SMART CAP Information Series

SmartCap Headwear

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Tested Fit for Purpose

Since our early designs, SmartCap headwear has come a long way. Every SmartCap headwear design goes through stringent fitness-for-purpose testing, which pushes well beyond everyday use. This is so that we, and you, can be confident that your SmartCap headwear will stand the test of time.

Engineered to Last

From fabric selection to final assembly and testing, SmartCap headwear is engineered for quality. Each and every piece of SmartCap headwear utilises our patented EEG sensors, which have been developed using best-practice standards in flexible electronics design and manufacture. We work closely with our suppliers who are equally committed to robustness and quality.

When it comes to wearable technology, materials selection matters. The fabrics, embroidery, plastics, adhesives and metals are chosen to be hypoallergenic, washable and comfortable. We've always ensured that more than one fabric option is available for individuals with specific allergies, and are continuing to further expand our product range.

Fitness for Purpose Testing

The SmartCap engineering team performs three levels of fitness-for-purpose testing; once headwear passes the second level of testing it is deemed fit-for-purpose.

Why do we push our headwear past fitness-for-purpose? We do this to learn more about our materials and their limits, so that every new design is tougher than the last.

Here's what we test:

A. Every Day Use

The first level of testing covers basic use, and represents 12 months of accelerated life testing:

- **SP Card docking:** The processor card is docked a minimum of 500 times to ensure that the dock is secure, and that the electronics are suitably aligned.
- **Worn on the head:** The headwear is placed on our tester's head 500 times and adjusted, to ensure that the normal flexing action doesn't compromise the electronics and that the internal structure allows a comfortable fit.
- **Machine washing:** The headwear is machine washed with varied load size (from a single item load to overloaded machine) to test the robustness of the assembly, fabric selection and the design's ability to protect the flexible electronics.

After this testing, we perform a full-functionality test to ensure that the headwear design is fit to withstand 12 months of everyday use.

B. Undesirable Treatment

The second level of testing covers undesirable storage (such as storage under load, twisting and folding) and inappropriate handling (such as bending headwear, shaking, dropping from various heights):

- **Brim tucking:** This involves tucking the brim into the dome of the cap 100 times, which is a typical yet undesirable fidgeting behaviour. For headband designs, this is performed as an end to end curl, which is the equivalent of the undesirable fidgeting behaviour.
- **Shock pull:** The inner band at the rear is pulled with sharp force away from the brim 500 times, to simulate harsh fidgeting behaviour. For headband designs, the centre of the padding is held in place of the brim.
- **Load with 1kg weight:** The headwear is impacted with a 1kg weight dropped from a 50cm height onto various locations a total of 200 times, to simulate undesirable storage and impact.
- **Curling:** The brim of the cap is curled edge-to-edge a total of 200 times to simulate inappropriate handling. For headband designs, this is a 180-degree fold at various locations of the electronics.
- **Violent shaking:** The cap is violently shaken 500 times holding the brim to simulate undesirable handling. For headband designs, the centre of the padding is held in place of the brim.
- **Dropping:** The headwear is dropped from a minimum height of 1.5m a total of 50 times, to simulate undesirable handling.

Headband designs are subjected to design-specific tests, including:

- **Transverse impact:** the SP Card dock is aggressively impacted against a rigid surface in a slapping motion as the band is held at the centre of the padding a total of 200 times.
- **S-bending:** The band is stressed into an unnatural s-bend in two locations (neck and centre) a total of 40 times.

Afterwards, we perform a full-functionality test to ensure that the headwear design is fit to withstand 12 months of undesirable treatment.

C. Harsh Treatment

The third level of testing includes scenarios that are not covered under warranty. It includes storage under extreme load, heavy impact, and sharp angle bending:

- **Load with > 5kg:** Headwear is impacted 10 times with a weighted metal disc 10 times in various locations to simulate irresponsible storage.
- **Sit on headwear:** An adult male sits on the headwear 20 times to simulate unintentional damage through mishandling.
- **Step on headwear:** An adult male stands on the headwear at the location of the red dock a total of 5 times to simulate irresponsible storage and handling.
- **Hammer impact:** The dock area is impacted with significant force using a hammer to simulate intentional damage or irresponsible storage.

Quality Delivered

Even after our design has been validated through Fitness for Purpose testing, we always make sure that our manufacturing and assembly is thoroughly vetted. Every individual piece of SmartCap headwear is comprehensively hand-tested and inspected against our strict quality requirements prior to shipping. Before being given the thumbs up, each item must past the following:

- ✓ **Electronics test:** The patented electronics are individually tested for signal processing and electrical noise rejection integrity to an accuracy of greater than 99%.
- ✓ **Continuity test:** The assembled headwear is tested for electrical continuity on the inner band to ensure that the locations for EEG signal measurement are electrically isolated.
- ✓ **Connectivity test:** A processor card is docked into the headwear and a Bluetooth connection established with a SmartCap display. This ensures that the electronics remain intact after assembly, and tests whether the individual headwear ID can be read.
- ✓ **Visual inspection:** The headwear is inspected for loose threads, markings or other imperfections before being sealed in individual packaging.

Of course, even though our headwear is pushed to the limit during the design testing stage, no headwear that is shipped is treated this way. Most importantly, every piece of headwear sent has never been worn.

Standing behind our product

At SmartCap Technologies we stand behind every item we ship, backing them with an industry-leading warranty for our customers. If an item of headwear should happen to stop functioning, it should be returned to us. Each and every return is investigated, and a report produced.

Within the warranty period, if there is no evidence of inappropriate handling or intentional damage, we will replace the headwear at our expense. Our engineering team regularly reviews the investigation reports to ensure that new designs benefit from any improvements we identify.

Looking after your SmartCap Headwear

Even though SmartCap headwear is tested well beyond everyday use, it is important to look after your SmartCap to ensure you maximise its life. What 'looking after your SmartCap' entails is outlined in the SmartCap Headwear Care Instructions, which can be downloaded from SmartCap Help Centre (**http://support.SmartCapTech.com**).