or energy flows below the 1% limit were ignored.
The inputs and outputs identified from the company data were examined for plausibility.
The expenses involved in providing the infrastructure (i.e. machinery, buildings etc.) of the entire primary system were not taken into consideration. This is based on the assumption that the total expenses associated with building and maintaining infrastructure do not exceed the 1% of total expenses referred to above. The requisite energy expenses for operating the infrastructure were taken into consideration in the form of heat and electricity. More detailed information on the cut-off criteria is documented in (S. Rüter, S. Diederichs: 2012).

3.5 Background data
All background data was taken from the GaBI Professional Data Base.

3.6 Data quality
With the exception of forest wood, the background data used for wood raw materials for material and energy use refers to the years 2008 to 2010. The power mix originates from 2009 while the provision of forest wood was taken from a publication dated 2008 which is essentially based on details from the years 1994 to 1997. All other information was taken from the GaBi Professional Data Base which does not permit any exact containment of quality. As the essential information is based on primary, highly-representative data surveys, the data quality can be regarded as very good.

3.7 Period under review
Data was collected over the period from 2009 to 2011, whereby data was always available for the respective calendar year. The data is therefore based on the years 2008 to 2010. All information is based on average values over 12 consecutive months.

3.8 Allocation

The allocations carried out comply with the EN 15804:2012 standard and are explained in detail in S. Rüter, S. Diederichs: 2012. The following essential system expansion processes and allocations were carried out.

General information

All material-inherent features were allocated according to physical causalities; all other allocations were performed on an economic basis. An exception is represented by the allocation of requisite heat in combined heat and power facilities which was allocated on the basis of the exergy of electricity and process heat.

Module A1

- Forestry: Expenses associated with forestry were allocated to logs and industrial wood on the basis of their prices.
- The provision of waste wood does not take consideration of any expenses from the previous life cycle.

Module A3

- Wood-processing industry: Expenses were allocated to the primary products and residual materials on the basis of their prices.
- With the exception of wood-based materials, the disposal of waste incurred during production was on the basis of a system expansion. Heat and electricity generated are credited to the system in the form of substitution processes. The credits achieved here are significantly less than 1% of overall expenses.
- In the case of combined generation of heat and power, all expenses associated with firing were allocated to this after exergy of these two products.
- The provision of waste wood does not take consideration of any expenses from the previous life cycle (similar to Module A1).

Module D

The system expansion process performed in Module D complies with an energetic recycling scenario for waste wood.

3.9 Comparability

As a general rule, EPD data can only be compared or evaluated when all of the data sets to be compared have been generated in accordance with EN 15804 and the building context or product-specific characteristics are taken into consideration.

4. LCA: Scenarios and other information

The scenarios on which the Life Cycle Assessment is based are described in detail below.

End of Life (C1-C4)

Description	Value	Unit
Waste wood for energy recovery	500.33	kg

Re-use, recovery and recycling potential (D), relevant scenario details

Description	Value	Unit
Electricity generated (per t atro waste wood)	1231	kWh
Waste heat utilised (per t atro waste wood)	2313	MJ

In the form of waste wood, the product is recycled at its end of life in the same composition as the declared unit. Thermal recycling in a bio-mass power plant is assumed with a total efficiency of 35% and an electric efficiency of 23%, whereby incineration of 1 tonne of wood (atro) (with 18% wood moisture) generates approx. 1231 kWh electricity and 2313 MJ useful heat. The exported energy substitutes fuels from fossil sources, whereby it is assumed that the thermal energy is generated from natural gas and the substituted electricity complies with the German power mix for 2009.

5. LCA: Results

SYSTEM BOUNDARIES (X = INCLUDED IN THE LCA; MND = MODULE NOT DECLARED)

Product stage			Construction process stage		Use stage							End-of-Life stage				Benefits and loads beyond the system boundary
Raw material supply	Transport	Production	Transport	Construction-installation process	Use	Maintenance	Repairs	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction / Demolition	Transport	Waste processing	Landfilling	Re-use, recovery or recycling potential
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	X	X	X	X

