Environmental Product Declaration

EPD of multiple products, based on a representative product for the product group.

In accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC:2021 for:

Langshyttan Greencut Bandsaw Blades by Micor Tooling

Covering 9 different product dimensions with lengths varying from 9 810 mm to 11 430 mm, width of either 180 or 181 mm, thickness of 1.47 mm, and pitch of 40, 45, or 50 teeth per inch.

Programme:	The International EPD® System, www.environdec.com
Programme Operator:	EPD International AB
EPD registration number:	EPD-IES-0016708
Publication date:	2024-10-01
Valid until:	2029-10-01
Multiple product grouping	EPD of multiple products, based on a representative product

An EPD may be updated or depublished if conditions change. To find the latest version of the EPD and to confirm its validity, see www.environdec.com.

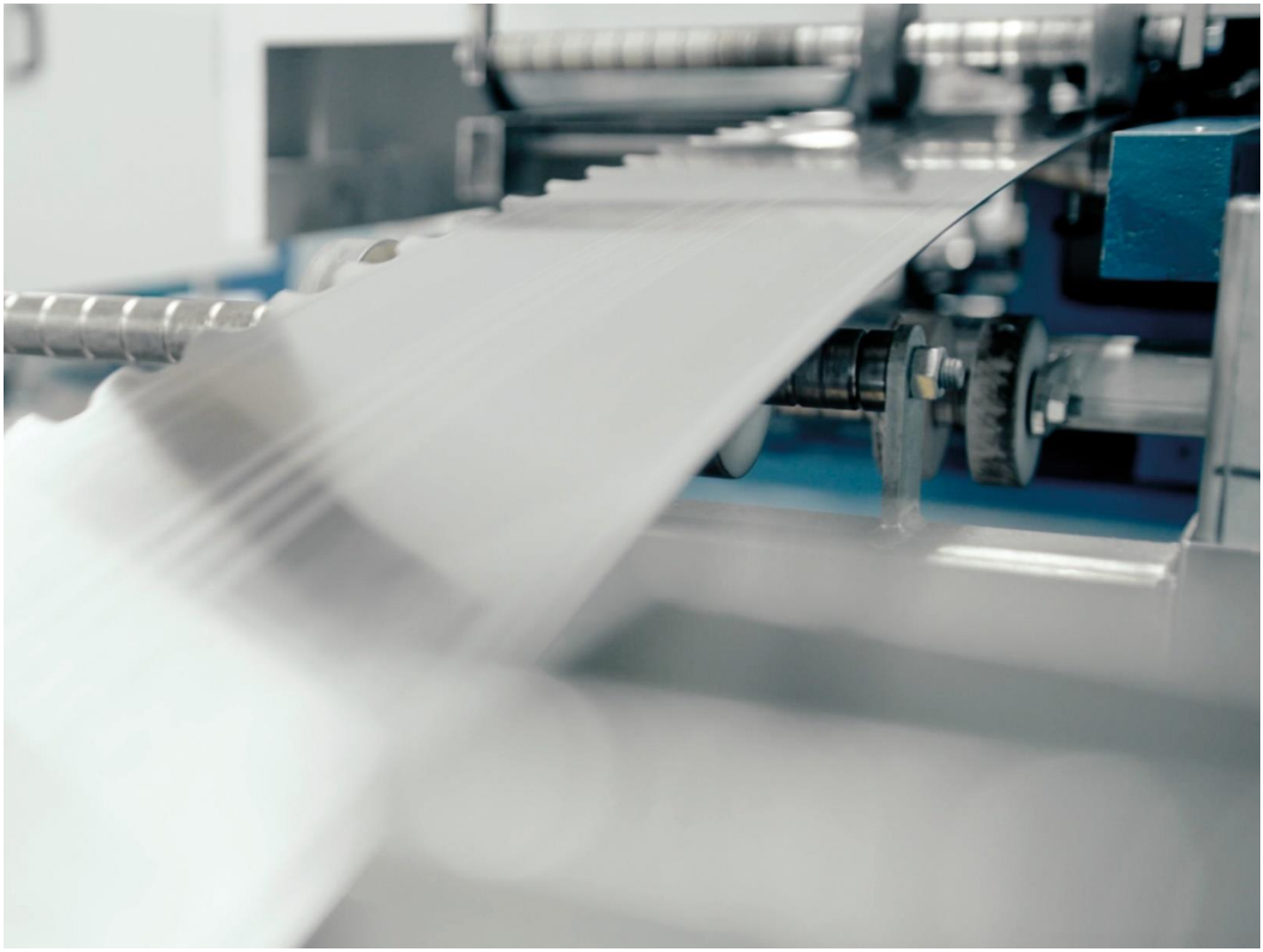
Executive summary

This LCA is commissioned by Micor Tooling, covering the product Langshyttan Greencut Bandsaw Blades. The LCA is done with the purpose of publishing a corresponding EPD with the International EPD® System. The EPD is an EPD of multiple products, based on a representative product, and follows the standards EN15804+A2:2019 and PCR 2019:14 v. 1.3.4, in addition to ISO 14040, ISO 14044, ISO 14025 and the general programme instructions for the International EPD® System.

The LCA presents the results of the steel bandsaw blades with the new steel production method the supplier has implemented, as well as a scenario analysis for the previous method the steel supplier used for steel production in order to compare the two.

The LCA shows that Micor Tooling can primarily influence their environmental impact by the choice of suppliers for their steel and their Stellite material, accounting for a combined 77% of the total GWP-GHG impact (including transport from supplier to facility). Choosing suppliers that both produce less harmful steel and are within relatively close proximity to Micor Tooling provides the most potential for environmental impact reduction. The LDPE used for protection of the bandsaw blades in packaging also results in a smaller but noticeable GWP-GHG impact, amounting to approximately 9% of the total impact.

Since A1-A2 has the highest impact in almost all LCIA categories, and steel is the primary material used, the input data for steel is a critical input for the LCA and needs to be evaluated with care. Therefore, Micor Tooling must check so that the declaration of GHG emissions are not out of date, and if any changes are made that the impacts are reviewed to see if it would lead to any significant changes to this LCA and EPD.



General Information

Programme Information

Programme Operator:	EPD International AB
Adress Programme Operator:	EPD International AB Box 210 60 SE-100 31, Stockholm Sweden
Website:	www.environdec.com
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Accountabilities for PCR, LCA and independent, third-party verification
Product Category Rules (PCR)
CEN standard EN 15804 serves as the Core Product Category Rules (PCR)
Product Category Rules (PCR): PCR 2019:14, Construction Products, version 1.3.4 UN CPC code: 44252 Parts and accessories for the goods of subclass 44221; parts and accessories of machine tools for working wood, bone, hard plastics, and the like.
PCR review was conducted by: The Technical Committee of the International EPD® System. See www.environdec.com/TC for a list of members. Most recent review chair: Claudia A. Peña, PINDA LCT SpA.
Life Cycle Assessment (LCA)
LCA accountability: Alexander Munge, Certway AB
Third-party verification
Independent third-party verification of the declaration and data, according to ISO 14025:2006, via EPD verification by individual verifier Third-party verifier: Claudia A. Peña, Director at PINDA LCT SpA. Approved by: EPD International AB
Procedure for follow-up of data during EPD validity involves third party verifier: ☐ Yes ☒ No

The EPD owner has the sole ownership, liability, and responsibility for the EPD.

