KEILHAUER

VERIFIED by SCS GLOBAL SERVICES ENVIRONMENTAL PRODUCT DECLARATION BASED ON LCA

Declaration Owner
Keilhauer
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Toronto, ON, M1P 2E3
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Product
Swurve 79001

Functional Unit
One unit of seating to seat one individual, maintained for a 10 year period

EPD Number and Period of Validity
SCS-EPD-07339
EPD Valid Sept. 28, 2021 through Sept. 27, 2026

Product Category Rule
BIFMA PCR for Seating: UNCPC 3811, Version 3.

Program Operator
SCS Global Services
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SCSglobal SERVICES

Declaration Owner	Keilhauer
Address	1450 Birchmount Rd, Toronto, ON, M1P 2E3
Product	Swurve 79001
Declaration Number	SCS-EPD-07339
Declaration Validity Period	EPD Valid September 28, 2021 through September 27, 2026
Program Operator	SCS Global Services
Declaration URL Link	https://www.scsglobalservices.com/certified-green-products-guide
LCA Practitioner	Jason Oscienny, Intertek
LCA Software	SimaPro 9.1
Independent critical review of the LCA and data, according to ISO 14044 and ISO 14071	☐ internal ☒ external
LCA Reviewer	Tess Garvey, Ph.D., SCS Global Services
Product Category Rule	BIFMA PCR for Seating: UNCPC 3811, Version 3.
PCR Review conducted by	
Independent verification of the declaration and data, according to ISO 14025 and the PCR	☐ internal ☒ external
EPD Verifier	Tess Garvey, Ph.D., SCS Global Services

Disclaimers: *This EPD conforms to ISO 14025, 14040, and 14044.*

Scope of Results Reported: *The PCR requirements limit the scope of the LCA metrics such that the results exclude environmental and social performance benchmarks and thresholds, and exclude impacts from the depletion of natural resources, land use ecological impacts, ocean impacts related to greenhouse gas emissions, risks from hazardous wastes and impacts linked to hazardous chemical emissions.*

Accuracy of Results: *Due to PCR constraints, this EPD provides estimations of potential impacts that are inherently limited in terms of accuracy.*

Comparability: *The PCR this EPD was based on was not written to support comparative assertions. EPDs based on different PCRs, or different calculation models, may not be comparable. When attempting to compare EPDs or life cycle impacts of products from different companies, the user should be aware of the uncertainty in the final results, due to and not limited to, the practitioner's assumptions, the source of the data used in the study, and the specifics of the product modeled.*

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About Keilhauer

Keilhauer thoughtfully manufactures seating and tables for all the different ways people work. Keilhauer products are made to support engaging communications in offices, lobbies, lunchrooms and more. Working with world-renowned designers, Keilhauer is internationally recognized for award-winning design, built with a craftsmanship that is held to the highest environmental standards.

Product Description

Keilhauer's Swurve chair, *model 79001,* brings comfort and elegance to meeting rooms of all sizes. The sculptured form is inspired by forms found in nature with dramatic curves and flowing lines. With its integrated ergonomics, clean lines and verified sustainability accomplishments Swurve delivers the perfect trifecta of design credentials in a beautiful selection of meshes and upholstery.

Material Composition

Table 1. *Material composition of Swurve. Results are shown per unit of seating and as a percent of total.*

Material Type	Material Resource	Amount (kg/unit of seating)	Amount (%)
Aluminum	Virgin non-renewable and recycled content	7.638	55.47%
Grease	Virgin non-renewable	0.0003	0.00%
HDPE	Virgin non-renewable	0.006	0.04%
Lacquer – Paint	Virgin non-renewable	0.011	0.08%
Lubricant Oil	Virgin non-renewable	0.003	0.02%
Nitrogen	Virgin non-renewable	0.003	0.02%
PA6	Virgin non-renewable	0.696	5.05%
PA6 25GF	Virgin non-renewable	0.002	0.01%
PA6 30GF	Virgin non-renewable	1.694	12.30%
PET GF45	Virgin non-renewable	0.004	0.03%
Polyester – Fabric (Back)	Virgin non-renewable	0.148	1.07%
Polyester – Fabric (Seat)	Recycled content	0.652	4.73%
POM	Virgin non-renewable	0.094	0.68%
PP	Virgin non-renewable	0.340	2.47%
PU Foam	Virgin non-renewable	0.272	1.97%
Rubber	Virgin non-renewable	0.010	0.08%
Steel*	Virgin non-renewable and recycled content	1.913	13.89%
Steel – Raven Fabricators	Virgin non-renewable and recycled content	0.285	2.07%
TOTAL		13.77	100%

