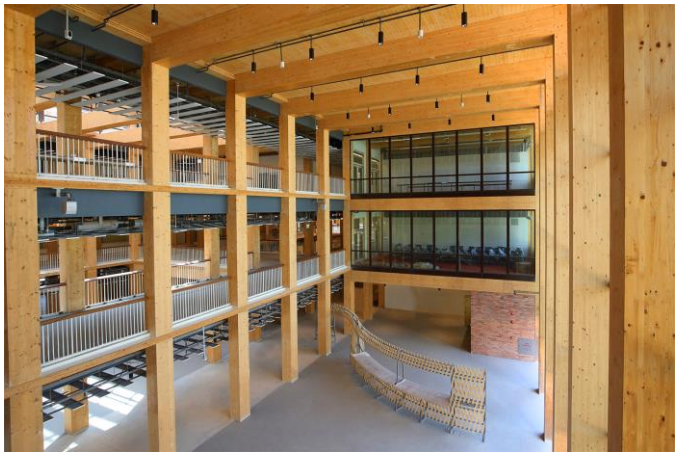
Environmental
Product
Declaration
According to EN15804+A2 (+indicators A1)

This declaration is for:
Glued laminated timber

Provided by:
WIEHAG Timber Construction GmbH



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COMPANY INFORMATION

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SCOPE OF DECLARATION

This MRPI®-EPD certificate is verified by Martijn van Hövell, SGS Search Consultancy. The LCA study has been done by Therese Daxner and Susanne Lehner, Daxner & Merl GmbH. The certificate is based on an LCA-dossier according to EN15804+A2 (+indicators A1). It is verified according to the 'MRPI®-EPD verification protocol November 2020.v4.0'. EPD's of construction products may not be comparable if they do not comply with EN15804+A2. Declaration of SVHC that are listed on the 'Candidate list of Substances of Very High Concern for authorisation' when content exceeds the limits for registration with ECHA.

PROGRAM OPERATOR

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PRODUCT

Glued laminated timber

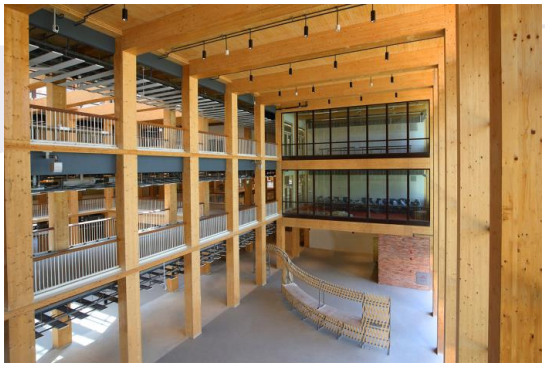
DECLARED UNIT/FUNCTIONAL UNIT

1 m³ of glued laminated timber with an average density of 466 kg/m³

DESCRIPTION OF PRODUCT

WIEHAG GLT is used as a load-bearing structural glued construction product in residential and industrial buildings, and in timber engineering projects and bridge construction.

VISUAL PRODUCT



MORE INFORMATION

www.wiehag.com/en/products/glued-laminated-timber-bearing-systems/

DEMONSTRATION OF VERIFICATION
CEN standard EN15804 serves as the core PCR(a)
Independent verification of the declaration an data according to EN15804+A2 (+indicators A1) internal: external: x
Third party verifier: Martijn van Hövell, SGS Search Consultancy
[a] PCR = Product Category Rules

DETAILED PRODUCT DESCRIPTION

WIEHAG Timber Construction glued laminated timber*1) is a dimensionally stable, homogeneously glued product which is used for load-bearing structures, primarily in timber engineering. WIEHAG glued laminated timber consists of at least 2 laminations/boards and is manufactured from kiln-dried softwood in accordance with the harmonised European EN 14080 product standard and includes also glued solid timber as well as composite components made of glulam and glulam with universal finger joints and special forms based on the German manufacturing and design standard for timber structures DIN 1052-10.

*1) Called WIEHAG GLT in the remainder of this text, this term stands for glued laminated timber, glued solid timber, glulam composite components, glulam with universal finger joints and special forms of glulam.

Placement of this product on the market in the EU/EFTA (with the exception of Switzerland) is subject to Regulation (EU) No. 305/2011(CPR) of 9 March 2011. The product requires an EN 14080 declaration of performance and CE marking. Its use is subject to the relevant national regulations.

Application

WIEHAG GLT is primarily used as a load-bearing structural glued construction product in residential and industrial buildings, as well as in timber engineering projects and even bridge construction. In general, the glulam is not treated with chemical wood preservatives. The use of preventive chemical wood preservation according to DIN 68800-3 is unusual and only permissible if structural wood preservation according to DIN 68800-2 is not sufficient on its own. If, in exceptional cases, a preventive chemical wood preservative is used, this must be regulated by a general building authority approval or approval according to the Biocidal Products Regulation.

