

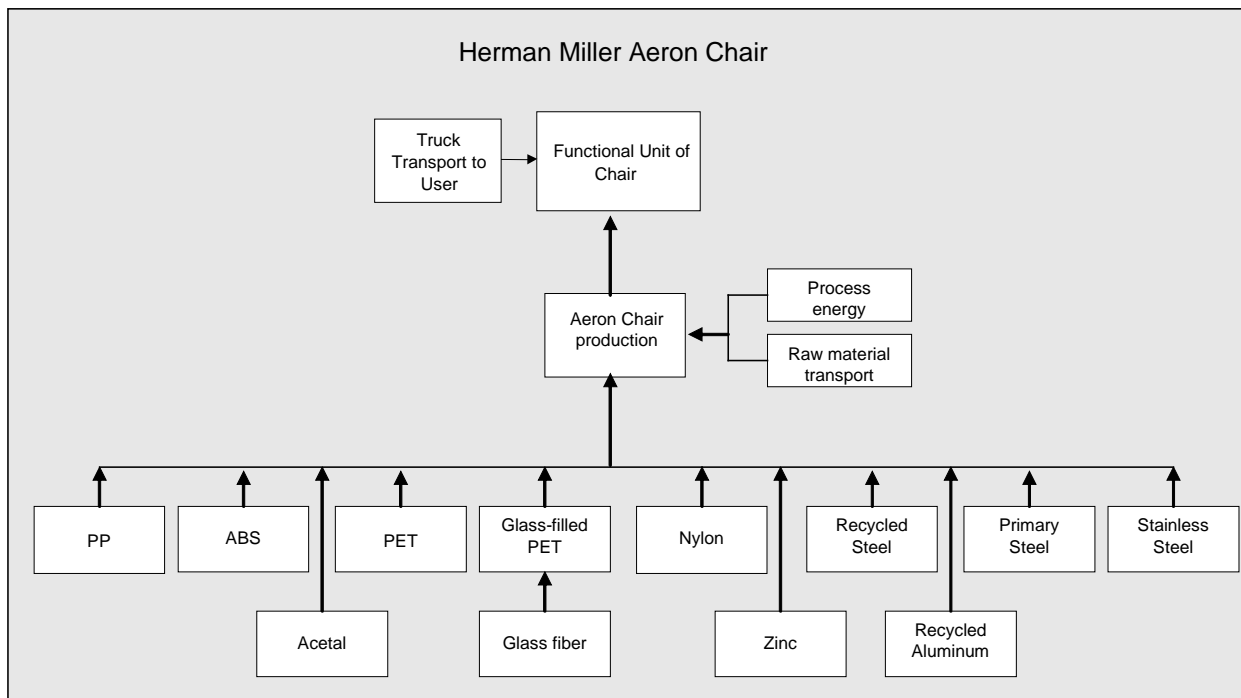
# Herman Miller Aeron Office Chair

## Product Selection and Description

Herman Miller is a worldwide producer of office furniture systems, seating, and accessories; filing and storage products for business, home office and healthcare environments; and residential furniture. The Herman Miller Aeron business chair consists of more than 50 different components and subassemblies from more than 15 direct suppliers. These components and subassemblies are constructed from four major materials: plastics, aluminum, steel, and foams/fabrics.

## Flow Diagram

The flow diagram below shows the major elements of the production of this product, as it is currently modeled for BEES.



*Figure 1: Herman Miller Aeron Chair System Boundaries*

## Raw Materials

Approximately 60 % of the Aeron chair, by mass fraction, is comprised of recycled materials including steel, polypropylene, glass-filled nylon, 30 % glass-filled PET, and aluminum. The mixture of all the chair constituents in terms of their mass fractions is provided in the Table below.

**Table 1: Herman Miller Aeron Chair Major Constituents**

<b>Constituent</b>	<b>Description</b>
Plastics	27 % for all plastics (24 % for seat and back frame assemblies, 9 % for knobs, levers, bushings, covers)
Aluminum	35 % for aluminum base, swing arms, seat links, arm yokes
Steel	23.5 % for tilt assembly, 2 % for nuts, bolts, other components
Foam/fabric (arm rests, lumbar supports)	Less than 4 %; Pellicle seat & back suspension system is a combination of synthetic fibers and elastomers
Composite subassemblies	3 % for 5 casters; 6.7 % for pneumatic cylinder; 6.2 % for moving components of tilt assembly

Of the plastics and metals in the Aeron chair that are nonrenewable, over two-thirds are made from recycled materials and can be further recycled at end of life.