LCA RESULTS – ENVIRONMENTAL IMPACT: 1 m³ Duobalken, Triobalken

Parameter	Unit	A1	A2	A3	C2	C3	C4	D
GWP	[kg CO_2 equiv.]	-7.552E+2	1.395E+1	6.724E+1	4.5E-1	8.146E+2	0.0E+0	-3.665E+2
ODP	[kg CFC11 equiv.]	5.017E-6	3.79E-8	1.543E-5	9.0E-10	1.186E-6	0.0E+0	-8.381E-5
AP	[kg SO_2 equiv.]	2.721E-1	6.025E-2	2.2E-1	1.932E-3	6.981E-3	0.0E+0	-3.776E-1
EP	[kg $(PO_4)^3$ equiv.]	6.078E-2	1.388E-2	3.597E-2	4.477E-4	5.893E-4	0.0E+0	-3.738E-3
POCP	[kg ethene equiv.]	6.045E-2	6.435E-3	5.06E-2	2.091E-4	4.642E-4	0.0E+0	-2.532E-2
ADPE	[kg Sb equiv.]	6.711E-4	3.204E-7	9.441E-5	9.5E-9	1.225E-7	0.0E+0	-6.404E-6
ADPF	[MJ]	7.472E+2	1.963E+2	7.665E+2	6.35E+0	4.616E+1	0.0E+0	-4.141E+3

Legend	GWP = Global Warming Potential; ODP = Ozone Depletion Potential; AP = Acidification Potential of soil and water; EP = Eutrification Potential; POCP Photochemical Ozone Creation Potential; ADPE = Abiotic Depletion Potential for Elements; ADPF = Abiotic Depletion Potential of Fossil Fuels

LCA RESULTS – USE OF RESOURCES: 1 m³ Duobalken, Triobalken

Parameter	Unit	A1	A2	A3	C2	C3	C4	D
PERE	[MJ]	1.031E+3	3.121E-1	7.349E+2	8.413E-3	4.701E+0	0.0E+0	-3.373E+2
PERM	[MJ]	8.523E+3	0.0E+0	4.055E+1	0.0E+0	0.0E+0	0.0E+0	0.0E+0
PERT	[MJ]	9.554E+3	3.121E-1	7.755E+2	8.413E-3	4.701E+0	0.0E+0	-3.373E+2
PENRE	[MJ]	8.687E+2	1.977E+2	1.301E+3	6.382E+0	8.777E+1	0.0E+0	-7.366E+3
PENRM	[MJ]	4.998E+1	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0
PENRT	[MJ]	9.187E+2	1.977E+2	1.301E+3	6.382E+0	8.777E+1	0.0E+0	-7.366E+3
SM	[kg]	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0
RSF	[MJ]	7.904E+1	0.0E+0	1.088E+2	0.0E+0	0.0E+0	0.0E+0	4.334E+3
NRSF	[MJ]	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0
FW	[m³]	8.272E+2	4.117E+0	6.952E+2	1.197E-1	4.987E+1	0.0E+0	3.422E+3

Legend	PERE = Primary energy, renewable; PERM = Primary energy, renewable, used as raw materials; PERT = Total use of renewable primary energy; PENRE = Primary energy, non-renewable; PENRM = Primary energy, non-renewable, used as raw materials; PENRT = Total use of non-renewable primary energy; SM = Use of secondary materials; RSF = Renewable secondary fuels; NRSF = Non-renewable secondary fuels; FW = Use of fresh water resources

LCA RESULTS – OUTPUT FLOWS AND WASTE CATEGORIES: 1 m³ Duobalken, Triobalken

Parameter	Unit	A1	A2	A3	C2	C3	C4	D
HWD	[kg]	6.611E-2	0.0E+0	2.468E-2	0.0E+0	0.0E+0	0.0E+0	1.506E+0
NHWD	[kg]	3.036E-2	0.0E+0	6.226E-3	0.0E+0	0.0E+0	0.0E+0	4.546E-5
RWD	[kg]	6.079E-2	4.735E-4	1.913E-1	1.124E-5	1.489E-2	0.0E+0	-1.045E+0
CRU	[kg]	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0
MFR	[kg]	0.0E+0	0.0E+0	0.0E+0	0.0E+0	4.998E+2	0.0E+0	0.0E+0
MER	[kg]	0.0E+0	0.0E+0	2.104E+0	0.0E+0	4.998E+2	0.0E+0	-5.019E+2
EEE	[MJ]	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0
EET	[MJ]	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0

Legend	HWD = Hazardous waste, disposed of; NHWD = Non-hazardous waste, disposed of; RWD = Radioactive waste, disposed of; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported energy,electricity; EET = Exported energy, thermal

6. LCA: Interpretation

The interpretation focuses on the production phase (Modules A1 to A3) as it is based on specific information provided by the company.

Global Warming Potential
Of the fossil greenhouse gases analysed in Modules A1 to A3, 41% is attributed to the provision of raw materials, 10% to transport and 49% to production. The provision of wood raw materials also comprises extensive areas of the refining chain as the appropriate refined products are purchased for production. Electricity consumption in the plant is an essential influential factor (39%). Accounting for approx. 10%, transport of wood raw materials also plays a significant role. The generation of heat and other emissions essentially comprising combustion of diesel fuel on the plant site together account for approx. 11% of cradle-to-gate emissions.