Key Environmental Parameters

Table 2. *Summary of key environmental parameters.*

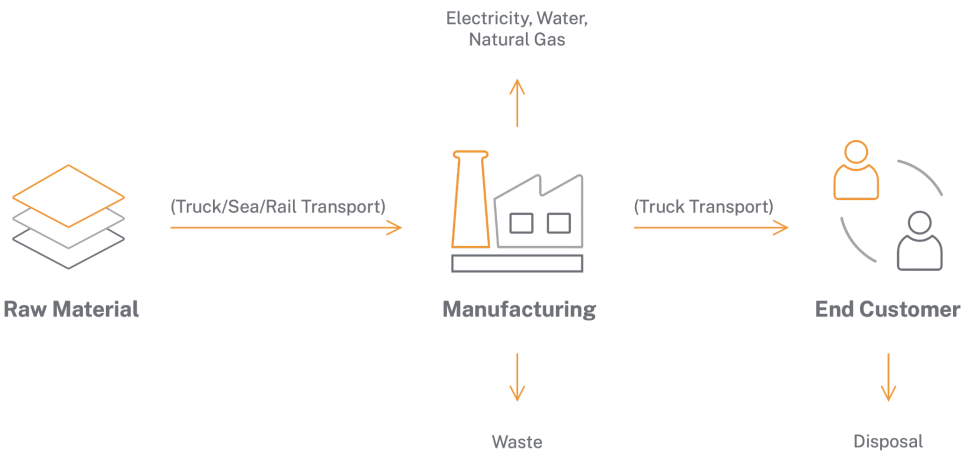
Parameter	Value	Unit
Global Warming Potential	1.16E+02	kg CO2e
Primary Energy Demand	2.55E+02	MJ
Recycled Content	19.29	%

Life Cycle Assessment Cycle

The system boundary is cradle-to-grave and includes resource extraction and processing, product manufacture and assembly, distribution/transport, use and maintenance, and end-of-life. The diagram below illustrates the life cycle stages included in this EPD.

Product Life Cycle Flow Diagram

The diagram below is a representation of the most significant contributions to the life cycle of Swurve. This includes resource extraction, raw material processing, component manufacturing, transportation, assembly of chair, use and maintenance, and end-of-life.



Life Cycle Inventory

The resource use and emissions from each step of the product life cycle are summed to obtain the life cycle inventory results. Table 4 shows inventory categories for energy and water consumption.

Table 4. *Inventory categories for energy and water consumption.*
Results are shown for one unit of seating to seat one individual over a 10 year time period.

