

K1DM3 Technical Note 872-LTN1021

Axial and Lateral Witness Sample Test Procedure

1 Introduction

This is a test procedure for the strength testing of the axial and lateral puck witness samples that are created during the bonding processes on the K1DM3 mirror. Procedures and practices are essentially identical to those followed by Keck's segment repair program (SRP). The only difference is that where only two samples are made in the SRP for each bonding run, three will be made during K1DM3 sequences.

2 Ultimate Strength Test

2.1 Objective

Tests shall be performed to determine the ultimate strength of the test samples, to be conducted under conditions specified in sections below.

2.2 Requirements

1. Each sample shall be loaded until failure to determine the ultimate strength of the sample.
2. Testing procedures and equipment will be similar to those used and described in Reference 1.
 - a. The axial pucks estimated ultimate limit is 455 kgf (1004 lbs).
 - b. The axial pucks estimated ultimate limit is 1037 kgf (2286 lbs)
3. The load measurement system (load cell) shall have capacity to measure the load on the sample with a minimum measurement accuracy of $\pm 0.5\%$ of reading.
4. Samples shall be loaded at a rate of 8.3 to 9.7 MPa/min (1200 to 1400 psi/min).
 - a. For the axial pucks this is a rate of 149 to 174 kgf/min (329 to 383 lbf/min).
 - b. For the axial pucks this is a rate of 339 to 396 kgf/min (748 to 873 lbf/min).
5. Tests shall be conducted in a chamber capable of maintaining the specified temperature and humidity over the test period if specified in the test conditions.
6. A suitable fixture shall be designed and implemented that will support the test sample in the proper alignment for testing. Load shall be supplied to the sample and the fixture shall be such that no bending or buckling moment is placed on the sample bond area.
 - a. The loading of the axial samples shall be applied as shown in Figure 1. The block will be restrained or held in place while the puck is loaded in tension by a rod threaded into its top surface. Loading and test configuration are similar to those used for the axial puck proof testing [3].

- b. Loading of the lateral samples shall be applied as shown in Figure 2. Here too the block will be held fixed and the load applied thru the puck arm which is attached to the puck. This puck arm is designed so that the load is applied in shear at the midplane of the epoxy bond.

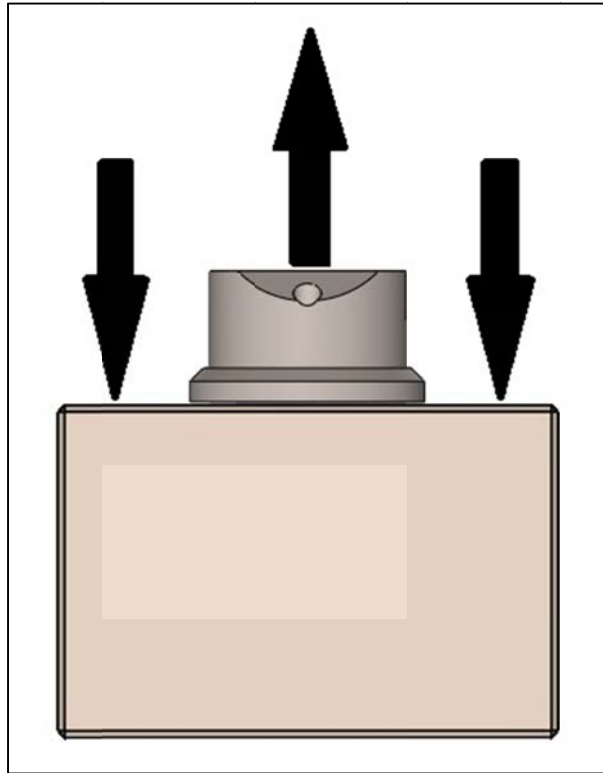


Figure 1 - Axial sample showing the directions of force and restraint on the puck and Zerodur block

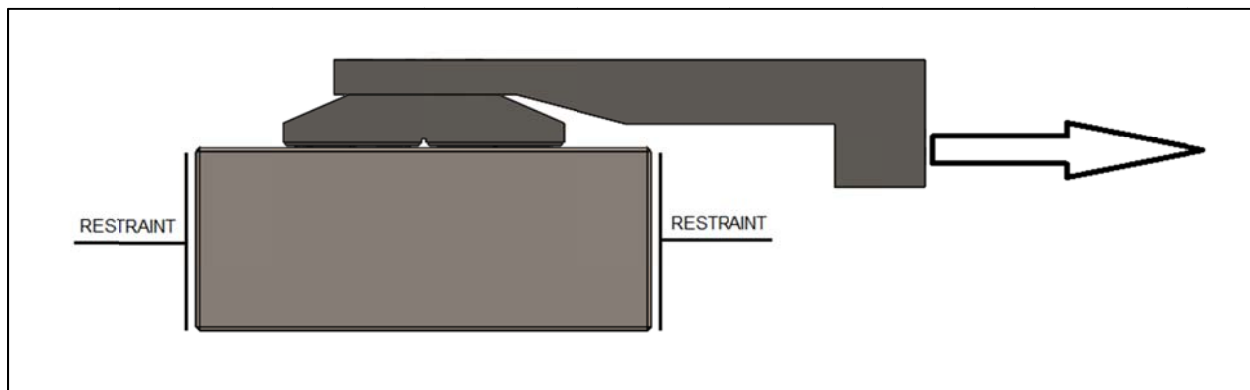


Figure 2 - Lateral sample showing the force applied thru the puck arm and the restraints applied to the block.

2.3 Test Conditions

1. Samples shall be pre-conditioned for temperature and humidity, transferred to the test chamber and conditioned there prior to testing in the manners used for the Keck SRP.

2. Separate tests to failure shall be conducted at 0°C (32°F). Temperature shall be maintained at test temperature $\pm 1^\circ\text{C}$ ($\pm 1.8^\circ\text{F}$) during the test.
3. There shall be 3 samples tested at each test temperature.

2.4 Report the following

1. Photos of the actual test apparatus during the test.
2. Description of the materials, procedures, and equipment used.
3. Temperature and relative humidity in the test room.
4. Any conditioning procedures used for the samples prior to testing.
5. The maximum load at the point of failure for each test sample.
6. The ultimate strength of the samples at each temperature, calculated as the average of the loads at the point of failure the three test samples 0°C.
7. Results shall be reported in metric and US customary (inch-pound) units.
8. Location and nature of failure (relative percentage of adhesive, cohesive or substrate) for each sample.
9. Failed test pieces

3 Sample preparation

1. Samples will be created as described in Reference 2 and 4. The pucks and glass blocks will be cleaned and prepared according to the practices and procedures Keck follows in the segment repair program.
2. The ¼ mm bond gap is obtained by setting the height of the of the fix plate to the value noted on the respective assembly drawings [2 & 4].
3. Puck in their fixture assembly must be held firmly against the glass for the duration of the bonding and cure time for the epoxy.

4 References

1. Axial Insert and Radial Pad Qualification Tests, KOTN 824, Dennis McBride, 22 October 2005
2. Axial Test Block Fixturing Set-up, UCO/Lick drawing 872-LM8310
3. Axial Puck Test Plan, K1DM3 Tech Note 872-LTN1020, Cabak, 18 August 2016
4. Lateral Test Block Fixturing Set-up, UCO/Lick drawing 872-LM8311

5 Revisions

Rev	Date	Description
A	24Aug16	Initial draft