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OSEM Alternative Magnetic Flag Mount Test Report

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This is an internal working note
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http://www.eng-external.rl.ac.uk/advligo/papers_public/ALUK_Homepage.htm

1. Introduction

The purpose of this technical note is to address the issues regarding the durability of the OSEM flag, and to compare the robustness between the vac-sealed and magnetic versions of the flag mount. I also investigate the maximum displacement of the flag before it either breaks or ceases to return to its original position.

2. Background

The flag mount for vacsealing is composed of an aluminium flag, magnet and aluminium spacer (Figure 1). The magnetic version of the flag mount consisted of a circular cap at the end of the flag. The cap contained a flat magnetic disc and acted like a magnetic plug, ensuring that it attached neatly to the magnet. At the other end, the magnet was inserted into a tapped hexagonal head screw (Figures 2a and 2b).

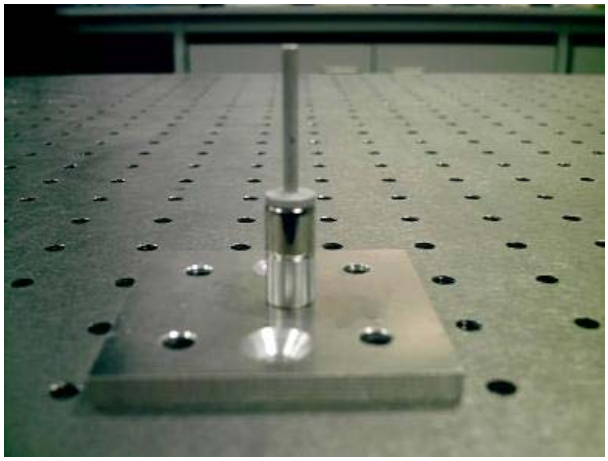
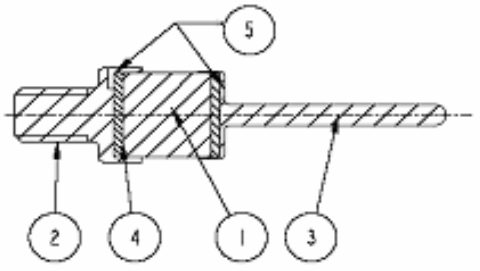


Figure 1

Components of vacseal-bonded OSEM flag

Figure 2a

Components of magnetic OSEM flag



Notes:

1. *Magnet (∅10mm x 10mm)*
2. *Hexagonal head screw*
3. *Flag*
4. *Magnetic plug*
5. *Vent holes to prevent micro-leaks*

Figure 2b

Cross-section of magnetic flag and mount

3. Vacseal

3.1 Bonding process

The contact surfaces of the flag, magnet and spacer were prepared and sanded with 600 grit sand paper in order to increase surface areas and thus aid the bonding process. The parts were already sand-blasted when delivered to Birmingham. The vacseal was applied to the surfaces in an even layer. The parts were assembled and placed in a Prior Clave bake-out oven and left to cure at a temperature of 110°C for 96 hours.

3.2 Testing the Vacseal bond

The flag was screwed into a mount attached to an optical bench, with the flag orientated horizontally. In order to determine the strength of the bond, weights were suspended from the end of the flag, approximately 5mm from the end (Figure 3). Weights were added until the bond broke. Maximum displacement was determined using a translation stage. The base was adjusted against the flag so that one of the bonds eventually broke (Figure 4). It was found continuously that the bond between the magnet and the spacer was the one to give way first in both experiments.

3.3 Surface cleaning

In order to ensure that all vacseal residue was removed after testing, the flag components were soaked in acetone overnight, and re-used for further tests.

Figure 3

Vacseal-bonded flag mounted on a metal stand, with weights suspended on the end

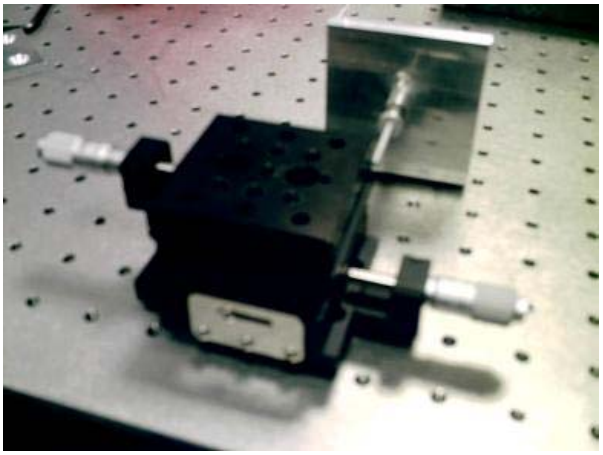


Figure 4

Translation stages were used for determining the maximum flag displacement

4. Magnet

4.1 Magnetic attachment

The flag was simply screwed into a mount, attached to an optical bench.

4.2 Testing the magnetic force

As before, weights were suspended approximately 5mm from the end of the rod, and the maximum weight that could be carried before the magnetic forces were overcome was established (Figure 5). Translation stages were used to determine displacement tests. For small displacements, the flag returned to its original position due to magnetic attraction. The distance at which the flag failed to return to its original position was therefore determined (Figure 6). The magnetic force was consistently overcome first between the magnet and the bolt in both experiments.

Figure 5

Weights suspended from a magnetic flag

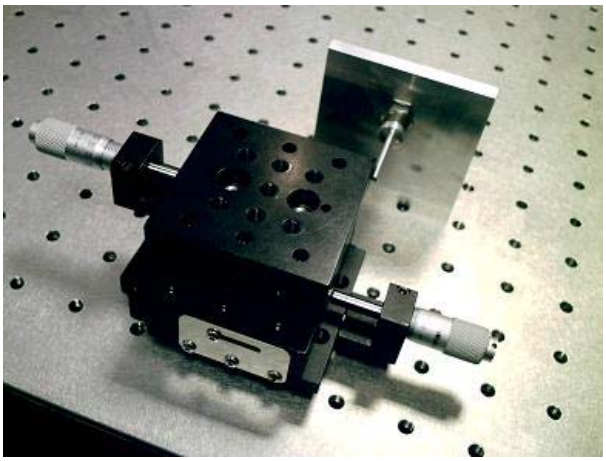


Figure 6

Displacement test on magnetic flag

5. Results

The figures below correspond to the mean values, recorded just before the vacseal/magnetic bond broke.

Method	**Max weight[1] / g**	**Max displacement[2] / mm**
Vacseal	2000	0.88
Magnet	183.03	12.8

[1] Maximum weight supported by the flag just before the point of breaking/detachment.

[2] Maximum displacement just before breaking-point. In the case of the magnet, this is the point at which the magnet was displaced inside the bolt, and as a consequence failed return to its original position.

6. Conclusion

The vacseal-bonded flag was rather more robust and able to support a considerable amount of weight, compared to the magnetic flag. However, its performance regarding the displacement tests was poor – a displacement of less than one millimetre resulted in a broken bond.

The magnetic flag was found to return to its original position when displaced by any distance less than 12.8mm. As the earthquake stops within the OSEM are situated 0.5mm on either side of the flag, so it can be assumed that after 0.5mm of flag displacement, the force of the load would then be transferred through the earthquake stops.

In terms of time and convenience, the magnetic flag offers the benefit of easy preparation and assembly. In addition, there is also the provision to control the orientation of the flag during assembly and installation, should this be required.

7. Acknowledgements

I wish to thank Ian Wilmut (RAL) for providing the drawings and parts for the magnetic flag mount assembly.