Manufacture

WIEHAG GLT is made of softwood, predominantly spruce and fir, from sustainable forestry in accordance with PEFC or FSC standards. The wet sawn timber delivered fresh from the sawmills passes through the stacking and sorting system first. This system sorts the selections into packages with intermediate strips according to the visual characteristics of the wood. The slats are then kiln dried in drying chambers to an average wood moisture content of about 11 % and made ready for production in an airconditioned warehouse. During the production process, the wood moisture content and the curvature or twist of each individual wooden lamination is measured and fed to the pre-planning system or sorted out immediately, depending on requirements. In the downstream process, the laminations are evaluated visually or mechanically, depending on the wood characteristics, in order to detect the strength-relevant features. These features, which have a significant impact on the strength and rigidity of the board laminations, are marked and cut out according to the quality requirements. The boards, once sorted by strength, are finger jointed into a continuous lamination, planed to size and cut to the desired length as specified in the lamination plan (truss structure).
After the finger-joint has cured in lamination storage, the adhesive is applied to the flat side and bonded in various pressing systems for straight and curved structural components to form a raw truss (the semifinished product). After the curing process, the structural components are planed to size and glued again depending on the product type. This allows the fabrication of composite components with large dimensions or complex load-bearing structures. Depending on the finishing stage, woodworking equipment is then used to process the components in accordance with the design drawings. The GLT surfaces are finished to the customer's requirements and can be treated for protection against weather and assembly damage, or with a wood preservative.

Delivery status

WIEHAG GLT is offered in various finishing levels from standard products to special components in visible or industrial quality levels. The permissible dimensional deviations comply with EN 14080.
The maximum product dimensions are:
Length: up to 51 m
Width: up to 1.5 m
Height: up to 3.2 m

Packaging

Polyethylene (PE) films are mainly used as weather protection during storage and transportation.

Product processing/Installation

WIEHAG glued laminated timber can be processed using the standard tools suitable for timber construction. The health and safety instructions must also be observed during processing and installation.

Environment and health during use

Environmental protection: According to current knowledge, the use of WIEHAG glued laminated timber poses no risk to water, air or soil.
Health protection: According to the current state of knowledge, no injury or adverse effects on health are to be expected under normal conditions of use of WIEHAG GLT. WIEHAG GLT, as it is predominantly manufactured with a melamine-based adhesive (MUF), releases formaldehyde during its life cycle.

The MUF-based adhesives used are classified as low-emission with regard to formaldehyde due to their low adhesive content, structure and form of use. Compared to the limit value of 0.1 ml/m³ (0.124 mg/m³) of the REACH Regulation or Chemicals Regulation (1907/2006/EC) in connection with the test (EN 717-1), these emissions are to be classified as low, in the range of 0.02 to 0.03 mg/m³.

Reference service life

Glued laminated timber has been used in timber engineering for more than 100 years. When used as directed, there is no known or expected time limit on its stability. The useful life of WIEHAG GLT is therefore the same as the useful life of the building when used as intended. Thus, 100 years can acc. to a manufacturer declaration be regarded as reference service life.

Re-use phase

If WIEHAG GLT is professionally dismantled, it can be reused or repurposed at any time without any problems. If the GLT is not reused, its calorific value of around 16 MJ/kg (at a wood moisture content of around 12 %) means that it can be used to generate energy for process heat and electricity. All country specific regulations must be taken into account.

Disposal

Landfill disposal of waste wood is not permitted according to §9 AltholzV (Waste Wood Ordinance).
Waste specification according to the Austrian Waste Catalogue:
Code 17218
Waste code number according to the European waste list (2014/955/EU): Code 17 02 01

Technical Data

The product's technical performance data are declared along with its essential characteristics in the declaration of performance in accordance with the EN 14080 harmonised product standard and are available for download from www.wiehag.com at any time. The table below lists example structural data in accordance with EN 14080 for GL 24h to GL 30h/c.

Structural data	Value	Unit
Wood types by trade names according to EN 1912, with codes, if provided, in accordance with EN 13556 *1	PCAB Common (Norway spruce), ABAL (silver fir), PNSY (Scots pine), LADC (European larch), PSMN (Douglas fir)	
Wood moisture according to EN 13183-1 *2	≤ 15	%
Use of wood preservatives (the DIN 68800-3 test grade of the wood preservative must be specified) *3	Where other preservative means are insufficient	
Compressive strength parallel according to EN 14080 *4	24 - 30	N/mm²
Compressive strength rectangular according to EN 14080 *4	2.5	N/mm²
Tensile strength parallel according to EN 14080 *4	17 - 24	N/mm²
Tensile strength rectangular according to EN 14080 *4	0.5	N/mm²
Modulus of elasticity according to EN 14080 *4	11500 - 13600	N/mm²
Shear strength according to EN 14080 *4	3.5	N/mm²
Shear modulus according to EN 14080 *4	650	N/mm²
Dimensional deviation according to EN 14080 *5	Width: +/ 2 mm; heights ≤ 400 mm: +4 mm / 2 mm; heights > 400 mm: +1% / 0.5%; lengths (≤ 2 m): +/ 2 mm; lengths (2 m < / ≤ 20 m): +/ 0,1%; length (> 20 m): +/ 20 mm	mm, %
Length (min. max.)	up to 51	m
Width (min. max.)	up to 1.5	m
Height (min. max.)	up to 3.2	m
Gross density according to EN 14080 *4	420 - 480	kg/m³
Surface quality (list possible variants)	industrial quality, visible quality	
Thermal conductivity according to EN 12664	0.13	W/(mK)
Specific heat capacity according to EN 12664	1.6	kJ/kgK
Water vapour diffusion resistance factor according to EN ISO 12572	20 to 50	
Formaldehyde emissions according to EN 14080	≤ 0.124	mg/m³

