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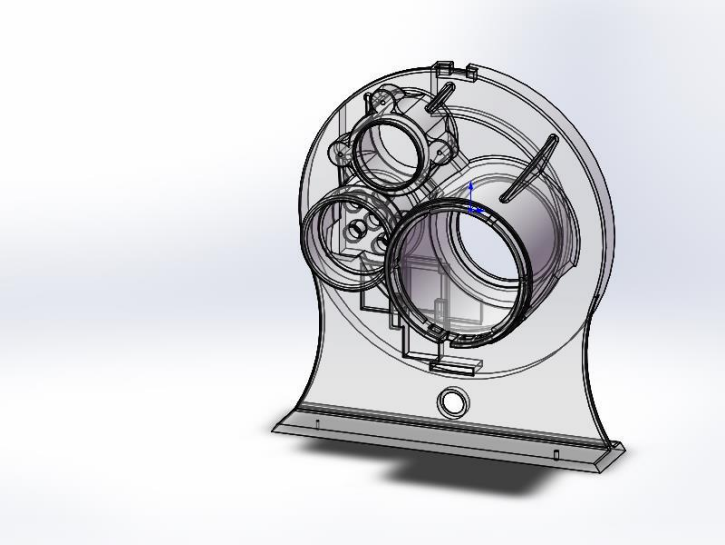
Sustainability Report



| | |
|---|---|
| Model Name: | Back air duct |
| Material: | Acrylic (Medium-high impact) |
| Recycled content: | 0.00 % |
| Weight: | 0.28 kg |
| Manufacturing process: | Injection Molded |
| Surface Area: | 1.25E+5 mm² |
| Built to last: | 1.0 year |
| Duration of use: | 1.0 year |

### Manufacturing Region

The choice of manufacturing region determines the energy sources and technologies used in the modeled material creation and manufacturing steps of the product's life cycle.

### Use Region

The use region is used to determine the energy sources consumed during the product's use phase (if applicable) and the destination for the product at its end-of-life. Together with the manufacturing region, the use region is also used to estimate the environmental impacts associated with transporting the product from its manufacturing location to its use location.

## Summary

**Learn more about Life Cycle Assessment**

## Sustainability Report

| | | | | | | |
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| | | | | Duration of use: | 1.0 year | |

| | | |
|---|---|---|
| **Material** | Acrylic (Medium-high impact) | 0.00 % |
| **Material Unit Cost** | 4.60 USD/kg | |

### Manufacturing

| | |
|---|---|
| Region: | North America |
| Process: | Injection Molded |
| Electricity consumption: | 1.8 kWh/lbs |
| Natural gas consumption: | 0.00 BTU/lbs |
| Scrap rate: | 2.0 % |
| Built to last: | 1.0 year |
| Part is painted: | No Paint |

### Use

| | |
|---|---|
| Region: | North America |
| Duration of use: | 1.0 year |

### Transportation

| | |
|---|---|
| Truck distance: | 2600 km |
| Train distance: | 0.00 km |
| Ship distance: | 0.00 km |
| Airplane Distance: | 0.00 km |

### End of Life

| | |
|---|---|
| Recycled: | 33 % |
| Incinerated: | 13 % |
| Landfill: | 54 % |

Comments

Click here for alternative units such as 'Miles Driven in a Car'

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## Sustainability Report

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## Environmental Impact (calculated using CML impact assessment methodology)

### Carbon Footprint

1.2 kg $CO_2e$

| | |
|---|---|
| Material: | 0.560 kg $CO_2e$ |
| Manufacturing: | 0.410 kg $CO_2e$ |
| Transportation: | 0.035 kg $CO_2e$ |
| End of Life: | 0.152 kg $CO_2e$ |

### Total Energy Consumed

18 MJ

| | |
|---|---|
| Material: | 12 MJ |
| Manufacturing: | 5.9 MJ |
| Transportation: | 0.519 MJ |
| End of Life: | 0.111 MJ |

### Air Acidification

4.0E-3 kg $SO_2e$

| | |
|---|---|
| Material: | 1.0E-3 kg $SO_2e$ |
| Manufacturing: | 2.8E-3 kg $SO_2e$ |
| Transportation: | 1.6E-4 kg $SO_2e$ |
| End of Life: | 7.7E-5 kg $SO_2e$ |

### Water Eutrophication

4.7E-4 kg $PO_4e$

| | |
|---|---|
| Material: | 1.4E-4 kg $PO_4e$ |
| Manufacturing: | 1.0E-4 kg $PO_4e$ |
| Transportation: | 3.6E-5 kg $PO_4e$ |
| End of Life: | 1.9E-4 kg $PO_4e$ |

### Material Financial Impact 0.80 USD

Comments

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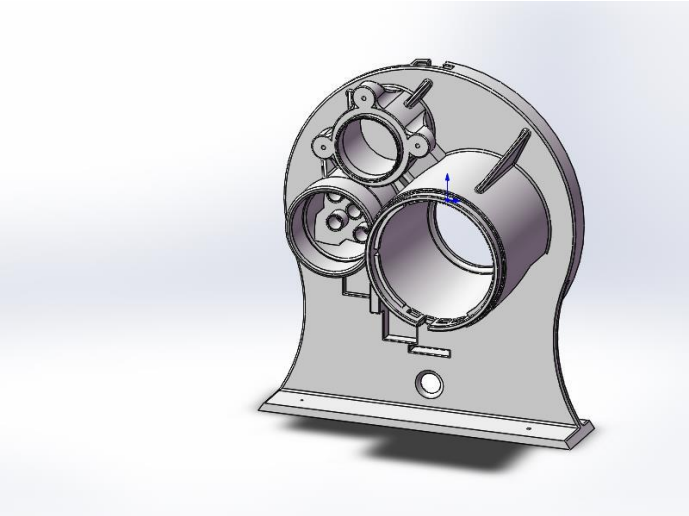
## Baseline



| | |
|---|---|
| Model Name: | Back air duct |
| Material: | PC High Viscosity |
| Recycled content: | 0.00 % |
| Weight: | 0.273 kg |
| Manufacturing process: | Injection Molded |
| Surface Area: | 1.25E+5 mm² |
| Built to last: | 1.0 year |
| Duration of use: | 1.0 year |

**Manufacturing Region**
The choice of manufacturing region determines the energy sources and technologies used in the modeled material creation and manufacturing steps of the product's life cycle.