Information on the use of the EPD

EPDs within the same product category but registered in different EPD programmes, or not compliant with EN 15804, may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see EN 15804 and ISO 14025.

Results of modules A1-A3 should not be used without considering the results of module C.

The use of the EPD is restricted to the steel bandsaw blade representative product and product variations defined in the Product Information chapter of this EPD. Contact Micor Tooling AB directly for information if this EPD is valid for a specific purchase.

Contact Information

Owner of the EPD

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Description of the Organisation

Micor Tooling is part of the LSAB Group in Sweden. Tooling offers a complete range of saw blades, bandsaw blades, planning tools, moulders, and PCD tools. At our three manufacturing sites in Sweden, as well as in Finland, we produce our world-leading brands, Micor, Langshyttan, BBM, and LTT, which are sold to over 40 countries worldwide. Building on our combined know-how of more than 150 years, we know what is required. Thanks to Micor Tooling's multiple production sites, we can ensure short lead times and flexibility when service counts.

Management system certification

Micor ABs Management System has been assessed and approved to the provisions of ISO 9001:2015 and ISO 14001:2015, issued by Scandinavian Business Certification AB.

Name and Location of Production Site

Micor Tooling Production Plant

Svinöhed 415, Långshyttan

Sweden

This EPD only refers to the Micor Tooling production plant in Långshyttan as that is the only production site that manufactures Langshyttan Greencut Bandsaw Blades.

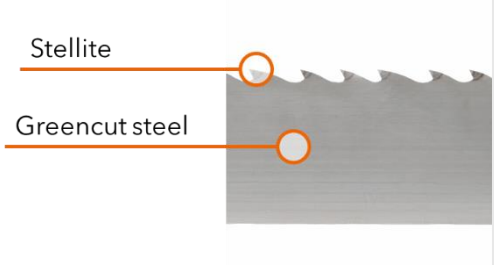
Product Information

Product Name

Langshyttan Premium Greencut Bandsaw Blades

Product Description

The studied product is the Langshyttan Premium Green Cut Bandsaw Blade made from steel and Stellite. Micor Tooling purchases steel and Stellite from their suppliers that are transported to Micor Toolings production facility in Långshyttan, Sweden. At the production facility, the steel is shaped to the required dimensions and form before Stellite is applied to the teeth of the saw blades. After the product is grinded to the final dimensions, the bandsaw blades undergo a quality inspection before being packaged and sent to end customer for use in their sawmills.



The product is used at sawmills for cutting lumber, primarily in the Nordic regions, where the bandsaw blade is attached to an upper and lower wheel in the sawmill machine.

The UN CPC classification for the product is 44252 Parts and accessories for the goods of subclass 44221; parts and accessories of machine tools for working wood, bone, hard plastics, and the like.

The product is sold to end customer in a variety of different dimensions, where the covered dimensions of the product are defined in the table below. The LCA and EPD covers the baseline product, with conversion factors included in chapter 5.11 in the LCA to calculate an approximate impact for the other product dimensions mentioned below.

Table 1: Overview of product dimensions covered in this EPD

Product	Length [mm]	Width [mm]	Thickness [mm]	Pitch [Teeth per inch]
Langshyttan Premium Green Cut Steel Bandsaw Blades	9 810	180	1.47	45
	9 840	180	1.47	40
	9 850	180	1.47	50
	9 855 (baseline)	**180**	**1.47**	**45**
	9 900	181	1.47	45
	10 035	180	1.47	45
	10 100	180	1.47	50
	10 170	180	1.47	45
	11 430	180	1.47	45

The declared lifecycle stages are according to a type b) EPD in PCR 2019:14 v. 1.3.4. (Cradle-to-gate with options A1-A3, A4, C1-C4 and D), where all activities within the modules take place in Europe (from suppliers and end-of-life depending on customer location) and Sweden (production of product).

The EPD is declared as an EPD of multiple products based on a representative product, covering the product variations described in the table above, in accordance with chapter 2.2.2.1 from PCR 2019:14 v. 1.3.4 (The International EPD Programme, 2024). The product is not considered an identical product as the end product is sold to customers in various sizes. The representative product was chosen based on the production volume of the product group, representing a significant majority compared to the other variations listed above.

The results are based on the Greentec Steel Edition 600 from the supplier which is being used to produce the Langshyttan Greencut Bandsaw Blades. The previous steel that was used, Cold-rolled steel strips from the previous supplier, is reviewed in a scenario analysis and presented as additional environmental information in accordance to chapter 7.2.3 in ISO 14025:2010 (International Organization for Standardization [ISO], 2006a).

Since the volumes and the internal activities at Micor Tooling will not differentiate between the previous input steel and the new input steel, and the properties of the steel types are almost identical, this method is deemed as appropriate. However, the input data for environmental impact is different between the two as the Langshyttan Greencut Bandsaw Blades are based on the GWP-GHG impact from the GWP-GHG declaration of the steel supplier, and complemented with generic datasets, whereas the input data for environmental impacts for the previous steel used is based on an A2 EPD from the same supplier but for the previous steel. This is considered acceptable as the two products, Langshyttan Greencut Bandsaw Blades and the product Langshyttan Bandsaw Blades are identical with the exception of the method of steel production from their supplier.

The steel types (Greencut and the previous steel) are almost identical in their technical properties, where the chemical composition (defined in the sub-chapter of content declaration) is identical and the mechanical properties are compared in a table below. The tests for the properties presented below are in accordance with EN 10204-3.1.

Table 2: Overview of mechanical properties between the Greencut steel and the previous steel used for bandsaw blades

Material	Supplier	Yield strength (Rp0,2), mPa	Tensile strength (Rm), mPa	Hardness
Greentec Steel Edition 600	Supplier A	1 502	1 641	49 HRC
		1 552	1 695	50 HRC
Previous steel	Supplier A	1 486	1 635	49 HRC
		1 540	1 680	50 HRC

Geographical Scope

Primarily European coverage. The input material is purchased from suppliers in Austria and Sweden, whereas the use phase and end-of-life treatment is assumed to be in Sweden.

LCA Information

Declared unit

The declared unit is one unit steel bandsaw blade. For product dimension, see table 1 in product description. The conversion factor to mass per declared unit is 20.81 kg, which represents the weight of one unit of the baseline steel bandsaw blade.

Reference Service Life

RSL is not applicable as the system boundary for this LCA is cradle-to-gate with modules C1-C4 and D.