**Plastic components.** Roughly one-fourth (27 %) of the Aeron chair, by mass fraction, is made up of various plastic resin materials including polypropylene, ABS, PET, nylon, and glass-filled nylons. The seat and back frame assemblies make up 23.6 % of the chair's weight. The seat and back frames are made of glass-filled PET, two thirds of which consists of post-industrial recycled materials. The plastic in the Pellicle suspension system (approximately 2 % of the chair weight) can be removed for replacement or for recycling of the seat and back frames. The remaining plastic components are various knobs, levers, bushings, and covers.

According to the manufacturer, these single-material plastic components used in the Aeron chair are identified with International Organisation for Standardization (ISO) recycling symbols and ASTM, International material designations to help channel them into the recycling stream.

Data for production of the plastic components comes from American Chemistry Council 2006 data developed for submission to the U.S. LCI Database.

**Aluminum.** Roughly 35 % of the Aeron chair is made from aluminum. Major components include the base, swing arms, seat links, and arm yokes. Aluminum components from the Aeron chair at the end of its life can be segregated and entered back into the recycling stream to be made into the same or other components, so they can be considered part of a closed-loop recycling system.

All aluminum components are made from 100 % post-consumer recycled aluminum, for which production data is found in the U.S. LCI Database.

**Steel.** The tilt assembly, approximately 23.5 % of the chair's weight, is largely made up of steel stampings and screw-machined components. These steel components represent 74 % of the tilt, by mass fraction, or 17.3 % of the mass of the chair. From 7 % to 50 % of the steel components in the tilt are made from recycled materials. The remaining steel materials (less than 2 % of the chair) are nuts, bolts, and other components that require the high strength properties of steel.

Production of primary and secondary steel is based on LCI data submitted by the American Iron and Steel Institute (AISI) and the International Iron and Steel Institute (IISI), which represents late 1990s worldwide steel production.

**Foam/Fabric.** The armrests and lumbar supports are the only Aeron chair components made from foams or fabrics. The Pellicle seat and back suspension system is a combination of synthetic fibers and elastomers and comprises a small percentage of the chair. Fabric scraps from Herman Miller's production facilities are recycled into automobile headliners and other similar components. Foam scraps are recycled into carpet padding. Data on synthetic fibers and elastomers comes from elements of the U.S. LCI Database and the SimaPro database.

**Composite Subassemblies.** The Aeron chair has three composite subassemblies of multiple material types. They consist of five casters, a pneumatic cylinder, and the moving components of the tilt assembly. The pneumatic cylinder can be returned to the manufacturer for disassembly and recycling. All material production data is based on elements of the U.S. LCI Database and the SimaPro database.

### **Manufacturing**

Energy requirements and emissions from chair assembly are included in the model but not shared to protect company-specific confidential data. The energy used for processes that form materials into chair parts (plastic extrusion, steel rolling and stamping, etc.) is included in the product data for the raw materials acquisition life cycle stage.

### **Transportation**

Packaging materials for the Herman Miller Aeron chair include corrugated paper and a polyethylene plastic bag to protect the product from soiling and dust. Each of these materials is part of a closed-loop recycling system. As such, they are not included in the system boundaries. On larger shipments within North America, disposable packaging can be eliminated through use of reusable shipping blankets.

Transportation of the chair by heavy-duty truck to the building is modeled as a variable of the BEES system. Data on diesel trucking is based on the U.S. LCI Database.

### **Use**

The plastics in the chair are low-VOC emitting and most painted parts are powder-coated. The small amounts of foam and fabric are insignificant contributors of VOC.

### **End of Life**

The Herman Miller Aeron chair is designed to last at least 12.5 years under normal use conditions, so the chair is assumed to be replaced three times over the 50-year BEES use period. As with all BEES products, life cycle environmental burdens from these replacements are included in the inventory data.

### **References**

#### **Life Cycle Data**

National Renewable Energy Laboratory (NREL): *U.S. Life-Cycle Inventory Database*. 2005. Golden, CO.

Found at: <http://www.nrel.gov/lci/database>.

PRé Consultants: *SimaPro 6.0 LCA Software*. 2005. The Netherlands.

<http://www.hermanmiller.com>.

### **Industry Contacts**

Gabe Wing, Herman Miller (2001)