Case study

Specifying durability and repair in LCD televisions

June 2011

A case study of three LCD (liquid crystal display) televisions to identify and encourage durability and repair.
Introduction

Why buy televisions that last longer?

This case study complements WRAP’s buying specifications for televisions that have been developed to assist buyers and manufacturers procure and produce higher-quality products that last longer, and can be more easily repaired leading to lower environmental impacts.

WRAP’s environmental assessment of 15 electrical products¹ found that the total LCD TV material and production impacts were over three times higher than the total material and production impacts of any other product purchased in the UK. There is a clear opportunity for significantly reducing the environmental impacts of televisions by making them last longer by increasing their durability and ability to be repaired.

This case study highlights the most beneficial measures that extend the product’s life, and some of these can be relatively easy to achieve within the product’s price-point constraints. The buying specifications include further detail for companies wanting to take a more ambitious approach and deliver greater environmental savings, as well as differentiating their brand for reliability.

The buying specifications were developed by assessing televisions through research with manufacturers, retailers and repairers, and also through carrying out ‘teardown’ on a range of models to identify design features that facilitate repair.

¹ Environmental Assessment of Consumer Electrical Products
www.wrap.org.uk/retail_supply_chain/research_tools/research/report.html
Product information

Three television models (one supermarket own-brand model and two leading brand manufacturers) were selected for detailed assessment to typically represent different market segments and these were:
- 19” low-cost supermarket’s own-brand - HD ready with HDMI (high definition multi-media interface) input and loudspeakers, retailing at around £110;
- 20” medium-cost model - PC interface and input, digital tuner and loudspeakers and not HD ready, retailing at around £220; and
- 40” high-cost model - HD ready with HDMI inputs, memory card slot and service port, digital tuner and high-quality stereo sound, retailing at between £500-600.

Of these, good practice specifications that facilitate durability and repair were found relatively equally across the range, therefore examples of the best features from each model have been used to highlight the most beneficial best practice features.

LCD TV durability

The LCD television has recently become the most dominant TV technology in UK homes and is one of the most frequently purchased household electrical items (9 million LCD televisions were sold in 2009). When televisions break down after the end of their warranty period they are typically considered as uneconomical to repair and are often disposed of and replaced with newer technology with more functionality.

Research carried out for this project with the repair industry found that the most common faults that cause failure and shorten the product’s lifetime are:
- screen faults – due to damage, sometimes caused by impact;
- power circuit board faults;
- main circuit board faults - including hardware and microchip software;
- damage to connections - often between circuit boards; and
- damage to television stands.
Durability

Although televisions are not designed to be portable items, they are exposed to potential damage during transport from the manufacturer to the retailer and from there to the consumer. Assemblies such as the screen that are fragile and critical to use, are particularly susceptible to damage. Damage occurs through strains on connectors and PCBs (printed circuit boards) that are subject to flexing, causing strain on soldered joints. Electronic components and solder can also become damaged by variations in temperature and humidity for example, that exacerbates poorly soldered joints and corrupts chips.

Mechanical robustness

All three of the models assessed demonstrated good practice specifications by having external function-critical parts such as the power lead connectors, ports and sockets (aerial, audio visual, HDMI and SCART), on-off switches and function buttons, supported in strong housings. They are protected from damage by being positioned away from vulnerable locations such as corners. The example below shows the sockets and ports recessed in the centre of the back panel, protected from potential damage.

Figure 1 Recessed connector positioning
The three televisions demonstrate chassis and outer casings that have inherent strength and rigidity, which is important to minimise flexing of the screen and reduce the displacement of PCBs and electrical connectors. The 40” higher-cost model was found to be constructed from a particularly strong steel chassis and robust PCABS (poly-carbonate acrylonitrile butadiene styrene) plastic case with high rigidity that prevents damage in transit or use.