Time Representativeness

Specific data collected for production taking place in 2023 (Jan-Dec). The generic data used from ecoinvent 3.10 are all still valid and have less than 6 years difference from the last update of the dataset to the publication of this EPD.

Database(s) and LCA Software Used

The LCA software used for modelling was SimaPro version 9.6.0.1 with ecoinvent 3.10 as a complementary database in addition to direct input from the steel supplier EPD.

Description of System Boundaries

EPD type b) Cradle to gate with options, modules C1-C4, module D and with optional modules (A1-A3, A4, A5, C1-C4, and D). No activities or processes were left out in the modelling.

A1-A3 Cradle-to-gate

Production of steel and Stellite from suppliers, where the input data for the steel supplier is based on an existing EN15804+A2 EPD. The EPD used as input data includes production and handling of raw materials, energy use, auxiliary materials, transportation to production site, disposal, and handling of production scrap. The production of Stellite is based on the safety data sheet collected from the supplier, where concentration levels of each component was used for modelling purposes. The range of concentration values are presented in the Content Information chapter of this EPD.

Since the GWP-GHG impacts allocated to pre-consumer scrap (in this case solely based on the EPD input data) does not exceed 10% of total GWP-GHG impacts, the GWP-GHG of the pre-consumer scrap does not need to be declared in this LCA nor EPD in accordance to chapter 4.5.5. of PCR 2019:14 v.1.3.4.

Transportation from supplier to Micor Tooling's facility is covered in module A2, according to the following table:

Table 3: Material transport distances

Material	Distance (km)	Type of transport	Comment
Cold-rolled steel strip	1 859	Truck	From Austria to production facility
Stellite	80	Truck	80 km by truck when arriving in Sweden, to production facility

In module A3, the electricity consumption, consumables, packaging materials, waste from manufacturing, and waste from packaging materials were included. The electricity consumption was modelled based on the grid mix confirmed through a certificate from the electricity supplier (as they have annulled the guarantee of origins documents). The modelling was based on the dataset representing the residual grid mix for Sweden during 2022, adjusted to match the grid mix declared by the supplier. The GWP-GHG impact of the modelled residual mix is 0.03 kg CO_2-eq/kWh.

A4 Transportation

The transportation distance to end customer was based on a weighted average to end customers during the full year 2023. The weighted average was calculated and a distance of 497 km was obtained. The transportation distance was represented by truck as it represents to most frequent transportation and is also considered a conservative approach as the emissions per kgkm is higher for truck than transporting by shipping (as some transports were done by shipping).

A5 Installation

As there is no activities required for the actual installation of the product (it is manually connected to the sawmill), the only activities included in module A5 is the waste treatment of the product packaging material. See table below for material amount that is recycled, landfilled or incinerated.

Table 4: Activities for product packaging waste treatment

Material	Treatment type	Share, %
Mixed plastics	Material Recycling	53.2%
	Landfilled	0.7%
	Incinerated (without energy recovery)	46.1%
Corrugated paper box	Material recycling	75%
	Landfilled	0.4%
	Incinerated (without energy recovery)	24.6%
EU-Pallet	Material recycling	75%
	Landfilled	0.4%
	Incinerated (without energy recovery)	24.6%

C1 Demolition/deconstruction

No activities are identified in module C1, as the products are expected to be manually demounted from machinery based on sawmill machine examples that are used by Micor Toolings customers. There may be some differences depending on the sawmill machine the bandsaw blade is attached to, but the process of removing a bandsaw blade remains similar.

C2 Transport to Waste Processing

The transportation distance to waste processing is estimated to be approximately 50 km to waste facility in Sweden, which is the same distance as transportation of Stellite and Steel waste generated in manufacturing to waste facility, however, this distance is dependent on customer location and where they dispose of the product at end-of-life.

C3 Waste pre-processing

The materials are assumed to go through a crushing and sorting process according to values in the table below. All datasets presented below are based on the database ecoinvent 3.10. Since the end customer is in different locations, and the waste pre-processing is not handled by Micor Tooling, the waste pre-processing was modelled based on recycling rates based on a report by the European Environment Agency (European Environment Agency, 2023).

Table 5: Activities at the waste pre-processing plant and recycling rates

Material	Treatment type	Amount (kg/DU)
Steel	Sorting and pressing	21
Steel	Material recycling	18

The recycling rate of steel is assumed to be 85.8% based on a report on Sweden by the European Environment Agency (European Environment Agency, 2023). The Stellite is assumed to be sorted in the sorting and pressing step, where only the steel is recycled in the material recycling step. The processing of steel in Sweden, where it is first processed and recycled, before the remaining amounts being landfilled, is in accordance with the Swedish iron and steel producers association (Jernkontoret, 2024).

C4 Final disposal

After the recycling streams are separated, the remaining metals are assumed to go to landfill in accordance with the description provided by the Jernkontoret, the Swedish iron and steel producers association (Jernkontoret, 2024).

Table 6: LCI for product waste treatment

Material	Waste type	Amount (kg/DU)
Steel	Inert waste	3

D Benefits and Loads Beyond the Product System

The D module is calculated with a formula originally proposed in EN 15804 and adjusted with a factor for material yield (Y) in PCR:2019:14 v. 1.3.4. The scenario modelled for module D is the benefits from the recycling waste streams. Each waste stream recycled is credited with the avoided production of the raw material they would be displacing in the technosphere if recycled.

Formula for calculating net benefits and loads for export of secondary materials (recycling of materials):

$$e_1 = \Sigma(Y \bullet M_{MR,out} - Y \bullet M_{MR,in}) \bullet (E_{MR\ after\ EoW\ out} - E_{VM\ Sub\ out} \bullet \frac{Q_{R,out}}{Q_{Sub}}) \quad \text{(Eq.1)}$$

No benefits or loads from export of energy.

$M_{MR,In}$ was calculated by taking the R2 value of 0.85 for post-consumer steel within Europe in accordance with the PEF guidance document, annex C version 2.1, May 2020 (European Commission, 2020) as stated in the construction PCR (The International EPD Programme, 2024). This value was used as there is no c-PCR at the time of writing this LCA and EPD that has a specific value for R2.

System Diagram

The system boundary of the EPD is a cradle-to-gate with options, meaning that modules A1-A5, C, and D are declared, exempting modules B1-B7 from the model. Module A1 is represented by the production of steel and Stellite from the respective suppliers, which are then transported to Micor Tooling's facility in Långshyttan (module A2). Module A3 represents the manufacturing of the product, where the steel undergoes several processes after being retrieved from Micor Tooling's warehouse, initially punched, then welded and grinded to the right specifications and toothform, before applying Stellite. The bandsaw blade is further processed by additional grinding before undergoing quality control. After approval from quality control, the bandsaw blade is packaged before being sent to end customer for installation. The use phase (Modules B1-B7) are not declared in this EPD.