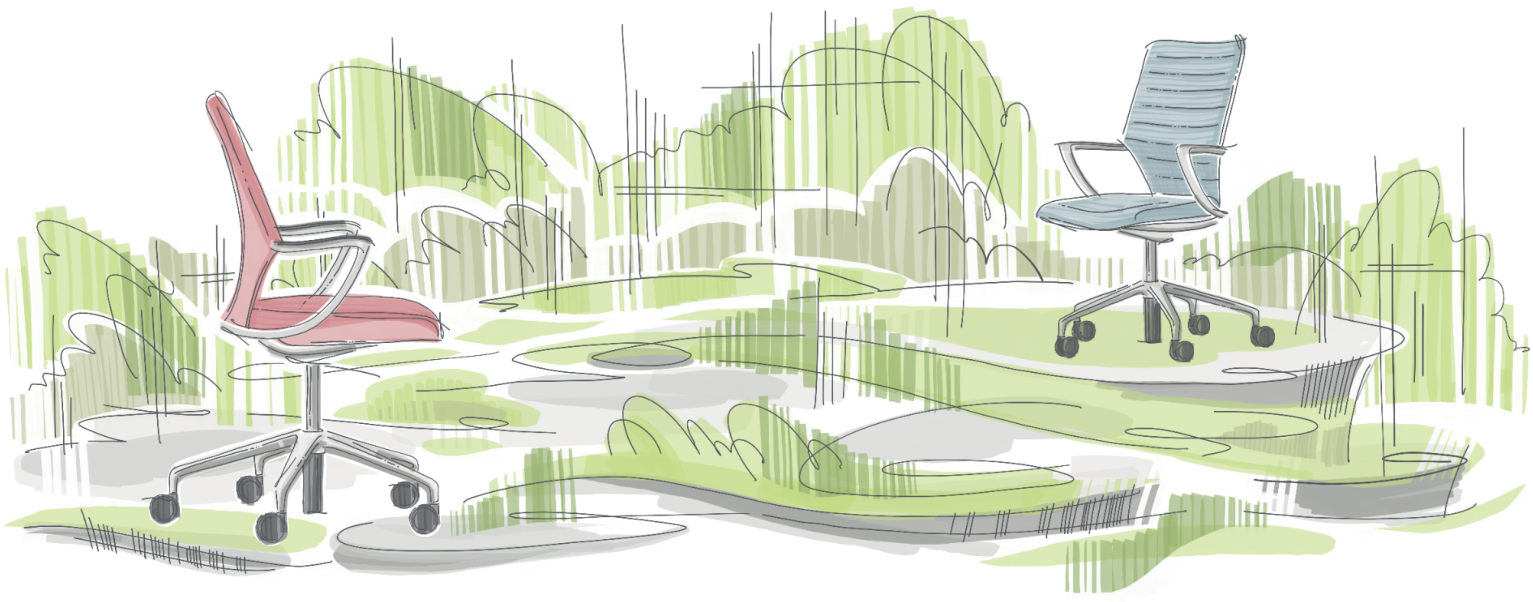
Parameter	Units	Total (per 1 unit of seating)
Primary Energy Demand	MJ	2.55E+02
Non-Renewable Energy, Fossil Fuels	MJ	1.65E+03
Non-Renewable Energy, Nuclear	MJ	
Renewable Energy	MJ	2.38E+02
Freshwater Consumptions	m3	2.83E+00

Life Cycle Impact Assessment

Impact category indicators are calculated using TRACI 2.1 characterization methods, including acidification potential, eutrophication potential, smog potential, ozone depletion potential, and global warming potential based on IPCC, in accordance with the BIFMA PCR. Additionally, the IPCC GWP result for a 20-year time horizon is reported following the BIFMA PCR requirements for IPCC. Note, biogenic carbon uptake and biomass CO_2 emissions are not included.

Table 5. Life cycle impact assessment results for the Swurve.
Results are shown for one unit of seating to seat one individual over a 10 year period.

Impact Category	Units	Raw Material Extraction & Processing	Production (Manufacturing & Assembly)	Distribution, Use & Maintenance	End-of-Life	Total
Global Warming Potential, 100 year time horizon	kg CO_2 eq	9.73E+01	6.73E+00	5.82E+00	6.46E+00	1.16E+02
Acidification Potential	kg SO_2 eq	4.63E-01	1.60E-02	2.30E-02	1.08E-03	5.03E-01
Ozone Depletion Potential	kg CFC-11 eq	5.37E-06	9.34E-07	1.22E-06	3.47E-08	7.55E-06
Smog Formation Potential	kg O_3 eq	5.39E+00	2.60E-01	5.53E-01	9.16E-02	6.29E+00
Eutrophication Potential	kg N eq	6.98E-02	1.31E-03	3.12E-03	2.31E-04	7.44E-02



Additional Environmental Information

Swurve is certified by Carbonfund.org to be carbon neutral through their Carbonfree® product certification.