*1) For glued laminated timber made primarily of softwood.
*2) EN 14080 allows other equivalent measurement methods.
*3) According to DIN 68800-1, wood preservative treatment is only permitted if structural measures have been exhausted, so it is uncommon.
*4) EN 14080 allows the declaration of more elastomechanical properties, in particular flexural strength. It is customary to specify strength classes such as GL 24h, GL 28c or GL 30h. The ranges specified here are based on average or characteristic values for the specified strength classes. Different values can be declared. The declared bulk density values may deviate from this average value due to the different densities of the types of wood used.
*5) EN 14080 specifies further tolerances, e.g. for angularity or for curved structural components.

WIEHAG GLT is predominantly manufactured from softwood (primary types of wood: spruce/fir, Douglas fir, larch, pine) in accordance with EN 14080. The boards for lamination are kiln dried in a drying chamber, sorted according to strength, finger jointed and then glued. On delivery, GLT has an average moisture content of about 10–11 %. Gluing is done with appropriate approved lowemission adhesives. The mechanical strength properties of WIEHAG Timber Construction GLT are based on EN 14080. Technical data for the product can be found in the latest versions of the declarations of performance (DOP, DOC), which are available in the download area of the homepage (www.wiehag.com).
Since the characteristics of the GLT product vary in terms of the crosssectional structure of the number and thickness of the layers as well as their size and shape, the dimensional tolerances of the GLT product are defined based on EN 14080 and are also described in the GLT fact sheet prepared by the Studiengemeinschaft Holzleimbau e.V.
The product characteristics of WIEHAG GLT sometimes also include wider cross-sections, which are referred to as GLT composite components. These are made from individual glued laminated timber crosssections that are bonded over their entire surface. GLT is primarily available in strength classes GL 24, GL 28 and GL 30 and is manufactured with a combined (c) or homogeneous (h) layer structure in either the visible or industrial quality grades.
Preventive chemical wood preservatives in accordance with DIN 68800-3 with active substances against insects and fungal infestation are permitted depending on the requirements, but should be avoided to the extent possible. They are only permitted if other protective measures for structural wood protection specified in DIN 68800-2 are not sufficient alone.

Base materials/Ancillary materials
WIEHAG glued laminated timber consists of at least two fibre-parallel bonded (duroplastic), kiln dried softwood board laminations that have been sorted for strength.
A class 1 MUF (melamine-urea-formaldehyde) adhesive is used for finger-jointing, surface and block bonding, permitting the production of glued laminated timber for EN 1995 service classes 1–3.
The following proportions have been determined for the composition of 1 m³ of glued laminated timber from WIEHAG Timber Construction:

Component (> 1%)	(kg / %)
Coniferous wood (atro), predominantly spruce, app.	89%
Water, app.	10%
Glue, app.	1%

SCOPE AND TYPE
The EPD was created according to the specifications of EN 15804:2012+A1:2013 and EN 15804:2012+A2:2019

The life cycle assessment of average glued laminated timber produced by WIEHAG refers to a cradle-to-grave analysis of the environmental impacts (A1–A3, A4, A5, B1-B5, C1-C4, D). This EPD is based on a declared unit of 1 m³ of glued laminated timber (moisture of 11 % at a raw density of 466 kg/m³), produced by WIEHAG Timber Construction GmbH in Altheim (Austria). The results refer to a representative average of glued laminated components including special shapes and represent the typical product variety of the company. The production site represents 100 % of the total production of WIEHAG Timber Construction glued laminated timber.

Scenarios and standard values are acc. to the "Environmental Performance Assessment Method for Construction Works Calculation method to determine environmental performance of construction works throughout their service life, based on EN 15804" and the "Forfaitaire waarden voor verwerking-scenario's einde leven behorende bij: Bepalingsmethode Milieuprestatie Bouwwerken" of the Nationale Milieudatabase.

The ecoinvent 3.6 background database in the open LCA software version 2.0.3 was used to calculate the LCA.

The following life cycle phases are part of the analysis:

Module A1–A3 | production stage
The production stage includes the upstream burdens of raw material supply, their transports, and the manufacturing plant of WIEHAG Timber Construction GmbH in Altheim (Austria). Main raw material inputs therefore refer to sawn timber and the production of the adhesive system. Within the plant boundaries the sorting, drying, finger-jointing, pressing and planning as well as the packaging of the product are considered. The production site is supplied with internally produced thermal and electric energy from the company's own timber gasification heat and power plant complemented by biomass boilers. Furthermore,
electricity is internally produced by the own photovoltaic system. The remaining electricity is purchased as 100 % green electricity from the external grid. Direct emissions from drying are based on worst case assumptions and are included in the study. Primary data from adhesive production was used as far as possible. The packaging of the products is considered in module A1–A3 as well.

