Design for **Product Lifetime**

Quick Reference Guide

Access a product's components. | **Keep it alive longer.** | **Enable a responsible end-of-life.**

Design for Disassembly

Ensure products are easy to take apart quickly.

Parts

- Minimize the number of parts.
- Simplify structure and form.
- Use ferromagnetic materials to enable sorting and disassembly.

Tools & Fasteners

- Require only a few standard tools.
- Avoid requiring tools for the most common actions.
- Minimize the number and variety of fasteners.
- Use intuitive snap-fits, clips, or sliding connections.
- Design connections that are visually and physically accessible.
- Access fasteners from the same axis.
- Hold multiple parts with one fastener.
- Use coarse threaded screws for speed; use nuts and bolts for strength.
- Use human-scale fasteners.
- Use hand-strength press-fits instead of tight press-fits.
- Avoid glues, and use only glues that are easily soluble or heat reversible.
- Ensure fasteners are adequate for structural integrity.
- Use fasteners that will hold up over repeated use.

Documents

- Embed clear, graphical disassembly instructions onto the product.
- Document materials and methods for deconstruction for the user.

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Design for Repair

Ensure product repair is simple for everyone.

Product Architecture

- Use modular assemblies that enable the replacement of discrete components.
- Ensure easy access to parts likely to need maintenance.
- Use self-locating parts.
- Use robust connectors.
- Label and color-code parts to enable troubleshooting.
- Standardize between product lines and across generations.

Documents

- Make technical documentation freely available or open-sourced.
- Include parts list and part numbers.
- Create user interfaces and troubleshooting tools to diagnose problems.

Business

- Make repair and services options clear to customers.
- Consider repair-friendly warranty terms.
- Make replacement parts available and affordable.

Design for Upgrade

Keep products relevant and useful longer.

Product Architecture

- Use standard-size modular parts to enable interchangeability and customization.
- Design easy access to parts likely to become obsolete.
- Use standard, cross-platform connections (for example, USB).

Documents

- Build diagnostic tools to help users understand the components that are limiting performance.

Design for Recycling

Make it easy to properly dispose of the product.

Materials

- Choose materials that are recycled everywhere.
- Minimize the number of materials used. When possible, use only one.
- Label parts with recycling codes or other permanent ways to identify materials.
- Avoid paints, additives, and surface treatments. Use inherent color.
- Avoid combinations of materials that are difficult to separate.
- Make it easy to separate components that are hazardous, toxic, or not conventionally recyclable.

Business

- Specify the use of recycled materials in your products (this also helps stimulate demand for recycling).
- Create easy take-back programs to ensure proper disposal of complicated products.

Design for Remanufacturing

Enable reuse of old components in new products.

Business

- Create product-as-service business model.
- Design smooth touchpoints between the company and users.
- Design a quality-control system for testing returned components.