Keilhauer has reduced emissions at every stage of our processes – from design and the materials we use to production, distribution, and end-of-life. Throughout the life cycle of the chair, there is inevitable carbon that can't be eliminated. Keilhauer completely offsets this carbon with investments in third-party verified carbon offset projects through Carbonfund.org. We have carefully chosen to support three projects.

1. The US Truck Stop Electrification Project

Swurve seating, along with all Keilhauer products, are transported via truck to reach the final customer. Keilhauer is supporting this project to specifically address the carbon emissions of our product transportation.

2. The Minnesota Forestry Improvement Project

Many of Keilhauer's products contain wood components and it is important to us to consistently measure and manage our natural resource use. Supporting this project means contributing to the management and improvement of Minnesota woodlands.

3. The Aqua Clara Water Filtration Program

Keilhauer believes clean water is a basic human right that every person should have access to. This water filtration program provides Kenyan communities with access to safe drinking water while generating employment opportunities and reducing deforestation.

For more carbon neutral information regarding Swurve seating, please visit www.swurvechair.com.

Swurve seating has been certified by SCS Global Services under BIFMA's multi attribute sustainability standard: LEVEL®.

Swurve seating has been certified by SCS Global Services for Indoor Air Quality achieving Indoor AdvantageTM Gold. This means they meet rigorous and comprehensive air quality standards.

Supporting Technical Information

Unit processes are developed with SimaPro 9.1 LCA software, drawing upon data from multiple sources. Primary data were provided by Keilhauer and part suppliers including Everform and Comp Sit Inc for their manufacturing processes. The primary sources of secondary LCI data are from Ecoinvent 3.4, Industry 2.0 and LTS DATASMART databases.

Table 10. Data sources used for the LCA study.

Component	Material Dataset	Data Source	Publication Date
Aluminum	Aluminum, cast alloy {GLO}| market for | Cut-off, U	ecoinvent	2018
HDPE	Polyethylene, high density, granulate {GLO}| market for | Cut-off, U Injection moulding {GLO}| market for | Cut-off, U	ecoinvent	2018
Lacquer - Paint	Alkyd paint, white, without water, in 60% solution state {RoW}| alkyd paint production, white, water-based, product in 60% solution state | Cut-off, U	ecoinvent	2018
Lubricant Oil	Lubricating oil, at plant/US- US-EI U	DATASMART	2017
Nitrogen	Nitrogen, liquid {RER}| market for | Cut-off, U	ecoinvent	2018
PA6	Nylon 6 {RoW}| production | Cut-off, U Injection moulding {GLO}| market for | Cut-off, U	ecoinvent	2018
PA6 25%GF	Nylon 6 {GLO}| production | Cut-off, U Glass fibre {GLO}| market for | Cut-off, U Glass fibre reinforced plastic, polyamide, injection moulded {GLO}| market for | Cut-off, U	ecoinvent	2018
PA 30%GF	Nylon 6 {GLO}| production | Cut-off, U Glass fibre {GLO}| market for | Cut-off, U Glass fibre reinforced plastic, polyamide, injection moulded {GLO}| market for | Cut-off, U	ecoinvent	2018
PET 45%GF	Polyethylene terephthalate, granulate, amorphous {GLO}| market for | Cut-off, U Glass fibre {GLO}| market for | Cut-off, U Glass fibre reinforced plastic, polyamide, injection moulded {GLO}| market for | Cut-off, U	ecoinvent	2018
Polyester	Polyester resin, unsaturated {RoW}| production | Cut-off, U	ecoinvent	2018
	Fabric pretreatment, dyeing and finishing, combined process/US U	DATASMART	2017