Module C1-C4 includes the deconstruction of the steel product, transport to waste processing, waste processing and eventually final disposal of material that is not recycled. See the figure below for an overview of included and excluded modules.

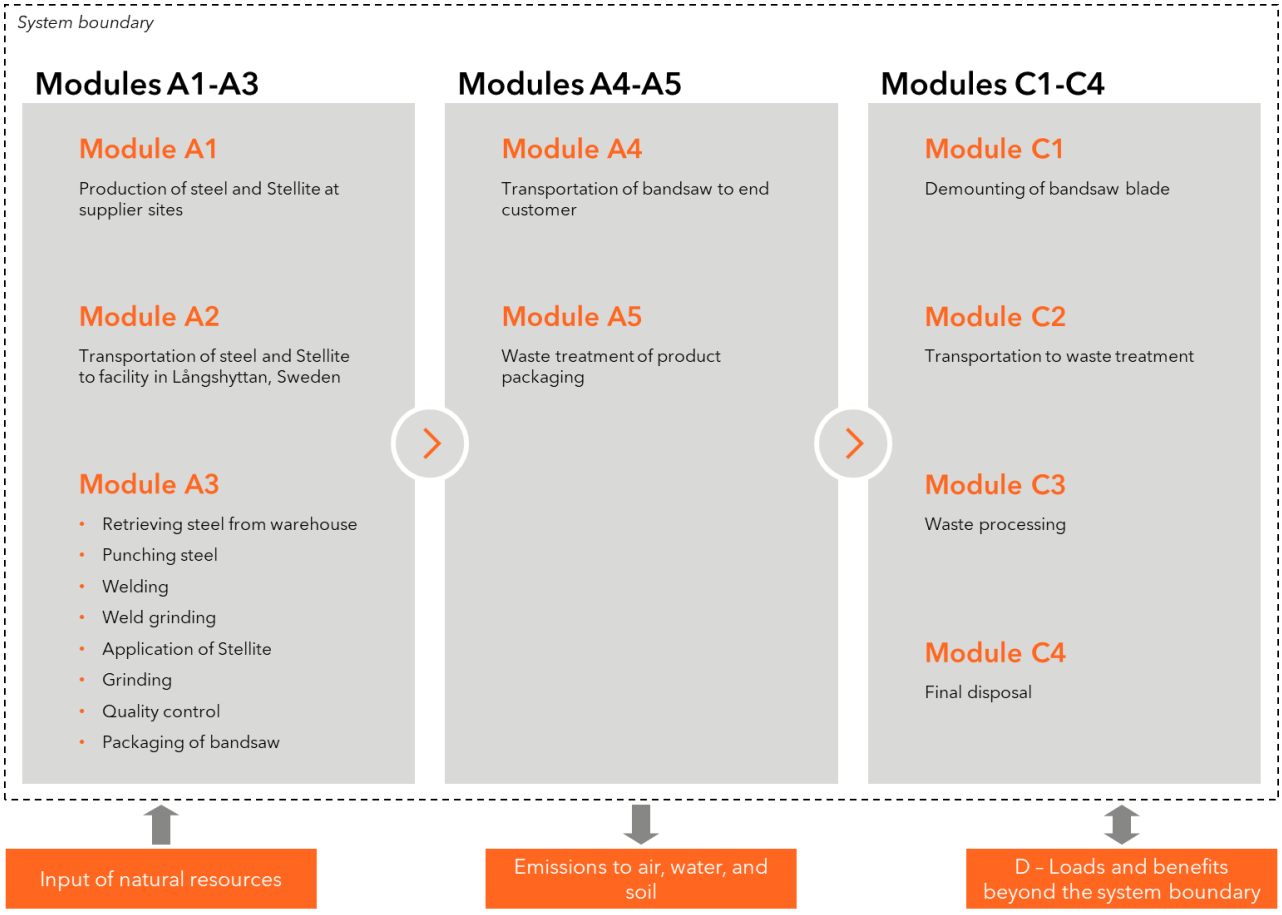


Figure 1: Included modules in the system boundary and exchange to nature

The system boundary to nature is set to include those processes that provide the material and energy inputs into the system and the following manufacturing, and transport processes up to the factory gate as well as the processing of any waste arising from those processes.

All infrastructure/capital goods are included as a standard through the datasets used in ecoinvent for all generic data. Data used from the input EPD cover infrastructure/capital goods in modules A1-A3 and is therefore included by extension in this EPD.

Assumptions

This chapter deals with general assumptions that are used throughout the LCA study. For assumptions relating to specific unit processes, see the LCA information chapter.

- Transports not under Micor Toolings control are assumed to be performed by Euro 6 class vehicles.

Cut-off criteria

The cut-off criteria are in accordance with PCR 2019:14 v. 1.3.4 (The International EPD Programme, 2024), therefore a maximum of 1% of the renewable and non-renewable primary energy use and max 1% of the total mass input of a specific unit are excluded. For a full module, the combined cut-off of all unit processes do not exceed 5%. Particular care should be taken to include materials or processes that have the potential to cause significant emissions into air, water, or soil for any of the declared LCIA categories. Not cut-offs were implemented in this LCA except for the cut-off defined in the EN15804+A2:2019 EPD used as input, as they are indirectly included by extension in this LCA.

Allocation

In the EPD from the steel supplier, an allocation procedure was described. Since the EPD was used for modelling, the allocation procedure described in the EPD is subsequently included in the modelling.

All A3 flows existing for Micor Tooling (electricity use, packaging material, consumables, and waste generated from manufacturing) were allocated based on the mass of the products. All products are simple steel products and have similar economic value, which permits the application mass allocation in accordance with PCR 2019:14 v. 1.3.4 (The International EPD Programme, 2024).

Modules Declared, Geographical Scope, Share of Specific Data (in GWP-GHG Indicator) and Data Variation

Table 7: Declared modules for the life cycle

	Product stage			Construction process stage		Use Stage							End of life stage				Resource recovery stage
	Raw Material Supply	Transport to manufacturing	Manufacturing	Transport to customer	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction / Demolition	Transport to waste management	Waste processing	Final Disposal	Reuse – Recovery – Recycling - potential
Module	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Modules Declared	X	X	X	X	X	ND	ND	ND	ND	ND	ND	ND	X	X	X	X	X
Geography	EU 27	EU 27	SE	SE	SE	ND	ND	ND	ND	ND	ND	ND	SE	SE	SE	SE	SE
Specific data used	30%																
Variation - Products	-3%/+12%																
Variation - Sites	0%																

X = Module declared
ND = Module not declared

Share of specific data used was calculated by taking the total GWP-GHG impact from the GWP-GHG declaration used in A1, transport in module A2, as well as impacts from Micor Tooling's core processes, in accordance with PCR 2019:14 v. 1.3.4 (The International EPD Programme, 2024). The product variation was calculated by taking the lowest GWP-GHG value and the highest GWP-GHG value and comparing it to the baseline product. The product is produced at one site and therefore the variation in sites is 0%.