Module A4 - A5 | construction stage
A4 transport to construction site: The transport covers 880 km distance by truck between Utrecht (Netherlands) and the production site in Altheim (Austria).
A5 assembly at construction site:
Glued laminated timber can be processed using the standard tools suitable for timber construction. The energy required for small machines as well as a crane and a work platform are considered in the study (0,12 kWh electricity and 12,8 kWh diesel). The actual energy demand depends on the installation of the products and can therefore vary greatly in the building context. Module A5 covers the transport to waste treatment and the disposal of product packaging as well as of off-cuts at the construction site (3%). The waste treatment scenarios acc. to the Dutch requirements are considered. Potentials from energy recovery and recycling are considered in Module D.

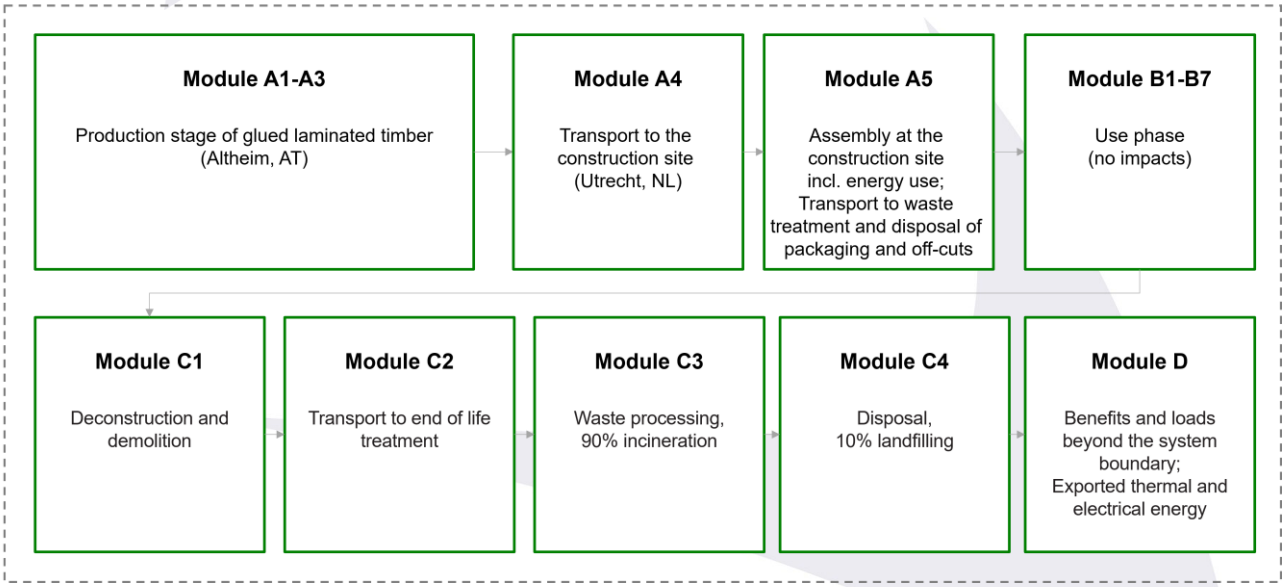
Module B1-B5 | use stage
B1 use: Glued laminated timber has been used in timber engineering for more than 100 years. When used as directed, there is no known or expected time limit on its stability. The useful life of WIEHAG GLT is therefore the same as the useful life of the building when used as intended. No changes of the product are to be expected during its use. As a result, no environmental impacts can be asserted to module B1.
B2-B5 maintenance, repair, replacement, renovation: Glued laminated timber is installed permanently in the structure and does not require maintenance, repair, replacement or refurbishment under normal use conditions. As a result, no environmental impacts can be asserted to modules B2-B5.

Module C | end of life stage
C1 deconstruction and demolition: After the removal of other building components, the joints can simply be loosened by screwing or sawing and lifted by cranes to the place of removal. Required energy demand can be neglected. The actual energy demand depends on the installation of the products and can therefore vary greatly in the building context. Therefore, no environmental burdens are declared in module C1.
C2 transport to end of life: Module C2 includes the transport to waste treatment. In this case, transport by truck over a transport distance of 100 km to incineration and 50 km to landfill is considered.
C3 waste processing: In Module C3, the chipping after the removal of the products is considered. Acc. to the Dutch requirements, 90% of the wooden products are incinerated in a municipal waste treatment plant and used for energy recovery. Emissions from incineration are declared in module C3. Plant-specific values are considered acc. to the Dutch requirements.
C4 disposal: The applied scenario declares 90% energetic recovery of the wooden products, and 10% landfilling. From the share that is incinerated, no environmental impacts are to be expected from waste processing of the products in C4. C4 includes the environmental burdens of landfilling 10% of the product.

Module D | benefits and loads beyond the system boundary
Applying a Dutch scenario, module D describes the energetic recovery of 90% of the product at the end of life including the corresponding energy substitution potentials. Furthermore, energetic recovery of off-cuts and plastic packaging (both from module A5) as well as recycling of plastic packaging are considered acc. to the Dutch scenario.

