

Measurements Taken on AOSEM Screws

LIGO-T1000240-v1

R. Abbott, CIT, B. Bland, LHO

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1. **Overview** – The flexible circuit boards used in the AOSEM have an alumina stiffener. The question arose as to how to tighten down the screws that hold the flexible circuit board in place, without cracking the alumina stiffener.

A test was devised to measure the torque on the set screw used to fix the alumina stiffener in place. Various weights were hung on the tip of an Allen key until the point of failure was reached, and the alumina circuit board cracked. Samples were taken of the amount of torque needed to turn the set screw within the plastic body of two AOSEMs, serial number 213 and 209.

All masses were recorded. The actual set screw used to break the alumina stiffener would turn under the weight of the Allen key alone, so its torque is negligible as compared to the required torque to crack the alumina. For this reason, the inherent screw torque needed to simply turn the set screw is not required to be subtracted from the torque required to crack the alumina.

Seven other screws were measured, and the torque required to turn them within the plastic body was significantly higher and quite varied

2. **Measurement Results**

- 2.1. The torque required to crack the alumina stiffener – 2.02 inch-pounds

- 2.2. Torque required to turn a sample of seven screws

Head Serial Number	Torque to turn screw (inch-pounds)
213	0.18
213	0.18
213	0.35
209	0.07
209	0.11
209	0.03
209	0.05

- 2.3. Characteristics of Allen key

- 2.3.1. Total Mass – 1.5 grams

- 2.3.2. Length of lever arm – 3 inches

- 2.3.3. Total length of Allen key – 3.5 inches

3. **Conclusions**

- 3.1. The required torque to break one sample of alumina stiffener is **2.02 inch-pounds**.

- 3.2. The torque required to simply turn the screws within the PEEK plastic AOSEM head is of order 10% of the torque required to crack the alumina stiffener.

- 3.3. A good starting point for a torque specification would be 0.5 inch-pounds above the torque needed to turn the screw.