Description of Production Activities

This chapter describes the production of Langshyttan Premium Greencut Bandsaw Blades in further detail than described in the flowchart above (figure 1). All modules declared are represented by one or several datasets, with the exception of module C1 as demounting the bandsaw blade from customer machinery is assumed to be done manually.

The end-of-waste (EoW) criteria are applied as described in Annex B of EN 15804+A2:2019. No burdens are declared for material that has reached the EoW point for flows exiting the system boundaries for Micor Tooling. As these flows are part of A1-A3, they must be dealt with through allocation, unless it can be avoided. However, since it is unknown where the steel scrap eventually ends up, the process is assumed to be cut-off and not have any allocated emissions as all emissions are allocated to the final product.

The production of the bandsaw blades start with purchasing cold-rolled steel strips from a supplier in Austria and Stellite from a supplier in Sweden (which is originally shipped from England to supplier, and then from supplier to Micor Tooling). The steel undergoes several processes after being retrieved from Micor Tooling's warehouse, initially punched, then welded and grinded to the right specifications and toothform, before applying Stellite to the teeth. The bandsaw blade is further processed by additional grinding before undergoing quality control. After approval from quality control, the bandsaw blade is packaged before being sent to end customer for installation.

The use phase is not included in the scope of this study. The end-of-life phase is modelled using relevant scenarios combined with generic datasets representative of the regions, in this case Sweden.

Content Information

Below is an overview of the purchased materials that end up in the final product, presented as amount per declared unit (of one unit steel bandsaw blade), including variations from the lowest value and the highest value of input material based on the products covered in this EPD. The content declaration represents the representative product, defined as baseline in table 1.

Table 8: Overview of material content in product, pre- and post-consumer scrap, and biogenic content in material

Product components	Weight, kg/DU	Post-consumer material, weight-%	Pre-consumer material, weight-%	Biogenic material, weight-%	Biogenic material, kg C/DU
Cold-rolled steel strip (Baseline - Greentec Steel Edition 600)	20.58 Range: -0.5%/+16%	0.2%	24.8%	0%	0
Mälarit (Stellite)	0.23 Range: -11%/+11%	N/A	N/A	0	0
Cold-rolled steel strip (baseline – previous steel)	*20.58* *Range: -0.5%/+16%*	*0%*	*13.5%*	*0%*	*0*

The supplier reports a 25% recycled steel content, of which 99% is pre-consumer and 1% is post-consumer. The EPD from the steel supplier, used for the scenario analysis, does not differentiate between pre- and post-consumer, therefore the recycled steel used in the production of steel described in the EPD is assumed to be pre-consumer steel. Therefore, the pre-consumer steel is 13.5%, whereas the remaining 86.5% is primary steel.

The chemical composition of the steel and the Stellite from each supplier is presented in the table below. The values are obtained from the EN 15804:2012+A2:2019 EPD from the steel supplier and the safety data sheet of the Stellite product from the Stellite supplier.

Table 9: Chemical composition of steel and Stellite used as input for the product

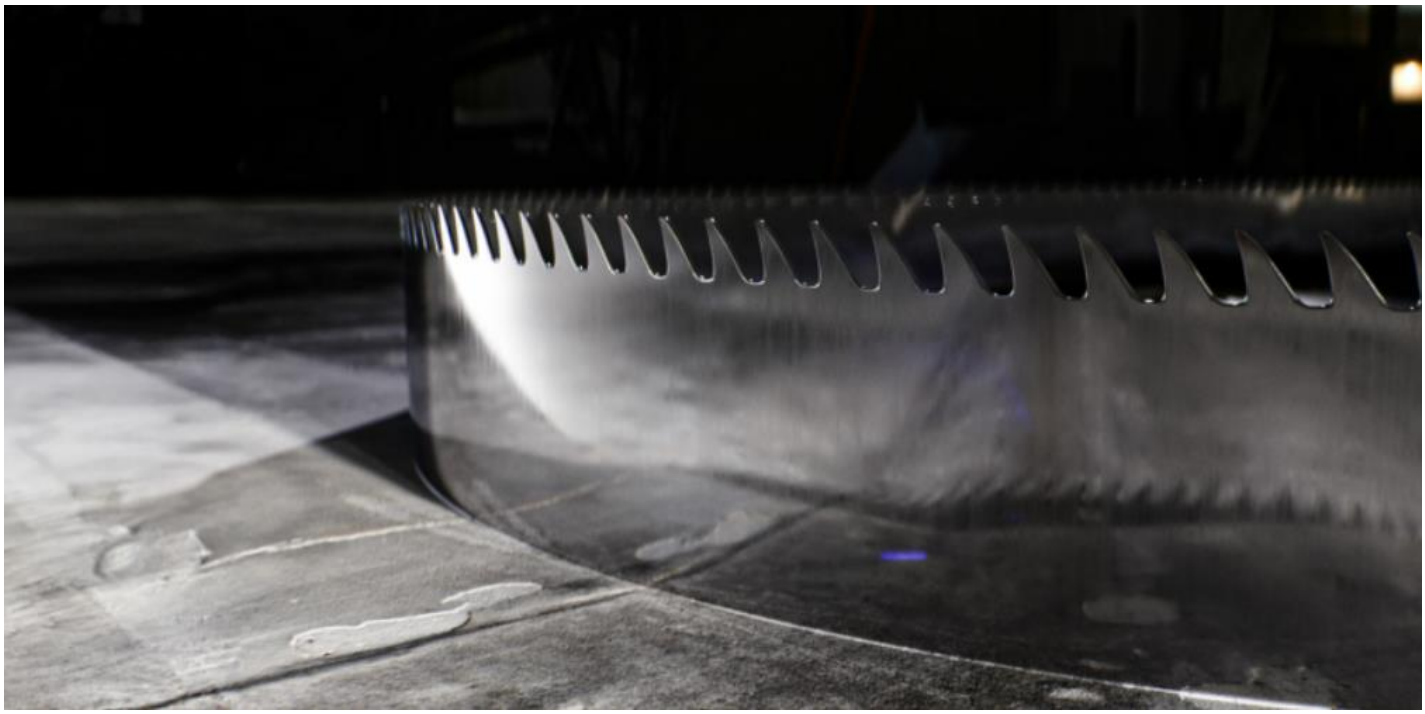
Material	Chemical input	Share of composition
Cold-rolled steel strip	Iron, Fe	96.699%
	Carbon, C	0.750%
	Silicon, Si	0.170%
	Manganese, Mn	0.430%
	Phosphorus, P	0.009%
	Sulfur, S	0.002%
	Chromium, Cr	0.120%
	Nickel, Ni	1.820%
Stellite	Cobalt, Co	50-99%
	Chromium, Cr	20-49%
	Tungsten, W	5-9%
	Iron, Fe	1-<5%
	Nickel, Ni	1-<5%
	Carbon, C	1-<5%
	Silicon, Si	1-<5%
	Manganese, Mn	0.1-<1%
	Molybdenum, Mo	0.1-<1%

Below is a description of the packaging materials used, as well as the consumables during manufacturing. The amount of packaging materials and consumables used during manufacturing is very similar for all product variations covered in this EPD, where there is only a marginally small difference. Therefore, it is assumed that the amount of packaging materials and consumables is equivalent to each product variation and no range is included.