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USER STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport gate to 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	X	X	X	X	X	X	ND	ND	X	X	X	X	X
X= Modules Assessed ND= Not Declared																

System boundary



REPRESENTATIVENESS

This EPD is based on a declared unit of 1 m³ of glued laminated timber (moisture of 11 % at a raw density of 466 kg/m³). The results refer to a representative average of glued laminated components including special shapes and represent the typical product variety of the company. The data basis for the preparation of the LCA is based on the production data of WIEHAG Timber Construction GmbH in Altheim (Austria). The production site represents 100 % of the total production of WIEHAG Timber Construction glued laminated timber.

The present study includes a declaration of average products from a manufacturer's factory. The production conditions are comparable for all products included in the average. Differences in energy consumption for different formats cannot be quantified and can be considered negligible due to their small share of the overall result. The robustness of the declared LCA values can therefore be categorised as good.

ENVIRONMENT IMPACT per functional unit or declared unit (core indicators A1)

	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
ADPE	kg Sb eq.				1,65 E-04	6,96 E-05	8,23 E-06	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	7,28 E-06	7,06 E-06	5,47 E-07	-3,63 E-05
ADPF	MJ				1,32 E+03	8,52 E+02	1,28 E+02	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	8,92 E+01	8,01 E+01	1,07 E+01	-3,74 E+02
GWP	kg CO2 eq.				8,55 E+01	5,65 E+01	1,11 E+01	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	5,92 E+00	1,78 E+01	2,89 E+01	-3,05 E+01
ODP	Kg CFC11 eq.				1,35 E-05	1,00 E-05	1,48 E-06	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	1,05 E-06	8,97 E-07	1,32 E-07	-8,76 E-06
POCP	Kg ethene eq.				1,74 E-01	1,66 E-02	8,02 E-03	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	1,74 E-03	8,91 E-03	6,32 E-03	-6,19 E-02
AP	kg SO2 eq.				5,03 E-01	2,49 E-01	5,77 E-02	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	2,61 E-02	1,06 E-01	4,78 E-03	-6,24 E-01
EP	kg (PO4) 3- eq.				2,55 E-01	6,09 E-02	2,58 E-02	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	6,37 E-03	1,37 E-01	1,39 E-01	-2,15 E-01
Toxicity indicators for Dutch market																			
HTP	kg DCB-Eq				1,48 E+02	3,27 E+01	1,02 E+01	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	3,42 E+00	1,94 E+01	7,49 E+00	-1,00 E+02
FAETP	kg DCB-Eq				2,92 E+01	4,31 E+00	3,99 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	4,51 E-01	4,80 E+00	8,86 E+00	-5,31 E+00
MAETP	kg DCB-Eq				1,27 E+05	1,36 E+04	7,74 E+03	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	1,42 E+03	1,06 E+04	8,54 E+03	-1,44 E+04
TETP	kg DCB-Eq				1,58 E+00	1,53 E-01	6,50 E-02	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	1,60 E-02	9,98 E-02	6,93 E-02	-7,63 E-01
ECI	euro				3,60 E+01	8,91 E+00	2,86 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	9,32 E-01	5,52 E+00	4,53 E+00	-1,68 E+01
ADPF	kg Sb eq.				6,36 E-01	4,10 E-01	6,15 E-02	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	4,29 E-02	3,85 E-02	5,16 E-03	-1,80 E-01

ADPE = Abiotic Depletion Potential for non-fossil resources
ADPF = Abiotic Depletion Potential for fossil resources
GWP = Global Warming Potential
ODP = Depletion potential of the stratospheric ozone layer
POCP = Formation potential of tropospheric ozone photochemical oxidants
AP = Acidification Potential of land and water
EP = Eutrophication Potential
HTP = Human Toxicity Potential
FAETP = Fresh water aquatic ecotoxicity potential
MAETP = Marine aquatic ecotoxicity potential
TETP = Terrestrial ecotoxicity potential
ECI = Environmental Cost Indicator
ADPF = Abiotic Depletion Potential for fossil resources expressed in [kg Sb-eq.]

ENVIRONMENT IMPACT per functional unit or declared unit (core indicators A2)

