SoftX CHAIR

Environmental impact assessment

1 Description and assessment of the Materials used in the Product

2 Description and assessment of the Production process

3 Description and assessment of the Surface Treatment Methods

4 Description and assessment of the Packing practices

5 The product structure

1 Description and assessment of the Materials used in the Product

Materials are assessed according to energy consumption and burdening of the environment when the Product reaches the end of its life cycle, their physical characteristics and feasibility for recycling.

- **Steel**

Energy contents: 23.4 MJ/kg *recycled: 10 MJ/kg*
Steel is a commonly used and economical construction material. Due to good mechanical properties, it can be used in wide variety applications. Further it is suitable for many different processing and fabrication methods.

The waste generated by steel (→rust) has hardly any impact on the environment. Moreover, the material is very suitable for recycling and the infrastructure for recycling steel is well established.

- **Aluminium**

Energy contents: 198.2 MJ/kg *recycled: 10 MJ/kg*
Aluminium is an extremely energy-intensive material. On the other hand, it is very easy to recycle with an extremely low energy consumption level. Recycling does not change its mechanical characteristics, so that it can be recycled a limitless number of times. Infrastructure for recycling aluminium is well established.

The aluminium used in the Product's components typically consists for more than 50 % of recycled aluminium (or up to 100 % depending on the supply of recycled aluminium).

- **Plastic**

Energy contents: 70 MJ/kg *recycled: 10 MJ/kg*
Plastic takes little energy to produce. Most synthetics are suitable for recycling, although their mechanical characteristics deteriorate each time. Because of its relatively low price, the demand for recycled plastics is minnow, and further the infrastructure for recycling plastics is not well organized. Due to these factors, plastics are burned most of the time → energy production.

- **Foam**

Cold foam is used for the padding components of the chairs. The cold foam process is a reaction between polyoles (polyol and isocyanate MDI) inside the mould impression, blowing agent is water. Provided that no other substances are coated in foam, such as metal parts, it is very suitable for re-use in the shape of polypress plates, i.e. plates of compressed and glued, ground cold foam.

Foam parts used in the Product do not contain any foam-coated parts, are CFC-free and are produced in countries with strict environmental regulations, i.e. Finland or Estonia.

- **Upholstery**

Energy contents: 45 MJ/Lin Metre (wool fabric AQ)
Fabric: for the upholstery of the Product the company standard collection is used. Fabrics in the collection are mainly made out of wool. Wool is a natural product, but requires a lot of water during production and the dyes used often contain heavy metals that may end up in the waste water. However, the fabrics in our collection do not contain any heavy metals, and water used during production is purified and neutralised. We have two main sources for woollen fabrics, both manufacturers operating under strict environmental legislation:

- fabrics origin from a Danish manufacturer with a Oeko-Tex, Ecolabel Flower and DS certificates and
- British manufacturer with ISO 14001 and BS standard

2 Description and assessment of the Production process

The production processes are assessed according to energy consumption, emissions during the process and residual waste.

- **Aluminium die-casting and plastic injection-moulding**

During die-casting and injection-moulding, the processed material is heated to melting-point and pressed into a die cavity or mould impression. As the mould is cold, the material solidifies. When the mould is opened, the product is ready. Depending of the component, some additional fabrication or surface treatment may be needed.

Heating and pressing of materials takes place electrically. In case of aluminium die-casting, waste and rejects are re-melted and used again. Depending on the plastic type used in injection-moulding waste and rejects are reused or alternatively used in energy production. During the process, no substances that burden the environment are released.

- **Steel punching, forming and cutting**

Steel is punched, formed and cut by electrically driven hydraulic machines which form and cut the steel with knife-like tools. No substances that burden the environment are released in this process. Cutting waste is removed as scrap metal and delivered to recycling.

- **Welding**

In the welding process, steel parts are joined by being melted, while welding wire is added. The welding pool is heated electrically. During welding, vapours of combusted pollution are released. These are extracted and filtered.

- **Machining techniques**

Metal axles and pipes are produced by means of machining techniques such as turning, milling and sawing. Cutting oil is used in the machining process. This is a mixture of water and a very small quantity of soluble oil. The chips are collected, while the oil residues are removed by means of centrifugation. The oil is processed as chemical waste. The chips are removed as scrap metal and recycled.

3 Description and assessment of the Surface Treatment Methods

Surface treatment techniques are assessed for emissions and residual waste.

- **Powder coating**

Coating
The coated parts are covered in powder in an electrostatic process (i.e. coating) and powder polymerizes when the part is placed in a heated furnace (approx. 200 ºC). Any powder that is lost is collected and reused or cured in the furnace. Cured powder results in a ‘block’ of plastic which has no impact on the environment and disposal is permitted.

Degreasing
Before the powder is applied, the parts must be degreased. This takes place in hot alkaline water. Apart from the water vapours, no vapours that burden the environment are released. When the water is saturated, the dissolved greases are separated by a water treatment plant. The water is discharged, whilst the greases are removed as chemical waste.

This makes powder coating one of the most environmentally friendly surface treatment techniques.

- **Black annealing**

During black annealing, the steel parts are provided with a black oxide coating in a salt solution. The oiling of the products causes slight anticorrosion and a lubricating effect. This technique is used for axles and pins.

- **Thermo galvanising**

In the thermo galvanising process, plate steel is passed through a zinc melting bath, which leaves a thin layer behind. This thin coating provides excellent protection against rust. No waste is produced in this process. The disadvantage is that thermo galvanised parts cannot be welded. This makes it suitable only for loose parts.