Table 10: Overview of packaging materials and consumables used

Packaging material	Weight, kg/DU	Weight-% of product	Biogenic material, kg C/DU	Biogenic material, weight-%
Grinding discs (consumable during production)	0.07	<1%	0	0%
Emulsion (consumable during production)	0.03 litres	<1%	0	0%
Plastic protection (for packaging of end product)	1.00	5%	0	0%
Corrugated paper (for packaging of end product)	0.19	<1%	0.09	<1%
Pallet (for transportation of end product)	0.02 pieces	<1%	0.16	<1%

No Substances of Very High Concern (SVHC) in accordance with the Candidate List of SVHC from the European Chemicals Agency that constitutes more than 0.1% of the weight of the product is included in the steel bandsaw blades.



Results of Performance Indicators

When analyzing the results, the impacts from all modules should be considered. The estimated impact results provide an indication, but should be seen as relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks.

The results of the impact categories abiotic depletion of minerals and metals, land use, human toxicity (cancer), human toxicity (non-cancer), and ecotoxicity (freshwater) may be highly uncertain in LCAs that include capital goods/infrastructure in generic datasets in case infrastructure/capital goods contribute greatly to the total results. This is due to the LCI data of infrastructure/capital goods used to quantify these indicators in currently available generic datasets sometimes lack temporal, technological, and geographical representativeness. Caution should be exercised when using the results of these indicators for decision-making processes.

All results shown are per declared unit of one unit steel bandsaw blade, and represent the representative product of the product group. All referenced emission factors are based on the environmental footprint package 3.1 (E.F. 3.1.).

The impact category indicators are presented according to EN 15804:2012+A2:2019/AC:2021. The included impact category indicators are presented in the tables below.

Mandatory indicators in EN 15804

The LCIA methodology is chosen in accordance with EN 15804:2012+A2:2019/AC:2021. Characterization factors according to EF 3.1 are selected. The mandatory impact categories are presented below:

Table 11: Mandatory impact categories in EN 15804

Impact Category	Indicator	Unit	Model	Disclaimer
Climate Change - Fossil	Global Warming Potential fossil (GWP-fossil)	Kg CO_2 eq. (Carbon dioxide equivalents)	Baseline model of 100 years of the IPCC based on IPCC 2021	None
Climate Change - Biogenic	Global Warming Potential biogenic (GWP-biogenic)	Kg CO_2 eq. (Carbon dioxide equivalents)	Baseline model of 100 years of the IPCC based on IPCC 2021	None
Climate Change – Land Use and Land Use Change (LULUC)	Global Warming Potential Land use and land use change (GWP-LULUC)	Kg CO_2 eq. (Carbon dioxide equivalents)	Baseline model of 100 years of the IPCC based on IPCC 2021	None
Climate Change - Total	Global Warming Potential total (GWP-total)	Kg CO_2 eq. (Carbon dioxide equivalents)	Baseline model of 100 years of the IPCC based on IPCC 2021	None
Ozone Depletion	Depletion potential of the stratospheric ozone layer (ODP)	Kg CFC 11 eq. (Trichlorofluoromethane equivalents)	Steady-state ODPs, WMO 2014.	None
Acidification	Acidification potential, Accumulated Exceedance (AP)	Mol H+ eq. (Hydrogen ions equivalents)	Accumulated Exceedance, Seppälä et al. 2006, Posch et al., 2008.	None
Eutrophication aquatic freshwater	Eutrophication potential, fraction of nutrients reaching freshwater end compartment (EP-freshwater)	Kg P eq. (Phosphorous equivalents)	EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe.	None
Eutrophication aquatic marine	Eutrophication potential, fraction of nutrients reaching freshwater end compartment (EP-marine)	Kg N eq. (Nitrogen equivalents)	EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe.	None
Eutrophication terrestrial	Eutrophication potential, Accumulated Exceedance (EP-Terrestrial)	Mol N eq. (Nitrogen equivalents)	Accumulated Exceedance, Seppälä et al. 2006, Posch et al.	None
Photochemical ozone formation	Formation potential of tropospheric ozone (POCP)	Kg NMVOC eq. (Non-methane volatile organic compounds equivalents)	LOTOS-EUROS, Van Zelm et al., as applied in ReCiPe.	None

Depletion of abiotic resources – Minerals and metals	Abiotic depletion potential for non-fossil resources (ADP-minerals & metals)	Kg sb eq. (Antimony equivalents)	CML 2002, Guinée et al., 2002, and van Ooers et al. 2002	1
Depletion of abiotic resources – Fossil fuels	Abiotic depletion potential for fossil resources (ADP-fossil)	MJ, net calorific value (Megajoules)	CML 2002, Guinée et al., 2002, and van Ooers et al. 2002	1
Water deprivation potential	Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	m^3 world eq. Deprived	Available Water Remaining (AWARE) Boulay et al., 2016.	1

Optional indicators in EN 15804

Following are additional indicators that are mandatory to present in the LCA report and optional in an EPD report according to PCR2019:14.

Table 12: Optional impact categories in EN 15804

Impact Category	Indicator	Unit	Model	Disclaimer
Particulate matter emissions	Potential incidence of disease due to PM emissions (PM)	Disease incidence	SETAP-UNEP, Fantke et al 2016	None
Ionising radiation, human health	Potential Human exposure efficiency relative to U235 (IRP)	kBq U235 eq. (kiloBecquerel equivalents)	Human health effect model as developed by Dreicer et al. 1995 update by Freischknecht et al., 2000	2
Ecotoxicity (freshwater)	Potential comparative Toxic Units for ecosystems (ETP-fw)	CTUe (Comparative Toxic Units ecosystems)	UseTox version 2 until the modified USEtox model is available from EC-JRC	1
Human toxicity, cancer effects	Potential comparative Toxic Units for humans (HTP-c)	CTUh (Comparative Toxic Units humans)	UseTox version 2 until the modified USEtox model is available from EC-JRC	1
Human toxicity, non-cancer effects	Potential comparative Toxic Units for humans (HTP-nc)	CTUh (Comparative Toxic Units humans)	UseTox version 2 until the modified USEtox model is available from EC-JRC	1
Land use related impacts/soil quality	Potential Soil Quality index (SQP)	Dimensionless	Soil quality index based on LANCA.	1

Disclaimer 1: The results of this environmental impact indicator shall be used with care as the uncertainties of the results are high and as there is limited experience with the indicator.