	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
GWP-total	kg CO2 eq.				-6,71 E+02	5,71 E+01	1,14 E+01	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	5,98 E+00	7,79 E+02	3,51 E+01	-3,18 E+01
GWP-fossil	kg CO2 eq.				8,72 E+01	5,71 E+01	1,12 E+01	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	5,97 E+00	1,79 E+01	2,40 E+00	-3,11 E+01
GWP-biogenic	kg CO2 eq.				-7,60 E+02	2,13 E-02	1,31 E-01	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	2,23 E-03	6,85 E+02	1,09 E+02	-3,76 E-01
GWP-luluc)	kg CO2 eq.				2,59 E+00	2,09 E-02	7,68 E-02	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	2,19 E-03	9,41 E-03	2,03 E-04	-3,46 E-01
ODP	kg CFC11 eq.				1,61 E-05	1,26 E-05	1,82 E-06	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	1,32 E-06	8,46 E-07	1,55 E-07	-8,91 E-06
AP	mol H+ eq.				6,85 E-01	3,31 E-01	7,99 E-02	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	3,47 E-02	1,53 E-01	6,11 E-03	-9,81 E-01
EP-freshwater	kg PO4 eq.				3,06 E-02	5,23 E-03	1,44 E-03	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	5,47 E-04	6,18 E-03	6,11 E-04	-5,92 E-03
EP-marine	kg N eq.				2,32 E-01	1,18 E-01	3,28 E-02	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	1,23 E-02	6,88 E-02	8,29 E-02	-2,87 E-01
EP-terrestrial	mol N eq.				2,64 E+00	1,29 E+00	3,56 E-01	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	1,35 E-01	7,37 E-01	1,84 E-02	-4,72 E+00
POCP	kg NMVOC eq.				1,27 E+00	3,67 E-01	1,14 E-01	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	3,84 E-02	1,93 E-01	1,51 E-02	-8,27 E-01
ADP-minerals & metals	kg Sb eq.				1,67 E-04	7,05 E-05	8,38 E-06	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	7,38 E-06	8,44 E-06	5,94 E-07	-3,67 E-05
ADP-fossil	MJ, net calorific value				1,46 E+03	8,66 E+02	1,34 E+02	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	9,07 E+01	1,16 E+02	1,26 E+01	-3,83 E+02
WDP	m3 world eq. Deprived				1,41 E+02	4,00 E+00	4,74 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	4,19 E-01	1,05 E+01	2,53 E-01	-2,24 E+01

GWP-total = Global Warming Potential total
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 Exceedence
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 Exceedence
POCP = Formation potential of tropospheric ozone photochemical oxidants
ADP-minerals&metals = Abiotic Depletion Potential for non-fossil resources [2]
ADP-fossil = Abiotic Depletion for fossil resources potential [2]
WDP = Water (user) deprivation potential, deprivation-weighted water consumption [2]

Disclaimer [2]
- The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

ENVIRONMENT IMPACT per functional unit or declared unit (additional indicators A2)

	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
PM	Disease incidence				1,57 E-05	5,16 E-06	1,83 E-06	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	5,40 E-07	1,16 E-06	7,92 E-08	-1,33 E-05
IRP	kBq U235 eq.				1,25 E+01	4,14 E+00	8,35 E-01	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	4,33 E-01	2,13 E+00	1,60 E-01	-1,86 E+00
ETP-fw	CTUe				5,48 E+03	7,84 E+02	2,27 E+02	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	8,20 E+01	1,74 E+02	2,32 E+02	-9,53 E+03
HTP-c	CTUh				9,80 E-07	2,24 E-08	3,42 E-08	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	2,34 E-09	1,24 E-07	1,28 E-09	-8,18 E-08
HTP-nc	CTUh				3,44 E-06	7,63 E-07	1,70 E-07	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	7,98 E-08	4,38 E-07	6,73 E-08	-3,31 E-06
SQP	----				4,29 E+04	7,28 E+02	1,28 E+03	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	7,62 E+01	2,44 E+01	1,05 E+01	-3,74 E+04

PM = Potential incidence of disease due to PM emissions
IRP = Potential Human exposure efficiency relative to U235 [1]
ETP-fw = Potential Comparative Toxic Unit for ecosystems [2]
HTP-c = Potential Comparative Toxic Unit for humans [2]
HTP-nc = Potential Comparative Toxic Unit for humans, non-cancer [2]
SQP = Potential soil quality index [2]

Disclaimer [1]
- This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste.

Disclaimer [2]
- The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

OUTPUT FLOWS AND WASTE CATEGORIES per functional unit or declared unit (A1 / A2)

	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
HWD	kg			5,65 E-03	2,18 E-03	4,00 E-04	5,65 E-03	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	2,28 E-04	1,47 E-04	4,65 E-05	-1,30 E-03
NHWD	kg			2,72 E+01	5,45 E+01	1,26 E+00	2,72 E+01	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	5,71 E+00	3,09 E+00	-4,65 E+01	-1,09 E+01
RWD	kg			8,03 E-03	5,65 E-03	8,44 E-04	8,03 E-03	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	5,92 E-04	6,45 E-04	9,11 E-05	-2,33 E-03
CRU	kg			0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00
MFR	kg			0,00 E+00	0,00 E+00	3,81 E-02	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00
MER	kg			0,00 E+00	0,00 E+00	6,48 E-01	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	4,19 E+02	0,00 E+00	0,00 E+00
EEE	MJ			0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	1,30 E+03	0,00 E+00	0,00 E+00
ETE	MJ			0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	2,23 E+03	0,00 E+00	0,00 E+00

HWD = Hazardous Waste Disposed
NHWD = Non Hazardous Waste Disposed
RWD = Radioactive Waste Disposed
CRU = Components for reuse
MFR = Materials for recycling
MER = Materials for energy recovery
EEE = Exported Electrical Energy
ETE = Exported Thermal Energy

RESOURCE USE per functional unit or declared unit (A1 / A2)