POM	Polyoxymethylene (POM)/EU-27	Industry Data 2.0	2017
	Injection moulding {GLO}| market for | Cut-off, U	ecoinvent	2018
PP	Polypropylene, granulate {RoW}| production | Cutoff, U Injection moulding {GLO}| market for | Cut-off, U	ecoinvent	2018
PU Foam	Polyurethane, flexible foam {RoW}| production | Cut-off, U	ecoinvent	2018
Rubber	Synthetic rubber {RoW}| production | Cut-off, U	ecoinvent	2018
Steel*	Steel, low-alloyed {RoW}| steel production, electric, low-alloyed | Cut-off, U Steel, low-alloyed {RoW}| steel production, electric, low-alloyed | Cut-off, U** Metal working, average for steel product manufacturing {GLO}| market for | Cut-off, U	ecoinvent	2018
Electricity	Electricity, medium voltage {CA-ON}| market for | Cut-off, U	ecoinvent	2018
Natural Gas	Heat, district or industrial, natural gas {CA-ON}| heat and power co-generation, natural gas, conventional power plant, 100MW electrical | Cutoff, U	ecoinvent	2018
Water	Tap water {RoW} | market for | Cut-off, U	ecoinvent	2018
Cardboard	Corrugated board box {RoW}| production | Cut-off, U	ecoinvent	2018
LDPE bag	Packaging film, low density polyethylene {RoW} | production | Cut-off, U Extrusion of plastic sheets and thermoforming, inline {RoW} | processing | Cut-off, U	ecoinvent	2018
PE	Packaging film, low density polyethylene {RoW} | production | Cut-off, U Extrusion of plastic sheets and thermoforming, inline {RoW}| processing | Cut-off, U	ecoinvent	2018
Road	Transport, freight, lorry 16-32 metric ton, EURO4 {RoW}| transport, freight, lorry 16-32 metric ton, EURO4 | Cut-off, U	ecoinvent	2018
Rail	Transport, freight train {US}| diesel | Cut-off, U	ecoinvent	2018
Ship	Transport, freight, sea, transoceanic ship {GLO} | market for | Alloc Rec, U	ecoinvent	2018

* The dataset for Steel was modified to account for the recycled content by removing the amount of recycled content in the raw materials, further no credits for “avoided burden” were given to the material.

Data Quality

Data Quality Parameter	Data Quality Discussion
Time-Related Coverage: Age of data and the minimum length of time over which data is collected	The material and energy inputs provided by Keilhauer are from the manufacturer based on measured primary data in 2019 for their products. Data for the Life Cycle Inventory (LCI) was obtained primarily from Ecoinvent 3.4 datasets. Many of the parameters included in the study, reference data from 2018 and 2017 are used. Thus, it is considered high quality data.
Geographical Coverage: Geographical area from which data for unit processes is collected to satisfy the goal of the study	The Ecoinvent 3.4 database, typically base their research and measurement on specific producers, usually in Europe and adjust for global energy and transport considerations. The electricity grid selected for the production phase was specific to the Province of Ontario, where the manufacturer is located, but certain material and processes are represented by global datasets. Thus, the data is considered medium quality.
Technology Coverage: Specific technology or technology mix	Keilhauer provided the primary material and energy input data, based on their sales data and composition of Swurve Conference Chair and its transport packaging. Swurve Conference Chair production and materials do not evolve quickly and thus analysis is based on current technologies for the product. Technology, materials and processes used in the Ecoinvent 3.4 are mostly current and typically reference data from 2018 and 2017. Thus, it is considered medium quality.
Precision: Measure of the variability of the data values for each data expressed	Keilhauer provided the primary material and energy input data, based on sales data and composition and density. Given the simplicity of this data, it is anticipated that there are few opportunities for variability in data. Thus, the data is considered high quality. Additionally, an uncertainty analysis was performed and reported in the uncertainty section of the report.
Completeness: Percentage of flow that is measured or estimated	Keilhauer provided the primary material and energy input data, based on sales data and composition. All materials reported in the data were included in the raw materials phase of the LCA. Energy data was provided by the manufacturer and was measured in a current year on for the product; thus, this is considered 100% measured. Background or secondary data provided by the Ecoinvent 3.4 database, are globally regarded as high quality and researched data. Thus, it is considered medium quality.
Representativeness: Qualitative assessment of the degree to which the data set reflects the true population of interest	Keilhauer provided the primary material and energy input data, based on sales data, material composition and measured energy consumption. Given Keilhauer expertise and in-depth knowledge of their products, it is anticipated that primary data is representative of actual data. Thus, considered high quality.
Consistency: Qualitative assessment of whether the study methodology is applied uniformly to the various components of the analysis	The same methodology was applied consistently to all the studies. Thus, considered high quality.
Reproducibility: Qualitative assessment of the extent to which information about the methodology and data values would allow an independent practitioner to reproduce the results reported in the study	Provided the practitioner has access to the same data sources described in the report, the results would be reproducible. It is considered high quality.
Sources of the Data: Description of all primary and secondary data sources	Keilhauer provided the primary material and energy input data, based on sales data, material composition and measured energy consumption. Thus, the data is considered high quality. Secondary data was derived from open sources, such as Ecoinvent 3.4, research and literature review.
Uncertainty of the Information: Uncertainty related to data, models, and assumptions	Key uncertainty assumptions are stated in the report and evaluated by the pedigree matrix method.