The stands are mounted directly onto the chassis and provide sufficient strength and good stability. The smaller, low-cost model is mounted and secured to the stand by screws alone (figure 2) which is less robust. The larger, high-cost model demonstrated good design practice by using fasteners and the stand’s bracket sliding into an opposite male/female connector on the television to ease assembly and also provide stability. This is particularly important as damage can easily occur when the stand and set are being assembled for the first time.

**Figure 2 Stand mount to TV body using only screws**

---

**Electrical robustness**

Some of the television casings are designed to support electrical connectors (such as aerial mounts), rather than solely relying on soldered joints to keep the printed circuit board in place. This helps to prevent weak electrical connections and subsequent failure through solder damage.

This research found that surface-mounted solder rarely presents problems, whereas ‘through-mount’ soldered components showed damage or reduced connectivity from joints where solder was insufficiently applied. The PCBs in the models examined use predominantly surface-mounted technology.

Failure of individual components, and subsequently the entire unit, can be caused by critical overheating. Sufficient heat sinks should
be used to ensure adequate airflow as well as internal spacing, particularly important in smaller models where space restrictions cause components to be closer together. Unlike in computers, fans are rarely used in televisions where appropriate slots in the casing help air to circulate and provide cooling to a lesser extent.

A feature found on products in the market that should be avoided is the interconnection of components making them jointly vulnerable to failure. A fault on a power circuit for example may cause damage to other components, such as the main control board. Suitable electronic protection can be provided by isolating parts.

**Repair**

**Fault diagnosis**

The built in self-diagnosis function found in the high-cost 40” model is a significantly beneficial feature for repair. The timer/standby light uses ‘blink’ codes to indicate a fault and these fault codes are provided by the manufacturer online.

Another good design feature demonstrated by the high-cost model is the ‘service only’ memory card or USB (universal serial bus) port on the main circuit board, as shown in figure 3 below. This can be accessed by service engineers for software updates and used to identify and diagnose faults (for example with a particular batch of televisions), and in some cases to enhance functionality leading to extended product life.
Technical support and parts

The two major brand manufacturers assessed in this study (mid and high-cost models) offer customer support services beyond the period of warranty which helps to prolong product life. Support includes contact with a service support team, online FAQs and trouble-shooting tips, discussion forums and repair advice.

Only one of the brands provided free service manuals, fault codes and relevant software information available to users and independent repairers beyond its own authorised repairers. Section 17 of the WEEE Regulations states that manufacturers must make instructions for product repair available within one year of being placed on the market.

The price and availability of spare parts can be a significant barrier for television repairers, once the product goes beyond the warranty period. Our research found in some cases it can be difficult to source parts for models that are only three years old and some own-brand models sold in the UK have no spare parts. This can be attributed to models changing rapidly and some manufacturers not making parts available beyond three years. There is a bewildering range of television parts, and although parts can sometimes be interchanged between models, repair isn’t usually considered a priority by manufacturers as sourcing and replacement of parts isn’t facilitated. Here sensible pricing of parts should be considered to enable cost-effective repair.

The two brand manufacturers assessed provide dedicated websites for the sale of parts and accessories. In the high-end brand, cost of parts can make repair unfeasible. The own-brand model manufacturer doesn’t provide online repair information, although cost-effective parts are available through UK distributors. A power supply board for example can be purchased online for between £30-50 – in this case making repair financially viable.

The key part to consider for price and availability is the LCD screen replacement where the cost of a 32” or 40” screen replacement on the market were found to range between £200 to over £300, depending on the supplier with brand manufacturers being more expensive. In some cases the cost of a replacement screen is more than the original purchase price which represents a pricing practice that inhibits repair.
Access for repair

Casing

Easy and straightforward access to key components is critical to enable repair. It was found to be common practice on the market to clip casings together inhibiting access for repair and making them difficult to open without damage. This practice was demonstrated equally across the television price points.

