Design for End-of-Life / Recycling - DFx & Circularity blog series

Nicolas Avril – Enging.net – Blog 10 – August 2025

With all the talks about moving toward a more circular economy, the concepts of designing for end_of_life (DFEOL) activities are familiar to design teams. The idea of making a hardware product easy to disassemble so that different materials can be separated is simple to grasp. But few are the companies that execute it well.

I recently had the opportunity to do a teardown of a smoke detector made by the company ELRO. For full disclosure, I am not associated in any way with this company except for the fact that I own seven of their products. I dare say that I was impressed by the care the design team took to make sure the product could be disassembled and the different parts separated.

Figure 1 - ELRO smoke detector before teardown

Within a few minutes, I had four groups of parts in front of me. Disassembly required only a small screwdriver to unsnap the three tabs connecting the two sides of the enclosure (See Figure 2). It is to be noted that the two sides can only be connected in one orientation, making mistakes during assembly impossible (Poka-Yoke design).

- Plastic parts, made by injection molding, five in total: Three large white pieces made of PS and two smaller black pieces (these are not fully yet designed for recycling (see next step below)). It is to be noted that the parts being unpainted, not

covered with many stickers, and made of a single material type made them ready for entering the recycling process.

- Metal parts. One made by wire bending, cleverly designed so as to perform its function (presence of a battery) without being attached to the plastic part it mates with. The other was soldered (see next step)
- Electronics: One single PCBA with about 32 components
- Miscellaneous: One 9V battery connector with two wires, one speaker with three wires. The speaker was connected to the enclosure with a silicon-like joint that had been dispensed/formed-in-place. During disassembly, the silicon stuck to the metal of the speaker leaving the PS enclosure free of sealant. The PS was therefore not contaminated.

Figure 2 – The two sides of the enclosure are connected with three tabs and can only be mounted in one orientation.

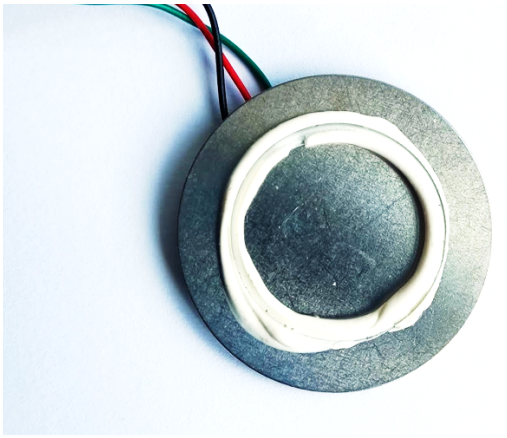

Figure 3 – The formed-in-place joint between the speaker and the enclosure clearly showing the shape of the enclosure feature to which it was mated.

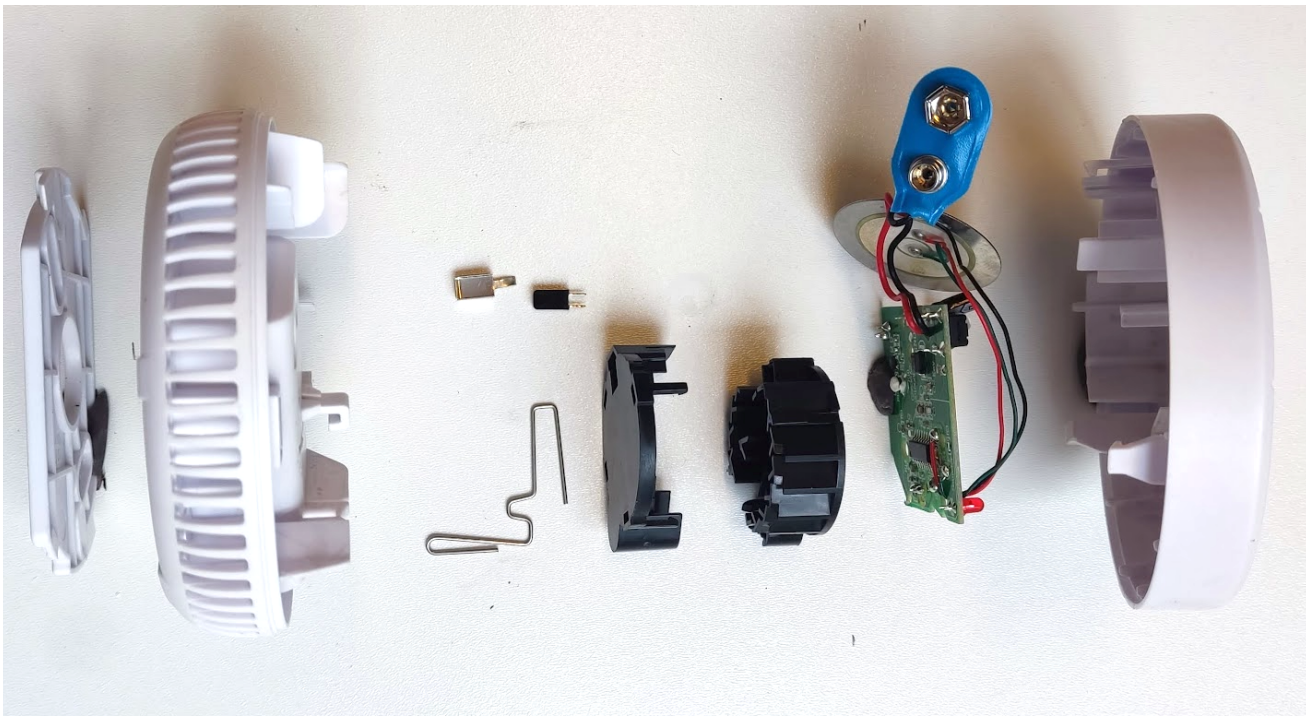

Figure 4 – All parts and sub-assemblies in an exploded view.

Conclusion. Even though the BOM might only contain about 45 items, praise should be given to the design team at ELRO for the care they took to make a hardware product easy to disassemble and to recycle.

Next step. One improvement I suggest is to find a way to accurately locate the sensor inside the black cavity without passing the soldering tabs through it. The design of the unit that was taken apart requires the tabs to be broken or desoldered to separate the two. This design change will make recycling the black material of the sensor cavity more likely.

Have you come across a hardware designed for a more circular economy recently? Please let me know by email at nicolas@enging.net .