Analysis of carbon from bio-mass

A total of approx. 984 kg carbon dioxide enters the system in the form of carbon stored in the bio-mass, of which 96 kg carbon dioxide are emitted along the upstream chains and 74 kg within the framework of heat generation on site. Approx. 4 kg carbon dioxide are added to the system via packaging and re-emitted within the framework of disposal of packaging. The volume of carbon ultimately stored in the product is extracted from the system when recycled in the form of waste wood.

Acidification Potential
The combustion of wood and diesel are the sources of essential relevance for emissions representing a potential contribution towards the acidification potential. Drying the bought-in products, provision of the requisite heat and utilisation of fuels in forestry account for around half of emissions. The emissions from the provision of adhesives are negligible by comparison (4%). Transport of raw materials accounts for another 11% while heat generation on site makes a total contribution of 16% to all cradle-to-gate emissions.

Summer Smog Formation Potential
Emissions contributing to the formation of ground-level ozone are primarily incurred during wood drying. Nitric oxides from incineration processes also play a role. 28% of emissions are incurred during drying on site. Furthermore, essential percentages of the drying processes are incurred in the upstream chains. Transport expenses only play a subordinate role.

Eutrification Potential
18% of emissions contributing towards eutrification (primarily nitric oxides) are incurred during wood firing on site, 47% during the drying and incineration processes associated with the upstream chains and 7% in manufacturing the adhesives.

Ozone Depletion Potential
60-70% of emissions with ozone depletion potential are incurred during generation of electricity for the processes in the upstream chains on site.

Use of primary energy
Renewable energy carriers are primarily used in the form of wood for generating process heat. Of the total of 1954 MJ, 188 MJ are incurred by burning waste wood.
Non-renewable energy is primarily used for generating electricity and in the form of fuels for the transport processes. Smaller quantities are also required for manufacturing the adhesives.

Range of results
The individual results of participating companies differ from average results in the Environmental Product Declaration. Deviations of +161%/-29% (GWP), +68%/-13% (AP) and +28%/-12% (POCP) were measured for the three GWP, AP and POCP indicators in relation to the results outlined here. These deviations are primarily attributable to differences in the fuels used and specific electricity consumption values during the processes.

Depletion of abiotic resources
Resources depleted for material utilisation are largely used for manufacturing the machining tools. Resources for energy utilisation are largely depleted for the electricity supply.

Waste
Special waste is primarily incurred during the provision of consumables (approx. 20%) and adhesives (approx. 50%).

7. Requisite evidence

The following evidence of environmental and health relevance was provided:

7.1 Formaldehyde
A total of 7 measurement reports were available on formaldehyde emissions. The measurements were carried out by experienced test laboratories. Maximum steady state emission values were established.
Measurements were performed in test chambers in accordance with DIN EN 717-1 at a uniform temperature of 23 °C, relative humidity of 45% and a ventilation rate of 1.0 per hour. Loading factors differed in some cases. The measured values were therefore initially used to calculate the area-specific emission rates.
As anticipated, most of the measured values (22) are available for Duobalken® / Triobalken® beams with MUF adhesive. The average area-specific emission rate is 34.8 µg/h x m². With reference to a loading factor of 0.3 m²/m³ suggested by the Stuttgart Materials Testing Institute and specified in the DIN EN 14080:2005, this gives rise to a formaldehyde equalisation concentration in the test chamber of 0.008 ml/m³. This value is less than one-tenth of the limit value of 0.1 ml/m³ in accordance with the Ordinance on Chemicals. If the highest values measured (71 mg/h x m³) are taken as a basis for derivation, this results in an equalisation concentration of 0.017 mg/m³. Duobalken® / Triobalken® beams glued using PUR or EPI adhesives give rise to area-specific emission rates in the range of non-adhesive wood. The derived equalisation concentration is approx. 0.004 ml/m³. Similar values were also measured for other, non-adhesive types of wood and comply with the natural formaldehyde emissions by wood.

7.2 MDI
When Duobalken® / Triobalken® beams are glued, the MDI contained in the polyurethane adhesives reacts out in full. MDI emissions from the hardened glued solid timber are not therefore possible: there is no test standard in place.
The tests submitted are concerned with the temporary MDI emissions arising during gluing in the factory. As there is no standardised measurement process in place for these emissions, one of the tests submitted determined the MDI emissions on the basis of the measurement method for determining formaldehyde emissions outlined in EN 717-2.
Result: MDI emissions were not detected in any of the 7 Duobalken® / Triobalken® beams examined within the framework of the detection limit (0.05 µg/m³).
An additional test based on a project-related measurement method involving a wooden lamella glued with PUR adhesive but not hardened displayed MDI emissions slightly above the detection limit (0.05

µg/m³) during the first two hours after applying the adhesive. MDI emissions could not be measured after that.