Disclaimer 2: 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 disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

Required indicators in PCR 2019:14

The following indicators are mandatory indicators to report according to PCR 2019:14 states that GWP-GHG shall be reported as well.

Table 13: Required indicators in PCR 2019:14 v.1.3.4

Impact category	Unit	Model	Comment
Climate Change – GHG	Kg CO_2 eq. (Carbon dioxide equivalents)	Baseline model of 100 years of the IPCC based on IPCC 2021	This impact category is identical to GWP-total except for biogenic CO_2 having a CF = 0.[1]

[1] Details can be seen in PCR 2019:14 v 1.3.4 Annex 1

Indicators describing resource use, waste & biogenic content in EN 15804

The following indicators are mandatory indicators in EN15804 that describe waste & resource use.

Use of resources

Table 14: Results for use of resources according to EN 15804

Parameter	Unit
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	kWh
Use of renewable primary energy resources used as raw materials	kWh
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	kWh
Use of non-renewable primary energy excluding non- renewable primary energy resources used as raw materials	kWh
Use of non-renewable primary energy resources used as raw materials	kWh
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	kWh
Use of secondary material	kg
Use of renewable secondary fuels	kWh
Use of non-renewable secondary fuels	kWh
Net use of fresh water	m3

Waste production and output flows

Table 15: Results for Waste production according to EN 15804

Waste production	Unit
Hazardous Waste Disposed	Kg
Non-Hazardous Waste Disposed	Kg
Radioactive Waste Disposed	Kg

Table 16: Results for Output flows according to EN 15804

Output Flows	Unit
Components for reuse	kg
Material for recycling	kg
Materials for energy recovery	kg
Exported energy, electricity	MJ
Exported energy, thermal	MJ

Information on biogenic content

Table 17: Requirements for reporting Biogenic content in product and product packaging

Biogenic carbon content	Unit
Biogenic carbon content in product	Kg C
Biogenic carbon content in accompanying packaging	Kg C
NOTE: 1 kg biogenic carbon is equivalent to 44/12 kg of CO_2.	

Mandatory LCIA indicators results

Table 18: Mandatory impact category results for baseline product, presented per declared unit

Indicator	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP - Fossil	kg CO2 eq	3.91E+01	1.96E+00	5.13E-01	0.00E+00	1.98E-01	5.44E-01	2.39E-01	-6.20E+00
GWP - Biogenic	kg CO2 eq	1.51E-01	3.22E-04	7.83E-03	0.00E+00	3.25E-05	9.92E-04	1.32E+00	2.74E-02
GWP - Land use and LU change	kg CO2 eq	1.54E-01	6.52E-04	8.34E-05	0.00E+00	6.56E-05	7.68E-04	4.64E-05	8.66E-03
GWP - total	kg CO2 eq	3.94E+01	1.96E+00	5.21E-01	0.00E+00	1.98E-01	5.45E-01	1.56E+00	-6.17E+00
Ozone depletion	kg CFC11 eq	4.65E-07	3.90E-08	5.07E-10	0.00E+00	3.93E-09	7.47E-09	7.34E-09	5.45E-08
Acidification	mol H+ eq	1.35E-01	4.09E-03	3.15E-04	0.00E+00	4.12E-04	5.98E-03	1.46E-03	6.12E-03
Eutrophication, freshwater	kg P eq	1.88E-03	1.53E-05	8.57E-07	0.00E+00	1.54E-06	2.38E-05	5.22E-06	1.86E-03
Eutrophication, marine	kg N eq	2.00E-02	9.57E-04	1.53E-04	0.00E+00	9.64E-05	1.36E-03	1.21E-03	3.88E-03
Eutrophication, terrestrial	mol N eq	2.50E-01	1.06E-02	1.45E-03	0.00E+00	1.07E-03	1.56E-02	6.60E-03	-1.45E-02
Photochemical ozone formation	kg NMVOC eq	9.06E-02	6.79E-03	3.80E-04	0.00E+00	6.84E-04	4.67E-03	3.01E-03	-2.90E-03
Resource use, minerals, and metals	kg Sb eq	1.95E-03	6.39E-06	7.70E-08	0.00E+00	6.43E-07	3.35E-05	4.81E-07	6.02E-05
Resource use, fossils	MJ	1.03E+02	2.30E+00	8.15E-02	0.00E+00	2.31E-01	2.35E+00	3.47E-01	-7.73E+01
Water use	m3 depriv.	6.63E+01	1.15E-01	3.66E-02	0.00E+00	1.15E-02	9.10E-02	2.30E-02	6.80E+00

Module D presents negative values for GWP-total, which indicates a potential benefit of recycling the steel material in the product as opposed to producing primary steel, considering the GWP-total indicator.

For all indicators, the variation between the products do not exceed 10% except for GWP-Fossil (-3%/+12%), GWP-Biogenic (-1%/+13%), GWP-total (-3%/+12%), and resource use, fossils (-23%/+7%). Despite the impact variations exceeding 10%, the results are within close proximity of the 10% range and is considered to be an acceptable deviation, especially considering the other impacts are within the 10% range.

Additional LCIA Indicators

This chapter presents all indicators that are mandatory to present in the LCA report but optional to present in the EPD according to EN15804+A2.

Table 19: Additional impact category results for baseline product, presented per declared unit

Impact category	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
Particulate matter	disease inc.	1.82E-06	1.44E-07	3.06E-09	0.00E+00	1.45E-08	8.30E-08	3.53E-08	-2.43E-07
Ionising radiation	kBq U-235 eq	2.16E+00	1.27E-02	2.04E-04	0.00E+00	1.28E-03	1.81E-02	2.90E-03	3.08E-01
Ecotoxicity, freshwater	CTUe	2.17E+02	7.51E+00	2.20E+00	0.00E+00	7.57E-01	5.28E+00	3.32E+00	-6.04E+02
Human toxicity, cancer	CTUh	1.42E-07	1.39E-08	6.02E-10	0.00E+00	1.40E-09	4.71E-09	1.34E-09	-2.18E-06
Human toxicity, non-cancer	CTUh	5.49E-07	1.73E-08	5.87E-09	0.00E+00	1.75E-09	2.91E-08	5.03E-09	1.37E-06
Land use	Pt	2.37E+02	1.67E+01	2.31E-01	0.00E+00	1.68E+00	1.31E+01	1.25E+01	6.48E+00

GWP-GHG according to IPCC 2021

Table 20: GWP-GHG results for baseline product, presented per declared unit

Impact category	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
Climate change - GHG	kg CO2 eq	3.93E+01	1.96E+00	5.21E-01	0.00E+00	1.98E-01	5.45E-01	1.56E+00	-6.17E+00

Use of resources

This chapter presents the use of material and energy resources by the product system. This chapter presents the use of material and energy resources by the product system. The results are based on option A in Annex 3, guidance to calculating the primary energy use indicators as described in PCR 2019:14 v. 1.3.4 (The International EPD Programme, 2024). As described in the PCR, in option A the energy use as raw materials is declared as input to the module where it enters the product system and as an equally large output from the product system where it exits the product system. Outputs in the form of waste is reported as an input in the indicator for energy used as energy carriers.

