

## K1DM3 – Technical Note

### Axial Puck Pull Test

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#### 1 Introduction

Axial puck pull tests were conducted by WMKO on samples provided to Keck to obtain bond strengths in tension, thereby validating the K1DM3 mirror puck design.

#### 2 Procedure & background

Keck has researched several adhesives and have conducted extensive testing on bond strength under various conditions. Their work and results are recorded in Reference 1. Keck is implenting a new axial pad design for their segment repair program. This new pad, along with the existing lateral restraint radial pads, react in shear. Since the K1DM3 lateral pucks act in this same manner, Keck's results for the Loctite Hysol E-120-HP adhesive can be used for loads seen by these components.

Keck proof tested both axial inserts & lateral pads. Static design loads are 70 lbs for axial inserts and 275 lbs for lateral pads. Mechanical strength test at 0 C failed axial inserts at a nomimal load of 1433 lbs. Based on glue pad area this is a stress of 4172 psi. None of the lateral pads failed. The pull bracket failed at 3900 lbs. Based on glue pad area the stress at this load was 3065 psi.

The static design stress for the K1DM3 lateral pucks is 136 psi. Using the most conservative value reported by Keck (3065), this is in excess of a safety factor of 20.

Since the axial pucks act in tension/compression some additional testing was necessary to obtain strength values for this mode of loading. Test samples for four sets were made and sent to Keck for bonding and testing. Parts were cleaned and prepped using the same procedures used for the segment repair program. Four new tests were conducted according to Reference 2. And the results of these tests were reported in Reference 3.

#### 3 Results

The test results are shown in the table is directly from Reference 3. Only one sample failed, at sustained load for about 30 minutes. The K1DM3 static axial load is 21.5 lbs. Based on the maximum load of 1000 lbs, this is a safety factor of more than 40. Based on these findings the axial puck design is adequate.

Table 1 - Test results table from Reference 3

Sample	Conditioning	Test Temperature	Test Date	Load Rate	Maximum Load	Time @ Max Load	Failure
1	24 hr @ 1°C, 19 hr @ 21°C	21°C	2/20/2017	40 psi/min (5 lb/min)	1000 lb	30 min	Failed after ~30 min. @ 1000 lb
2	24 hr @ 1°C, 23 hr @ 21°C	21°C	2/20/2017	40 psi/min (5 lb/min)	1000 lb	2 min	No failure
3	67 hr @ 1°C	1°C	2/20/2017	1200 psi/min (300 lb/min)	1000 lb	2 min	No failure
4	71 hr @ 1°C	1°C	2/20/2017	1200 psi/min (300 lb/min)	1000 lb	2 min	No failure

#### 4 References:

- 4.1 Axial Insert and Radial Pad Qualification Tests, KOTN 824, Dennis McBride, 22Oct15
- 4.2 Axial Puck Proof Test Procedure, K1DM3 Technical Note, 872-LTN1020, 18Aug16
- 4.3 K1 Deployable Tertiary Mirror Axial Support Tests, PowerPoint, Dennis McBride, 21Feb17

#### 5 Revisions

Rev	Date	Description
A	5 May 17	Initial draft