

Product design review of a Vacuum Cleaner

This case study describes a vacuum cleaner that has been carefully designed with sustainability criteria at the forefront for durability and lifetime extension. The design review identified a number of opportunities for further improvement and presents significant cost and environmental savings through reduced materials and components. Based on an estimated 100,000 unit sales per annum, savings were estimated to be:

- ~ £30,090 per annum
- ~ 88.06 tonnes of CO₂e per annum
- ~ 20.06 tonnes of material per annum

The Vacuum Cleaner

The product considered was a top end vacuum cleaner with a price point around £300. It is of robust construction and is aesthetically pleasing with ergonomic design. It has been designed with a number of positive design features in mind, including:

- All polymer components are of good moulding quality and are marked which aids recycling at end of life;
- Use of Torx screws throughout, therefore no tool change was required during disassembly;
- Good robust cable rewind assembly, which gave a complete recoil in each test;
- Removable roller brush, enabling cleaning, replacement, and segregation at end of life;
- Use of up to 70% post-consumer recycled content in polymer components; and
- The main body is packaged in an LDPE clear sleeve rather than a full bag.



Opportunities for Further Improvement

The review identified a number of opportunities where design and/or manufacturing changes could save money and improve environmental performance:

- Reduce the amount of polymer material used for the double cover;
- Review the assembly and quality assurance procedure for the filter to reduce the amount of glue used;
- Make the handle and main body from one material with over-mouldings to eliminate the need for snap fits;

- Reduce the overall amount of packaging used with more strategic packing of the components and accessories; and
- Eliminate the user guide and guarantee slip and replace with a quick start guide, including advice on how to maintain the efficiency of the vacuum cleaner.

These opportunities are described in detail within this case study.

Reduce the amount of material used for the double cover

The vacuum cleaner has a double lid, which gives access to the tool housing and bag compartment. The current design could be improved to significantly reduce the amount of polymer material used and associated costs. A suggestion would be to redesign a single lid with a small hinge flap only covering the tool compartment.

Reduce glue use on the filter

This vacuum cleaner uses a washable filter which is adhered inside an ABS frame with glue. The amount of glue that has been used is excessive and looks untidy for a customer-facing part. A suggestion would be to review the assembly and quality assurance procedure for the filter and try to reduce the amount of glue used. This will reduce production costs and result in greater customer satisfaction.

Eliminate the need for snap fits

The handle and main body on the vacuum cleaner has two polymer side strips attached with clip fits on each side (Figure 2). Although these parts are removable, they are purely for aesthetics. To minimise material use, a recommendation would be to manufacture these components (the main body and handle) from a single material and use over-mouldings if a different look and feel is required. This would eliminate the need for the side strips, thus reducing the overall number of components.



Figure 2: Side strips on the main body

Reduce the amount of packaging used

The vacuum cleaner is packaged in a corrugated carton board outer box and inserts. With more strategic packing, the width of the outer box could be reduced by approximately 100mm, and the corrugated carton board inserts eliminated. This would significantly reduce packaging costs.

The main body and accessories are protected with clear sleeves, which are much larger than they need to be, and are made from various polymers. The size of the sleeves could be reduced significantly to reduce materials. The same polymer film should be used throughout, such as LDPE or PE, and the polymer should be marked to facilitate segregation for recycling.

“Quick start” guides

The vacuum cleaner came with a large paper user manual with full gloss cover and a guarantee slip. A “quick start guide” could be included in the start of the user manual, to include basic set up instructions and advice on how to maintain the efficiency of the vacuum cleaner, e.g. regular cleaning of filters.

Design Reviews and Buying specifications

Having undertaken 16 product design reviews WRAP are building on this work by developing [buying and specification guidelines](#) that will improve the durability of electrical products.

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