**Use Region**
The use region is used to determine the energy sources consumed during the product's use phase (if applicable) and the destination for the product at its end-of-life. Together with the manufacturing region, the use region is also used to estimate the environmental impacts associated with transporting the product from its manufacturing location to its use location.

Comments

Learn more about Life Cycle Assessment

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## Sustainability Report

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|---|---|---|---|---|---|---|
| Model Name: | Back air duct | Material: | PC High Viscosity | Weight: | 0.273 kg | Manufacturing process: |
| | | | | Surface Area: | 1.25E+5 mm² | Injection Molded |
| BASELINE | | Recycled content: | 0.00 % | Built to last: | 1.0 year | |
| | | | | Duration of use: | 1.0 year | |

## Material

PC High Viscosity 0.00 %

## Material Unit Cost

4.60 USD/kg

## Manufacturing

| | |
|---|---|
| Region: | North America |
| Process: | Injection Molded |
| Electricity consumption: | 1.8 kWh/lbs |
| Natural gas consumption: | 0.00 BTU/lbs |
| Scrap rate: | 2.0 % |
| Built to last: | 1.0 year |
| Part is painted: | No Paint |

## Use

| | |
|---|---|
| Region: | North America |
| Duration of use: | 1.0 year |

## Transportation

| | |
|---|---|
| Truck distance: | 2600 km |
| Train distance: | 0.00 km |
| Ship distance: | 0.00 km |
| Airplane Distance: | 0.00 km |

## End of Life

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|---|---|
| Recycled: | 33 % |
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| | | | | Duration of use: | 1.0 year | |

# Environmental Impact Comparison

New Design: Better Worse

Original Design: Baseline

### Carbon Footprint - Comparison

Total
- Acrylic (Medium-high impact) : 1.2 kg $CO_2e$
- PC High Viscosity : 2.6 kg $CO_2e$

### Total Energy Consumed - Comparison

Total
- Acrylic (Medium-high impact) : 18 MJ
- PC High Viscosity : 44 MJ

### Air Acidification - Comparison

Total
- Acrylic (Medium-high impact) : 4.0E-3 kg $SO_2e$
- PC High Viscosity : 6.3E-3 kg $SO_2e$

### Water Eutrophication - Comparison

Total
- Acrylic (Medium-high impact) : 4.7E-4 kg $PO_4e$
- PC High Viscosity : 9.1E-4 kg $PO_4e$

### Material Financial Impact Comparison


Comments

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Sustainability Report


RAW MATERIAL
EXTRACTION
MATERIAL
PROCESSING
PART
MANUFACTURING
ASSEMBLY
PRODUCT
USE
END OF LIFE
SUSTAINABLE
DESIGN

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# Glossary

Air Acidification - Sulfur dioxide, nitrous oxides other acidic emissions to air cause an increase in the acidity of rainwater, which in turn acidifies lakes and soil. These acids can make the land and water toxic for plants and aquatic life. Acid rain can also slowly dissolve manmade building materials such as concrete. This impact is typically measured in units of either kg **sulfur dioxide equivalent ($SO_2$), or moles H+ equivalent**.

Carbon Footprint - Carbon-dioxide and other gasses which result from the burning of fossil fuels accumulate in the atmosphere which in turn increases the earth's average temperature. Carbon footprint acts as a proxy for the larger impact factor referred to as Global Warming Potential (GWP). Global warming is blamed for problems like loss of glaciers, extinction of species, and more extreme weather, among others.

Total Energy Consumed - A measure of the non-renewable energy sources associated with the part's lifecycle in units of megajoules (**MJ**). This impact includes not only the electricity or fuels used during the product's lifecycle, but also the upstream energy required to obtain and process these fuels, and the embodied energy of materials which would be released if burned. Total Energy Consumed is expressed as the net calorific value of energy demand from non-renewable resources (e.g. petroleum, natural gas, etc.). Efficiencies in energy conversion (e.g. power, heat, steam, etc.) are taken into account.

Water Eutrophication - When an over abundance of nutrients are added to a water ecosystem, eutrophication occurs. Nitrogen and phosphorous from waste water and agricultural fertilizers causes an overabundance of algae to bloom, which then depletes the water of oxygen and results in the death of both plant and animal life. This impact is typically measured in either kg **phosphate equivalent ($PO_4$) or kg nitrogen (N) equivalent**.

Life Cycle Assessment (LCA) - This is a method to quantitatively assess the environmental impact of a product throughout its entire lifecycle, from the procurement of the raw materials, through the production, distribution, use, disposal and recycling of that product.

Material Financial Impact - This is the financial impact associated with the material only. The mass of the model is multiplied by the financial impact unit (units of currency/units of mass) to calculate the financial impact (in units of currency).

**Learn more about Life Cycle Assessment**