	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
PERE	MJ				1,23 E+04	1,08 E+01	3,75 E+02	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	1,13 E+00	6,92 E+03	1,61 E+00	-7,82 E+03
PERM	MJ				7,68 E+03	0,00 E+00	2,07 E+02	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	-6,91 E+03	0,00 E+00	0,00 E+00
PERT	MJ				2,00 E+04	1,08 E+01	5,82 E+02	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	1,13 E+00	1,44 E+01	1,61 E+00	-7,82 E+03
PENRE	MJ				1,44 E+03	9,20 E+02	1,39 E+02	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	9,63 E+01	2,34 E+02	1,33 E+01	-4,08 E+02
PENRM	MJ				1,25 E+02	0,00 E+00	3,36 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	-1,12 E+02	0,00 E+00	0,00 E+00
PENRT	MJ				1,56 E+03	9,20 E+02	1,43 E+02	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	9,63 E+01	1,22 E+02	1,33 E+01	-4,08 E+02
SM	kg				0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00
RSF	MJ				0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00
NRSF	MJ				0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00
FW	m3				3,29 E+00	9,32 E-02	1,10 E-01	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	0,00 E+00	9,75 E-03	2,43 E-01	5,90 E-03	-5,21 E-01

PERE = Use of renewable energy excluding renewable primary energy resources
PERM = Use of renewable energy resources used as raw materials
PERT = Total use of renewable primary energy resources
PENRE = Use of non-renewable primary energy resources excluding non-renewable 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 materials
RSF = Use of renewable secondary fuels
NRSF = Use of non-renewable secondary fuels
FW = Use of net fresh water

BIOGENIC CARBON CONTENT per functional unit or declared unit (A1 / A2)

	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
BBCpr	Kg C	2,08 E+02	0E +00	0E +00	0E +00	0E +00	0E +00	0E +00	0E +00	0E +00	0E +00	0E +00	0E +00	-1,87 E+02	-2,08 E+01	0E +00	2,08 E+02	0E +00	0E +00
BCCpa	kg C	0,00 E+00	0E +00	0E +00	0E +00	0E +00	0E +00	0E +00	0E +00	0E +00	0E +00	0E +00	0E +00	0E +00	0E +00	0E +00	0,00 E+00	0E +00	0E +00

BCCpr = Biogenic carbon content in product
BCCpa = Biogenic carbon content in packaging

CALCULATION RULES

Estimates and assumptions

All assumptions are verified through detailed documentation and correspond to the best possible representation of reality based on the available data. Regional applicability of the used background data refers to average data under European conditions taken from the ecoinvent-database. Swiss data were used for the Austrian and Dutch market whenever European or regionalised average data were not available. Emissions from wood drying were included in the calculations according to Rüter & Diederichs 2012.

Cut-off criteria

The LCA model covers all available input and output flows, which can be represented based on robust data and from which a significant contribution can be expected. Data gaps are filled with conservative assumptions of average data or generic data if available and are documented accordingly. Only data with a contribution of less than 1 % were cut off. Thus, no data were neglected, of which a substantial impact is to be expected. All relevant data were collected comprehensively. Cut-off material and energy flows were chosen carefully based on their expected quantitative contribution as well as potential environmental impacts. Thus, it can be assumed that the sum of all neglected input flows does not account for more than 5 % of the total material, water and energy flows.

Background data

This study uses generic background data for the evaluation of upstream environmental impacts from ecoinvent 3.6 database in the openLCA software version 2.0.3, as well as recognised literature such as Rüter & Diederichs 2012.
The analysis of the major amount of adhesives used for glued laminated timber production is based on primary data from WIEHAG's suppliers.

Data quality

Data collection is based on product-specific questionnaires. It follows an iterative process of clarifying questions via e-mail, telephone calls or in personal/web meetings. Intensive discussions between WIEHAG and Daxner & Merl results in an accurate mapping of product-related material and energy flows. This leads to a high quality of foreground data collected. Data collection relies on a consistent process according to ISO 14044.
The representation of the main raw materials used for the production of glued laminated timber is based on supplier specific primary data (adhesive systems) leading to a high data quality.
The technological, geographical and time-related representativeness of the database was kept in mind when selecting background data. Whenever specific data were missing, either generic datasets or representative average data were used instead. The implemented ecoinvent-background datasets refer to ecoinvent versions 3.6 as required acc. to the Assessment Method. As a result, some datasets are more than 10 years old.

Period under review

Foreground data were collected in the 2022/2023 production year (01.03.2022 28.02.2023), and the data are based on the volumes produced on an annual basis.

Allocation

Carbon content and primary energy content of the products were assessed based on their material inherent properties according to underlying physical relationships.
The production of the declared products generates co-products such as rejects and saw dust, which are sold externally. The environmental impact of the production is allocated to the main and the co-products based on their market value in line with the recommendations according to EN 16485.
In addition to thermal and electrical energy, biochar is also produced at the site-specific pyrolysis plant. The allocation of the associated environmental impacts is based on the exergy content of electrical and thermal energy and the calorific value of the biochar. Due to the high fluctuation of energy prices in the past years and the associated uncertainties, an allocation based on the economic value of the products was not used. However, the allocation ratios based on exergy lie in a comparable range with the allocation based on market price.

SCENARIOS AND ADDITIONAL TECHNICAL INFORMATION

Module A4 - A5 | construction stage

At the construction stage scenarios for transportation to the construction site and losses at construction site acc. to the Dutch requirements are used.