The three models assessed in this study however use standard screws to secure the outer casing together, making it simple to take them apart and reassemble. There is a balance between providing adequate strength to the unit, and reducing the number of fastenings to enable quick access for repair. Standardising screw types and head sizes helps by preventing tool changes for the repairer, saving time and cost.

Fastening points for the low-cost model are visible and clearly marked, providing easy access to internal components. However, some of the fastening points on the mid to high-cost models are not as easy to find and this can hinder disassembly.

Circuit boards

The power circuit boards, main control boards and their components are easily accessible in the models assessed. In general, power boards can be repaired at component level or the whole board can be replaced if there is a fault. Our research found that EMC (electro-magnetic compatibility) screening boxes used to be a barrier to repair, but this is no longer found to be the case as demonstrated in the models assessed.

On some of the models the video circuit board and the screen control inverter (DC to AC converter) were located between the chassis, screen assembly and the screen. These components seldom fail, however access could be improved by enabling easier access via the chassis.
Most of the electrical joints demonstrated accessible spade or clip-fit connectors (figure 4) rather than soldered joints. This is a good feature and allows easy replacement of components like the controller board, power board, inverters and speakers.

**Figure 4** Clip-fit connectors

An additional good design feature found in the high-cost model was the PCBs being clip-fitted into a slot in the moulding, eliminating the need for screws (figure 5).

**Figure 5** PCB clip-fit into a plastic moulding

Many key components in the high-cost model are colour-coded to enable parts identification for repair (capacitors shown above), and this should also be used to label hazardous components such as the LCD screen for removal and treatment at end of life to facilitate recycling. Plastic polymers are also marked to assist recycling.
The LCD screens

The screen is the major component of a television that is prone to faults or damage due to its fragility, and it is important that access and replacement is easy. Discussions with repair organisations revealed that some models do not allow easy access to repair or replace the screen.

The 19” screen model offered the simplest removal with no screws on the screen assembly once the back casing is removed. The assembly is located on moulded plastic lugs and can be removed by four screws. This feature may only be possible in smaller units where greater reliance can be placed on the rigidity of plastic mouldings and the back cover.

On the 40” screen, access could be enhanced by providing integrated handles to help lift the heavy screen out of the moulding.
Conclusion

The televisions examined are designed to be generally robust and durable; it is possible and in some cases easy to access many of the major components and assemblies for repair or replacement. The best features for durability and repair demonstrated by the models that could be relatively easy to implement include:

- online and open access for users and repairers to diagnostic information, repair advice and parts listings;
- main casing with minimum number of standard screws or clip-fits for multiple access cycles;
- easy access to the main power and control circuit boards;
- clear component identification by colour coding;
- easy screen replacement;
- good parts availability and reasonable spares pricing; and
- dedicated repairer service ports.

Good design to prevent mechanical damage by:

- strong and well-mounted stands;
- robust case and chassis;
- protected external parts such as ports and switches; and
- securely fixed and supported internal components.

Good electrical design to reduce parts failure by:

- use of surface-mount solder technology;
- adequate heat sinks to ensure component cooling; and
- protection against electrical power faults causing component damage.

WRAP recommends that buyers and procurement professionals seek to specify as many of these design features into their products as possible, within their price point constraints.
While steps have been taken to ensure its accuracy, WRAP cannot accept responsibility or be held liable to any person for loss or damage arising out of or in connection with this information being inaccurate, incomplete or misleading. This material is copyrighted. It may be reproduced free of charge subject to the material being accurate and not used in a misleading context. The source of the material must be identified and the copyright status acknowledged. This material must not be used to endorse or used to suggest WRAP's endorsement of a commercial product or service. For more detail, please refer to our Terms & Conditions on our website: www.wrap.org.uk

Waste & Resources Action Programme

The Old Academy
21 Horse Fair
Banbury, Oxon
OX16 0AH

Tel: 01295 819 900
Fax: 01295 819 911
E-mail: info@wrap.org.uk

www.wrap.org.uk/retail