- **Electro-zincing**

In the electro-zincing process, a very thin layer of zinc is added to, for example, steel. This thin coating provides excellent protection against rust.

The process takes place in a container with water and a dissolved zinc compound. Subsequently, the products are rinsed in the water, during which a small part of the zinc comes into the water.

The rinse water is purified in a treatment plant and discharged. What is left is chemical waste and must be processed.

- **Chromium-plating**

The chromium-plating process is similar to the electro-zincing process. In many cases, several layers are applied underneath the chromium, such as copper and nickel. Since chromium, copper and nickel form part of the group of “heavy metals”, they are hazardous to the environment. The heavy metals are recovered from the residues of the water treatment plant. They can then be re-used.

4 Description and assessment of the Packing practices

Packing operations are assessed for burdening of the environment and recycleability.
There are two packing operations involved in production:

- packing of parts
- packing of finished product

Parts
For the packing of large parts, pallets and wire-mesh trolleys are used, which are recycled.
For smaller parts, cardboard boxes and plastic bags (LDPE) are used, which are recycled several times.

Finished product
For the packing of finished product, cardboard boxes and plastic bags (LDPE) are used. Since Martela takes care of its own transport, we are able to take back our packing material and have it recycled or disposed of in a responsible manner.

Cardboard
In cardboard production main raw materials are recycled paper and virgin fibre. As a waste product, it can be used again as a raw material for cardboard. This makes cardboard the most environmentally friendly packing material. Only white (bleached) cardboard is an extra burden on the environment and is therefore not used as a packing material. On average the raw material mixture in our cardboard packages is: 40% recycled and 60% virgin fibre.

Plastic bags (PE)
A plastic bag is often needed for proper scratch-resistant and dust-proof packing. Natural PE is the most environmentally friendly plastic for this. Since the bags are very thin (=0.05mm), they require only very little

material. Moreover, the plastic bags can be used several times. Hardly any hazardous substances are released when processed in a waste incinerator.

5 The product structure

- **Environment-related issues**

Dismantling
The chair can be dismantled entirely, since all materials can be separated. No composite materials have been used in the product.

- **Materials and weights**

Steel, plywood, plastics/foam and aluminium are materials that are suitable for recycling. 94% of the chair 365 is made from these materials and accordingly 95 % of the chair 368SK

365, low back, without armrests

	Kg	%
Steel	1.784	18.38
Plywood	2.6	26.67
Plastic	0.089	0.91
Aluminium	3.34	34.26
Fabric (wool)	0.598	6.13
Foam/pur	1.338	13.72
Total	**9.75**	**100**

The total energy content is 277 MJ. (including fabric /AQ)

368SK, high back, with upholstered armrests

	Kg	%
Steel	3.278	27.97
Plywood	2.61	22.27
Plastic	0.004	0.03
Aluminium	3.685	31.44
Fabric (wool)	0.598	5.10
Foam/pur	1.544	13.18
Total	**11.72**	**100**

The total energy content is 500 MJ. (including fabric /AQ)

- **The structure of the product**

o **Seat / back design**

Weight: 5.18 kg energy contents: 211 MJ [low back including fabric wool/AQ]
Weight: 5.35. kg energy contents: 218 MJ [high back including fabric wool/AQ]

– The seat and back inserts are made out of bent plywood and fixed together with steel fittings and screws
– Actual stuffing has been made out of cold foam (polyurethane) and is produced CFC-and HFC-free
– The inserts (plywood) can be used in energy production
– The upholstery is glued onto the foam, which makes it relatively easy to separate
– Used glue is solvent free water based 2-component glue
– Standard upholstery according to Martela collection

- **Seat control with height adjustment**

Weight: 0.99 kg *energy contents: 23 MJ*

– Punched steel plate with steel wire lever and plastic knob
– Surface treatment powder coating

- **Seat fastening flange and column**

Weight: 1.93 kg *energy contents: 39 MJ*

– The flange is cast aluminium (consists recycled aluminium up to 100%)
– Column is steel tube either powder coated or chromed, fastening element welded inside the tube.
– Bearing unit is injection moulded nylon
– Axle inside is made out of steel shaft

- **Gas-spring**

Weight: 1.2 kg *energy contents: 26 MJ*

– gas-springs are steel cylinders with synthetic sealing and a small quantity of oil for lubrication
– gas inside is compressed nitrogen
– surface treatment chrome plating
– at the end of their life cycle, the gas-springs are taken back and dismantled by the manufacturer

- **Base with 4-prongs**

Weight: 2.7 kg *energy contents: 28 MJ*

– The base is made of die-cast aluminium (consists recycled aluminium up to 100%)
– the base is taken back and recycled by the manufacturer
– is provided with glides; PA6 or alternatively PA6 + synthetic felt

- **Base with 5-prongs**

Weight: 1.55 kg *energy contents: 16 MJ*

– the base is made out of die-cast aluminium (consists recycled aluminium up to 100%), surface treatment polishing
– the base is taken back and recycled by the manufacturer

- **Castors**

Weight: 0.94 kg *energy contents: 185 MJ*

- The wheels are made of polyamide and PU with steel axles, the housing is die cast aluminium. Surface treatment chrome plating

- **Upholstered arm rests**

Weight: 1.9 kg *energy contents: 35 MJ*

– The armrests are made of die-cast aluminium (consists recycled aluminium up to 100% depending of supply, min 50%), surface treatment either powder coating or polishing
– The top cover in upholstered version is made out of polyurethane, steel insert inside.