Table 21: Use of resources for baseline product, per declared unit

Impact category		Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
Primary Energy Resources - Renewable	Use as energy carrier	MJ	2.42E+02	4.74E-01	7.47E+00	0.00E+00	4.77E-02	1.19E+00	1.40E-01	1.09E+01
	Used as raw materials	MJ	7.46E+00	0.00E+00	-7.46E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Total	**MJ**	**2.50E+02**	**4.74E-01**	**1.11E-02**	**0.00E+00**	**4.77E-02**	**1.19E+00**	**1.40E-01**	**1.09E+01**
Primary Energy Resources - Non-Renewable	Use as energy carrier	MJ	1.08E+02	2.40E+00	8.61E-02	0.00E+00	2.41E-01	2.45E+00	3.59E-01	-8.13E+01
	Used as raw materials	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Total	**MJ**	**1.08E+02**	**2.40E+00**	**8.61E-02**	**0.00E+00**	**2.41E-01**	**2.45E+00**	**3.59E-01**	**-8.13E+01**
Other categories	Secondary Material	kg	5.25E+00	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	0.00E+00	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	0.00E+00	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	2.29E-01	4.15E-03	1.60E-03	0.00E+00	4.18E-04	2.74E-03	5.62E-04	7.54E-01

Waste production

This chapter presents all the waste that is generated in the product system. Since ecoinvent is used as the main database, the waste management is contained within the system boundaries and no waste generation is reported[2]. This means that the waste is 0 for all modules and all products except module A1.

Table 22: Waste generated exiting the system boundary for all products, presented per declared unit

Waste production	Unit	Baseline
Hazardous Waste Disposed	Kg	0.00E+00
Non-Hazardous Waste Disposed	Kg	0.00E+00
Radioactive Waste Disposed	Kg	0.00E+00

Output flows

This chapter presents flows that exit the system boundary that are not waste.

Table 23: Other flows exiting the system boundary for baseline product, presented per declared unit

Output flows	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
Components for reuse	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Material for recycling	kg	0.00E+00	0.00E+00	9.18E-01	0.00E+00	0.00E+00	1.80E+01	0.00E+00	0.00E+00
Materials for energy recovery	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy, electricity	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy, thermal	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

[2] A detailed description of this can be read at the bottom of this page: https://www.environdec.com/resources/indicators

Biogenic Carbon Content

This chapter presents the carbon content in the products and the packaging. The same value is applied to all product variations.

Table 24: Biogenic carbon content in the products and packaging, presented per declared unit

Material	Carbon content, in kg
Biogenic carbon content in product	0
Biogenic carbon content in accompanying packaging	2.54E-01

There is no biogenic carbon in the product, the biogenic carbon only exists in the wooden EU-Pallet and the corrugated paper box for packaging. The biogenic carbon was calculated by multiplying the weight of each material by the biogenic carbon content fraction of 49.4%, for dry weight (Phyllis2, n.d.).

Additional Environmental Information

Conversion factors for variations in product group

The table below presents conversion factors for the impact category GWP-GHG according to IPCC 2021 and E.F. 3.1, compared to the baseline scenario. The conversion factors were calculated in three steps. The first step consisted of adjusting the steel input of raw material to the volume of the product variations. For instance, the first product variation in the table has a steel volume of approximately 9 810 mm * 180 mm * 1.47 mm, which compared with the baseline scenario of 9 855 mm * 180 mm * 1.47 mm gives a factor of approximately 0.995. Therefore, in this case, the steel input was scaled down by a factor of 0.995 since the declared unit is one unit steel bandsaw blade.

The second step to calculating the conversion factor is to consider the pitch, which is used to scale the Stellite input. This may not be entirely accurate as an increased pitch also has slightly more steel, however, since Stellite has a larger environmental impact per kg than the steel input, using the entire factor to scale Stellite is considered a conservative approach. The pitch scaling factor was calculated in a similar way to the steel, where the baseline pitch of 45 was compared to the pitch alternatives, for instance, for the variations with a pitch of 50, the amount of Stellite was increased by 50/45 = 1.11.

The third step is to calculate the conversion factor for the impacts. This was done by simulating the GWP-GHG results after scaling the steel input and the Stellite input by the corresponding scaling factors. When the results were extracted, the GWP-GHG results were compared to the baseline scenario, which can be seen below.

The conversion factors are included as described in chapter 5.4.6.1 in PCR 2019:14 v.1.3.4 with the purpose of converting the declared results of a product group to results for specific products within the group. Since the conversion factors were calculated based on a linear scaling of Steel and Stellite input, the conversion is considered to be in line with the statement in the same chapter of the PCR that the results shall scale linearly with the conversion factor.

Table 25: Conversion factors for each variation of product covered by this LCA and EPD

Product	Length [mm]	Width [mm]	Thickness [mm]	Pitch [Teeth per inch]	Conversion factor for GWP-GHG	A1-A3 GWP-GHG results, kg CO_2-eq
Langshyttan Premium Green Cut Steel Bandsaw Blades	9 810	180	1.47	45	0.997	3.91E+01
	9 840 (lowest)	180	1.47	40	0.976	3.82E+01
	9 850	180	1.47	50	1.022	4.01E+01
	9 855 (baseline)	**180**	**1.47**	**45**	**1.000**	**3.91E+01**
	9 900	181	1.47	45	1.006	3.95E+01
	10 035	180	1.47	45	1.011	3.97E+01
	10 100	180	1.47	50	1.038	4.07E+01
	10 170	180	1.47	45	1.019	4.00E+01
	11 430 (highest)	180	1.47	45	1.097	4.29E+01

Scenario analysis

In order to compare the GWP-GHG impact of the Greentec Steel Edition 600 with the previous steel used in the manufacturing process, a scenario analysis has been done. Since the supplier has only shared the GWP-GHG impact of the steel, this is the only indicator being used to evaluate the change of impact. According to the supplier, the evaluation was done through the EN 15804+A2:2019 standard, as defined in their declaration of GHG-emissions.

The Greentec Steel Edition 600 reportedly has GWP-GHG impact of 0.60 kg CO_2-eq per kg steel with an additional 0.20 kg CO_2-eq per kg steel for finishing treatment of the coil, resulting in a total of 0.80 kg CO_2-eq per kg steel. The previous steel used has a GWP-GHG impact of 2.19 kg CO_2-eq per kg steel.

The resulting GWP-GHG results is approximately 67.5 kg CO_2-eq/declared unit, an increase of around 81% compared to the baseline scenario of approximately 37.4 kg CO_2-eq/declared unit.

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