

## Technical Note K1DM3 – 872-LTN1020

## Axial Puck Proof Test Plan

## 1 Introduction

This is a test plan for the proof testing of the axial pucks. Lateral pucks will not be tested due to the extensive testing as reported in KOTN 824 [1]. Keck's radial and axial pads all act in shear loading. This was fully researched in their testing. The resulting ultimate bond strength is approximately 3600 psi<sup>1</sup>. The K1DM3 axial pucks are loaded in tension/compression. For this reason some proof testing of the axial pucks is warranted to obtain an ultimate load for this geometry and loading condition. The test plan described here is based on the procedures outlined in KOTN 824 and borrows heavily from that text.

## 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 in tension 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. The axial pucks estimated ultimate limit is 455 kgf (1004 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). For the axial pucks this is a rate of 149 to 174 kgf/min (329 to 383 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. The loading of the sample 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.

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<sup>1</sup> A value of 3667 psi based on the average of three tests.

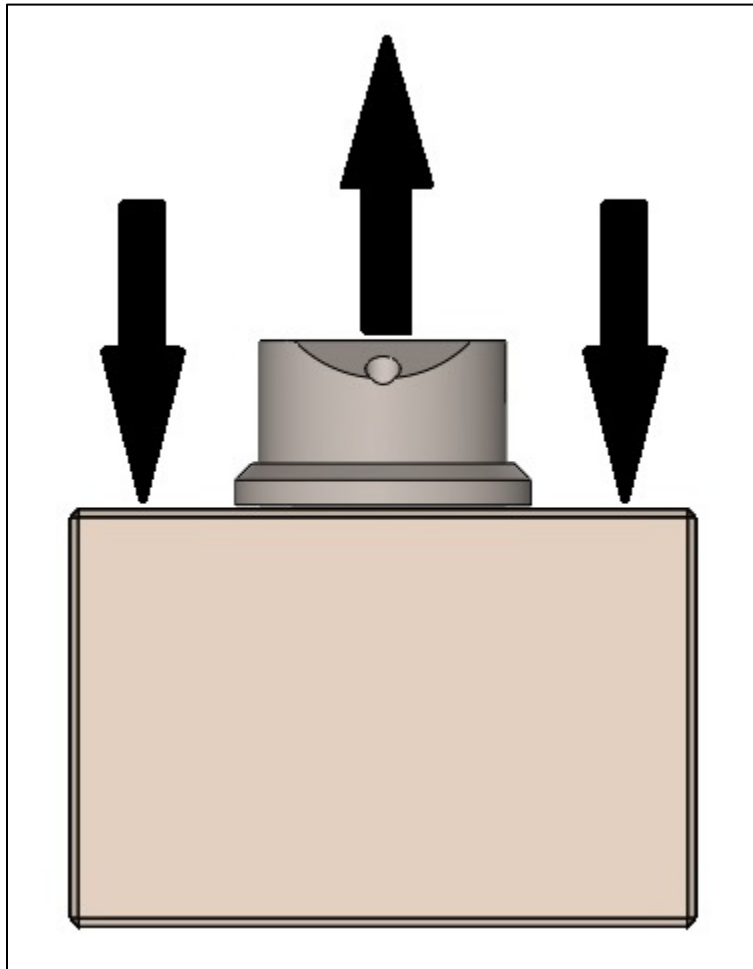


Figure 1 - Axial sample showing the directions of force and restraint on the puck and Zerodur block

### 2.3 Test Conditions

1. Samples shall be pre-conditioned for a minimum of 7 days at  $23 \pm 1^\circ\text{C}$  ( $73.4 \pm 1.8^\circ\text{F}$ ) and  $50 \pm 5\%$  relative humidity prior to testing.
2. Samples shall be conditioned within the test chamber for a minimum of 4 hours prior to testing at the test temperature  $\pm 1^\circ\text{C}$  ( $\pm 1.8^\circ\text{F}$ ). The relative humidity shall be maintained at  $50 \pm 5\%$ . Samples are to be placed in the conditioning/test chamber within 30 minutes of removal from the pre-conditioning chamber.
3. Separate tests to failure shall be conducted at  $+20^\circ\text{C}$  ( $68^\circ\text{F}$ ) and  $0^\circ\text{C}$  ( $32^\circ\text{F}$ ). Temperature shall be maintained at test temperature  $\pm 1^\circ\text{C}$  ( $\pm 1.8^\circ\text{F}$ ) during the test.
4. There shall be 2 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 two test samples at the two temperatures, +20°C and 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. The puck and glass block 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 assembly drawing [2].
3. The puck in its 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

### 5 Revisions

<b>Rev</b>	<b>Date</b>	<b>Description</b>
A	18 Aug 16	Initial draft