8. References

Institute Construction and Environment e.V., Königswinter (pub.):

General Principles for the EPD range of Institute Construction and Environment e.V. (IBU), 2011-09

Product Category Rules for Building Products, Part A: Calculation rules for the Life Cycle Assessment and requirements on the background report, 2012-09

DIN EN ISO 14025:2011-10, Environmental labels and declarations — Type III environmental declarations — Principles and procedures

EN 15804:2012-04, Sustainability of construction works — Environmental product declarations — Core rules for the product category of construction products

Product Category Rules for Building Products, Part B: PCR solid wood products, 2012-07

Beuth-Verlag, Berlin:

DIN 1052: 2008-04, Design of timber structures – General rules and rules for buildings

DIN 68800-2: 2012-02, Wood preservation - Part 2: Preventive constructional measures in buildings

DIN 68800-3: 2012-02, Wood preservation - Part 3: Preventive protection of wood with wood preservatives

DIN EN 336: 2003-09, Structural timber – Sizes, permitted deviations

DIN EN 717-1:2005-01, Wood-based panels – Determination of Formaldehyde release – Part 1: Formaldehyde emission by the chamber method

DIN EN 717-2:1995-01, Wood-based panels – Determination of Formaldehyde release – Part 2: Formaldehyde emission by the gas analysis method

DIN EN 1995-1-1: 2010-12, Eurocode 5: Design of timber structures – Part 1-1: General – Common rules and rules for buildings

DIN EN 1995-1-1/NA: 2010-12, National Annex – Nationally determined parameters – Eurocode 5: Design of timber structures – Part 1-1: General – Common rules and rules for buildings

DIN EN 14080: 2005-09, Timber structures - Glued laminated timber - Requirements

Other sources:

S. Rüter, S. Diederichs: 2012, Ökobilanz Basisdaten für Bauprodukte aus Holz (Basic LCA data for wood-based construction products), Hamburg, Johann Heinrich von Thünen Institut, Institut für Holztechnologie und Holzbiologie, Final Report

General Building Authority Approval Z 9.1-440 of the German Institute for Structural Engineering (DIBt): 2012, Duobalken and Triobalken (glued solid timber made of two or three glued boards, planks or squared timbers)

DIN EN 13501, Fire classification of construction products and building elements, German version EN 13501:2007+A1:2009

GaBi 4 2011: Software and data base for comprehensive analysis. LBP, University of Stuttgart and PE International, 2011

Federal Immission Control Act (BImSchG): Act protecting against harmful environmental impact caused by air pollution, noise, shocks and similar processes, 2002

Waste Wood Act (AltholzV): Act governing the requirements on utilisation and disposal of waste wood, 2012

Institut Bauen und Umwelt e.V.	**Publisher** Institut Bauen und Umwelt e.V. Rheinufer 108 53639 Königswinter Germany	Tel. Fax E-mail Web	+49 (0)2223 296679-0 +49 (0)2223 296679-0 info@bau-umwelt.com **www.bau-umwelt.com**
Institut Bauen und Umwelt e.V.	**Programme holder** Institut Bauen und Umwelt e.V. Rheinufer 108 53639 Königswinter Germany	Tel. Fax E-mail Web	+49 (0)2223 296679-0 +49 (0)2223 296679-0 info@bau-umwelt.com **www.bau-umwelt.com**
KVH® BS Holz	**Holder of the Declaration** Studiengemeinschaft Holzleimbau e.V. und Überwachungsgemeinschaft Konstruktionsvollholz e.V. Elfriede-Stremmel-Strasse 69 42369 Wuppertal Germany	Tel. Fax E-mail Web E-mail Web	+49 (0)202 9783581 +49 (0)202 9783579 info@brettschichtholz.de **www.brettschichtholz.de** info@kvh.de www.kvh.de
vTI Johann Heinrich von Thünen-Institut	**Author of the Life Cycle Assessment** Johann Heinrich von Thünen Institut, HTB Leuschnerstr. 91 21031 Hamburg Germany	Tel. Fax E-mail Web	+49 (0)40 73962-600 +49 (0)40 73962-699 stefan.diederichs@vti.bund.de **www.vti.bund.de**

Studiengemeinschaft Holzleimbau e.V.

Studiengemeinschaft Holzleimbau e.V.
Heinz-Fangman-Str. 2
D-42287 Wuppertal
0202/769 7273-3 Fax
www.brettschichtholz.de
info@brettschichtholz.de

Überwachungsgemeinschaft KVH e.V.
Heinz-Fangman-Str. 2
D-42287 Wuppertal
0202/769 7273-5 fax
info@kvh.de
www.kvh.de