Allocation

Keilhauer has two assembly facilities located at 1450 Birchmount Rd., Toronto and 50 Underwriters Rd., Toronto.

The 1450 Birchmount facility is 100% dedicated for cutting upholstery patterns and manufacturing certain upholstered products. For upholstered products manufactured at 50 Underwriters, the pre-processed fabric patterns are trucked to 50 Underwriters for final assembly. Further, Keilhauer provided the percentage operation dedicated to their Aesync chair at both facilities based on the number of products sold in FY2019; thus, a physical allocation is applied. The primary data for resource use (electricity, natural gas, water, etc.) and waste are allocated using this percentage operation to determine the resources required and waste generated to manufacture 1 seating product (January 2019 to December 2019).

The steel used by Keilhauer's primary steel fabricator includes amount of recycled content, which is allocated using the recycled content allocation method, in which the system inputs do not receive any burden from the previous life other than reprocessing of the waste material and no credit/avoided burden were allocated to the recycled content material in the study. The amount of recycled content in the steel was provided in a letter from the steel milling facility, where they also confirmed the usage of electric arc method for recycled steel production. The recycled Steel only accounts the re-processing and transportation and does not account any impacts due to extraction.

Additionally, ISO 14044 addresses allocation procedures for reuse and recycling situations. Several allocation scenarios and procedures are addressed by the standard, including consideration of both closed-loop and open-loop recovery systems. For this LCA study there are no closed or open loop system.

Impacts from transportation were allocated based on the mass of material and distance transported.

System Boundaries

The system boundaries of the life cycle assessment for Swurve was cradle-to-grave. A description of the system boundaries for this study are as follows:

- Raw Material Extraction and Processing – This stage includes extraction of virgin materials and reclamation of non-virgin feedstock. This includes the extraction of all raw materials, including the transport to the manufacturing site. Resource use and emissions associated with both the extraction of the raw materials used in the workstation, as well as those associated with the processing of raw materials and workstation component manufacturing are included. Impacts associated with the transport of the processed raw materials to manufacturing facilities (upstream transport) are also included in this stage.

- Production – This stage includes all the relevant manufacturing processes and flows, excluding production of capital goods, infrastructure, production of manufacturing equipment, and personnel-related activities. This stage includes the impacts from energy use and emissions associated with the processes occurring at the manufacturing facility. Energy use at the facility is excluded unless used directly for the manufacturing process. This stage also includes the production and disposal (including transport) of the product packaging materials.

- Distribution, Use, and Maintenance – This stage includes the delivery of the seating product to the point of use (downstream transportation) and the use, cleaning and maintenance of the workstation for a period of 10 years. Also included are the impacts from extraction, manufacture and transport of all sundry material for maintenance and cleaning.

- End of life stage – The end-of-life stage includes transport of the seating product to material reclamation or waste treatment facilities. Emissions from disposal of seating product components in a landfill or from incineration are included.

Cut-off criteria

According to the PCR, cumulative omitted mass or energy flows within the product boundary shall not exceed 5%. In the present study, except as noted, all known materials and processes were included in the life cycle inventory.

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