Name	Value	Unit
Transport to Utrecht (NL) by truck (module A4)	880	km
Generated off-cuts during construction (module A5)	3	%
Electricity used at construction site (module A5)	0,12	kWh
Diesel used at construction site (module A5)	12,8	kWh

Module C | end of life stage
At the end-of-life stage scenarios in line with the Dutch requirements are used for waste processing.

Name	Value	Unit
Transport distance to incineration by truck (module C2)	100	km
Transport distance to landfill by truck (module C2)	50	km
Incineration (module C3)	90	%
Waste wood for energy recovery (module C3)	419	kg
Landfill (module C4)	10	%
Waste wood for landfill (module C4)	47	kg

Module D | benefits and loads beyond the system boundary
For the end-of-life of the WIEHAG solid wood products, the Dutch scenario with 90% energy recovery from waste incineration in a waste treatment plant is assumed. As the scenario covers the Dutch conditions, the main sales market for the solid wood products is located in the Netherlands, plant-specific characteristic values such as efficiency of power plant (49%) correspond to the Dutch scenario. The scenario considers a reprocessing rate of 90 % for the solid wood products after removal from the building. At the end of life of the product, the equilibrium moisture is comparable to the moisture content at delivery. This value can vary depending on the storage of the product before energy recovery.
Furthermore, substitution potentials from energy recovery of off-cuts (90% incinerated) and packaging (85% energy recovery), both from module A5, are considered in module D.

The waste incineration plant generates thermal and electrical energy. Resulting potentials from the substitution of thermal energy and electricity mix are taken into account in Module D. It is assumed that the thermal energy generated by energy recovery can potentially replace thermal energy or electrical energy. When incinerating waste based on fossil raw materials, electricity from natural gas (NL) and heat from natural gas (Europe without Switzerland). When incinerating waste based on renewable raw materials, electricity from wood chips (NL) and heat from wood chips (NL).

Furthermore, substitution potentials of recycling of 5% of the plastic packaging, are considered in module D. It is assumed that the recycled material can replace the production of primary polyethylene.

Name	Value	Unit
Processing rate (energy recovery wood)	90	%
Processing rate (energy recovery PE-packaging)	85	%
Efficiency of power plant (electrical)	18	%
Efficiency of power plant (thermal)	31	%
Processing rate (recycling PE-packaging)	5	%

DECLARATION OF SVHC
The product/article/at least one part of the product contains substances on the candidate list (date: 14/06/2023) in the amount of over 0.1 percent of mass: no.

The product/product/at least one subproduct contains other carcinogenic, mutagenic, reproductively harmful (CMR) substances of category 1A or 1B, which are not on the candidate list, in the amount of over 0.1% by mass in at least one subproduct: no.

Biocidal products have been added to this construction product or it has been treated with biocidal products (it is therefore a treated product within the meaning of the Biocidal Products Regulation (EU) No. 528/2012): no.

REFERENCES
DIN 1052-10: DIN 1052-10:2012-05, Design of timber structures Part 10: Additional provisions.

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

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

EN 717-1: ÖNORM EN 717-1:2005-02-01, Woodbased panels Determination of formaldehyde release Part 1: Formaldehyde emission by the chamber method.

EN 1912: ÖNORM EN 1912:2013-10-15, Structural timber Strength classes Assignment of visual grades and species.

EN 1995: ÖNORM EN 1995-1-1:2019-06-01, Eurocode 5: Design of timber structures Part 11: General Common rules and rules for buildings.

EN 12664: DIN EN 12664:2001-05, Thermal performance of building materials and products Determination of thermal resistance by means of guarded hot plate and heat flow meter methods Dry and moist products with medium and low thermal resistance.

EN 13183-1: ÖNORM EN 13183-1:2004-02-01, Moisture content of a piece of sawn timber Part 1: Determination by oven dry method.

EN 13556: ÖNORM EN 13556:2003-09-01, Round and sawn timber Nomenclature of timbers used in Europe.

EN 14080: ÖNORM EN 14080:2013-08-01, Timber structures – Glued laminated timber and glued solid timber Requirements.

EN 15804+A1: DIN EN 15804:2012+A1:2013, Sustainability of construction works - Environmental Product Declarations - Core rules for the product category of construction products.

EN 15804+A2: DIN EN 15804:2012+A2:2019+AC:2021, Sustainability of construction works Environmental product declarations Core rules for the product category of construction products.

ISO 12572: DIN EN 12572:2017-05, Hygrothermal performance of building materials and products Determination of water vapour transmission properties Cup method.

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

ISO 14044: DIN EN ISO 14044:2006-10, Environmental management – Life cycle assessment – Requirements and guidelines.

NMD, 2022: Nationale Milieudatabase, 2022. NMD Assessment Method for Construction works. Version 1.1 (March 2022).

Stichting Nationale Milieu Database, 2022: Nationale Milieu Database, 2022. Forfaitaire waarden voor verwerking-scenario's einde leven behorende bij: Bepalingsmethode Milieuprestatie Bouwwerken. Version: May 2022.

REMARKS
None.